# Report of Safety Audit

Conducted at

# Thermal Power Plants

by

# Safety Audit Committee

## (Under Hon’ble NGT Order dated 22-12-2020)

## Central Electricity Authority
## (January 2022)

## FOREWORD

Hon'ble National Green Tribunal vide its Order dated 22.12.2020 in O.A. No. 108/2020 with O.A. No. 130/2020 issued the directions that "*Secretaries, Ministry of Power and Coal, Government of India, in coordination with such other Departments/ Institutions, as may be necessary, to undertake Safety Audits of similarly placed thermal power stations throughout the country expeditiously preferably within six months to avoid recurrence of such incidents in future".*

In compliance to the above said Order, the Ministry of Power ("MoP") in consultation with Ministry of Coal ("MoC") requested Central Electricity Authority ("CEA") to undertake the safety audits of similarly placed thermal power stations throughout the country. A Safety Audit Committee was constituted by Central Electricity Authority vide Office Order dated 16.03.2021 comprising of representatives from Central Electricity Authority (CEA), Ministry of Coal, Central Boiler Board (CBB), Director General Fire Safety (DGFS), Oil Industry Safety Directorate (OISD), NTPC Ltd., NLC India Limited (NLCIL) and Bharat Heavy Electrical Limited (BHEL).

To make the process of audit comprehensive, the safety audit checklist containing around 800 questions on four broad areas (General Safety, Boiler, Turbine-Generator and Balance of Plant) of safety was prepared and sent to various (more than 150) coal/lignite based thermal power plants for getting their responses. The responses received from the utilities were analyzed. The main objective of this checklist was to sensitize the thermal power stations about their safety.

Considering the spirit of the Hon'ble NGT's Order on similarly placed thermal power station, the Committee selected ten (10) nos. lignite based units of twenty years and above age and five (5) nos. coal based units of age between 25 to 35 years of units for physical safety audit.

Physical Safety Audit of selected units was carried out during the months of August 2021 to November 2021. The detailed Safety Audit Reports of respective plants were sent for their compliance.

It is worth mentioning that Committee has carried out the safety audit task within the time frame given by Hon'ble NGT despite the challenges of Covid situation. I wish to express my appreciation to all the members of the Committee for sparing their valuable time & sharing their experience and making valuable contribution in bringing out this report. Further, I thank the management of all audited plants for taking this safety audit in positive spirit and extending all the cooperation to the Committee members during the audit.

(D. K. Srivastava)
Chief Engineer (TE&TD)
and Chairman of the Committee

## Disclaimer

The Audit recommendations are based on the field visit, sample observations made, discussions had with plant team and documents provided by the plant at the time of audit. Safety audit committee has exercised all reasonable skill, care and diligence in carrying out the safety audit, however timely implementation of the recommendations would be in the plants' own interest. This report should not be deemed to be any undertaking, warranty or certificate related to preventing accidents in future.

## Table of Contents

## 1.0 Introduction

Hon'ble National Green Tribunal vide its Order dated 22.12.2020 **(Annexure-I)** in O.A. No. 108/2020 with O.A. No. 130/2020 in the matter of Meenava Thanthai K.R. Selvaraj Kumar Meenavar Nala Sangam Vs Union of India and Ors. has inter-alia issued the directions under para 13 of the said order, which are reproduced below:

> *"13. We also direct the Secretaries, Ministry of Power and Coal, Government of India, in coordination with such other Departments/ Institutions, as may be necessary, to undertake Safety Audits of similarly placed thermal power stations throughout the country expeditiously preferably within six months to avoid recurrence of such incidents in future."*

In compliance to the above said Order, the Ministry of Power ("MoP") in consultation with Ministry of Coal ("MoC") vide its communications dated 04.01.2021 and 22.02.2021 (**Annexure-II**) has requested the Central Electricity Authority ("CEA") to take the necessary action on behalf of the Ministry of Power to comply with the orders of the Hon'ble Tribunal by undertaking the safety audits of similarly placed thermal power stations throughout the country. MoC communication dated 04.02.2021 to MoP in this regard is placed at **Annexure-III**.

