मानकः पथप्रदर्शकः

BUREAU OF INDIAN STANDARDS

COMPENDIUM ON SAFETY IN CONSTRUCTION, OPERATION, AND MAINTENANCE OF RIVER VALLEY PROJECT

WATER RESOURCES DEPARTMENT

नदी घाटी परियोजनाओं के निर्माण, संचालन और रखरखाव में सुरक्षा पर सार-संग्रह

COMPENDIUM
ON
SAFETY IN CONSTRUCTION, OPERATION, AND MAINTENANCE OF RIVER VALLEY PROJECTS

From

Water Resources Department,
Bureau of Indian Standards,
9, Bahadur Shah Zafar Marg, New Delhi - 110002

Contact Details:

Water Resources Department, BIS
Email - wrd@bis.gov.in
Telephone No.: 011-23231906

INTRODUCTION

India, with its vast river systems and varied topography, has long relied on river valley projects for irrigation, hydropower generation, flood management, and water supply. These projects — comprising dams, barrages, canals, tunnels, and hydropower stations — play a pivotal role in the country's economic development, agricultural productivity, and energy security.

Given the critical nature of such infrastructure, safety in the construction, operation, and maintenance of river valley projects is of paramount importance. Incidents such as dam failures, embankment breaches, equipment malfunctions, and natural disasters like floods and earthquakes can pose serious threats to human life, ecosystems, and national infrastructure.

Complementing these efforts, the Bureau of Indian Standards (BIS), as the National Standards Body of India, has developed a suite of standards under its Sectional Committee WRD 21 – Safety in Construction, Operation, and Maintenance of River Valley Projects. The IS 10386 series of standards cover various aspects of safety including general safety practices, personal protective equipment, machinery handling, electrical systems, fire safety, excavation protocols, and maintenance procedures.

This Compendium brings together all the standards published by WRD 21, along with other relevant Indian Standards, government guidelines, and international best practices such as those from ISO etc. It is designed to serve as a comprehensive reference tool for engineers, contractors, regulatory authorities, and project managers engaged in planning, executing, and overseeing river valley projects.

TABLE OF CONTENTS

Compendium on

SAFETY IN CONSTRUCTION, OPERATION, AND MAINTENANCE OF RIVER VALLEY PROJECTS

1 SCOPE

1.1 This handbook is based on the guidelines provided in the Indian Standard IS 10386 (Parts 1 to 13) of 2013, IS/ISO 45001 and various other Indian Standards and manuals which covers the safety aspects related to the construction, operation, and maintenance of river valley projects.

1.2 These safety codes provide guidelines for various aspects such as general safety practices, safety in construction, excavation, Material and explosives handling, electrical safety, fire safety, excavation safety, canal safety, special works, Tunneling, and Common hazards. The implementation of these standards ensures that workers are equipped with the proper training, tools, and infrastructure to safely carry out tasks and minimize risks associated with such massive projects.

Note: Users are encouraged to refer to the Indian Standard for details and final interpretation

SECTION 1

1 TERMINOLOGY

The terms and definitions used in this handbook shall be interpreted as per the definitions provided in the following standards, unless otherwise specified:

- **IS 10386 (Parts 1 to 11)** – Safety Code for River Valley Projects
- **IS 4410 (All Parts)** – Glossary of Terms Relating to Water Resources
- **IS/ISO 45001** – Occupational Health and Safety Management Systems – Requirements with Guidance for Use

SECTION 2

(Recommendation of IS 10386 (Part 1) : 2013 and IS 15883 (Part 5) : 2013)

2 GENERAL

2.1 Health and Safety Management System

Organizational structure depends on the project delivery model, a typical organizational chart for health and safety management is given in Fig.1 for reference.

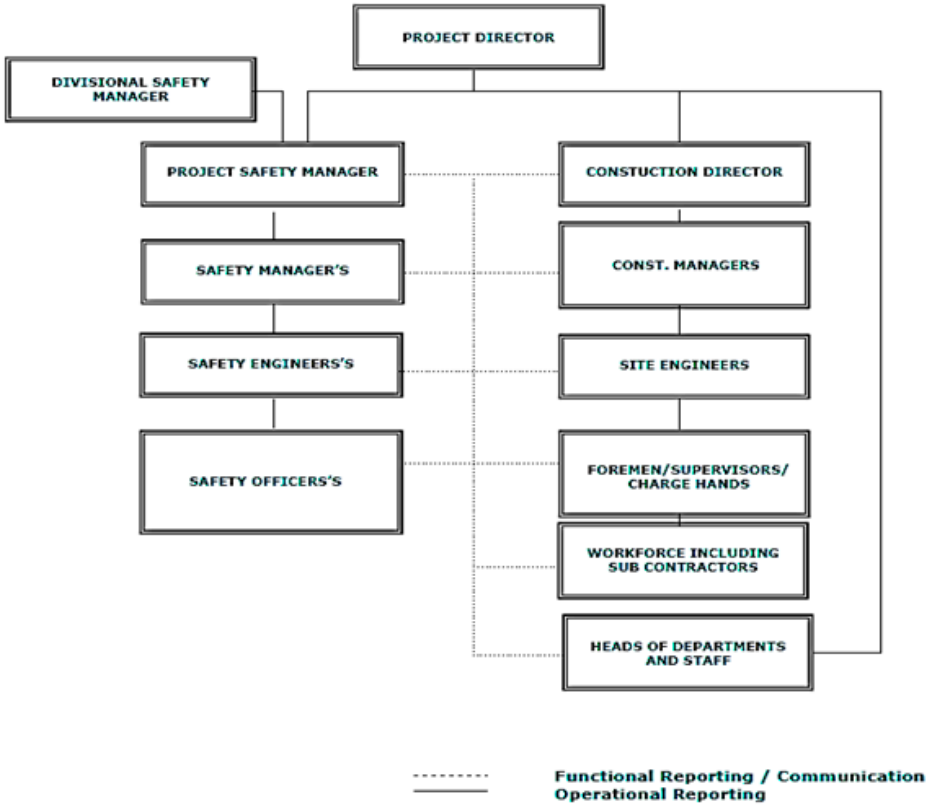
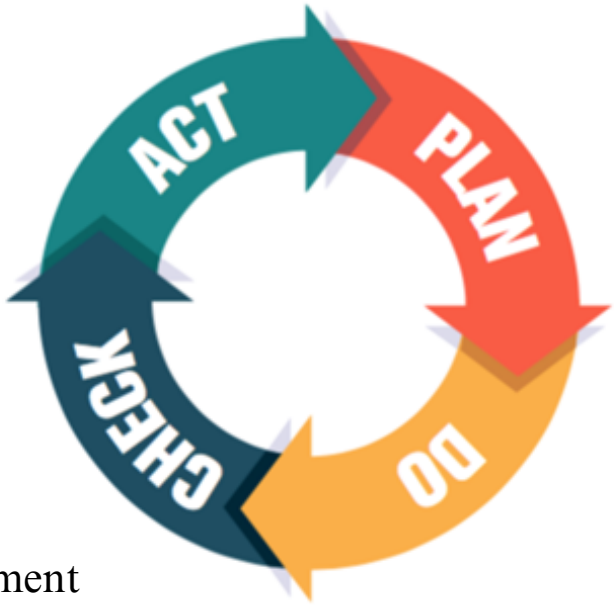


FIG. 1 TYPICAL PART STRUCTURE FOR HEALTH AND SAFETY MANAGEMENT IN A ORGANIZATION

A structured Health and Safety Management System, aligned with IS/ISO 45001, provides a framework for identifying and mitigating workplace hazards during the lifecycle of river valley projects. Key elements include:



- Safety Policy
- Risk and Hazard Management
- Safety Procedures and Controls
- Training and Competency Development
- Incident Reporting and Investigation
- Monitoring and Evaluation
- Continuous Improvement

Refer to IS/ISO 45001 and IS 15883 (Part 5) for detailed system framework and implementation guidelines.

2.2 Organizational Structure for Health and Safety at Various Project Stages

Health and safety considerations span all project stages—pre-construction, construction, and commissioning. Each stage should have defined responsibilities, as per organizational structure suited to the delivery model. The safety team should report directly to the Project Manager. Refer IS 15882 (Part 5) for detailed guidance.

2.2.1 *Pre-construction* — Health and safety management during this stage may be carried out in-house and/or through a consultant.

2.2.2 *Construction* — This is carried out generally through one or more contractors. Each contractor may engage sub-contractors, although the main contractor remains responsible for the overallperformance of the contract. Typical health and safety organizational structure of a construction agency is given in Fig. 2.

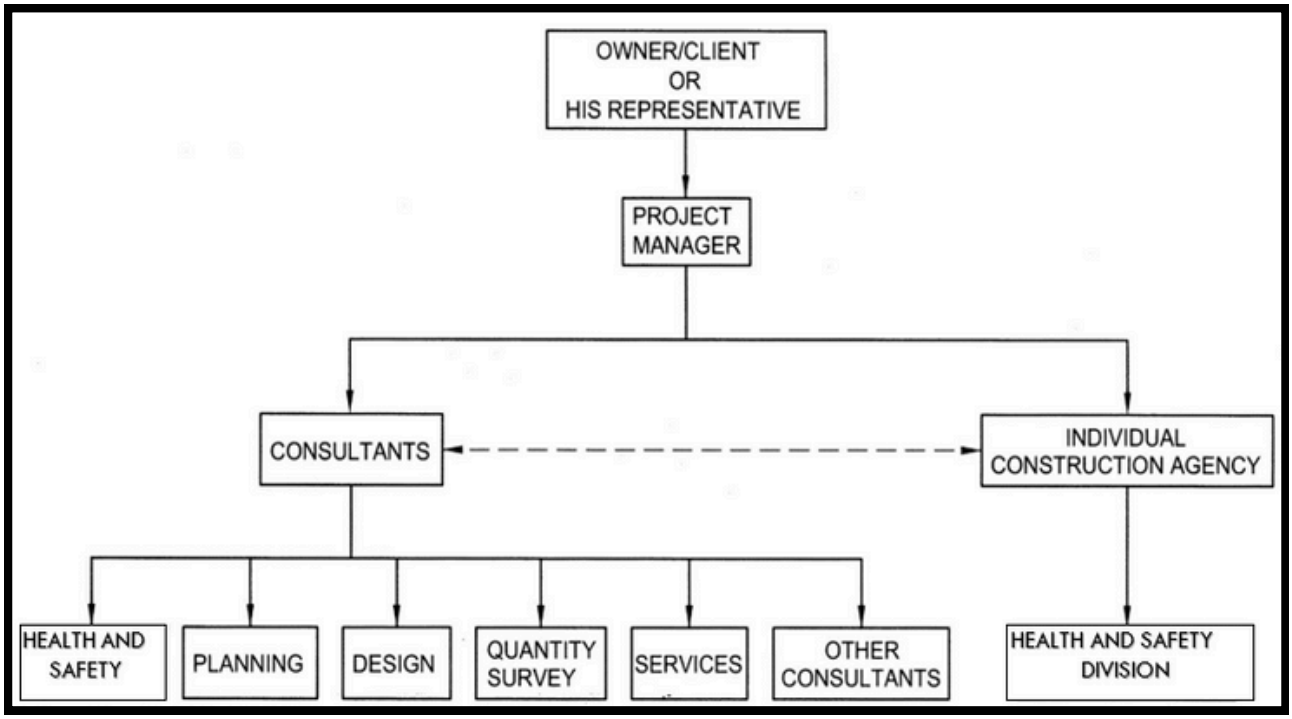


FIG. 2 TYPICAL DESIGN-BID-BUILD MODEL

2.2.3 *Commissioning and handing over* — While the construction agency or agencies may hand over the project or the concerned component, owner may also be involved in commissioning and subsequent operation of the project.

