CHAPTER-7
ADDITIONAL STUDIES - RISK ASSESSMENT & DISASTER MANAGEMENT PLAN

As per generic structure of the EIA/EMP report prescribed in EIA Notification dated 14.09.2006, this chapter is to comprise of public consultation, disaster management, social impact assessment and R&R Action plan. The aspect of R&R has already been covered in section 4.11, Chapter 4. Public Hearing has been held on the basis of draft EIA report and added in this Chapter at section 7.5. The Corporate Social Responsibility (CSR) has been detailed in Chapter 9. Only the aspect of disaster management plan has been covered in this chapter.

This chapter deals with identification of hazards and disaster and preventive measures for disaster. Proposed Expansion of Dhenkanal Steel Plant may face certain types of hazards which can disrupt normal activities abruptly and lead to disaster like fires, inundation, failure of machinery, hot metal spill, electrocution to name a few. DRI plant, WHRB plant, etc. also pose fire, electrocution, spill and explosion hazards. Disaster management plan is formulated with an aim of taking precautionary steps to control the hazard propagation and avert disaster and also to take such action after the disaster which limits the damage to the minimum.

Definitions pertinent to this chapter are:

- "Hazard" is a source or a situation with the potential for harm in terms of human injury or ill-health, damage to property, damage to the environment, or a combination of these.

- "Risk" is defined as a likelihood of an undesired event (accident injury or death) occurring within a specified period or under specified circumstances. The level of risk reflects the likelihood of the unwanted event and the potential consequences of the unwanted event.

- "Incident" is a "work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

- "Accident" is a particular type of incident in which an injury or illness actually occurs.

- "Emergency" is an unexpected occurrence requiring immediate action.

- "Disaster" is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origin.

7.1 HAZARD IDENTIFICATION AND RISK ASSESSMENT

As a consequence of health and safety awareness many measures are being taken to ensure the security of an individual working in the industrial premises. Risk assessment follows an extensive hazard analysis. In the working atmosphere, it is not possible to avoid or eliminate risk factor completely. However it is possible to minimize the risk factor to minimal or acceptable level.

The risk assessment process includes:

1. Identification of a hazard and associated risk.
2. Assessment of the risk, which includes the likelihood, the severity and assigning a priority for correction followed by control of the risk, which includes elimination, engineering a barrier, administration controls and personal protection equipment.
3. Documentation of the process.
4. Monitoring and review of the process.

7.1.1 Identification of a hazard and associated risk

The hazard shall be higher for workers directly exposed to coal handling areas where not only the danger due to failure of machinery but also inhalation of dust exists. In other areas where heat generating equipment such as boiler and steam conduits are there, the risks pertain to exposure to heat and hazard of explosion due to high pressure. Several examples of hazards that may cause injury or illness can be:

(i) slips, trips and falls on the same level;
(ii) falls from height;
(iii) unguarded machinery;
(iv) falling objects;
(v) engulfment;
(vi) working in confined spaces;
(vii) moving machinery, on-site transport, forklifts and cranes;
(viii) exposure to controlled and uncontrolled energy sources;
(ix) exposure to mineral wools and fibres;
(x) inhalable agents (gases, vapours, dusts and fumes);
(xi) skin contact with chemicals (irritants (acids, alkalis), solvents and sensitizers);
(xii) contact with hot metal;
(xiii) fire and explosion;
(xiv) extreme temperatures;
(xv) radiation (non-ionizing, ionizing);

(xvi) noise and vibration;

(xvii) electrical burns and electric shock;

(xviii) manual handling;

(xix) failures in automation

(xx) flammable liquids in the presence of ignition sources.

(xxi) poorly designed tools having the potential to cause injury.

(xxii) degraded and worn hand tools.

(xxiii) used/ waste oil on the floor, causing a slipping hazard

There can be hazards on the road while coming and going from duty, during transportation of material as follows:

- High concentration of traffic during duty hours
- Heterogenous traffic
- Violation of traffic rules/ speed limit
- Road Condition
- Condition of vehicle

In the existing plant & proposed expansion project, type of likely hazards and possible areas where this can occur are tabulated in **Table No. C7-1**.

Table No. C7-1: Hazard identification of the proposed expansion of steel plant

Group	Item	Nature of Hazard	Hazard Potential
Raw materials handling	Coal for DRI, coking, CPP, etc	Fire	Moderate
Chemical handling	Water treatment Chemicals like acids/ alkalis	Toxic, corrosive	Major
	Lube oils/greases	Fire	Moderate
Production units			
- Iron making	Release of untreated DRI/ Blast furnace wastewater	Contaminated, can cause Pollution of surface water	Major
	Blast furnace reactor	Explosion, flying debris, spreading of hot material to surroundings, damage, fore, fatality, injury	Major
	Slag pipe & slag pit	Explosion, fire	Major
	Blast furnace gas	Fire, toxicity due to CO, asphyxiation	Major
	Dolochar/ hot metal & slag handling	Fire/ Heat radiation & injury	Major

Group	Item	Nature of Hazard	Hazard Potential
- Steel making	Release of untreated furnaces wastewater	Contaminated, can cause water pollution	
	Hot liquid steel & slag Handling	Heat radiation, contact with hot metal, injury, fatality	Major
	Electric Arc Furnaces, submerged arc furnaces, Basic oxygen Furnace & other furnaces	Explosions, fatality, injury, heat radiation, contact with hot metal	Major
- Rolling Mills	Gas firing/ fuel firing	Fire	Major
	Release of untreated wastewater	Contaminated, can cause water pollution	Major
- Annealing	Heating & cooling processes, core sanding	Heat radiation, injury	Moderate
- Pickling	Acid treatment effluents, fumes and sludges	Toxicity, Pollution of surface water, hazardous waste	Major
- Galvanizing	Electrolysis effluents and fumes, zinc skimmings, zinc dross, sludges etc	Toxicity, Pollution of surface water, hazardous waste	Major
- Coke Plant	Dusts and fumes	Asphyxiation, Air pollution	Moderate
	VOC emissions from battery	Toxicity	Moderate
	Coke oven gas	Fire & Toxicity	Major
- Agglomeration (Sintering, pelletisation)	Dusts	Respiratory issues, ambient air pollution	Moderate
- Captive Power Plant (CPP)	Coal, middlings	Fire	Major
Utilities			
- Fuel gas	Gas leaks	Fire & Toxic	Major
- Electric Power Supply	Electrical components, cables	Fire, shock, injury	Major
- Liquid fuel	Fuel handling & storage area	Fire & Toxicity	Major
- Hydraulic oil and lubricants	Accidental discharge of hydraulic oil under pressure	Fire & Toxicity, injury	Moderate

Accidents are more common in the older plants compared to those built with new technology and inbuilt safety features. Some, but not limited to these, known case studies of where the hazards converted into incidents and/ or accidents, which should be studied in detail by the company while operating the plant are as follows:

- 8 November 2001 - Blast Furnace no. 5 of Corus, Port Talbot where the ingress of cooling water into the blast furnace containing hot metal caused significant internal overpressure within the lower part of the furnace, causing an explosion.
- 13 November 2013 - Explosion in slag pit/ pipe due to reaction with water in blast furnace no. 2 of Bhushan's Steel Plant at Mermundali, Dhenkanal, Odisha.
- 15 August 2017 - Blast (explosion) occurred at a coke oven at Gerdau's plant in the center-south state of Minas Gerais, Brazil.
- 1 November 2017 - At Unchahar Thermal Power Station of NTPC, in a 500 MW boiler, ash buildup caused the unit to over-pressurize, which caused an explosion that released hot gas, killing several workers instantly.
- Explosions in Electric Arc furnace plants, is common enough that on an average, one accident comes light every year from various parts of the world. The most common cause is the explosion caused by water leak in cooling system.

7.1.2 Assessment of the risk and its control

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of potential impact. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population, etc. Much of this information is difficult to get or generate. Consequently the risk analysis is often confined to maximum credible accident studies.

Risk evaluation

The risk may be computed by the following formula:

$$FAR = \frac{108}{24*365*N} \sum_{i=1}^{n} (xi*fi)$$

Where:

FAR	=	Fatality accident rate
xi	=	Number of deaths from a particular accident
fi	=	Frequency of occurrence of the particular accident
n	=	Potential types of accidents
N	=	Total number of people at risk

The above concept of risk is quite straight forward. It is based on one specific aspect i.e. individual working in a particular environment that is exposed to a definite level of risk. In the present case of risk analysis in context, this formula is the best and appropriate to serve the practical purpose.