In pursuance of the said communications from Ministry of Power and in compliance with the order passed by the Hon'ble Tribunal, a Safety Audit Committee headed by Chief Engineer, TE&TD Division was constituted by Central Electricity Authority vide Office Order dated 16.03.2021 (**Annexure-IV**).

The Safety Audit Committee comprises of representatives from Ministry of Coal, Central Boiler Board (CBB), Director General Fire Safety (DGFS), Oil Industry Safety Directorate (OISD), NTPC Ltd., Neyveli Lignite Corporation of India Limited (NLCIL), Bharat Heavy Electrical Limited (BHEL) and Central Electricity Authority (CEA). The nominated members of the Safety Audit Committee are as under:

| S. No. | Name (Sh) | Designation/ Organization |
|---|---|---|
| 1. | D. K. Srivastava | Chief Engineer (TE&TD), CEA & Chairman of the Committee |
| 2. | K B Jagtap* | Director (TE&TD), CEA & Member Convenor |
| 3. | Baleshwar Thakur | Director (TCD), CEA |
| 4. | D. K. Sami** | Fire Advisor, Directorate General |

| | | |
|---|---|---|
| | | Fire Services (DGFS), Civil Defence & Home Guards, Ministry of Home Affairs |
| 5. | Peeyush Kumar | Director, Ministry of Coal |
| 6. | T S G Narayannen | Secretary, Central Boiler Board |
| 7. | B V N Kishore | GM (PS-Technical Services), BHEL |
| 8. | Ramanath Pujari | GM (Safety), NTPC Ltd. |
| 9. | A.Chellasamy | GM (Safety), NLC India Ltd. |
| 9. | Hirak Dutta | Former- Executive Director, OISD, MoP&NG |

* Shri Sunit Kumar Gupta, Director (TE&TD) replaced Shri K B Jagtap w.e.f. 03.01.2022.

** Shri Moreshwar Kudkilwar, Deputy Fire Advisor replaced Sh. D. K. Sami w.e.f. 27.10.2021 as a representative of DGFS.

# 2.0 Safety Audit Objective and Methodology

Safety Audits are intended to promote, improve and maintain good safety performance. These Audits are conducted in order to meet not only the statutory requirement under Factories Act and ensure that requirements as per Manufacture, Storage, and Import of Hazardous Chemicals (MSIHC) Rules, 1989 – entrusted functions and Response Rules and CEA safety regulation are complied with, but also to self-assess the performance of the safety management systems and site specific safety improvements.

Though the Safety and safety audit are the prerogative of power utilities, this safety audit on the direction of Hon'ble NGT was carried out by safety audit committee with the following objective:

**Safety Audit Objectives**

- To provide the auditee with an opportunity to assess its own Occupational health and safety management systems(OH&S)
- To determine the conformity of the implemented OH&S systems with specified requirements and identify areas for improvement.
- To review the compliance to existing protection systems and preventative measures.
- To review the compliance to the statutory/regulatory requirements.
- To carry out a systematic critical appraisal of all potential hazards involving personnel, plant, services and operational methods.

**Audit Methodology**

Keeping in view the time frame given by Hon'ble NGT for audit and restrictions being faced at the time because of second wave of Covid-19, the safety Audit of thermal power plants was done in two stages. In Stage-I, the thrust was given for the activities which could be done following the Covid-19 restrictions. The following major activities were carried out in Stage-I:

Stage – I

- Formation of Audit team
- **Preparation of Safety Audit Checklist-** A Safety Audit checklist covering General Aspects of Safety in Thermal Power Plant, Fire Safety, Boiler, Turbine-Generator & Balance of Plant (BoP) areas of safety was prepared. The safety Audit checklist (**Annexure-V**) was a

comprehensive document, comprising around 800 questions related to safety in Thermal power plants. The checklist was sent to all Thermal Power Plants across country by email for their response. The main objective of this checklist was to sensitize the thermal power stations about their safety.

- **Analysis of response received from TPS on the Safety Audit Checklist-** The responses received from the Power Plants were analyzed during this stage. There were around 800 questions from different areas of thermal power plant safety, almost all plants responded majority of questions.