Note: The organizational structure for health and safety management process may vary from project to project depending on size of the project, delivery model and construction methodologies. On large and medium value projects, it may be necessary to have a separate health and safety team for each sub-contractor who in turn shall report to health and safety team of the main construction agency. In small value projects, this role may be merged with some other functions.

2.3 Requirements for Health and Safety Management

A documented Health and Safety Plan must align with the organization's safety policy. It should include site-specific objectives, risk control measures, emergency preparedness, training, compliance to statutory requirements, and subcontractor management. Refer IS 15883 (Part 5) for recommended plan components.

2.4 Safety Programme

Each contractor, private or government agency, shall have facilities for conducting a safety programme, commensurate with the magnitude of work under contract. Details of safety programme to be adopted by the contractor shall be given by the contracting Officer/Engineer-in-Charge, prior to the start of construction operation. The programme shall give details of the provisions proposed by the contractor, to provide for safety of the employees and for elimination of health hazards. In case the work is undertaken by a government agency itself, the chief executive or the chief authority shall constitute a unit/cell to prepare a detailed safety programme to be approved by the Chief Executive.

2.5 Safety Laws and Regulations

All health and safety measures must comply with applicable central and state laws including:

a.) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996;
b.) Environment Protection Act, 1986; and
c.) Relevant BIS standards (indicative list at Annexure C).

2.6 Safety Personnel and Safety Meetings

Contractors and executing agencies shall designate competent safety supervisors and establish safety cells. Regular safety meetings must be conducted:

a) Pre-construction meetings with stakeholders;
b) Bi-monthly joint safety policy meetings; and
c) Monthly tool-box meetings at worksites.

2.7 Employee Qualification and Training

Only medically fit and qualified personnel shall be employed. Certification of physical fitness is mandatory for operators of heavy equipment. Periodic safety training shall be imparted to all workers and supervisors. Refer IS 10386 (Part 3) and IS 15883 for detailed guidance.

2.8 Special Responsibility

The project leadership must empower the safety officer with necessary authority and resources. Safety principles should be integrated at the planning stage. Emphasis should be on both physical controls and behavioural safety.

2.9 Reporting Mechanism

A structured reporting system shall be maintained to document all incidents, injuries, near-misses, and unsafe conditions. Standard formats (Annex B) must be used. Immediate reporting of major incidents to project authorities is mandatory.

SECTION 3

(Recommendation of IS 15656 and IS 3786, IS 45001)

3 Hazard Identification and Risk Assessment

3.1 Hazard identification and risk assessment (HIRA) is a systematic process to recognize potential hazards, evaluate associated risks, and prioritize appropriate mitigation measures. When applied diligently, it supports safer design, operation, and maintenance of River Valley Projects by preventing accidents and minimizing consequences.

Refer: IS 15656, IS/ISO 45001, IS 14489, IS 3786, IS 8756, and international practices such as ISO 31000 (Risk Management) and IEC 61882 (HAZOP).

3.2 A typical HIRA or Quantitative Risk Assessment (QRA) process includes:

- *Hazard Identification*: Recognition of potential sources of harm or process failures.
- *Consequence Analysis*: Estimation of potential effects (e.g., fire, explosion, toxic exposure).
- *Frequency Estimation*: Evaluation of the probability of occurrence using techniques such as fault tree and event tree analysis.
- *Risk Estimation and Evaluation*: Risk = Likelihood × Consequence. Comparison against acceptable risk thresholds.
- *Risk Mitigation and Prioritization*: Implementation of control measures and prioritization based on risk level.

3.3 Techniques such as HAZOP (Hazard and Operability Study) are recommended for complex systems. A multidisciplinary team systematically examines process deviations from design intent using guidewords to identify potential causes and consequences.

3.4 Risk assessments should be conducted across all stages of project lifecycle—design, construction, commissioning, operation, and decommissioning—as each stage introduces unique hazards. Refer Fig. 4: Stages of Process Project and Risk Analysis.

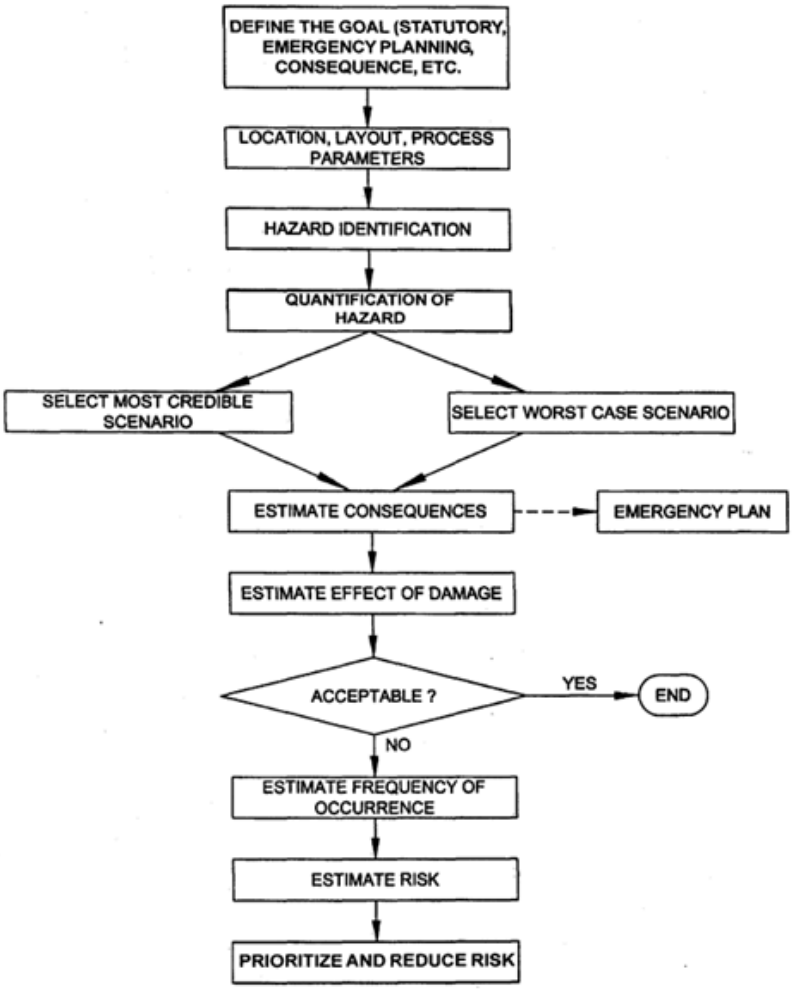


FIG. 4 STAGES OF PROCESS PROJECT AND RISK ANALYSIS

3.5 Safety Performance Indicators

To monitor ongoing safety performance, the following metrics are recommended in accordance with IS 3786:

a) *Frequency Rate* — The frequency rate shall be calculated both for lost time injury and reportable lost time injury as follows:

FA = Number of lost time injury ×1 000 000 Man-hours worked

FB = Number of reportable lost time injury ×1 000 000 Man-hours worked

b) *Severity Rate*- The severity rate shall be calculated from man-days lost both of lost time injury and reportable lost time injury as follows:

SA = Man-days lost due to lost time injury ×1 000 000 Man-hours worked

SB= Man-days lost due to reportable lost time injury

c) *Incidence Rate* — The incidence rate is the ratio of the number of injuries to the number of persons during the period under review. It is expressed as the number of injuries per 1 000 persons employed. The incidence rate may be calculated both for lost time injuries and reportable lost-time injuries as follows:

$$\text{Lost} - \text{time injury incidence} = \frac{\text{Number of lost time injuries} \times 1\,000}{\text{Average number of persons employed}}$$

$$\text{Injury incidence rate} = \frac{\text{Number of reportable lost} - \text{time injuries} \times 1\,000}{\text{Average number of persons employed}}$$

⚖ SECTION 4

[Recommendation of IS 10386 (Part 2) : 2013]

4 OCCUPATIONAL HEALTH AND SAFETY (OHS)

Occupational health and safety is a core responsibility of the employer and must be integrated into the management system, aligned with national regulations and international frameworks such as IS/ISO 45001 and IS 3786. The employer must demonstrate commitment through effective implementation, resource provision, and enforcement.

4.1 Personal Protection Equipment

PPE should be considered only after all other risk reduction measures have been exhausted. Employers are responsible for:

- Supplying appropriate PPE as per identified risk.
- Ensuring proper training, maintenance, and use.
- Enforcing compliance through regular monitoring.

Refer IS 2925 (Helmets), IS 15298 (Safety footwear), IS 9167 (Respirators), and relevant IS codes for gloves, goggles, and protective clothing.

Key Provisions:

- Workers in tunnels with flammable/toxic gas must use breathing apparatus;
- Minimum two-person rule for entry into hazardous zones;

- Mandatory eye/ear/face protection during welding or noisy operations;
- Special protection for cement handlers, steel erectors, and workers exposed to sharp edges or chemicals; and
- Safety Data Sheets (SDS) must be available for all hazardous substances, providing clear instructions on handling, PPE, first aid, and emergency measures.

4.2 Frist Aid

First aid arrangements must be readily available at all worksites.

Employer's Responsibilities:

- Ensure prompt, accessible first aid kits (minimum one per 25 workers);
- Display emergency contacts and provide trained personnel; and
- Enable emergency transport and maintain proper signage.

Refer: IS 3786 and National Factory Rules for first aid standards.

The Objectives of Frist Aid are:

a) Preserve life and prevent further injury;
b) Minimize deterioration of condition (e.g., control bleeding, immobilize fractures); and
c) Promote recovery using available resources and techniques (e.g., CPR, wound dressing).

4.3 Ventilation and Lighting

a) Adequate forced ventilation systems (with backup power) must be installed in tunnel areas to ensure air quality;

b) Entry is prohibited in spaces with oxygen levels less than 19.5 percent or where dangerous gases are present unless certified safe; and
c) Gaseous conditions must be tested every 2 hours during operations, especially after rockfalls or disturbances.