The formula is based on actual historical record of the accident episodes reported in that particular type of environment.

All systems natural or man made shall be subject to failure. The nature of failure varies widely as do the causes of failure and the events leading to failure. The failure of systems could be due to:

- Misconception of required capability of systems or environment.
- Design deficiencies and erroneous assumption.
- Errors in operational process
- Improper management of the systems.
- Risk evaluation to determine the acceptable level and reduce the risk level.
- Control decision monitored for meticulous implementation to prevent the occurrence of unclassified and unacceptable accidents.

Attempts have been made to reduce failures of man-made systems with the introduction of safety measures, quality control, reliability analysis, condition monitoring and other approaches in design in order to reduce the probability of failure. Use of measures such as factor of safety shall be usually resorted to in order to improve the reliability of design and where health of the person is at great risk. Such factor has to be very high reducing probabilities of accidents/ disaster to a very low level.

Light Diesel Oil (LDO), Furnace oil (FO) & High Speed Diesel (HSD) are/ will be required at existing, under construction as well as to be constructed steel plant and the same will be required after proposed expansion project and installation of additional facilities. For storage of auxiliary fuels, underground fabricated steel tanks have been installed in existing plant and shall be installed for expansion areas, which shall conform to the regulations. Since the tank(s) shall not be above ground, assessment of fire in tank and pool fire in dyke have not been carried out.

The fuel storage tanks shall be operated at ambient conditions. Fire hydrant points and fire extinguishers shall be provided at these locations. The characteristics of auxillary fuel based on IS 11489 -1985 (Reaffirmed in 2020) has been given in **Table No. C7-2**.

Table No. C7-2: Fuels characteristics

Sl. No.	Characteristics	Unit	Specifications		
			FO	HSD	LDO
1.	Density @ 15ºC,Max	gm/ml	0.991	0.845	0.909
2.	Flash Point COC Min	ºC	66	35	66
3.	Gross Cal Value, Min	Cal/gm	10000	10,500	10,400
4.	Pour Point, Max	ºC	15	3 (winter) & 15 (Summer)	+ 21
5.	Sediment, Max	%/Wt.	0.25	0.05	0.10
6.	Sulphur Total Max	%/Wt.	4.0 %	350 mg/kg	1.5 %
7.	Water Content Max	%/Vol.	1.0	0.05	0.25
8.	Ash Percentage Max	%/Wt.	0.1	0.01	0.02

"Hazard Identification, Risk Assessment, Emergency Plan & Disaster Management Plan" has been prepared by Prof. B. C. Meikap, Department. of Chemical Engineering, Indian Institute of Technology, Kharagpur. The report has been prepared as follows:

- Unit wise hazard identification is done through steps like the discussion with the plant personnel and reviewing related literature. From the above-mentioned steps the system description, identification of hazardous energy sources, hazardous energy processes/events, human negative interaction for every section are identified.
- Based on the identified hazards a detailed questionnaire for each of the sections is prepared and distributed among the experts. After data collection from the experts, the fuzzy failure mode and effect analysis (FMEA) technique is conducted to provide the quantified values (risk values) of each of the hazard on a scale of 0-1. Then, the hazards are ranked based on the descending order of the risk values in every section.
- From risk values, it is also observed that the hazards of a particular section can be clustered in five different groups, namely hazards with very low risk, low risk, medium risk, high risk, and very high risk.
- Further, Pareto chat for every section is also provided to verify the critical hazards obtained from the clustering. In order to reduce the impact of the hazards or eliminate the hazards with higher rankings (critical hazards) in each section, certain actions must be taken and activities must be modified.
- Hence, based on the list of the critical hazards, obtained from the clustering and Pareto analysis, risk control systems are suggested for each of the section. These risk control systems are useful in preventing the hazards as well as mitigating the effect of the hazards.

- Finally, a risk control measure matrix including best practices around the world has been proposed for controlling and improving the safety of the entire organization.

The findings of the reports have been summarised in **Table No. C7-3**.

Table No. C7-3: Unit wise risk assessment and control systems

Sl. No.	Name of Unit	No. Of Hazards analysed	Highest Ranking Hazard	Hazards in very high risk ranking group	Risk Control Systems
1	Pelletisation Plant	67	Gas leakage	• Gas leakage • Fine dust deposition • Fire and explosion • Rotating machines	• Pressure sensors • Alarm system • Regular inspection and maintenance • Proper training and communication among the workers • Covering of the rotating machines • Standard operating procedures (SOP) for working near rotating machines • Permit to work near rotating machines
2	Coal Washery Plant	8	Coal handling and storage	• Coal handling and storage	• Open-mesh walkways/fencing in critical zones • SOPs for authorised entry • Proper communication with ground workers • Proper training on material handling • Dust extraction system • Permit to work in confined spaces • Regular inspection and maintenance
3	DRI Plant	46	electrical shock due to electrical panels	• Electrical shock • Fine hot dust • Fire hazard	• Proper PPEs • Permit to work • Proper covering of electrical panels • The competent authority for electrical work • Regular inspection and maintenance to control the fine hot dust deposition • Alarm system • Regular monitoring of DRI storage area • Temperature sensors in the storage area to detect overtemperature situation • Reroute the waterworks to avoid the water availability in close vicinity of the storage area • Proper drying of sponge iron

Sl. No.	Name of Unit	No. Of Hazards analysed	Highest Ranking Hazard	Hazards in very high risk ranking group	Risk Control Systems
					before storing it
4	Mini Blast furnace	44	Inhalable agents (gases, vapors, dust, and fumes)	• Inhalable agents (gases, vapors, dust, and fumes) • Handling hot liquid, dust, heat • Exposure to gas leakage • Slip/trip/fall & material falling from the height	• Proper PPEs(dust mask, safety goggles, safety gloves, footwear, and other leg protection guard) • SOPs for working near hot metal • Permit to work • Effective audible and visual communication devices. • Proper training for handling liquid metal • Provision of hand railing near pig casting machine (PCM) pouring end • Online Gas monitoring at strategic locations • Portable "CO" monitors to detect gas leakage • Proper and regular housekeeping • Fencing at critical zones
5	Sinter Plant	44	structural corrosion	• Structural corrosion • Dust, fine dust deposition • Noise • Fine hot dust • Hot flue gases • Rotating machinery/Rotating parts of the conveyor system	• Regular inspection, maintenance, and cleaning of structural components of the plant • Proper PPEs (dust mask, earplugs, fire retardant jacket, safety goggles, safety gloves, footwear, and other leg protection guard) • Dust extraction (DE)/De-dusting system (avoid manual cleaning) • Permit to work • Separate glass cabin for tanker staff • Signage in the high noise area • Proper training and communication among the workers • Covering of the rotating machines • Standard operating procedures (SOP) for working near rotating machines
6	Coke Oven Plant	18	gas off take system	• Gas off take system • Gas Leakage and backfire in cellar and gas pipelines	• Installation of oven positioning system to ensure the exact oven opening • Proper training of oven top man • Proper SOPs for staying away from the flue caps and charging holes • Proper PPEs (dust mask, fire retardant jacket, safety goggles) • Pressure sensors • Auto opening system of the bleeder valve • SOP to avoid unauthorized entry