Stage – II

In stage-II, the main focus was the physical audit of thermal power plants selected as per the deliberation of safety audit committee. The criteria for selecting the power plant for physical audit has been mentioned in next chapter. The methodology adopted for the physical audit of thermal power plant is as follows:

- Field Visit/site inspection
- Familiarization of the plant process and maintenance system
- Documents/records verification and Interaction with Plants Executives
- Verification of information as submitted in the checklist
- Appraisal of major observations to plant

# 3.0 Deliberations of the Committee

**3.1** The Committee held its first meeting on 24.03.2021 through VC and considering the spirit of the Hon'ble Tribunal's order on similarly placed thermal power stations, the Committee decided that the safety audit of lignite-based power plants / units which are more than 20 years of age would be undertaken by the Committee.

**3.2** To make the process of audit comprehensive, the safety audit checklist containing around 800 questions on four broad areas of safety (General Safety, Boiler, Turbine-Generator and Balance of Plant) was prepared and sent to various (more than 150) coal/lignite based thermal power plants for getting their responses. The responses received from the utilities were analyzed.

**3.3** There are 36 Lignite based units (In 12 Thermal Power Stations) comprising of a total capacity of 6120 MW. Out of these 36 lignite-based units, 10 units are more than 20 years of age which were finalized for audit by the committee. Further, the Committee also decided that in order to capture broad based analysis in the report, the audit of one coal/ lignite-based plant in each region of the country would also be audited. Therefore, the committee in its third meeting (held on 29.07.2021) identified the three-coal based thermal power plant/units in other regions of the country covering different utilities with criteria of largest capacity in the region and age of unit between 25 to 35 years old.

**3.4** Hence, fifteen (15) numbers (i.e. Ten (10) lignite based unit of twenty years and above age and five (5) coal based units of age between 25 to 35 years) of units have been selected by the Committee for physical safety audit.

# 4.0 Details of Plants identified for Physical Safety Audit

**4.1** Details of the plants physically audited by the Committee are as below:

| Sl. No. | Thermal Power Station | Unit Audited | Duration |
|---|---|---|---|
| 1 | Thermal Power Station-II of NLC India Limited | Units#1 to 7<br><br>(210 MW each) | 10.08.2021 to 13.08.2021 |
| 2 | Kutch Lignite Thermal Power Station (KLTPS) of Gujarat State Electricity Corporation Limited (GSECL) | Unit#3 (75 MW) | 15.09.2021 to 16.09.2021 |
| 3 | Surat Lignite Power Plant (SLPP) of Gujarat Industries Power Company Limited (GIPCL) | Units#1 & 2 (125 MW each) | 29.09.2021 to 01.10.2021 |
| 4 | Anpara Thermal Power Station of UPRVUNL | Unit#1 (210 MW, ATPS) &<br><br>Unit#4 (500 MW, BTPS) | 26.10.2021 to 27.10.2021 |
| 5 | Chandrapur Super Thermal Power Station of MAHAGENCO | Unit#3 (210 MW) | 10.11.2021 to 11.11.2021 |
| 6 | Farakka Super Thermal Power Station of NTPC Limited | Unit#1 (210 MW) &<br><br>Unit#5 (500MW) | 24.11.2021 to 25.11.2021 |

**4.2** Committee briefed all Auditees regarding the methodology and procedure to be adopted during Safety Audit with emphasis that:

- Safety audit is not an inspection of each and every activity/ item, but it is a sample inspection of the field / site and verification of key documents.
- Safety Audit shall cover the sample field visits, documents and records verification produced by power plants.
- Safety Audit also indicates the areas for improvement in Safety based on the observations, discussions at various levels and reference to the records & documents made available for verification.

**4.3** During closing meeting of Safety Audit Committee with the Auditees, the Committee orally informed the Auditee plants/units about their major observations during the audit and expected that power plants shall take steps for immediate improvement/ compliance. The detailed Safety Audit Reports were sent later on to the respective Audited Plants.

# 5.0 Observations and Recommendations of the Safety Audit Committee

Safety Audit Committee carried out the Safety audit of power plants from August' 2021 to November' 2021. Observations made during the physical safety audit of the fifteen (15) units at six (6) power stations are summarized for making a comprehensive document, which may be useful for all the coal/ lignite based thermal power generating stations in the country.