4.4 Water Supply, Drainage and Sanitation

a) Potable drinking water must meet central/state/local health standards, with periodic testing every two months;
b) Clearly marked drinking water outlets should be installed at worksites;
c) Proper sanitation and drainage systems are mandatory, with provision of toilets and washing facilities in accordance with local regulations; and
d) Debris and waste must be cleared promptly and disposed of as per environmental guidelines.

4.5 Dust and Noise Control

a) Cement handling areas and batching plants must provide nose masks and dust suppression systems;
b) Exhaust systems (fans, shafts, etc.) are required in tunnels to manage airborne particles;
c) Where noise exceeds permissible limits, engineering controls must be implemented, and hearing protection provided; and
d) Tunneling sites using compressed air must provide rest shelters with adequate amenities.

SECTION 5

(Recommendation of IS 10386 (Part 8) : 2024and IS 10386 (Part 11) : 2012, IS 3764: 1992)

5 EXCAVATION

Excavation is one of the most hazardous construction activities, essential for foundations, utility lines, and water/sewer systems. It includes any man-made cut, trench, or depression in the earth formed by removal of soil. The major risks include cave-ins, contact with utility lines, and hazardous atmospheres. Awareness, planning, and safety management are critical.

5.1 Open Excavation

5.1.1 *General Safety Requirement*

Safety is a shared responsibility at the worksite. Awareness and adherence to safety rules are vital. Safety requirements vary based on structure type, soil strata, and machinery. A safety manager should oversee hazard identification, worker education, and maintenance of safety equipment. Excavation slopes must remain safe throughout construction. Warning signs should be displayed prominently

5.1.2 *Investigation Data*

Before excavation begins, data on subsurface strata must be collected. This includes overburden, rock type, faults, joints, and water tables. For depths above 10 m, physical and engineering properties of overburden must be assessed.

5.1.3 *Excavation Slope*

Excavation slopes adopted in the field should be safe against sliding or slip during the entire period of construction so they do not endanger the safety of men and machinery, as also the structure under construction, adjacent to the area of excavation. This is essential as the construction of river valley projects continues over years, during which time many normal and abnormal monsoons and other hazardous field conditions may be encountered.

For general guidance, the following slopes may be adopted for open excavation work up to 10m depth.

a) Soil over burden/boulder strata- 2 horizontal to 1 vertical to 1 horizontal to 1 vertical;
b) Soft/weathered rock- 0.5 horizontal to 1 vertical; and
c) Hard rock - 0.25 horizontal to 1 vertical.

5.1.4 *Tool Plant Machinery*

Tools and Machinery Tools must be kept away from trench edges. Heavy machinery should be at least 6 m away from excavation edges when idle. Vehicle movement near excavation should be supervised, and paths should avoid trench edges. Vigilance is required during loading to prevent slides or rockfall.

5.1.5 *Access or Escape Way*

Access and Escape Pathways should be non-slippery, wide, and strong. Gangways must be clear of obstructions. Ladders shall extend at least 1 m above the cut and comply with IS 3696.

5.2 Deep Excavation

Deep excavation poses even greater risks. Safety varies with structure type, excavation method, and soil conditions. Safety engineers must oversee all operations, and workmen must be trained.

5.2.1 *General Safety Requirements*

All personnel must remain alert to hazards. Safety managers must oversee the implementation of safety rules, education, and installation of safeguards. Underground excavation is inherently risky and must be approached with maximum caution.

5.2.2 *Investigation, Data and Survey*

Sufficient geological and geotechnical data are essential before excavation. Mapping, drilling, and seismic data collection help anticipate and mitigate geological surprises. IS 4967 and related codes should guide the planning of underground structures.

5.2.3 *Drilling and Blasting Operations*

Blasting must comply with legal norms for explosives. Warning signs and signals are mandatory. Explosives shall be stored in a safe place at a sufficient distance from the work site and under the special care of a watchman (As per 10386). Personnel must maintain safe distances. Unused or unblasted detonators must be removed. Only electrical blasting should be used in underground works.

5.2.4 *Blast Vibration Monitoring*

Blast-induced vibrations can cause structural damage. Surveys and modern instruments should be used to monitor vibrations. Extra precautions must be taken in soft strata or during rainy seasons. Tunnel entry points with minimal rock cover require careful design and safety consideration.

5.2.5 *Instrumentation*

Underground excavations alter stress patterns, potentially causing displacements and cracks. Instrumentation helps assess rock quality, monitor deformation, and evaluate support system performance. Proper support must be designed based on monitoring data.

5.3 *Dewatering*

Excavated areas must be dewatered to prevent slips and slope failures. Drainage systems should divert surface/storm water away from the excavation. Both temporary and permanent drainage should be constructed to ensure safety and stability.

SECTION 6

Recommendation of IS 7293 : 1974 and IS 10386 (Part 4) : 2013)

6 MATERIAL HANDLING

6.1 Transport

All motor trucks, tractors, and dumpers used at construction sites shall comply with IS 13367 for safety requirements:

a) Provide protective cabins/canopies for drivers;
b) Driver seats shall be vibration-absorbing and ergonomically designed;
c) Brakes must be capable of holding the vehicle under maximum load;
d) Use of draw gear shall prevent worker exposure during coupling;
e) Drivers must vacate cabins during loading;
f) Avoid loading under overhead materials (e.g., bucket lines);
g) Maintain minimum 0.6 m clearance from rotating machinery like excavators;
h) Use standardized hand signals per IS 7969 when vision is obstructed;
i) Ensure load is secure and evenly distributed before transport; and
j) Stop blocks must be placed at every tipping point per IS 13367.

6.2 Storage

6.2.1 *Cement Lime Pozzolana Handling*

Refer to IS 4082 for stacking and storage:

a) Workers must wear PPE including respirators and goggles;

b) Stacks shall not exceed 15 bags; use interlocking (header/stretcher) method if over 8;
c) Remove bags from the top uniformly;
d) Lockout/tagout ejection systems before silo entry; and
e) Use lifelines and a standby supervisor during confined space entry.

6.2.2 *Reinforcing and Structural Steel*

a) Stacking Reinforcing Steel — Reinforcing steel shall be stored according to length, size and shape, and shall be piled in such a manner as to prevent tipping or falling.
b) Lagging — Steel shall be stored on a solid foundation, utilizing lagging as necessary to ensure stable piles.
a) Safe Access — Adequate spacing shall be maintained between piles to ensure safe access.
b) Gloves — Workmen handling deformed steel bars, barbed wire, expanded metal and the like shall be required to wear gloves.
c) Manual Handling — Heavy steel sections and bundles shall be lifted and carried with the help of slings and tackles and shall not be carried on the shoulders of the workman.

6.2.3 *Sand Gravel and Crushed Stone*

a) Location of Stockpiles — Stockpiles of these materials shall be so located as to provide easy access for withdrawing. In stacking these materials minimum safety distances as mentioned under 3.5.5 shall be ensured between the material and the overhead power lines.
b) Overhanging Prohibited — When withdrawals are made from stockpiles, no overhang shall be permitted.
c) Superimposed Loading — Materials shall not be piled against walls that will be endangered by thrust, nor along the sides of any excavation or on the top of an embankment so as to cause slips.

d) Hoppers — Employees required to enter hoppers shall be equipped with safety belts and lifelines, attended by another person. driven hoppers, feeders, and loaders shall be locked in the off position prior to entry.

6.2.4 *Flammable Materials*

a) Regulations — Flammable materials shall be stored in accordance with the relevant regulations and rules so as to ensure the desired safety during storage. Explosives like detonators shall be stored in accordance with the existing regulations of Indian Explosives Act.

b) Personnel — Operations in connection with handling, storage and issuance of flammable liquids shall be under the supervision of qualified and experienced persons.

c) Clothing — Workmen shall be required to guard carefully against any part of their clothing becoming contaminated with flammable fluids. They shall not be allowed to continue work when their clothing becomes so contaminated.

d) Handling — Petroleum products delivered to the job site and stored there in drums shall be protected during handling to prevent loss of identification through damage to drum markings, tags, etc. Unidentifiable petroleum products may result in improper use, with possible fire hazard, damage to equipment, or operating failure. Bulk delivery and storage of petroleum products requires the same cart in identification, and particular attention to fire hazards during handling.

e) Storage — Outdoor storage of drums requires some care to avoid contaminations. Moisture and dirt in hydraulic brake and transmission fluid, gasoline, or lubricants may easily cause malfunction or failure of equipment, with possible danger to personnel. The storage area should be free of accumulations of spilled products, debris and other hazards. Compressed gases and petroleum products shall not be stored the same building or close to

each other.

f) Bulk Storage — For bulk storage of petroleum, kerosene oil and the like, the storage shall comply strictly with the specifications given in the Petroleum rules.

6.2.5 *Explosives*

Explosives are vital for tunneling, shaft sinking, and excavation in river valley projects. Their selection, handling, and use must comply with the Indian Explosives Act, 1884 and relevant rules.

Proper storage ensures safety and preserves effectiveness. Explosives are sensitive to temperature and humidity—gelatin, for instance, may harden in cold and should be gently warmed (not near fire) before use. Both overly moist and dry environments degrade explosive quality. Stocks must be used in manufacture-date sequence, and once opened, cases should be resealed and used promptly.

6.2.5.1 *Storage of different class of explosives*

Under the Explosives Rules, the various explosives and accessories are classified under separate headings as below:

a) Class 1 — Gunpowder

b) Class 2 — Nitrate mixtures (GN/L, Power flow 1, Power flow 2, and Power flow 3)

c) Class 3 — Nitro compounds

- Div. 1 — Blasting gelatin, special gelatins, opencast gelignite, permitted explosives, etc.
- Div. 2 — Seismex, seismex primers, gun cotton, PETN, TNT, primex, etc.

d) Class 4 — Chlorate mixtures
e) Class 5 — Fulminates
f) Class 6 — Ammunition

- Div. 3 — Safety fuse, fog signals, igniter cord connectors, electric lighters, safety electric fuses, percussion caps, safety cartridges for small arms.
- Div. 4 — Plastic igniter cord, detonation fuse, electric fuse, fuse igniters etc.
- Div. 5 — Detonators, detonating relays, etc.

g) Class 7 — Fireworks Under the Explosives Rules the following can be stored together in the same magazine:

1) Gunpowder: Class 1
2) Nitrate mixture: Class 2
3) Nitro compounds: Class 3
4) Chlorate mixtures: Class 4
5) Safety fuse: Class 6 Div. 1
6) Plastic igniter cord: Class 6 Div. 2
7) Detonating fuse: Class 6 Div. 2

Classes 1–4 and specific items from Class 6 may be stored together. Detonators must be stored separately, at least 15.24 m from explosives, unless fewer than 44,000, in which case a properly constructed annex is permitted.