Sl. No.	Name of Unit	No. Of Hazards analysed	Highest Ranking Hazard	Hazards in very high risk ranking group	Risk Control Systems
					• Online Gas monitoring at strategic locations • Portable "CO" monitors to detect gas leakage • Fire detector inside the cellar
7	SMS Electric Furnace	17	ladle cars	• Ladle cars • Rotating machinery	• The siren facility in cranes • Proper communication and coordination with shop floor movement • Installation of oven positioning system to ensure the exact oven opening • Effective audible and visual communication devices • Guarding to the rotating parts • Emergency switch availability • Proper PPEs during maintenance of rotating machinery
8	SMS Induction Furnace	11	pressurized vessels	• Pressurized vessels • Splashing slag	• Use of pressure sensors • Alarm system • Regular inspection and maintenance of pressure vessels, and calibration of switches • Ensure proper functioning of the auto drain valve • Proper communication and coordination with shop floor movement • Covering the splash exposed area • Wearing proper PPEs
9	Rolling Mill Long Product	26	gas cutting/ lancing (to remove cobble)	• Gas cutting/ Lancing (to remove cobble) • Falling of material • Gas poisoning due to leakage of gas • Loco movement • Slippage of tools • Trailer Movement	• Proper PPEs (Safety gloves, mask, fire retardant jacket, safety goggles) • SOPs for authorized access in the area • Cleaning of surroundings during gas cutting • Power backup for magnetic cranes • Effective audible and visual communication devices • VR based proper training to the operators • Fencing in critical zones • Provide open-mesh walkways wherever possible • Barricade on the sides of the track • Proper leveling of tracks • Clearly specify loading areas • Avoid over speeding inside the

Sl. No.	Name of Unit	No. Of Hazards analysed	Highest Ranking Hazard	Hazards in very high risk ranking group	Risk Control Systems
					plant
10	Rolling mill flat product	21	major repair job in rolling mill (automatic)	• Major repair job in rolling mill (automatic) • Handling of heavy loads (mill gearbox, mill motors, blowers, etc.) • Fire/ Explosion hazards • Hazards due to material transfer trolley • Roller Table Change	• Proper PPEs (Safety gloves, mask, fire retardant jacket, safety goggles, footwear, and other leg protection guard) • Permit to work during the repair • SOPs for repair work (depressurize pipelines before dismantling, removing inflammable substance before welding to be carried out, earthing of electrical equipment, power shut down, prechecking tools) • Barricading to control the unwanted movement in the repair area and below the heavy loads • Providing correct lifting tackles • Proper insulation of electrical wires to avoid overheating • Cooling and maintenance of electrodes • Power backup for magnetic cranes • Guarding to the rotating parts • The competent person for repair work
11	Cement Plant	23	noise	• Noise • Fine hot dust • Falling of material • The explosion in the boiler area and turbine room • Fire • Collapse - dust emission and material spillage	• Proper PPEs (earplugs, dust masks, safety helmet, safety gloves, fire retardant jacket, safety goggles, footwear, and other leg protection guard) • Open-mesh walkways/fencing in critical zones • SOPs for authorized access • Regular inspection and maintenance of boiler and turbine area, and silo's structure • Temperature sensors to detect over temperature situation • Signages for no smoking and no open flame • Barricading to control the unwanted movement in the repair area and below the heavy loads • The facility of lightning arresters at the top of the silos • Proper insulation of electrical wires to avoid overheating • Silo structure monitoring using sensors • Avoid overfilling of silos

Sl. No.	Name of Unit	No. Of Hazards analysed	Highest Ranking Hazard	Hazards in very high risk ranking group	Risk Control Systems
12	Power Plant	18	failure of Safety Relief devices	Failure of safety relief devices	• Regular inspection and maintenance • Proper PPEs (earplugs, safety helmet, safety gloves) • Pressure sensors
13	Lime Plant	3	dust particles/ small particle of limestone	-	• Proper PPEs (dust mask, safety goggles, earplugs, safety helmet, safety gloves) • Dust extraction (DE) system • Preventing calcium oxide contact with moisture and water • Regular inspection near lime production
14	Oxygen plant	5	enormous release of heat	-	• Pressure sensors • Continuous lubrication to reduce the friction and heat generation • Provision to avoid chemical reactions • Improve the design of fins to optimize the heat release • The latest corrosion protection technique • Proper PPEs (earplugs, mask, safety helmet, safety gloves, fire retardant jacket) • Sensors to detect the leakage of oxygen • Provision of proper separation layers • Regular inspection and maintenance by a competent authority

Risk control has been further summarised in **Table No. C7-4**.

Table No. C7-4: Risk Control Systems for entire organisation

Plants	Risk control systems							
	Inspection and maintenance	Staff competency	SOPs	Alarm	Communi-cation	Permit to work	Plant design	Emergency arrangement
Palletization Plant	√	√	√	√		√		√
Coal washery plant	√	√	√		√	√		√
DRI	√	√	√	√		√		√
Mini blast furnace	√	√	√		√	√		√
Coke oven plant	√	√	√			√		√
SMS electric furnace	√	√	√	√	√	√		√

Plants	Risk control systems							
	Inspection and maintenance	**Staff competency**	**SOPs**	**Alarm**	**Communi-cation**	**Permit to work**	**Plant design**	**Emergency arrangement**
SMS induction furnace	√	√	√	√	√	√		√
Rolling mill long product	√	√	√	√	√	√		√
Rolling mill flat product	√	√	√	√	√	√		√
Cement plant	√	√	√			√		√
Power plant	√	√	√			√		√
Lime plant	√	√	√			√		√
Oxygen plant	√	√	√			√	√	√

The HIRA report further concludes and recommends the following based on the overall analysis, for the entire organisation:

- Standard operating procedures (SOPs) for every section and general works. A system for adherence to the SOPs is also required.
- Personal protective equipment (PPEs) such as dust masks, safety goggles, safety gloves, safety helmets, safety vest, fire retardant jacket, earplugs, etc. should be made compulsory. Workers without appropriate and required PPEs should not be allowed at the worksite.
- Smart PPEs (IIoT: Industrial Internet of Things) may be more useful in detecting the workers without PPEs and workers using PPEs inappropriately.
- Sensor-based real-time monitoring such as pressure sensors, temperature sensors, etc. at different locations may be useful in controlling several hazards
- Proper training, especially to handle the liquid molten metal and to transfer the material through electrical overhead cranes, is necessary. Virtual/Augmented reality-based training to the operators is recommended here.
- Regular inspection, maintenance, and housekeeping for every section of the entire organization need to be ensured.
- Only competent personnel should be allowed for electrical and maintenance work.
- Permit to work using different colored lock system should be made compulsory.

- Energy isolation before the maintenance should be made compulsory.
- Proper communication among workers is necessary. So, effective audible and visual communication devices must be available in working condition. Some smart communication techniques may be more useful here.
- Danger signages at the required places must be available.
- The alarm system in every section must be available for emergency situations.
- Dust/fume extraction system should be implemented at the required places.
- On-line gas leakage detectors at the required places should be installed.
- The use of hand railings while using staircases should bring in culture. The three-point contact concept should be implemented.
- A safety management team, including safety experts, should be formed. This team will conduct meetings with the supervisors of every section. These meetings will be helpful for supervisors in identifying the hazards at their site. Accordingly, they may report the management and corrective actions may be taken.

7.1.3 Emergency Plan & Disaster Management Plan

Risk can be controlled through emergency planning, which has two aspects - on site as well as off site planning, as discussed below:

On site emergency planning

The on site emergency plan would be related to the final assessment and it is the responsibility of the management to formulate it. The plan must therefore, be specific to the site.

The plan sets out which designated people at the site of the incident initiate supplementary action either inside or outside the workers at an appropriate time. An essential of the plan is the provision for making the affected unit safe, for example, by shutting it down. The plan also contains the full sequence of key personal to be called in from other sections or from off site.

This is further detailed in section 7.4.

Off site emergency plan

The off site emergency plan is an integral part of any major hazard control system. It should be based on those accidents identified by the works management, which could affect people and the environment outside the works.

Thus, the off site emergency plan follows logically from the analysis that took place to provide the basis for the on site emergency plan and the two plans should therefore complement each other.

The key feature of a good off site emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan. The role of the various parties that may be involved in the implementation of an offsite plan are described in detail. The responsibility for the off site plan will be likely to rest either with the works management or with the local authority.

7.1.4 Monitoring and review of the process

For the effective implementation of the Onsite Emergency plan several measures are and will be taken. For example, Emergency Mock Drills are conducted at shop floor on regular basis as per the schedule. The findings of the mock drills are recorded in the prescribed format and actions are taken on the recommendations, if any.

The Onsite Emergency Plan is also reviewed by Safety department in consultation with departments concerned. Revision is done in the onsite emergency plan if there is any major modification in plant or process and in case of any dangerous occurrence. These aforementioned activities shall be continued in the expansion phase also.

7.2 TYPE OF DISASTER AT INTEGRATED STEEL COMPLEX

Disaster can be natural or man made which have a negative impact on society or environment or both.