A typical set up of the coal/lignite based thermal power plant is explained at **Exhibit–I**. For convenience of carrying out the safety audit expeditiously, the Committee members were divided into three Subgroups with the responsibility of audit of their corresponding areas as below:

1. General safety, Fire safety & Balance of Plant (BoP) safety
2. Boiler safety
3. Turbine-Generator safety

During the safety audit, each of the Subgroups prepared their observations/ recommendations which are mentioned in the respective sections. Plant Management was advised for carrying out early rectifications and thus ensure compliance to all observations and recommendations of each Subgroup.

The Committee would like to highlight some of the "Good Practices" being followed by Auditee Stations/ Units before making Subgroup wise recommendations. These "Good Practices" which are brought out below need to be imbibed by all the thermal power stations in the country.

(a) The management of some of the power stations deserves the appreciation for good upkeep and well maintenance of plant; general safety and work culture among their employee. Interactions with the personnel of these stations were meaningful and indicated their full involvement in the power plant operations/ safety activities.

(b) Personnel of two of the power stations were found to be fully conversant with the Safety Aspects and their documentation were complete in all aspects. In one of the power stations, it was observed that they have well established Safety Park and Safety training is given to workers and visitors at Safety Park. One of the plants has Safety Mascot, KAVACH, being displayed for spreading safety messages to all employees/ staff.

(c) Safety signage boards were widely displayed with different industrial safety messages. Some of the power stations have 'Reward and Recognition' scheme in place for contractual workers to encourage them.

(d) One of the power stations has implemented Contract Labour Information and Management System (CLIMS). CLIMS is a unique IT enabled gate pass issuing system.

## 5.1 General Safety, Fire Safety and Balance of Plant (BoP) Safety

The Subgroup on General Safety, Fire Safety and Balance of Plant (BoP) Safety during the audit process had following important observations/ recommendations.

### 5.1.1 General Aspects of Safety

1. Some of the power stations have a Safety Policy & a comprehensive Safety Management Manual in place. These stations have displayed Safety Policy at prominent locations & shared with all employees. Other stations have not prepared Safety Policy, Safety Objectives & Safety Management Manual which is of paramount importance to ensure safe, smooth & reliable operation.

   **Recommendation:** Comprehensive Safety Policy, Safety Management Manual must be prepared and shared with all employees, contractors & their workman.

2. In some of the power stations, it was observed that adequate nos. of Safety Officers were not deployed as per statutory requirement. It was also noticed that although Plant Level Safety Committee is in place in all the power stations and regular meetings are being held, these Safety Committee meetings are not chaired by Head of the plant.

   **Recommendation:** Safety Officers must be deployed as per statutory requirement and Safety Committee meetings must be held with participation of Head of plant, Management and employees.

3. Except in one of the audited stations, it is gathered that 'Safety Performance' KPA (Key Performance Area) for employees is not linked with Annual

Performance Assessment for officers at various levels. Management of power plants should take up this matter on priority basis as incentives for the staff.

**Recommendation:** Safety Performance KPA must be linked with Appraisal for officers at various levels.

4. Except in one of the audited stations, reporting of major/ minor incidents methodology is not properly followed. There is no proper investigation method and no records have been maintained for fixing the responsibility and the action taken thereafter.

   **Recommendation:** All major/ minor accidents must be properly investigated and analyzed to find the Root Cause of incident/accident.

5. In most of the power stations, except two stations, Emergency Response Disaster Management Plan (ERDMP) both On-site & Off-site have not been prepared.

   **Recommendation:** Emergency Response Disaster Management Plan (ERDMP) both On-site & Off-site shall be prepared by all power plants.

6. Most of the Power Plants are having Ambulances positioned within the plant premises. However, in some cases, it was found that these Ambulances were not equipped with all required life-saving gadgets/ kits as per statutory requirement.

   **Recommendation:** Ambulances must be positioned within the plant premises with all life-saving gadgets as Thermal Power Plants are hazardous factories under section 2 (cb) falling under item 5 of the First Schedule of the Factories Act 1948.