6.2.5.2 *Handling and transportation of explosives*

Explosives must be transported in licensed explosive vans as per Explosives Rules, 2008. Vans should have non-sparking (copper/brass) or wooden flooring, adequate side barriers, and clearly marked with 'EXPLOSIVE VAN'. Cargo must be secured before movement.

Metal tools, matches, oils, batteries, acids, etc shall be prohibited in the van. Vans must carry fire extinguishers and have earth chains touching the ground to prevent ignition from static or lightning.

For loads more than 5 kg, use insulated containers made of:

- Wood (not less than 50 mm)
- Plastic (not less than 6 mm)
- Fiberboard (not less than 10 mm)

Only approved, locked vehicles can transport explosives. Transfer on-site should use spark-proof canisters, and removal should occur only immediately before use.

No explosive should be transported in a mechanically propelled vehicle unless such a vehicle is locked and is of a type approved in writing by the Chief Inspector of Explosives.

6.2.6 *Machinery*

6.2.6.1 Operators and repair staff must be trained on new equipment with support from manufacturer's personnel, including safety aspects (e.g., through films/documentaries).

6.2.6.2 'Out of Service' tags must be securely fixed on faulty equipment and removed only by authorized personnel after ensuring safety.

6.2.6.3 On-the-job training should involve both safety officers and manufacturer's representatives.

6.2.7 *Electrical*

All exposed electrical installations either because of location or otherwise should be so guarded that dangerous contact by persons shall not be possible. Step bolts on structural steel tower columns should be placed such that their use shall not bring a person into the vicinity of electrical conductors, transformers or switch boxes that may be installed on the face of a tower, adjacent to the step bolts. Sufficient clearance should be provided in the design of substations, switchyards and transformer yards so that vehicles moving around and about high voltage equipment will not come in contact with equipment and damage it, or endanger themselves. Necessary provisions should also be made for stopping stray animals and cattle from coming into the vicinity of electrical installations.

6.2.7.1 *Grounding*

a) All non-current-carrying parts and static charge-prone equipment must be effectively grounded.
b) Grounding must comply with Indian Standards to ensure safe touch and step voltages.
c) Spark/explosion-proof enclosures should be used in hazardous areas (e.g., oil rooms).

6.2.7.2 *Substations*

a) Maintain clearances as per IS 3716;
b) Provide barriers and locked enclosures for high-voltage components; and
c) Only authorized personnel may access live conductor areas.

6.2.7.3 *Generators*

a) Use fire-retardant insulation materials;
b) Avoid CO_2 systems underground; prefer water spray;
c) Follow permit-to-work protocols;
d) Lockout controls and fire protection systems before maintenance; and
e) Do not bring metal near live parts.

6.2.7.4 *Transformer*

a) Must be fenced or installed in secure cubicles with firewalls and ducts;
b) Prefer dry-type transformers in underground stations;
c) Oil containment pits are required; and
d) Follow CEA Safety Regulations, 2010 for clearances and permits.

6.2.7.5 *Gas Insulated Switchgear*

a) Permit required for all work;
b) Personnel must be trained in SF_6 gas handling; and
c) Gas insulated switchgear systems offer high safety but must not lead to complacency.

6.2.7.6 *Cables*

a) Obtain permit-to-work;
b) Expose and identify cables before cutting;
c) Ensure cables are dead and earthed, then spike before cutting; and
d) Tag cables post-work and avoid stepping/resting materials on them.

6.2.7.7 *Lighting Arrestors*

a) Work only when arrestors are disconnected and earthed;
b) Avoid contact with tanks/shields when energized; and
c) Fence accessible HV/EHV arrestors; gates must be locked.

6.2.7.8 *Power Driven Machinery*

a) Includes wood/metal working tools like saws, lathes, grinders.
b) Equip all machines with grounded, waterproof, insulated 3-wire connections.
c) Use lower voltage (110V/24V) tools where necessary.

6.2.7.9 *Crane and Hoist*

a) Minimum safety factor: 5;
b) Must not exceed rated capacity and should include proper brakes;
c) Control switches should be lockable and accessible;
d) Include limit switches, safety shutoffs, escape hatches, and clearly marked controls; and
e) Elevators and hoists must have anti-drop mechanisms and auto-locking doors.

SECTION 7

(Recommendation of IS 10386 (Part 6) : 2020)

7 CONSTRUCTION

7.1 False Work /Scaffolds

a) Provide suitable scaffolds for jobs not safely done from ground or permanent structures;
b) Scaffolds above 3.25 m shall have guardrails (min. 1 m height), properly secured and extending along all sides with necessary openings; and
c) Must be secured to prevent swaying or designed to be self-supporting under live loads.

7.2 Platforms, Gangways and Runs

Constructed to prevent sagging; if above 3.25 m, shall be closely boarded, adequately wide, and conform to IS 3696 (Part 1) for slopes and dimensions.

7.3 Ladders

a) Made of steel/wood per relevant IS; rope ladders shall comply with IS 1084/1410;
b) Secure bottom to prevent slipping; non-skid materials recommended;
c) Inclination not steeper than 1:4 (H:V); width between rails not less than 30 cm (increased with length); and
d) Extend at least 1 m above platform for safe access.

7.4 Ramps

a) Evenly supported with adequate strength and railings;
b) Must be non-slippery and obstruction-free; cleats required on steep ramps; and
c) Material ramps must have skirt boards.

7.5 Openings

a) Floor/platform openings shall have 1 m high fencing/railings; and
b) Excavations must be fenced with toe boards and marked with night danger signals.

7.6 Dangerous Corners

a) Install danger/warning signs at exits and corners;
b) Protect with fencing/railings (min. 1 m); toe boards if necessary; and
c) Ensure proper lighting at night.

7.7 Forms of Concrete

a) Formwork must consider span, load, temperature, and safety factors;
b) Inspect timber and steel components; avoid defective materials;
c) Vertical supports must be braced and placed on firm soil with proper drainage;
d) Regular inspections during concreting; use safety gear during formwork removal; and
e) Dismantling must be supervised by a competent engineer and follow specific procedures.

7.8 Structural Steel Erection

a) Steel must be securely bolted/braced before permanent fixing;
b) Use certified equipment; mark safe working loads;

c) Only qualified operators at least 18 years old permitted; and
d) Ensure safety gear for all involved; restrict unauthorized access with signs and red flags.

7.9 Welding, Riveting and Cutting

Welding and cutting operations shall be done by workmen thoroughly trained for the job or by trainees who are under competent supervision. Workers engaged in welding, riveting and cutting shall be provided with protective clothing, hand gloves, sleeves and boots as per relevant Indian Standards. Workers engaged in welding and cutting shall be provided with protective goggles conforming to IS 1179.

7.10 Painting

a) Prohibit paints with lead or lead products;
b) Provide face masks during spray application or scraping; and
c) Store flammable materials in tightly closed containers away from heat or ignition sources.

SECTION 8

(Recommendation of IS 10386 (Part 5) : 2014)

8 ELECTRICAL ASPECT

All exposed electrical installations either because of location or otherwise should be so guarded that dangerous contact by persons shall not be possible. Step bolts on structural steel tower columns should be placed such that their use shall not bring a person into the vicinity of electrical conductors, transformers or switch boxes that may be installed on the face of a tower, adjacent to the step bolts. Necessary provisions should also be made for stopping stray animals and cattle from coming into the vicinity of electrical installations.

8.1 Grounding

a) Ground all non-current-carrying parts (tools, equipment, enclosures, etc.);
b) Ground structures prone to static charges, especially in oil/gas environments;
c) Use spark-proof enclosures in explosive zones;
d) Avoid simultaneous contact with energized parts and grounded objects; and
e) Follow IS standards for grounding; ensure step/touch potentials are within safe limits.

8.2 DE-Energizing Power Lines

a) Ensure proper de-energization and grounding before maintenance;
b) Keep interlock and chamber keys with authorized personnel; and
c) Follow clearance procedures per Central Electrical Board's model code.

8.3 Generators

a) Use non-combustible, flame-retardant insulation materials;
b) Avoid CO_2 fire systems in underground setups;
c) Obtain permit-to-work for maintenance;
d) Open all disconnect switches before starting work;
e) Disable fire protection and remote controls before maintenance; and
f) Keep metal tools away from live electromagnets.

8.4 Transformer

a) Ensure fencing to prevent contact with terminals;
b) Prefer separate transformer caverns or cubicles with fire protection;
c) Provide ducts for smoke/fume removal and oil soaking pits;
d) Use dry-type transformers in tunnels to reduce fire risks; and
e) Maintain clearances as per Indian Electricity Rules.

8.5 Cables

a) Obtain permit-to-work before cable maintenance;
b) De-energize, identify, and expose cables before cutting;
c) Spike cables only after confirming they're dead and earthed;
d) Tag cables post-repair and update records; and
e) Do not step on live cables or rest tools on them.

8.6 Caution

a) No smoking, flames, or spark-generating tools near battery cells during gassing; and
b) Avoid static electricity discharge near cell vents during overcharging.

SECTION 9

(Recommendation of IS 10386 (Part 7) : 2020)

9 FIRE SAFETY

9.1 General

Fire is a major hazard in construction, especially in hydroelectric and river valley projects, due to:

a) Proximity of key components (dams, powerhouses, transformers, storage, camps);
b) Presence of temporary residential and non-residential structures; and
c) Use of flammable materials, heavy machinery, and electrical systems.

9.1.1 *High-Risk Fire Areas*

a) Turbo generators and oil systems;
b) Oil-fueled generators, transformers, coolers, conservators;
c) Diesel engines/pumps and fuel storage;
d) Hydro generators, unit/auxiliary transformers, power/control cables;
e) Cable galleries in and between power house and switchyard;
f) Oil storage rooms (for transformer oil dehydration); and
g) Load dispatch centers and substations with oil-filled equipment.

9.1.2 *Fire Protection Planning*

a) Must begin at the design stage of the plant;
b) Incorporate active and passive fire safety measures throughout construction;

a) Account for smoke logging and toxic gases in protection design; and
b) Ensure adequate escape routes for life safety.

9.1.3 *Fire Emergency Preparedness*

a) Each installation must have a Fire Emergency Procedures Manual; and
b) Manual should include response actions and plans for:

1. Process area fires;
2. Storage tank fires;
3. Electrical fires; and
4. Building fires.

9.2 Communications

a) A reliable communication system is critical for fast firefighting response, especially in remote project areas;
b) Install fire alarms (manual & automatic), sirens, and loud phone alerts across key locations;
c) Emergency contact numbers (Fire, Ambulance, Plant In-charge, etc.) must be clearly displayed; and
d) CCTV systems should cover remote areas with displays at the control room for real-time monitoring.

9.3 Forest Fire

Forest fires often begin small and unnoticed but escalate quickly. While hydro project structures are generally not majorly affected, early detection and prevention are vital.