1) Natural disasters

A natural disaster is the consequence of a natural hazard (e.g. earthquake, flood, tsunamis, hurricane, etc.) which affects humans. The damage is caused by the lack of appropriate emergency management leading to financial, environmental and human life loss. Due to the location of this plant, earthquake is the first and foremost natural hazard followed by flooding. This area is not near the coast and thus, is not affected by tsunamis or hurricanes.

2) Man-made disasters

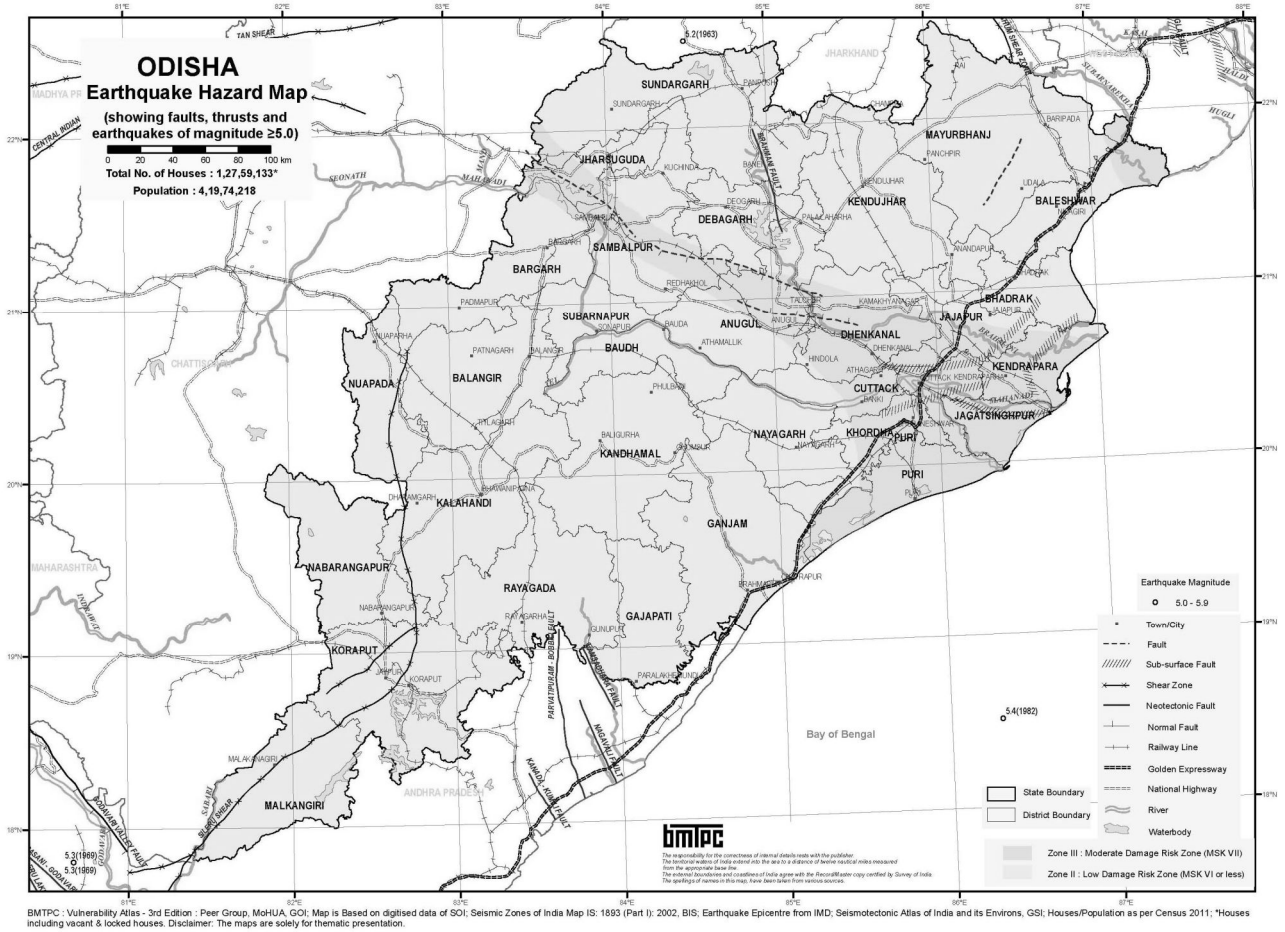
The man-made disasters shall be caused by human action, negligence, error, or involving the failure of a system. Human-made disasters can be termed as technological disaster. Technological disasters shall be the results of failure of technology involving material, design, system or operational failures.

7.2.1 Natural disasters

7.2.1.1 Seismic & Earthquake risk management

Districts that lie in the Mahanadi river valley lie in Zone II, and within Odisha this zone stretches from Jharsuguda along the border with Chhatisgarh in a south-easterly direction towards the urban centres of Bhubaneswar and Cuttack on the Mahanadi Delta. The maximum intensity expected in these areas would be around MSK VII. Districts in the north and south-west of the state lie in Zone II[1]. The earthquake hazard map from BMTPC is given in **Fig No. C7-1**.

Fig. No. C7-1: Earthquake hazard map



BMTPC : Vulnerability Atlas - 3rd Edition : Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Seismic Zones of India Map IS: 1893 (Part I): 2002, BIS; Earthquake Epicentre from IMD; Seismotectonic Atlas of India and its Environs, GSI; Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Source: https://bmtpc.org/DataFiles/CMS/file/VAI2019/eq-jh.html accessed 08.10.2021

Significant earthquakes in Odisha

No major earthquake has been noticed in Odisha state since 2002. However, details of the earthquakes in last 7 decades in Odisha, near the state boundary (with Jharkhand) and shoreline is given in **Table No. C7-5**.

[1] Source: ASC : Seismicity of Odisha (Orissa), India (asc-india.org) accessed 08.10.2021

Table No. C7-5: List of Earthquakes in Odisha & Around

Date	Description
08 May 1963	Bijakuli-Banei area, Odisha, Mb 5.2 (4) 21.700 N, 84.900 E, D=033.0 kms, OT=14:15:03 UTC (4)
05 August 1979	Dublabera-Majhgaon area, Jharkhand, Mb 4.7 (4). 22.100 N, 84.900 E, OT=01:18:37 UTC (4)
08 April 1982	Bay of Bengal, Mw 5.2 18.510 N, 86.310 E, D=024.0 kms, OT=02:41:16 UTC
14 October 1982	Khajuripada-Banigochha area, Odisha, Mb 4.7 20.390 N, 84.420 E, OT=12:56:09 UTC
01 July 1985	Bay of Bengal, Mw 5.4 18.367 N, 87.188 E, D=010.0 kms, OT=02:23:52 UTC
27 March 1995	Laimura-Deogarh area, Odisha, Mb 4.6 21.671 N, 84.565 E, D=010.0 kms, OT=07:52:10.60 UTC
21 June 1995	Kasijodi-Nuakot area, Odisha, Mb 4.7 21.780 N, 85.327 E, D=033.0 kms, OT=18:35:41.23 UTC
12 June 2001	Konokjora-Sundargarh area, Odisha, Mw 4.7 22.240 N, 83.918 E, D=025.5 kms, OT=12:41:00 UTC

Acronyms used: D=Depth, OT=Origin Time, Mw=Moment Magnitude, Ms=Surface Wave magnitude, Mb=Body Wave Magnitude, ML=Local Magnitude, M?=Magnitude Type unknown

Source: Amateur Seismic Centre, http://asc-india.org/seismi/seis-orissa.htm, last accessed on 8.10.2021

After assessment of the website https://earthquaketrack.com/in-21-dhenkanal/recent (accessed 08.10.2021) which lists the latest earthquakes, it was found that no earthquakes were found to have occurred in or within 10 km radius of the project site in the last ten years. The earthquake, nearest to project site was on January 19, 1986, 06:53 UTC (approximately 35 years ago) about 4.4 magnitude earthquake, with epicenter at 21.003, 85.172, 8.2 km from Talcher.

Despite the low level of seismicity and the proximity of low magnitude earthquake that has occurred in the region, the construction of the buildings will be done as per National Building Code and IS 875. In case of damage due to earthquake, the disaster management shall be done in line with National Disaster Management Authority's system.