7. Some of the Power Plants are not having well maintained and adequately staffed Occupational Health Center.

   **Recommendation:** Occupational Health Center must be developed at the plant premises. The company doctor with Statutory Associate Fellow of Industrial Health (AFIH) qualification must be positioned in the Occupational Health Center as per the statutory requirement.

8. In case of some of the power plants, Mutual Aid partners are not available. Since the power stations are installed in remote locations, no major industries/ establishments are available in the nearby vicinity of these power stations.

   **Recommendation:** Power plants in the remote areas have to maintain their own ambulances and medical facilities to meet any emergencies.

9. In most of the power stations except two stations, Safety training matrices for the employees and contract workers have not been prepared. Also, job specific training program were not available.

   **Recommendation:**

   i. Course design/ structure for conducting contractor workers training must be regularly reviewed and necessary changes should be incorporated to improve effectiveness.

   ii. All contract workers must undergo hands-on-firefighting program/ training.

10. Safety programs have not been conducted for some of the plant personnel including those posted in the TG hall and control room premises in some of the plants.

    **Recommendation:**

    i. All safety awareness related activities in the plant premises for safe work at site should be carried out.

    ii. Safety programs for safety awareness at site should be conducted regularly (Quarterly/monthly/Annually) for all concerned plant officials and contract workers.

11. In most of the power stations, there is a practice in place to observe/ celebrate Safety day, Safety week every year. There is reward system for the contractor & contract workers. However, there is no method in place to evaluate contractors for their safety performance.

    **Recommendation:** A documented procedure for evaluation of contractors w.r.t. their awareness and adherence to the safety aspects needs to be in place with all power plants.

12. In all the power stations, it was observed that reporting of near miss incidents are negligible.

**Recommendation:**

i. The root cause analysis (RCA) of all incidents (major/ minor) should be done and learnings from near-misses & accident investigation findings must be shared with all concerned in a structured manner.

ii. All technical officers of the power stations must endeavor to capture and report all near miss incidents.

13. Hazard and Operability/ Hazard Identification (HAZOP/ HAZID) study / analysis is not being done in some of the power stations. Instead 'Hazard identification and Risk assessment' (HIRA) has been followed.

**Recommendation:** Hazard Identification/ HAZOP study/ analysis must be undertaken by the power stations.

14. In most of the power plants, it was found that workers/ staff are not putting on appropriate job/ task specific PPE kits. Fire hydrant line workers were not wearing proper gloves; in lignite Bunker area workers/ staff were not putting on Goggles etc. Most of the power plants were not maintaining special kits like Arc Flash suits/ High heat suits and masks/ suits for Chlorine and chemical handling areas.

**Recommendation:** Power stations must keep inventory and provide the tasks specific PPE kits to all the workers/ staff.

15. Lock Out & Tag Out (LOTO) system for maintenance management has not been fully implemented in some of the power stations.

**Recommendation:**

i. LOTO should be implemented in the power stations for safe operation of the power plants.

ii. There should be seamless integration between LOTO & PTW System (and also to ERP system, if available).

iii. SOPs should also be made available on such shared network integrated LOTO/ERP.

16. In some of the audited power stations, a manual Permit to Work (PTW) system is being followed. In some stations, there is no provision for periodical assessment of efficacy of PTW system. Further, Job Safety Analysis (JSA) is not carried out before issue of PTW in some stations because of lack of awareness about JSA / non-availability of a format for JSA.

    **Recommendation:** PTW system must be followed and should be fully integrated with ERP. Further, Job Safety Analysis should be carried out before issuance of each PTW.

17. Some of the power stations either have not carried out Internal Safety Audit or its periodicity is once in two years or more. In these power stations cross functional teams have not been constituted to carry out Internal Safety Audits.

    **Recommendation:** Internal Safety Audits must be carried out once/ twice a year through cross functional teams/ internal trained staff and records must be maintained.

18. Similarly, some of the power stations either have not carried out External Safety Audit or periodicity is not regular. In case of some power stations where External Safety Audit has been conducted, the recommendations of External safety audit are pending and have not been liquidated in a time bound manner.