9.4 Prevention

a) Warning boards should caution visitors and trespassers about fire risks;
Observation towers should be closely spaced near hydro project sites;

c) Maintain strong coordination with forest authorities for fire-related alerts; and
d) Compensatory afforestation or plantation should be at least 30 m away from project components

9.5 Fire Extinguishment

a) Fires in early stages can be extinguished by trained personnel using beating methods;
b) Create fire barriers to contain spread;
c) Ensure adequate water supply near forest edges of project areas;
d) Train staff in efficient water use for fire control; and
e) Immediately alert local fire stations upon fire detection to deploy trained personnel and equipment.

9.6 Building Construction and Related Requirements

The structural elements of all buildings of an electrical generating/distributing station should be of Type 1 construction, complying with the requirements of IS 1642.

a) Install automatic smoke and toxic gas ventilation systems, especially above generator floors; ensure air change rate of 12–30 per hour based on fire load and room size;
b) Include smoke vents in cable tunnels, turbine halls, switchboard rooms, etc., and provisions for portable extraction units;
c) Ensure compartmentation using 2-hour fire-resistant walls in key areas to limit fire spread, such as:

1) Between generator units, control rooms, switchgear rooms, cable galleries, staircases/lifts.
2) Around flammable liquid storage, transformer yards, battery rooms.

d) Fire-rated glass/windows (minimum 45 min) or water curtains required in separation walls;
e) Avoid plastic foam insulation; use only non-combustible, Class I flame-spread materials;
f) Control rooms should have pressurized air conditioning to prevent smoke entry; and
g) Plastic ducts not allowed in ventilation; provide liquid drainage from fire-affected areas to safe zones.

9.7 Power Station Facility

9.7.1 *Generator Units*

a) Main fire risks are from leakage of lubricating/hydraulic/jacking oil;
b) Install bund walls around oil systems to contain leaks; and
Use concrete or protected steel for support structures; if steel is exposed, protect with automatic sprinkler systems.

9.7.2 *Oil Risks*

a) Prevent fire by separating lubricating and control oil circuits; and
b) Collect leaking oil via:

1) Concrete/steel-lined trenches for oil lines, or
2) Double-pipe systems, with inner pressure pipe inside a larger outer pipe that also functions as a return.

9.8 Electrical Installations and Equipment

9.8.1 *General Requirements*

a) All electrical systems shall follow IS 1646;
b) Do not use flammable cleaning fluids (e.g., gasoline, alcohol) on energized equipment. On de-energized equipment, allow 30 minutes before re-energizing;

c) Keep equipment free from oil, dust, and grease, and ensure effective earthing at two points; and
d) Conduct regular inspections and testing as per standards and OEM guidelines.

9.8.2 *Cables and Cable Galleries*

a) Follow IS 12459 for cable fire protection;
b) Use fire-resistant cables, segregated runs, and sealed wall/floor penetrations;
c) Clamp cables above and below floor level, protect with heat-resistant covers (450 mm high, sand-filled);
d) Separate cable groups with barriers (brick/tile/concrete) and fill trenches with pebbles;
e) Maintain 75 mm spacing between cable groups; run power and control cables separately; and
f) Provide emergency lighting and fire stops at substation entry points.

9.8.3 *Transformers*

All transformer installations should comply with the provisions of IS 1646 in addition to the following:

a) As a protection against excessive damage due to occurrence of faults, transformers fitted with conservators should be protected with Bucholz relay;
b) All other transformers should be equipped with oil temperature alarms or excess current relay protection.
c) The level and dielectric strength of the transformer oil should be checked at periodic intervals and in the event of presence of a large quantity of sludge, the oil shall be reconditioned/ replaced.
d) Diagnostic devices like PD monitoring system etc. shall be provided to read the health of transformers with capacity 20 MVA and above.

e) Differential protection should be provided for transformers rated 5 MVA and above.
f) Transformers connected to Grid supply should have 'ON LOAD TAP CHANGERS' for control of secondary voltage.

9.8.4 *Battery Room*

a) Separate MG sets/rectifiers from batteries; place all in dust-free, ventilated areas;
b) Mount batteries on non-conductive, fire-resistant benches insulated from the ground;
c) Arrange batteries to avoid more than 12 V difference between adjacent cells; avoid circular arrangements for more than 20 V;
d) Protect surrounding areas (up to 60 cm horizontal, 2 m vertical) with asbestos sheets;
e) Use MCBs, double/triple pole switches, and fuses not more than 7 A for charging circuits;
f) Control panels should be of non-ignitable, acid-resistant material;
g) Keep charging resistors/lamps 60 cm away unless enclosed;
h) Use non-combustible insulated wiring, protect terminals, and insulate conductors;
j) Ensure flameproof fittings, no switching inside battery room, and switches located externally; and
k) Line floors/walls (up to 1 m) with acid-resistant materials.
m) Provide eye washer/shower for safety.

9.9 Fire Protection Measures

9.9.1 *General*

Power stations must have adequate fire protection and exits, regardless of size, as per IS 1641. Stations in remote areas (e.g., hydropower) should maintain an independent firefighting service for response within 5 minutes.

9.9.2 Turbo Generators and Supporting Structures

a) Underground stations: Provide fixed water spray system;
b) Surface stations: Use CO_2 or water spray systems, backed by hydrants;
c) Protect turbo-generator oil systems and bearings with high-velocity water spray (10 lpm), divided into zones with detectors per IS 2175;
d) Prefer automatic extinguishing system with manual override;
e) Place zone control valves safely and enable isolation for maintenance;
f) Provide internal hydrants, foam capabilities, and adequate ventilation; and
g) Auto shutdown system to be in place during fire.

9.9.3 Transformer

a) No fixed system needed for less than 10 MVA oil-filled transformers with at most 2000 L oil;
b) Others require high-velocity water spray systems, installed outside fire zone, with automatic/manual operation;
c) Install fire barrier walls if transformers are less than 15 m apart or oil more than 2000 L;
d) Ensure oil spill containment and flame arrestors per IS 11006;
e) Use simultaneous deluge protection for generator transformer, conservator, and cooler batteries;
f) Seal trench gaps and cable entries to prevent fire spread due to explosion or 'stack effect';
g) Provide extinguishers and firefighting systems per CEA/OISD-STD-173; and
h) Use stone layers or oil pits based on oil capacity near buildings.

9.9.4 *Switch Gear*

a) SF_6 and vacuum breakers are preferred for lower fire risk.
b) Use hydrants nearby; install CO_2 flooding systems for unmanned rooms.
c) Seal all cable entries and keep rooms clean.
d) House switchboards in separate rooms:
e) 6.6 kV unit/station, 415 V unit/station boards.
f) Provide pressurized ventilation and interlocks to shut it off before gas system activation.
g) Install multi-sensor smoke detectors (cross-zoned) and intelligent fire detection systems.
h) Use fixed gaseous local extinguishing systems.
j) Provide ISI insulating mats (IS 15752).

9.9.5 *Control Room*

a) Seal cable entries, keep clean, and switch off AC system before extinguisher activation.
b) Use multi-sensor smoke detectors with intelligent fire systems.
c) Cable entries through fire-resistant MCTs; provide double door entry and air curtain.
d) Include communication systems:
e) PA system, emergency, radio, intrinsically safe phones.
f) Clearly mark exit doors.

9.9.6 *Cable Galleries*

a) Cable fires can affect multiple units. Use ventilation to control smoke/toxic gas.
b) Install compartmentation using fire barriers (IS 12459).
c) Provide exits every 60 m, sized for personnel with breathing apparatus.
d) Use automatic firefighting systems (preferred: water sprinklers).

e) Ensure complete coverage; install LHS cables and multi-sensor detectors.
f) Delay system activation until evacuation when using foam/gas.
g) Place breathing apparatus near entry points.
h) Keep areas clean and clear with controlled access.
i) Use LHS cables for EHV fire detection.

9.10 Water Supplies for Fire Fighting (External and Internal Hydrant Systems)

a) Water supply should conform to IS 9668, IS 3844 (internal hydrants), and IS 13039 (external hydrants).
b) System should meet peak demand of largest fixed extinguishing system plus 1,800 lpm for 2 hours.
c) Automatic-start, manual-stop pumps required; reservoir refill within 8 hours (preferably automated).
d) Looped water mains around main block with provision for future expansion.
e) Internal risers to be extensions of yard main, with dual valve connections.
f) Underground hydrant pipes preferred; hose cabinets to have IS 2871 universal spray nozzles.

9.11 Manual Fire Alarm System

a) Manual alarm system as per IS 2189 to be provided throughout plant.
b) Fire alarm panels located in control room and fire station control room.

9.12 Emergency Power

a) Emergency power needed for essential services (e.g., oil pumps, lighting, firefighting pumps).
b) Separate station battery banks for each unit and diesel generators

with auto-dead start capability.
c) Emergency lamps with auto-on at failure points like control rooms.

9.13 Additional Fire Protection Measures

a) Oil storage rooms: Sprinklers, HV water spray, or foam/CO_2 extinguishers.
b) Turbines: Auto shutoff devices for water flow and abnormal conditions.
c) Air-cooled generators not less than 100 MW: Must have protection.
d) Waterproof lighting mandatory in sprinkler zones.

9.14 Fire Protection for Power Plants During Construction

a) Higher fire risk during construction; early installation of permanent fire systems is ideal.
b) At least 2-hour firefighting water supply required on site.
c) Temporary 1.25 lakh litre tanks with replenishment if permanent system not ready.
d) Fire safety for material storage, welding/cutting operations essential.
e) Fire-trained supervisor and first aid firefighting equipment (as per IS 2190) mandatory.

9.15 Requirements of Major Fire Fighting Appliances/Equipment and Manpower

On account of the reason that hydra power stations are generally located in relatively remote areas with hardly any other assisting fire service within a reasonable distance, it is necessary for the power stations to be provided with an independent full-fledged and well

maintained fire service of their own. Quick response to a fire outbreak by firefighting service is vital as it makes a difference between a small fire or a major fire with catastrophic loss. In other words, power station fire brigades should be in a position to tackle a fire, control and extinguish it before any damage is done.

9.15.1 *Major Fire Fighting/Appliances /Equipment*

Scales of Major Appliances/Equipment for Power Stations Installed Capacity Less than 50 MW (Class IV Power Stations). There may not be any need for any major firefighting appliances for generating stations of this category, provided the station is located within 8 km from the nearest municipal/local fire brigade possessing adequate firefighting appliances. In case it is located at a further distance, or if the municipal fire appliances are not available, a trailer fire pump conforming to IS 944, or a higher capacity portable pump conforming to IS 12717, should be provided with a skeleton fire staff.

The power stations should have a hydrant system, and also at least three static water tanks of minimum 1.25 lakh litres capacity deployed at strategic locations.