There is no threat of landslide at project site, it being flat in topography. Although Jharbandh reserve forest is near to the project and located on a hill, the presence of forest will protect the hillside from sliding. The construction of a reservoir is proposed at the foot hill for which due precautions will have to be considered.

Management Measures:

Things that need to be done shall be as follows:

- During construction of the various building byelaws and BIS codes will be followed.
- A common meeting point inside the plant site and a contact outside the plant will be identified and known to all employees and workers.
- List important telephone numbers and torch, water, transistor, first-aid kit and non-perishable food will be kept at a designated place. An emergency kit shall be ready at all times.
- Train workers in basic first aid. Teams for first-aid; search and rescue etc. has been formed in the area and preparedness drills are and will be conducted for what to do in case of an event.

In case of occurrence of an earthquake, every individual would have to follow the pointers below:

- Keep calm and help others to keep calm. Do not panic.
- If you shall be inside of a building: Protect yourself by ducking under sturdy table, and staying there until the shaking stops. Turn off electricity and gas.
- If you shall be on the road in a built up area: Immediately move away from buildings, slopes, streetlights, power lines, hoardings, fly-overs etc. into open spaces. Do not run or wander; keep the roads free for movement.
- If you shall be driving: Stop the vehicle away from the buildings, slopes and electric cables; come out of the vehicle, hold it and stay by its side
- Keep calm and expect aftershocks.
- Check if you or anyone else is hurt. Use first-aid and wait for medical help.
- Do not move seriously injured people.
- Do not turn-on electrical appliances and gas.
- Check your building for damages.
- Do not waste water and do not block telephone lines.
- Do not spread rumours and don’t panic.
- Volunteer to help.
- Keep the streets clear for emergency services.
- Do not use matches, lighters, camp stoves or electrical equipments, appliances until you can be sure there are no gas leaks. They may create a spark that could ignite leaking gas and cause an explosion and fire.

- Do not use your telephone except for a medical or fire emergency. It could tie up the lines needed for emergency response. If the phone doesn't work send someone for help. Conserve mobile phone & laptop batteries for use in emergency as power may be cut for long.

For general structural safety, the following codes shall be followed:

- IS: 456:2000 (reaffirmed 2021) - "Plain and reinforced concrete - Code of practice (Fourth Revision)"
- IS: 800-2007 (reaffirmed 2017) - "General construction in steel - Code of practice (Third Revision)"
- IS: 801-1975 (reaffirmed 2021) - "Code of practice for use of cold - Formed light gauge steel structural members in general building construction (First Revision)"
- IS 875 (Part 2):1987 (reaffirmed 2018) - Code of practice for design loads (Other Than Earthquake) for buildings and structures: Part 2 imposed loads (Second Revision)
- IS 875 (Part 3):2015 (reaffirmed 2020) - "Design Loads (Other than Earthquake) for Buildings and Structures - Code of Practice Part 3 Wind Loads (Third Revision)"
- IS 875 (Part 5):1987 (reaffirmed 2018) - "Code of practice for design loads (Other Than Earthquake) for buildings and structures: Part 5 special loads and load combinations (Second Revision)"
- IS: 883:2016 - "Design of Structural Timber in Buildings - Code of Practice (Fifth Revision)"
- IS: 1904:1986 (reaffirmed 2020) - "Code of practice for design and construction of foundations in soils : general requirements (Third Revision)"
- IS1905:1987 (reaffirmed 2017) - "Code of practice for structural use of unreinforced masonry (Third Revision)"
- IS 2911-1-4:2010 (reaffirmed 2020) - "Design and construction of pile foundations - Code of practice: Part 1 concrete piles: Sec 4 precast concrete piles in prebored holes (First Revision)"

For Earthquake Protection, the following codes shall be followed:

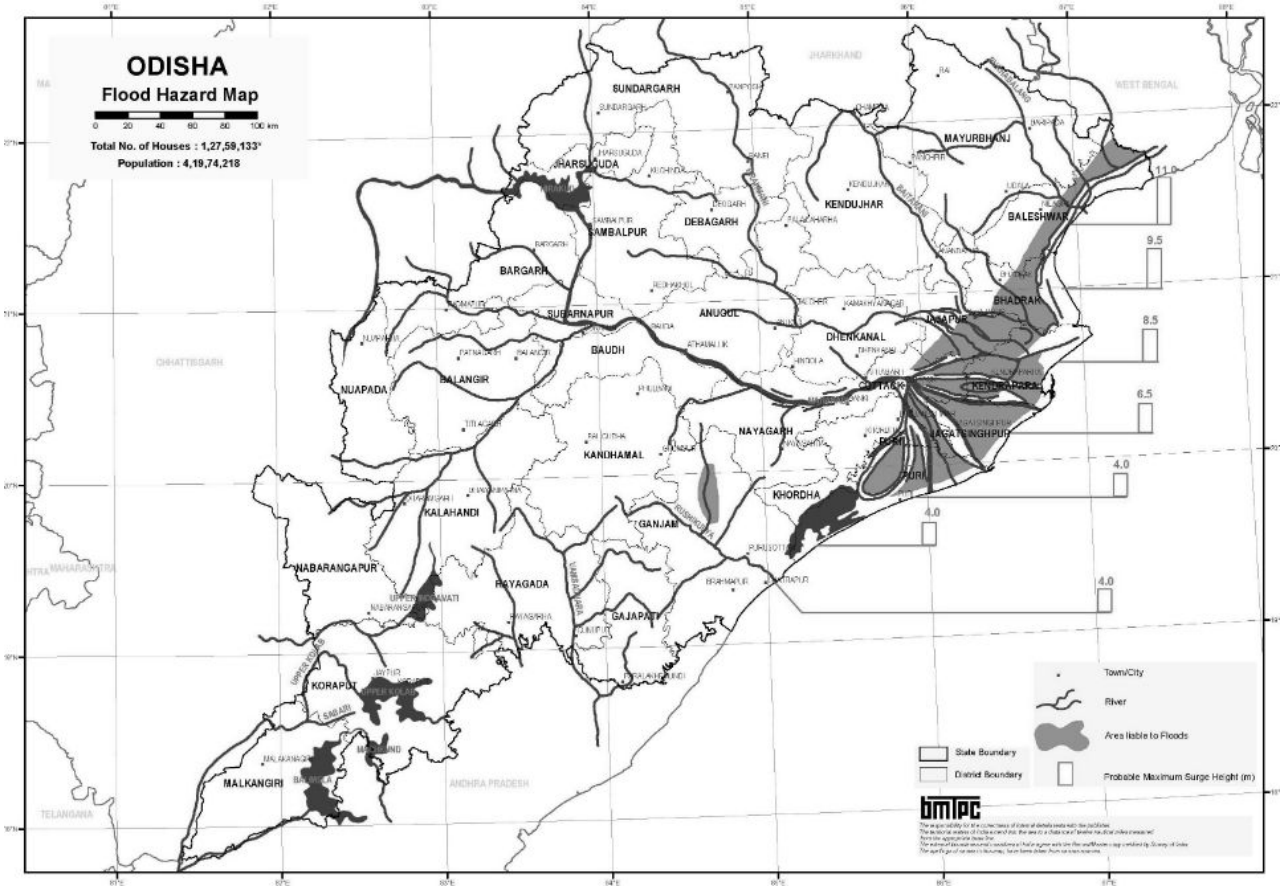
- IS: 1893:1984 (reaffirmed 2018) - "Criteria for earthquake resistant design of structures (Fourth Revision)"
- IS: 1893 (Part 1) : 2016 (reaffirmed 2021) - "Criteria for Earthquake Resistant Design of Structures - Part 1 : General Provisions and Buildings"
- IS: 1893 (Part 2) : 2014 (reaffirmed 2019) - "Criteria for Earthquake Resistant Design of Structures Part 2 Liquid Retaining Tanks"
- IS: 1893 (Part 3) : 2014 (reaffirmed 2019) - "Criteria for Earthquake Resistant Design of Structures Part 3 Bridges and Retaining Walls"

- IS: 1893 (Part 4) : 2015 (reaffirmed 2020) - "Criteria for Earthquake Resistant Design of Structures Part 4 Industrial Structures Including Stack - Like Structures (First Revision)"
- IS:13920-1993 (reaffirmed 2021) - "Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice (First Revision)
- IS:4326-2013 (reaffirmed 2018) - "Earthquake resistant design and construction of buildings - Code of practice
- IS:13828-1993 (reaffirmed 2018) - "Improving Earthquake Resistance Of Low Strength Masonary Buildings - Guidelines
- IS:13827-1993 (reaffirmed 2018) - "Improving Earthquake Resistance Of Earthen Buildings - Guidelines"
- IS:13935-2009 (reaffirmed 2019) - "Seismic Evaluation, Repair and Strengthening of Masonry Buildings - Guidelines"

7.2.1.2 Flood Hazard

A perusal of the flood hazard map of Odisha state given in **Fig No. C7-2** shows that the project area lies in the area of "no significant flooding".