    **Recommendation:** External Safety Audit must be carried out through registered Agencies as per statutory requirement. Action Taken Report (ATR) must be prepared & monitored to ensure early liquidation of pending recommendations.

19. Some of the power stations are not ISO: 45001 ‘Occupational Health & Safety Management System’ certified/ compliant.

    **Recommendation:** All power stations must be ISO: 45001 certified.

20. In all the power stations, it was observed that communications (emergency/ general calls) are made mostly through mobile phones. Proper Public Address system is also not in place.

    **Recommendation:** Proper Public Address system should be in place and functional. Further, mandatory use of 'Walkie/ Talkie’ be adopted in the power plant.

21. Some of the power stations have not made any provisions for Safety budget.

    **Recommendation:** Power station management should take actions to make provisions for Safety budget.

### 5.1.2 Fire Safety Aspects

1. In most of the power stations, except two power stations, Fire Water Pump house is not properly maintained. Scrap/ unused waste material were found lying in the Fire water pump house. In one of the power stations, scaffoldings were under erection since long time due to renovation work. In another power station, pipelines layout was seen obstructing the walkways of pump operator.

   **Recommendation:** Fire Water pump house must be maintained in proper healthy condition. There should be no obstructions in the pathways and approaches to equipment should be hindrance free.

2. In some of the power stations, Fire hydrant Pumps are operating in 'MANUAL MODE'. In some power stations jockey pumps were not in operating condition since long time. In one of the case, Fire hydrant discharge header flange was profusely leaking. In another power station, diesel operated fire hydrant pump got tripped again & again during demonstration while physical audit was being conducted.

   **Recommendation:**

   i. All fire hydrant pumps / jockey pumps must be maintained in healthy condition.

   ii. The Fire Hydrant pumps need to be operated in ‘AUTO MODE’ & Sequential starting system should be in place.

   iii. The reliability & availability of the Pumps are to be checked at frequent intervals and recorded.

3. In some plants, it was observed that fireboxes with hose reels were missing near the fire hydrant points at some locations. Auto fire detection & spray system were also not available in some of the stations.

   **Recommendation:**

   i. Power plant management must ensure fireboxes with hose reels at

fire hydrant points.

ii. Regulation 12 (5) (a), (b), (c) of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 shall be complied with in respect of Fire Detection, Alarm and Protection System which inter-alia states that:

(a) A comprehensive fire detection, alarm as well as fire protection system shall be installed for the Station in conformity with relevant IS.

(b) Automatic fire detection and alarm system shall be intelligent and addressable type and shall be provided to facilitate detection of fire at the incipient stage and give warning to the fire fighting staff.

(c) Major equipment to be used for fire detection and protection system shall be in accordance with Indian Standards or UL (Underwriters Laboratories, USA) or FM (Factory Mutuals, USA) or LPCB (Loss Prevention Certification Board, UK) or VDS (Germany)/

4. In most of the power stations except where CISF fire team is deployed, adequate firefighting crew are not deployed. Further, Firemen were not provided with adequate job specific trainings to handle emergencies/ fire incidents.

   **Recommendation:** Firefighting crew along with some identified regular employees must go through hands-on firefighting training including rescue and disaster handling to enhance effectiveness of firefighting & safety crew.

5. In some of the power stations, Manual call points (MCPs) were not in healthy operating condition.

   **Recommendation:** Manual call points (MCPs) must be provided at all the strategic locations of the power stations and must be integrated with DCS console in the Fire Control Room for effective monitoring and to ensure timely & quick response from fire-fighting crew.

6. Except for those power stations where CISF fire team is deployed, it was observed that records regarding conductance of Mock drills for situations like fire incidents are lacking in completeness/ not maintained. In such stations, it was observed that Fire Marshalls/ crew are not aware of the procedure of Mock drills and even they have not been provided with job specific trainings.

   **Recommendation:**

   i. Mock drills to be conducted at regular intervals and also at odd hours

for various emergencies scenarios & debriefing session must be conducted after each mock drill.

ii. The gaps observed are to be analyzed and mitigation measures are to be taken. These details are to be recorded in a register.

iii. Fire Marshalls/ firefighting crew must be trained for actual emergencies scenarios and proper records need to be maintained.