The under mentioned equipment should also be provided:

a) A minimum of 25 lengths of 63 mm diameter firefighting hose of 20 m length each (15 lengths of Type 'A' of IS 636, and 10 lengths conforming to IS 4927);
b) Universal branch pipes conforming to IS 2871 - 4 No;
c) Foam-making branches FB 5X (see IS 2097) - 2 No;
d) Foam-making branches FB 10X (see IS 2097) - 2 No;
e) Mechanical foam compound (see IS 4989) - As required;
f) B.A. sets (positive pressure type) - 4 No;

g) Blower and exhauster for fire-fighting as per IS 941 - 2 No;
h) Water jel blankets (fire blankets) 2 X 1.75 m - 2 No;
i) Water jel blankets (for burns) 1 X 0.75 m - 4 No; and
j) Water jel container - 1 No.

The above equipment should be equally applicable to load dispatch centres in major distribution stations (220 kV sub-stations and above).

Table 1
For Generating Stations of Installed Capacity from 50 MW to less than 200 MW (Class III)

Sl. No.	Type of Appliances	No.	Manning
(1)	(2)	(3)	(4)
i)	Foam and carbon dioxide tender (as per IS 951) Round the clock	1	
ii)	Water tender Type 'B' (as per IS 950) Reserve	1	
iii)	High capacity portable pump as per IS 12717 Reserve	1	
iv)	Portable water/foam monitors	1	
v)	B.A. sets (positive pressure type)	8	(sets at)
vi)	High pressure charging set (for B.A. sets) HQ)	1	
vii)	Blower and exhauster for fire fighting	2	
viii)	Water jet blankets – 2 x 1.75 m	4	
ix)	Water jet blankets – 1 x 0.75 m	8	
x)	Water jet container 2 Fire proximity suits	2	

Table 2
For Generation Stations of Installed Capacity from 200 MW to less than 1000 MW (Class II)

Sl. No.	Type of Appliances	No.	Manning
(1)	(2)	(3)	(4)
i)	Foam and carbon dioxide tender (see as per IS 951) Round the clock	1	
ii)	Dry chemical tender 2 000 kg (see as per IS 10993) Round the clock	1	
iii)	Water tender Type 'B' (see IS 950) Reserve	1	
iv)	High capacity portable pump (see IS 12717) Reserve	1	
v)	Portable water/foam monitors	2	
vi)	13.5 Light alloy extension ladder with rope (IS 4571)	1	

Table 3
For Generating Stations of Installed Capacity 1000MW and above (Class I)

Sl. No.	Type of Appliances	No.	Manning
(1)	(2)	(3)	(4)
i)	Foam and carbon dioxide tender (see IS 951) Round the clock	1	
ii)	Water tender Type '*B*' (see IS 950) Round the clock	1	
iii)	Dry chemical tender 2 000 kg (see as per IS 10993) Round the clock	1	
iv)	Emergency tender as per (IS 949) As reserve	1	
v)	Portable water/foam monitors Reserve	4	
vi)	13.5 Light alloy extension ladder with Rope (IS 4571)	2	
vii)	Lighting van	1	
viii)	Jeep 4 × 4	1	
ix)	B.A. sets (positive pressure type) sets	24	
x)	High pressure charging set (for B.A. sets) set	1	
xi)	Blower and exhauster (IS 941)	1	
xii)	Water jel blankets – 2 × 1.75 m	16	

9.16 Fire Stations

Power stations authorized for full time fire brigades with major firefighting appliances should have well designed fire stations for housing of appliances and firefighting staff. They should be so located that the response time is kept to a minimum, not to exceed 5 min. The design of the Fire Stations should conform to the standard Fire Station requirements as prescribed by the Standing Fire Advisory Council.

9.17 First Aid Fire Fighting Equipment

In the entire power station area, first aid firefighting equipment's like fire extinguishers should be deployed as per the scales prescribed in IS 2190. It is essential that these extinguishers are periodically inspected and maintained in accordance with the provisions contained in IS 2190.

9.18 Fire Emergency Orders

a) Every power station must have a documented fire emergency plan.
b) Should define staff actions during day and night, fire prevention protocols, and fire response organization.
c) Must include mutual aid schemes for support from nearby units.
d) Mock drills/training to be conducted regularly to assess preparedness, with records maintained.

⚠ SECTION 10

(Recommendation of NEEPCO Manual)

10 COMMON HAZARDS

10.1 Hazard Classification (Canals)

Canals are categorized based on proximity and public access:

- **Class A**: Near schools/playgrounds – high child presence.
- **Class B**: Near public recreational areas.
- **Class C**: Near farms/highways – possible child recreation.
- **Class D**: Remote, infrequent personnel visits.
- **Class E**: Hazard to domestic animals.
- **Class F**: Extreme hazard to large wildlife.

10.2 Toxic Fumes

a) Workers must not enter confined spaces (tanks, pits, chambers, etc.) unless air is tested and safe.
b) Ventilation must bring hazardous substances within permissible limits.
c) A permit to enter must be issued after:

1. Isolation and purging of equipment.
2. Air testing for toxicity, flammability, and oxygen sufficiency.
3. Electrical/power disconnections.
4. Personnel training and use of safety gear (e.g., breathing apparatus, 24 V lighting).
5. Rescue team kept on standby.

10.3 Noise Hazards

a) Noise surveys to be done annually by safety department.
b) Areas >85 dBA classified as high noise zones.

c) Audiometry tests required: Pre-employment and annually for exposed workers.
d) Noise control measures:
1. Engineering and administrative controls to maintain levels less than 85 dBA.
2. No exposure allowed more than 115 dBA.
3. PPE (earplugs/earmuffs) must be provided and used.
4. Awareness boards to promote PPE usage.

e) Equipment enclosures and acoustic doors must remain sealed during operation.
f) Regular inspection of PPE and replacement if defective.

10.4 Vibrations

Overhead conductors are affected by vibrations due to wind, corona effect, and snow, which may cause resonance, leading to conductor failure or flashover. Key influencing factors include span tension, bundle and spacer configurations, conductor type, wind velocity, terrain, and nearby trees.

Mitigation:

Vibration dampers (e.g., Stockbridge dampers) are installed to reduce Aeolian vibrations by absorbing wave energy. For distribution lines, twisted wire dampers are used; for EHVAC/HVDC lines, Stockbridge dampers with hollow weights are preferred. Spacers in bundled conductors also enhance damping.

10.5 Lighting, Warning and Signal

For excavation and night work:

a) Ensure adequate lighting and warning signals at pathways, roadways, and all site approaches.

b) Post danger signs and use a flagman with a red flag in hazardous areas.
c) Display directional signs at bends and crossings.
d) Workers climbing slopes must use safety ropes and belts.
Lone work in excavation zones is prohibited.

10.6 Maintenance

10.6.1 *General provisions relating to maintenance*

a) Maintenance starts only with written work permit/line clearance and adherence to LOTO procedures.
b) LOTO must be standardized (by colour, shape, or size), securely fixed, and include clear hazard tags (e.g., DO NOT START).

10.6.1.1 *Maintenance audit*

Entities may form an internal audit committee to ensure compliance with maintenance policies. Observations are submitted to management for action.

10.6.1.2 *Maintenance records*

All maintenance activities must be logged in both soft and hard formats with clear next due dates.

10.6.2 *Fire Hydrant System*

a) Weekly inspections mandatory; monthly tasks include valve checks, water flow tests, paint and brass cleaning.
b) Quarterly pressure/output tests should ensure at least 125 lpm at 5.25 kgf/cm^2.
c) Isolating valves must be operated monthly and overhauled annually.

10.6.3 *Working in confined spaces*

Entry into boilers shall be permitted only after cooling, draining, cleaning, and purging. Permit to work (PTW) must be issued post these activities.

10.6.4 *Skin Burns*

Maintenance near hot surfaces may cause burns. Workers must wear coveralls/boiler suits during cooling and draining.

10.6.5 *Electrical Shock*

Welding and tool usage can lead to shocks. Ensure proper earthing, ELCB protection, and adherence to LOTO to mitigate risk.

10.6.6 *Electric Equipment*

Equipment must be inspected before use and checked each shift. Before work:

a) Switch off current
b) Prevent re-energization
c) Test that equipment is de-energized

10.6.7 *Maintenance of Towers and Structures*

a) Stained structures must be prioritized for coating to prevent corrosion.
b) Corroded structures require costlier and extensive maintenance.
c) Proactive maintenance helps avoid higher costs by intervening before corrosion sets in.

Section 11

(Recommendation of IS 10386 (Part 9) : 1998 and IS 4756 : 1978)

11 SPECIAL WORKS

11.1 Guardrails

Guardrails serve to protect both vehicles and pedestrians:

a) Vehicle guardrails (e.g., along canal bank roads): typically made of steel cables or deflectors on short heavy posts. Reflectors are recommended for visibility at night.
b) Pedestrian guardrails: made of wood or pipe rails; wire mesh is advised to prevent children from passing through.
c) Required on both sides of bridges, open sides of ramps/stairways, and edges with a height of 1.0 m or more.
d) Must be installed around openings in floors, platforms, and low wall openings.

11.2 Bridges

a) All foot and vehicle bridges shall have appropriate guardrails based on the hazard.
b) Mixed-use bridges in populated areas shall include splash-proof barriers between lanes.
c) Operational bridges shall have railings and restricted public access.

11.3 Trash rack and Stilling Basin

a) Operating decks should have nonslip surfaces and guardrails.
b) Stilling basins pose fall hazards:
   1. Use fencing (e.g., chain-link) where wall height is low.
   2. Where walls are 1.2 m or higher, design them to prevent standing or walking.

3. Spillway wing walls require similar protection.

11.4 Canal Safety Devices

a) Sharp turns on canal roads: Guardrails and warning signs.
b) Deep water warnings for potential swimmers.
c) Lined canals of 0.9 m or more vertical height: Install escape ladders every 500 m on both sides and before hazards (e.g., siphons, falls).
d) Fencing is required where hazard risk justifies.

For additional safety in canals, escape devices are provided:

a) Devices include suspended cables with drop lines, floats/booms, escape nets, and modified trash racks to aid self-rescue.
b) Must be positioned above hazardous structures and reach the minimum operating water level to help individuals self-rescue.
c) Floats must support a person's weight.
d) Trash racks may double as escape aids if flattened in slope and paired with escape ladders.

11.6 Falls and Chutes

a) Rectangular falls/chutes 1.5 m or deeper in Class A, B, or C hazard zones must have fencing or guardrails on both sides.
b) For water depths greater than 1.2 m entering such structures, consider installing safety nets or cables with drop lines upstream to aid escape.

11.7 Stop Logs and Bulkhead Gates

a) Bulkheads are preferred over stop logs for temporarily closing penstock inlets or draft-tube outlets, provided suitable hoisting equipment (e.g., truck-mounted cranes) is available.

b) Benefits of bulkheads:
1. Simpler, faster, and safer operation.
2. Tighter seals and better protection for workers.

c) Stop-log grooves should be designed to accommodate bulkhead use.