Fig No. C7-2: Flood hazard map



(Source : https://bmtpc.org/DataFiles/CMS/file/VAI2019/od.html accessed 08.10.2021)

Flood management

In case of extreme scenario of occurrence of flood in study area, people from the nearby-flooded villages might flock for shelter to the higher elevations and this project could be one of their refuges in times of distress. Hence, arrangement of flood shelter is proposed in the project as follows:

- Several clean containers for water, large enough for a 3-5 day supply of water.
- A 3-5 day supply of non-perishable food and a non-electric can opener.
- A first aid kit and manual and prescription medicines and special medical needs.
- A battery-powered radio, flashlights, and extra batteries.
- Sleeping bags or extra blankets.
- Water-purifying supplies, such as chlorine or iodine tablets or unscented, ordinary household chlorine bleach.
- Baby food and/or prepared formula, diapers, and other baby supplies.
- Disposable cleaning cloths, such as "baby wipes" for the whole family to use in case bathing facilities are not available.
- Personal hygiene supplies, such as soap, toothpaste, sanitary napkins, etc.
- An emergency kit for your car with food, flares, booster cables, maps, tools, a first aid kit, fire extinguisher, sleeping bags, etc.
- Rubber boots, sturdy shoes, and waterproof gloves.
- Insect repellent containing DEET or Picaridin, screens, or long-sleeved and long-legged clothing for protection from mosquitoes which may gather in pooled water remaining after the flood.

7.2.2 Man made disasters

Disaster may occur due to following hazards in the steel complex.

- Fire
- Explosion
- Oil spillage
- Electrocution
- Hazardous waste
- Accident
- Liquid hot metal spill

In any plant there are various activities or areas which pose substantial threat to the workers and hence hazardous in nature. The potential hazardous areas and the likely accidents with the concerned area have been listed in **Table No. C7-1** earlier.

7.3 DISASTER PREVENTION MEASURES

In order to prevent disaster due to fire, explosion, oil spillage, electrocution, liquid hot metal spillage and other accidents, following preventive measures are being and shall be adopted:

1. Design, manufacture and construction of all plant and machineries building are and will be as per national and international codes as applicable in specific cases and laid down by statutory authorities.
2. Provision of adequate access way for movement of equipment and personnel is and shall be kept.
3. Minimum two no. of gates for escape during disaster are and shall be provided.
4. Water spraying in coal storage area.
5. System of fire hydrants comprising electrical motor division and diesel engine drivers fire pumps with electrical motor driver jockey pump for keeping the fire hydrant system properly pressurized and automatic water sprinkling system for all important transformers.
6. Fire hydrants with fire hoses in all areas where fire can break.
7. Shielded cover is and will be paved on the signal cable to separate from the power cable if they shall be laid together.
8. Steam fire extinguishers are and shall be adopted at all the dangerous places in the workshops and plant.
9. Heating facilities is set at all operation room, duty room, and assistant room as well as overhang fans to ensure labour health.
10. The design of this project is set with safety measurements such as lighting proof grounding and anti- electric shock.
11. The safety exit and safety evacuation space would meet the requirements of building design for fireproofing regulations GBJ16-87 (1997 Edition).
12. **Fire prevention and fighting :**

The different type of fire extinguishers are present and have been proposed at strategic locations in the plant and given in **Table No. C7-6**.

Table No. C7-6: Different fire extinguishers at different sites

Name of Site	Type of Fire Extinguishers
Cable galleries	CO_2 & Foam type, Dry chemical powder
High voltage panel	CO_2 & Foam type, Dry chemical powder
Control rooms	CO_2 & Foam type, Dry chemical powder
MCC rooms	CO_2 & Foam type, Dry chemical powder
Pump Houses	CO_2 & Foam type, Dry chemical powder
Fuel storage	CO_2 & Foam type, Dry chemical powder sand basket
Guest houses and offices	Dry chemical powder, foam type
Godowns, store	Foam type
Bunkers, Silo, enclosed dust collector	CO_2 type, N_2 type, automatic sprinkler, fixed spray nozzle (unless water reactive)
Material	
Pet Coke	Use: Water fog, CO_2, Foam, Dry Chemical
Fuel Oil	Use: Water spray, foam, dry powder or carbon dioxide Do Not Use: water jet as an extinguisher, as this will spread the fire
HSD	Use: Foam, Carbon dioxide, Dry Chemical Powder. Water may be used to cool fire-exposed containers
LDO	Use: water fog, foam, dry chemical or carbon dioxide (CO_2) to extinguish flames
Metal dust	Use: Certified class D Extinguishing agent
Fly Ash, gypsum, laterite	Non-Flammable

Source: Table 3.2, 3.3 of Final Technical Report on Hazard Identification and Risk Assessment (HIRA), Emergency Plan & Disaster Management Plan of Dhenkanal Steel Plant by IIT Kharagpur, Dec 2020

13. **Personal Protective Equipments (PPE):** Personal protective equipment are and shall be given in **Table No. C7-7.**

Table No. C7-7: Personal protective equipment

Sl. No.	Objective	Hazard	Suggested PPEs
1.	Eye and face protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation	a) Safety Goggles b) Eye wash taps c) Safety glasses with side-shields, protective shades
2.	Head Protection	Falling objects, inadequate height clearance, and overhead power cords	Plastic helmets with top and side impact protection

Sl. No.	Objective	Hazard	Suggested PPEs
3.	Hearing protection	Noise, Ultra sound	Hearing protectors (ear plugs or ear muffs)
4.	Foot protection	Failing or rolling objects, points objects. Corrosive or hot liquids	Safety shoes and boots for protection against moving and failing objects, liquids and chemicals
5.	Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures	Gloves made of rubber or synthetic material(Neoprene), leather, steel, insulation materials, etc.
6.	Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors	Face masks with appropriate filters for dust removal and air purification (chemical, mists, vapors and gases). Single or multi-gas personal monitors, if available
		Oxygen Deficiency	Portable or supplied air (fixed lines). Onsite rescue equipment
7.	Body / leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration	Insulating clothing, body suits, aprons etc. of appropriate materials

Source: ***Table 3.4 of Final Technical Report on Hazard Identification and Risk Assessment (HIRA), Emergency Plan & Disaster Management Plan of Dhenkanal Steel Plant by IIT Kharagpur, Dec 2020***

Personnel protective equipment play vital role in reducing the losses in case of an accident. They provide protection to the workmen from injuries during the execution of job. The various protective equipment used in the plant and will continue to be used during expansion are:

- Self Breathing Apparatus with portable oxygen cylinders.
- Canister with Mask
- Hand gloves
- PVC apron and hood
- Gum Boot
- Safety Belt (General Purpose)
- Leather shoes and apron (each)
- Safety and chemical goggles
- Helmet

The above items are inspected and ensured serviceable by the concerned shift incharge of the location on regular intervals.

Fitting dress and use of personnel protective equipment recommended for respective job should be adhered to by everyone.