7. Some of the audited stations did not have a well-formulated Fire Emergency Plan

   **Recommendation:** Each Power Station shall have a Fire Emergency Plan formulated so as to facilitate organized actions (in case of fire) by employees at various levels, during day as well as night. These orders shall also contain the instructions on fire prevention measures and the firefighting organization.

8. Control Rooms of most of the power stations are not having the latest environment-friendly fire-fighting systems/ equipment.

   **Recommendation:** In power stations, clean agent (environment friendly) fire suppression system must be provided in all control rooms.

### 5.1.3 Safety Aspects of Balance of Plant Systems

General upkeep of the various areas of Balance of power plant system was not adequate in some of the power stations. In some of the vulnerable areas like Crusher house, coal/ lignite Bunker etc. accumulation of coal/ lignite dust was observed. Wild vegetation growths in Switchyard, corroded support structures of coal/ lignite conveyor system, large quantities of scraps/ dismantled machinery were observed in various areas of the power station. Power plant management must take immediate action to improve housekeeping of the entire plant.

Detailed observations and recommendations as observed in Balance of Plant System by Safety Audit team are summarized here:

#### (A) Chlorination Plant

1. In some of the power stations, Chlorine leak sensor probes were not provided at some of the chlorine cylinder bays.

**Recommendation:** Chlorine leak sensor probes must be provided for all chlorine cylinder bays at proper locations.

2. In some power stations, there is no water sprinkler system in chlorination plant.

   **Recommendation:** Water sprinkler system need to be installed in chlorination plant to neutralize chlorine leak in addition to the extant system.

3. In most of the power stations, except two stations, proper PPEs kit like gas tight chemical protective suits, suitable masks & gloves were not provided to the operators working in the Chlorination plant area.

   **Recommendation:** Proper job specific PPEs kits must be made available to the operators.

**(B) Hydrogen Plant**

1. In some stations, it was found that hydrogen generating & filling plant is available. Except in one station, hydrogen plant was not properly locked to prevent entry of stray animals/ unauthorized persons. Even, operators/ staff have their seating arrangements near the Hydrogen compressor which indicates carelessness in operating Hydrogen plant.

   **Recommendation:**

   i. In Hydrogen plant, provisions must be made as per the requirements of a hazardous area.

   ii. $H_2$ charging & store room area and their isolation door should be kept in locked conditions so that unauthorized entry may be avoided.

   iii. Use of Mobile phone must be prohibited in $H_2$ Plant.

   iv. No unauthorized person should be allowed near $H_2$ Generator, Compressor and storage area.

   v. Static electric charge dissipater must be provided at the entry gate of each hydrogen plant.

   vi. Flame-proof electric fittings should only be used to avoid any fire / explosion hazard.

2. In some hydrogen plants, hydrogen leak detectors are not available. Instructions for use of hydrogen charging near rack were not available in the $H_2$ store room area in some of the plants. It was also observed that hydrogen cylinder mounting rack was not available while filling. $H_2$ and $CO_2$ gas cylinders were stacked in the $H_2$ filling room but were not properly chained in the rack area It was also observed that areas of empty and filled hydrogen cylinders are not clearly marked. Unused cylinders were not capped in some of the plants.

   **Recommendation:**

   i. Hydrogen leak detectors should be provided at appropriate locations in Hydrogen plant.

   ii. Instructions for correct method of usage of hydrogen charging near rack should be displayed in $H_2$ charging & store room area.

   iii. Do's and Don't boards to be displayed in each hydrogen plant before entry.

   iv. Hydrogen cylinders must be mounted on a rack while filling in order to avoid slippage or any such untoward incident.

   v. Filled/ empty hydrogen cylinders must be properly chained and stacked separately.

   vi. Unused cylinders must be capped in the hydrogen plants.

**(C) Switchyard Area, Electrical Panel and Control Room**

1. Electrical panel room is well maintained with proper Exhaust system, ventilation & Illumination systems in most of the stations. However, in some of the power stations, Insulation Rubber mats (Earth mats) near the Electrical panels were found missing. Electricals panels were not provided with 'Linear Heat Detection system'.