11.8 Tunneling

a) *Notification Requirement*: Written details (layout, methods, schedule) of tunneling work must be submitted to the Director General or Chief Inspector of Inspection at least 30 days before work begins.

b) *Registers*:
1. Maintain a log of entries/exits at the tunnel site.
2. Maintain a register of employed workers, available on request.

c) *Compressed Air Use*: Submit technical drawings and personnel details for man-locks, medical-locks, and appointed medical officers.

d) *Safety Oversight*:
1. Appoint a Project Engineer for overall safety.
2. Designate a Responsible Person to:
    i) Oversee operations.
    ii) Inspect and fix hazards.
    iii) Prevent unsafe conditions.

e) *Safety Signage*: Post warning signs in Hindi and local language, covering:
1. Dangers of compressed air.
2. Fire/explosion risks.
3. Emergency rescue procedures.

Section 12

(Recommendation of IS 16451: 2018 and IS 9457 : 2005)

12 SAFETY COLOURS AND GRAPHICAL SYMBOLS

12.1 Purpose and Use

To quickly attract attention to safety-related objects/situations and convey clear safety messages. Safety signs must be used only for health and safety instructions.

12.2 Design and Reproduction

12.2.1 *Borders*: Optional, but helpful for visibility; signs must be reproduced accurately.

12.2.2 *Modifications*: Minor graphical adjustments allowed for cultural relevance or application needs, as long as meaning remains clear.

12.2.3 *Mirroring*: Permitted when orientation is non-essential, except for prohibition signs, where the red bar must not block key symbol elements.

12.3 New or Custom Signs

If no standard sign exists, develop one using ISO 3864-1 & 3864-3 principles, or use ISO 7010 general signs with additional information.

12.4 Reference Standard

- For detailed specifications on colour, size, and examples, refer to IS 9457:2005. For illustration, few common signs used in a project are given below.


Caution, Risk of Ionizing Radiation
Caution, Risk of Electric Shock
First Aid
General Indication of Direction
Indication of Direction to First Aid
Eye Protector Must be Worn
Respiratory Protector Must be Worn
Head Protector Must be Worn
Hearing Protector Must be Worn
Hand Protector Must be Worn
Foot Protector Must be Worn

Annex A

List of Referred Standards

IS No.	*Title*
IS 4410 (Part 13) : 1985	Glossary of terms relating to river valley projects Part 13 operation, maintenance and repair of river valley projects
IS 15883 (Part 5) : 2013	Construction project management — Guidelines Part 5 health and safety management
IS 10386 (Part 1) : 2013	Safety code for construction, operation and maintenance of river valley projects Part 1 general aspects (*first revision*)
IS 10386 (Part 2) : 2013	Safety code for construction, operation and maintenance of river valley projects Part 2 amenities, protective clothing and equipment (*first revision*)
IS 10386 (Part 3) : 2014	Safety code for construction, operation and maintenance of river valley projects Part 3 plant and machinery (*first revision*)
IS 10386 (Part 4) : 2013	Safety code for construction, operation and maintenance of river valley projects Part 4 handling, transportation and storage of explosives (*first revision*)
IS 10386 (Part 5) : 2014	Safety code for construction, operation and maintenance of river valley projects Part 5 electrical aspects (*first revision*)
IS 10386 (Part 6) : 2024	Construction, operation and maintenance of river valley projects — Safety code Part 6 constructions (*first revision*)
IS 10386 (Part 7) : 2020	Construction, operation and maintenance of river valley projects — Safety code Part 7 fire safety aspects (*first revision*)
IS 10386 (Part 8) : 2024	Construction, operation and maintenance of river valley projects — Safety code Part 8 open excavation (*first revision*)

IS 10386 (Part 9) : 1998	Safety code for operation and maintenance of river valley projects Part 9 canals and cross drainage works
IS 10386 (Part 10) : 1983	Safety code for construction, operation and maintenance of river valley projects Part 10 storage, handling, detection and safety measures for gases, chemicals and flammable Liquids
IS 10386 (Part 11) : 2012	Safety code for construction, operation and maintenance of river valley projects Part 11 underground excavation
IS 15883 (Part 5) : 2013	Construction project management — Guidelines Part 5 health and safety management
Safety Manual	North eastern electric power corporation ltd safety manual
IS 3786 : 2022	Method for computation of frequency and severity rates for industrial injuries and classification of industrial accidents (*second revision*)
IS 18001 : 2007	Occupational health and safety management system — Requirements with guidance for use (*first revision*)
IS 3096 : 1965	Specification for Fine Grade Palladium
IS 1084 : 2005	Textiles — Manila Ropes — Specification (*fifth revision*)
IS 7205 : 1974	Safety Code for Erection of Structural Steel Work
IS 1179 : 1967	Specification for equipment for eye and face protection during welding (*first revision*)
SP 70	Handbook on construction safety practices
IS 7969 : 1975	Safety code for Handling and storage of building material
IS 4081 : 2013	Blasting and related drilling operations — Code of safety (*second revision*)
Manual ILO	Guidelines on occupational safety and health management systems
IS 1642 : 2013	Fire safety of buildings (general): details of construction — Code of practice (*second revision*)

IS 1646 : 2015	Fire safety of buildings (general): electrical installations — Code of practice (*third revision*)
IS 12777 : 1989	Method for classification of flame spread of products
IS 15793 : 2007	Managing environment', occupational health and safety legal compliance — Requirements of good practices
IS 4756 : 1978	Safety code for tunneling work (*first revision*)
IS 2309 : 1989	Code of practice for the protection of buildings and allied structures against lightning (Withdrawn)
IS 2551 : 1982	Danger notice plates (*first revision*)
IS 3043 : 2018	Code of practice for earthing (*second revision*)
IS 4051 : 1967	Code of practice for installation and maintenance of Electrical equipment in mines
IS 4691 : 1985	Rotating electrical Machines Part 5 Degrees of protection provided by enclosure for rotating electrical machinery (Withdrawn)
IS 5216 (Part 1) : 1982	Recommendations on safety procedures and practices in electrical work Part 1 general (*first revision*)
IS 5216 (Part 2) : 1982	Recommendation on safety procedures and practices in electrical work Part 2 life saving techniques (*first revision*)
IS 5571 : 2009	Guide for selection and installation of electrical equipment in hazardous areas (Other Than Mines) (Third Revision) (Withdrawn)
IS 1260 (Part 1) : 1973	Pictorial marking for handling and labelling of goods: Part 1 dangerous goods (*first revision*)
IS 1446 : 2024	Dangerous goods — Classification (*third revision*)
IS 9964 (Part 1) : 1981	Recommendations for maintenance and operation of petroleum storage tanks Part 1 preparation of tank for safe entry and work
IS 875 (Part 1) : 1987	Code of practice for design loads (other than earthquake) for buildings and structures: Part 1 dead loads - Unit weights of building materials and stored materials (*second revision*)

IS 875 (Part 2) : 1987	Code of practice for design loads (Other Than Earthquake) for buildings and structures: Part 2 imposed loads (*second revision*)
IS 1905 : 1987	Code of practice for structural use of unreinforced masonry (*third revision*)
IS 2750 : 1964	Specification for steel scaffoldings
IS 3483 : 1965	Code of practice for noise reduction in industrial buildings
IS 3696 (Part 1) : 1987	Safety code of scaffolds and ladders: Part 1 Scaffolds (*first revision*)
IS 3696 (Part 2) : 1991	Scaffolds and ladders — Code of safety Part 2: ladders (*first revision*)
IS 3764 : 1992	Code of safety for excavation work (*first revision*)
IS 4014 (Part 1) : 1967	Code of practice for steel tubular scaffolding: Part 1 definitions and materials
IS 4014 (Part 2) : 2013	Steel tubular scaffolding — Code of practice: Part 2 safety provisions for scaffolding (*first revision*)
IS 4081 : 2013	Blasting and related drilling operations — Code of safety (*second revision*)
IS 4082 : 1996	Stacking and storage of construction materials and components at site — Recommendations (*second revision*)
IS 4130 : 2024	Demolition of buildings — Code of safety (*third revision*)
IS 4138 : 1977	Safety code for working in compressed air (*first revision*)
IS 4435 : 1967	Wooden Ladders And Trestles (Withdrawn)
IS 4756 : 1978	Safety code for tunneling work (*first revision*)
IS 4912 : 2024	Temporary protection of floor and wall openings, open-side floors, staircases and guardrail systems — Safety requirements (*second revision*)
IS 5121 : 2013	Piling and other deep foundations — Code of safety (*first revision*)

IS 5878 (Part 2/Sec 1) : 1970	Code of practice for construction of tunnels: Part 2 underground excavation in rock: Sec 1 drilling and blasting
IS 5878 (Part 2/Sec 2) : 1971	Code of practice for construction of tunnels: Part 2 underground excavation in rock: Sec 2 ventilation, lighting, mucking and dewatering
IS 5916 : 2013	Constructions involving use of hot bituminous materials — Code of safety (*first revision*)
IS 6609 (Part 5) : 1972	Methods of test for commercial blasting explosives and accessories: Part 4 safety fuses
IS 6922 : 1973	Criteria for safety and design of structures subject to underground blasts
IS 7205 : 1974	Safety code for erection of structural steel work
IS 7293 : 1974	Safety code for working with construction machinery
IS 7323 : 1994	Operation of reservoirs — Guidelines (*first revision*)
IS 7969 : 1975	Safety code for handling and storage of building materials
IS 8091 : 2018	Industrial plant layout — Code of safe practice (*second revision*)
IS 8989 : 1978	Safety code for erection of concrete framed structures
IS 9706 : 2019	Material handling ropeways — Code of practice (*second revision*)
IS 9759 : 1981	Guidelines for dewatering during construction
IS 9937 : 1981	Specification for portable methanometer (electrical type)
IS 9944 : 2023	Textiles — Natural and man-made fibre rope slings — Recommendations for safe working loads (*second revision*)

Annex B

REPORTING FORMATS

B-1 INCIDENT REPORT FORM

ORGANIZATION LOCATION
Internal Incident no:.....(in NM/FA/MI/DO/FT/Year/no. format)

1. Date of incident.....Time.....Shift Gen 1st 2nd 3rd

2. Location of incident.....

3. Incident Type:

Type of Incident	Nearmiss (NM)	First AID (FA)	Major Injury (M)	Dangerous Occurrence (DO)	Fatality (FT)
Tick					

4. Details of injured person(s) fatality:

Sl. No.	Name	Sex	Age	Employee worker	Employee no./ gate pass no.	Nature of injury (NM / FA/ MI / FT)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)						
ii)						
iii)						
iv)						
v)						
vi)						

5. Description of incident (how the incident occurred):

6. Body parts affected:

Head			Hands			Legs			Trunk			Others
Eyes	Head	Face	Fingers	Arms	Shoulder	Fingers	Foot	Other	Chest	Stomach	Back	

7. Initial causes(s) of incident:

8. Name/ details of witness:

9. Remarks (first aid provided/ other details etc):

Signature of Site/ Dept. in-charge

Name……

……

Designation……

Medical Officer

10. Nature and extent of injuries

11. Period of estimated disablement

Name & Signature of Medical Officer:

Post Injury/ Incident Counselling Provided (if applicable):

Name & Signature of Counsellor

Distribution:

1. Head of Project/ Plant/ Occupier/ Factory Manager.
2. Head of Department
3. Head of Personal & Administration Department
4. Head of Safety Department.