14. **Industrial Safety:** For protection of working personnel, equipment and machineries from any damage or loss and to ensure uninterrupted production, adequate safety and fire fighting measures are present for the existing and have been planned for proposed expansion plant. Important provisions are and shall be as follows:

    - Laying down specific Safety, Health & Environment policy to guide.
    - Provision of adequate personal safety appliances to workers engaged in hazardous installations.
    - Practices of safety inspections / monitoring at regular intervals by a team of experienced professionals to guide & educate the workforce.
    - Provision of detection and alarm system to allow a developing fire to be detected at an early stage.
    - CO detection and prevention : to install carbon monoxide detector/ alarm to detect the presence of carbon monoxide (CO) and sounds an alarm to alert personnel in case there is CO leakage

    Plant uses a wide variety of specialized equipments and methods for handling raw materials. These equipment ranges from the most basic forklift to Cranes, Derricks, Hoists, Elevators and Conveyors. The hazards of using powerful equipment and of moving heavy materials require a wide variety of protective measures for employees on the site. The work talks about regulatory requirements and safe use for these equipment. The work covers safe rigging and slings for proper lifting and safety requirements for specific types of Cranes, Derricks, Hoists, Elevators, Conveyors and forklifts. Bearing this in mind the cranes, hoists, lifts shall be periodically tested and certificate issued for continuous use.

15. There are 25 safety guidelines that are being and have to be followed by steel plants, which have been detailed by The Ministry of Steel in 2019 as available at https://steel.gov.in/sites/default/files/Framework%20Document%20for%20Safety%20Guidelines.pdf (accessed 28.09.2021).

7.4 ON SITE EMERGENCY PLAN

7.4.1 Site emergency control room

In order to control the disaster more effectively, a Site Emergency Control Room (SECR) has been established at the plant site. The facilities present and proposed to be provided are given in following sections:

- Plant Layout
- Plant Layout with inventories and locations of fuel oil, storage tanks, coal storage etc.
- Hazard identification chart, maximum number of people working at a time, assembly points etc.
- Population around factory
- Internal telephone connections
- External telephone connections
- Hotline connection to district collector, police control room, fire brigade, hospital etc.
- Public address system
- Torch-lights
- List of dispensaries and registered medical practitioners around factory
- Area map of surrounding villages
- Nominal roll of employees
- Note pads and ball pens to record message received and instructions to be passed through runners.
- The blown up copy of Layout plan showing areas where accident has occurred.
- Fire hydrant system in different location
- Truck parking information
- Specialized monitoring & management equipment will be available at all the sensitive points to deal with small to medium spillages of the chemical.

The emergency control center is the place from which the operations to handle the emergency will be directed and coordinated. It will be manned by the site work main controller, key personnel and the senior officers of the fire and police services.

7.4.2 Safety department

Safety department is manned by experienced engineers and other supporting staff who shall bring safety consciousness amongst the work force of plant. The

safety department conducts regular safety awareness courses by organizing seminars and training of personnel among the various working levels.

The management have formed a "Safety Committee" consisting of equal number of representative of workers and management. The tenure of the committee is of 2 years and the worker's representative of committee are elected by the workers. As per the Onsite Emergency Plan, the committee meets quarterly and most of the safety activities and workers complaints and suggestions are implemented through this committee. The same practice shall continue to be followed during proposed expansion phase.

7.4.3 Contingency plan for management of emergency

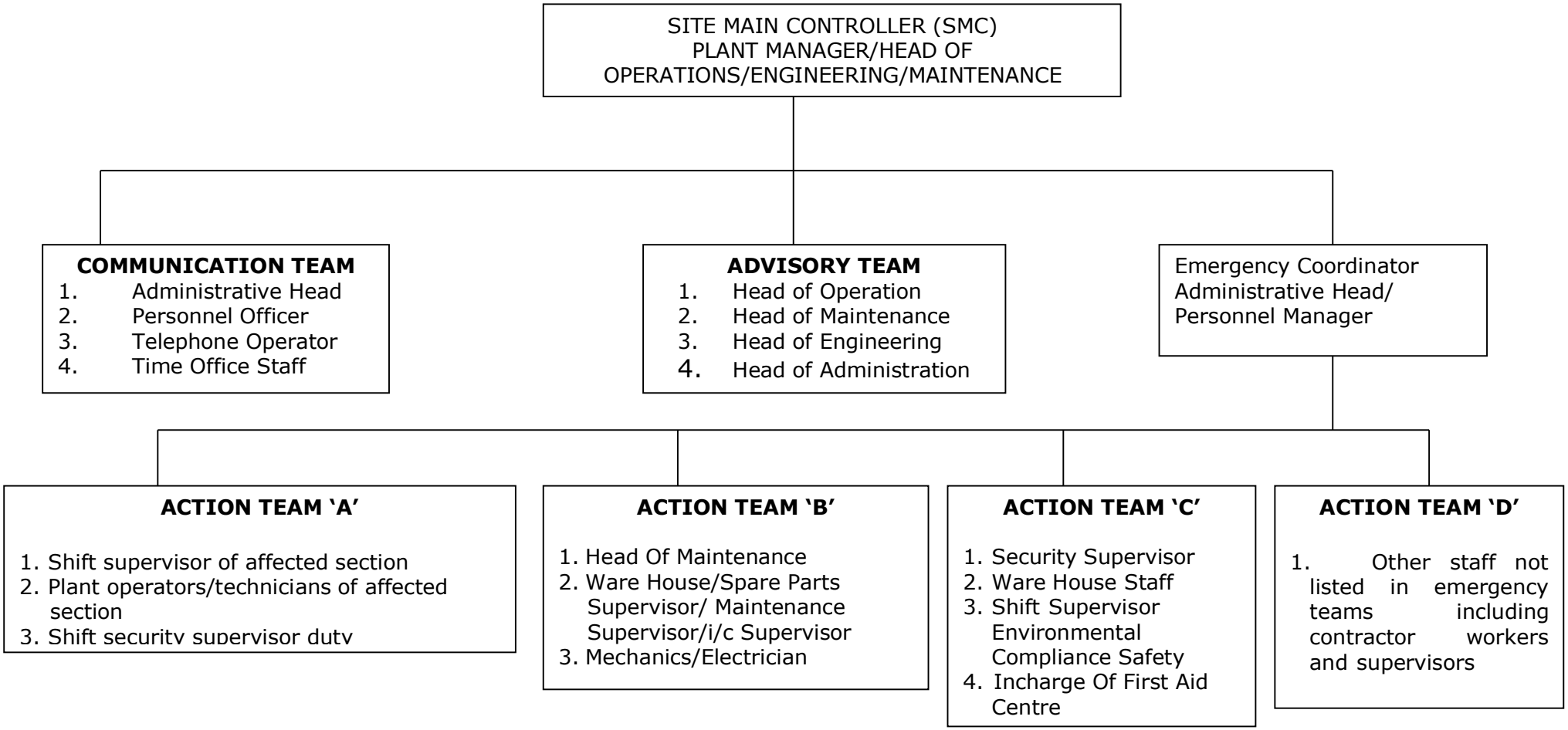
To tackle the situation, a disaster control room will be set up having links with all control rooms of the plant. An up to date communication facility will be provided to control rooms. In case of disaster, emergency meeting of all concerned sectional heads will be convened to decide control measures and ensure it's implementation. The emergency organisation shall be headed by emergency leader called Site Main Controller (SMC) who will be plant manager. In his absence senior most person available at plant shall be emergency leader till arrival of plant manager.

Besides the top officials described above, rest of the employees shall be divided into three action teams namely A, B, C, and a Non-action Group D. Action team 'A' will consist of staff of section in which accident has occurred. Action team 'B', will consist of staff of non-affected sections and maintenance department. Action team 'C' will consist of supporting staff i.e. Security supervisor, Ware house Supervisor, Shift Supervisor etc. Group 'D' will consist of people not included in those teams like contractor, labour, security men etc.

Team 'A' comprising staff of affected section will be taking up the action in case of an emergency. Team 'B' will help team 'A' by remaining in their respective sections ready to comply with specific instructions of SMC. Team 'C' consisting of supporting staff will help team 'A' as required and directed by Team 'B'. Group 'D' will be evacuated to safe region under supervision of Team 'C'.

A multichannel communication network shall connect SECR to control rooms of plant, various shops, and other departments of plant, fire station and neighboring industrial units. Co-ordination among key personnel and their team has been shown in **Fig No. C7-3**.

Fig No. C7-3: General coordination among on site emergency team members



7.4.4 Outside organisations involved in control of disaster

In the event of massive spillage of fuel oil or occurrence of fire, population inside and outside plant boundaries, vegetation and animal etc. may be affected. In such circumstances secondary fire may also take place. In such an event help shall be taken from outside agencies also.