PREPARED	REVIEWED BY	APPROVED BY

B-2 INCIDENT INVESTIGATION REPORT

Investigation Report No.....	Ref: Internal Incident No.....

Incident Title:

Location:

Incident Date: Time:

Investigation Initiated on:

Investigation Team:

1. Description of Accident:

2. Details of Injured Person(s) fatality:

Sl. No.	Name	Sex	Age	Employee/ worker	Employee no./ gate pass no.	Nature of injury (NM/ FA /MI/ FT)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)						
ii)						
iii)						
iv)						
v)						
vi)						

3. List of Name of Witness and Person Interacted During the Investigation:

4. Information from witnesses:

5. Part of Body Injured:

Head			Hands			Legs			Trunk			Others
Eyes	Head	Face	Fingers	Arms	shoulder	Fingers	Foot	Other	Chest	Stomach	Back	

a) Remarks (Name of Doctor, Dispensary at with Injured Person Gets First Aid Treatment, Details of First Aid Provided Etc):
b) Previous Accident Record of Injured Person:

c) Whether Injured Person at the time of Accident Wear Proper PPEs:

d) Whether Victim Person was Trained on at Site/ Workplace for Assigned the Job:

e) Whether the Injured Person was Under the Influence of Alcohol or Drugs at the of Accident:

f) Is the Injured Person Wilfully Misuses any Application or other things Provided for Securing Health, Safety of Workers:

g) Whether the Injured Person Wilfully Disobeyed any Order Given or Wilfully Neglects to Make use of Appliances or other Things Provided for Securing Health, Safety of Workers in the Industry:

h) Causes of Accident

i) Remedial/ Corrective Measures to Reoccurrence of Incident:

j) Action Plan for Remedial Measures

Sl. No.	Remedial Actions/ Measures	Target Date	Responsible Person	Status (Closed/ Open)	Remark
(1)	(2)	(3)	(4)	(5)	(6)
i)					
ii)					

6. Closing of Incident Investigation Report:

I/We hereby confirm the all remedial measures mentioned above by investigation team has been completed by the responsible person(s) within timeframe and hence this incident investigation report has been closed.

Sign: Sign: Sign:

B-3 PERMIT TO WORK AT HEIGHT

PERMIT NO.		
1. SITE DETAILS Date of Issue - Site Location: -		Record No:

2 SAFETY PRECAUTIONS REQUIRED TO BE FULFILLED AT SITE

Sl. No.	Safety Measures to be followed	YES	NO	NA
1.	Whether all work at Height equipments and tools / tackles are available at site and whether they are previously inspected by concern person and found safe to use?			
2.	Whether Area at ground level is cordoned off with rigid / chain link / fencing, so that no unauthorized people can enter the site?			
3.	Whether safety net is provided under working site to protect fall of person(s)?			
4.	Whether visual inspections of the WAH system and equipments are carried out prior to start of work. (Remove the equipment from site if any defect is found)			
5.	Whether two lines of safety (i.e. safety harness with lanyards and fall arrestor) are provided and both lines of safety are attached firmly to separate fixed / rigid structures?			
6.	Whether appropriate PPEs are available and used by site persons - (a) Full Body Safety Harness with lanyards (b) Fall arrestor (c) Hard Hat (d) Safety goggles (e) Safety Shoes (f) hand Gloves etc.			
7.	Whether Safety instruction boards and signage has been displayed at site (No Smoking, Work in progress, restricted area, Sorry for Inconvenience, Emergency contact numbers etc)			

8.	Whether workers and Supervisor are trained and experienced in working at height?			
9.	Whether workers have undergone height pass test and whether they have passed height pass test?			
10.	Whether workers are having problems like vertigo, epilepsy etc. which may cause dangerous to worker(s) during working at height?			
11.	In case of hot job at height whether it is ensured that no combustible / flammable material is available under the job location?			
12.	Whether Scaffold is erected as per the standard? (base plate, sole plate, cross bracings, proper and adequate means of access etc.)			
13.	Whether Scaffold is inspected by competent officer and provided GREEN TAG indicating safe to use?			
14.	Whether safe platform (with ladder, toe guard, handrails, rigid platform etc) provided to worker to protect against fall from height?			
15.	Whether Hazard Identification and Risk Assessment (HIRA) is carried out for the job site and record is maintained?			
16.	Whether Fire extinguisher with valid testing/refilling dates is available on site.			
17.	Whether First aid box in replenished condition is available at site?			
18.	Whether Tool Box Talk has been conducted before commencement of work and record is maintained?			

ANNEX C

RELEVANT INDIAN LEGISLATION ON OS&H AND THE ENVIRONMENT

(IT IS ONLY ILLUSTRATIVE AND NOT EXHAUSTIVE)

1	*The Factories Act*, 1948 *(Amended* 1987 *and* 2001*) and the State Factories Rules of respective States*	29	*The Gas Cylinders Rules*, 2004
2	*The Mines Act*, 1952 *(Amended* 1984*)*	30	*The Static and Mobile Pressure Vessels (Unfired) Rules*, 1981 *(Amended* 2002*)*
3	*The Mines Rules*, 1955 *(Amended* 1989*)*	31	*The Petroleum Act*, 1934
4	*The Coal Mines Regulations*, 1957	32	*The Petroleum Rules*, 2002
5	*The Metallic-Ferrous Mines Regulation*, 1961	33	*The Calcium Carbide Rules*, 1987
6	*Mines Vocational Rules*, 1966	34	*The Insecticides Act, 1968 and Rules*, 1971
7	*The Oil Mines Regulations*, 1984 (*Amended* 1996)	35	*The Poison's Act*, 1919 *and Rules*, 1972
8	*The Mines Rescue Rules*, 1985	36	*The Environment (Protection) Act*, 1986 (*Amended* 1991)
9	*The Dock Workers (Safety, Health and Welfare) Act*, 1986	37	*The Environment Protection Rules*, 1986 (*Amended* 2006)
10	*The Dock Workers (Safety, Health and Welfare) Regulations*, 1989	38	*The Hazardous Wastes (Management and Handling) Rules*, 1989 (*Amended* 2003)
11	*Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act*, 1996	39	*The Manufacture, Storage and Import of Hazardous Chemical Rules*, 1989 (*Amended* 1994/2000)
12	*Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules*, 1998	40	*The Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms, Genetically Engineered Micro-organisms or Cells Rules*, 1989

13	*The Plantation Labour Act*, 1951 *and the Rules and Regulations*	41	*Environmental (Protection) Rules- "Environmental Statement"* 1992/1993
14	*The Building and Other Construction Workers' Welfare Cess Act*, 1996 *and Rules* 1998	42	*Environmental (Protection) Rules- "Environmental Standards"* 1993
15	*Indian Port Act*, 1908 *and Rules thereunder*	43	*Environmental (Protection) Rules- "Environmental Clearance"* 1994
16	*The Shops and Commercial Establishment Acts enacted by respective State Governments*	44	*Environment (Protection) Rules- "Environmental Standards"* 1996
17	*The Workmen's Compensation Act*, 1923 *and Rules* 1924	45	Prohibition on the Handling of Azadyes, 1997
18	*The Maternity Benefit Act*, 1961	46	*The Ozane Depleting Substance (Regulation and Control) Rules*, 2000
19	*The Employees' State Insurance Act and Rules*	47	*Battery Management and Handling Rules*, 2001
20	*The Motor Transport Workers Act*, 1961 *and Rules*, 1964	48	*The Public Liability Insurance Act*, 1991 *and Rules*, 1991
21	*The Electricity Act*, 2003	49	*The National Environment Tribunal Act*, 1995
22	*The Indian Electricity Rules*, 1956	50	*National Environmental Appellate Authority Act*, 1998
23	*The Indian Boilers Act, 1923 (Amended* 1960)	51	*The Water (Prevention and Control of Pollution) Act, 1974 and Rules*, 1975
24	*The Indian Boilers Regulations*, 1950 (*Amended* 1997)	52	*The Water (Prevention and Control of Pollution) Cess Act*, 1977 *and Rules*, 1978
25	*Boilers Rules of various States*	53	*The Air (Prevention and Control of Pollution) Act*, 1981 *and Rules*, 1982/1983
26	*The Dangerous Machines (Regulation) Act*, 1983	54	*Drugs and Cosmetics Acts and Rules*, 1995
27	*The Fatal Accidents Act*, 1855	55	*Motor Vehicles Act*, 1988
28	*The Explosives Act*, 1884 *(Amended* 1983) *The Explosives Rules*, 1983 *(Amended* 2002)	56	*Motor Vehicles (Central) Rules*, 1989

ANNEX D

TYPICAL FORMAT OF LEGAL REGISTER

Sl. No.	Products, Processes or Services	Legislation on OHS	Date of Effect	Validity Date F1' mt/ To	Reference of Applicable Chapter/ Scc. Rule	Person Responsible for Complain	Frequency of Reporting	Reference to Procedures and Control	Record to Submitted to External Agency
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									

ANNEX E

(*Clause* **4.6.1**)

TYPICAL RECORD OF GOOD PRACTICES RELATED TO ENVIRONMENT, OCCUPATIONAL HEALTH AND SAFETY

D-1 Records under the good practices for compliance with the legal requirements related to environment, occupational health and safety can include, among others:

1	Safety organization chart	18	Calibration and testing records
2	Training records	19	Inspection books and other statutory records
3	Record of plant safety inspections	20	Records of previous audits
4	Accident investigation reports	21	Complaint records
5	Accidents and dangerous occurrences- statistics and analysis	22	Process monitoring records
6	Record of tests and examinations of equipment and structures as per statutes	23	Pertinent contractor and supplier records
7	Safe operating procedures for various operations	24	Management review results
8	Record of work permits	25	External communications
9	Record of monitoring of flammable and explosives substances at workplace	26	Records of applicable legal requirements
10	Maintenance and testing records of fire detection and fire-fighting equipment	27	Statutory licenses, consents and approvals
11	Medical records of employees	28	Legal compliance records

12	Material safety data sheets	29	Communications with interested parties
13	On-site emergency plans and record of mock drills	30	Water consumption record
14	Records of waste disposal	31	Tree plantation record
15	Housekeeping inspection records	32	Environmental statement
16	Minutes of safety committee meetings	33	Records of ambient air quality and stack monitoring
17	Records of any modifications carried out in plant or process	34	Environment management plan