The organizations that shall be involved are as follows:

(a) State and local authorities: District Collector, Revenue Divisional Officer, etc

(b) Factory Directorate, Director of factories and boiler, Joint Director of factories and boiler, Asstt. Director of factories and boiler

(c) Environmental agencies: Member Secretary of State Pollution Control Boards, Regional Officer State Pollution Control Board.

(d) Fire Department: Chief District Officer

(e) Police Department: District Superintendent of Police, SHOS of nearby Police Stations

(f) Public Health Department:

- District Medical Officer
- Residential medical officers of PHCs in a radius of 5 km around plant site

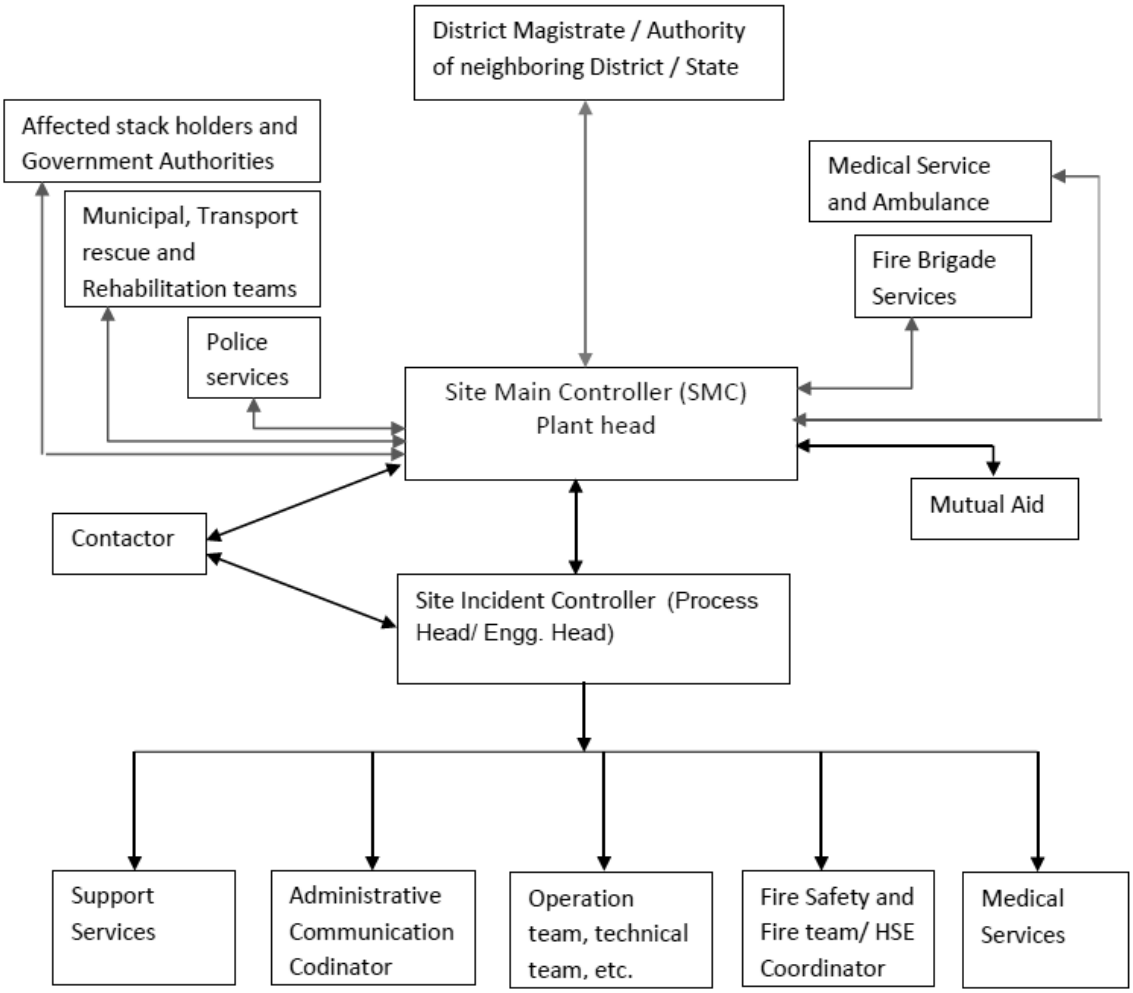
(g) Local Community Resources

- Regional Transport officer
- Divisional Engineer Telephones

The outside organisations are being and shall directly interact with district magistrate who in consultation with SMC shall direct to interact with plant authorities to control the emergencies.

The interaction with the outside as well internally will occur as shown in **Fig No. C7-4.**

Fig No. C7-4: Emergency Response Structure



7.4.5 Hazard emergency control procedure

The onset of emergency will in all probability, commence with a major fire or explosion. Following activities will immediately take place to interpret and take control of emergency.

1. Staff member on duty will go to nearest fire alarm call point and trigger off the fire alarm.

2. On site fire crew led by fireman will arrive at the site of incident with fire foam tenders and necessary equipments.

3. Site main controller will arrive at SECR, from where he will receive information continuously from incident controller and give decisions and direction to the incident controller, plant control room, Emergency security controllers and to the site medical officer to take care of casualties.

Site Main Controller will be directing and deciding a wide range of following disparate issues. In particular SMC has to decide and direct.

- Whether incident controller requires reinforcement of manpower and facilities
- Whether plant is to be shut down or more importantly kept running.
- Whether staff in different locations is to remain indoor or to be evacuated and assembled at designated collection center.
- Whether missing staff members are to be searched or rescued.
- Whether off-site emergency plan to be activated and a message to that effect is to be sent to district headquarter.

When the incident has eventually been brought under control as declared by the Incident Controller, the SMC shall send two members of his advisory team as inspectors to incident site for:

- An assessment of total damage and prevailing conditions with particular attention to possibility of re-escalation of emergency which might, for the time being, be under control.
- Inspection of other parts of site, which might have been affected by impact of incident.
- Inspection of personnel collection and roll call centers to check if all persons on duty have been accounted for.
- Inspection of all control rooms of plant to assess and record the status of respective plants and any residual action deemed necessary.

Post emergency, the inspectors will return to SECR with their observations and report of finding and will submit the same to SMC.

7.4.6 Alarm system to be followed during disaster

On receiving the message of "Disaster, from Site Main Controller, fire station control room attendant will sound SIREN I WAILING TYPE FOR 5 MINUTES. Incident controller will arrange to broadcast disaster message through public address system.

On receiving the message of "Emergency Over" from Incident Controller the fire station control room attendant will give "All Clear Signal, by sounding alarm straight for two minutes. The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster.

7.4.7 Actions to be taken on hearing the warning signal

On receiving the disaster message following actions will be taken:

- All the members of advisory committee, personnel manager, security controller, etc. shall reach the SECR.
- The process unit persons will remain ready in their respective units for crash shutdown on the instruction from SECR.
- The persons from other sections will report to their respective officer.
- Residents of township will remain alert.

7.4.8 Safety devices/equipment

In order to make the services more effective the workers and rescue team have and will be provided with the safety equipment and items like gas mask respirators, fire entry suits, fire blankets, rubber shoes or industrial shoes, rubber glove, ladders, ropes, petromax lamp torches etc.

7.4.9 Casualty services

The casualty services section will be headed by a medical officer who is responsible for immediate medical aid and first aid. The section will be fully equipped with all first aid medical facilities. An ambulance will be provided on duty round the clock to tackle any emergency. On receiving the call of emergency, the medical officer will report immediately to disaster site along with mobile first aid equipment and ambulance. The immediate first aid will be made available and the medical officer will assess further line of action in the best interest of victim.

7.4.10 Specific Treatment

Specific treatment / preventive measures for injuries and hazards will be provided in the Medical Centre. Eye and body showers are present and will be provided in different required places of plant, which shall be identified by the Safety Officer. Major hazards/injuries and treatment facilities in the plant shall comprise of all primary pathological diagnosis, X-Ray, Ultra sound, ECG, Trauma cases, Audiometry Test, Spirometry test, Vision testing, Eye treatment, Burn treatment, Poisoning treatment Electrical Shock treatment and Ambulance Facility.

The emergency, critical cases & diseases which cannot be treated shall be referred & treated at larger hospitals in the district or Medical Colleges or super specialty hospitals.