   **Recommendation:**

   i. Insulation Rubber mats (Earth mats) near the Electrical panels must be provided.

   ii. Regulation 12 (5) (a), (b), (c) of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 shall be complied-with in respect of Fire Detection, Alarm and Protection System {as brought out at Para 5.1.2 (3) (ii) above}

to be provided for Electrical Panel Room.

2. Earth system (Pit) maintenance and resistance value measurement is not done and recorded regularly in some of the stations.

   **Recommendation:** Resistance value of Earth pits and Tan Delta value of current transformers (CT) and all other oil filled electrical equipment are to be measured and records are to be maintained properly.

3. Battery Room is properly lined with 'Acid resistance tiles' up to the height of 'Battery Bank' except in one power station. Battery room is properly ventilated & illuminated. In some of the plants, battery room was kept neat and clean and eye-wash system was also available nearby. However, SOPs were not available in the battery room in some plants.

   **Recommendation:**

   i. Battery Room is to be properly lined with 'Acid resistance tiles' up to the height of 'Battery Bank'.

   ii. It is also suggested to provide Flame-proof lighting in the Battery room.

   iii. SOPs for battery room operator for safe operation of the battery needs to be provided.

   iv. It is also to be ensured that the Eye-wash system is located at a place nearby to the Battery Room.

**(D) Cable Gallery System**

1. In some of the power stations, Illumination level in the Cable Gallery/ Racks area was not adequate. In some power stations cable dressing in the racks was not properly done. Exhaust system in the cable gallery of some of the stations was found non-functional.

   **Recommendation:** Cable gallery/ racks must be maintained in healthy conditions with proper illumination levels, exhaust system and the cable dressing in the racks should be done properly.

2. It is observed that though fire doors have been provided in the cable Gallery area, entry & exit of cables are not sealed properly in some of the power stations.

   **Recommendation:** All entry & exit of cables must be sealed properly for preventing progression of fire and toxic gases to adjacent rooms.

3. **Observation:** In some of the stations, a fire-fighting and prevention system in the Cable Galleries were not found in place.

   **Recommendation:** Regulation 12 (5) (a), (b), (c) of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 shall be complied-with in respect of Fire Detection, Alarm and Protection System {as brought out at Para 5.1.2 (3) (ii) above} to be provided in Cable Gallery.

## (E) Generator Transformer Area

1. In some of the power stations, transformer oil soak pit was fully compacted with waste material without sufficient space to contain accidental oil spillage. Earth pits are also not properly maintained. In one of the power stations, it was observed that approach to the Generator Transformer was not properly maintained while in another station, the area was not properly fenced to prevent unauthorized entry.

   **Recommendation:**

   i. In all the transformers, oil soak pits need to be kept free of any waste material.

   ii. Earth pits need to be maintained in good condition.

   iii. Approaches to all the transformers including Generator Transformer need to be hindrance free and the GT Area should be properly fenced to prevent any unauthorized entry including that of stray animals.

## (F) Coal/ Lignite Handling System

1. In coal/ lignite yard, Fire hydrant system is in healthy condition. In some of the power stations, Dust suppression system along the coal/ lignite conveyor system was not in healthy condition. Accumulation of coal/ lignite dust was seen in the Crusher house floors, transfer junction/ point

area, coal/ lignite Bunker area. In one of the power station, Fire hydrant nozzle was found to be fully covered with coal dust.

**Recommendation:** Dust suppression system must be in operating condition to prevent coal/ lignite dust accumulation in confined spaces.

2. In some of the power stations, coal/ lignite conveyer structure is corroded / not painted properly.

   **Recommendation:** The supporting structure of the coal conveyor system must be regularly inspected and painted.

3. In some of the stations, fire-fighting system (with water spray/ mist nozzles) were not found in place along the conveyor belts to deal with any eventuality of a fire incident.

   **Recommendation:** Regulation 12 (5) (a), (b), (c) of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 shall be complied-with in respect of Fire Detection, Alarm and Protection System {as brought out at Para 5.1.2 (3) (ii) above} to be provided along the conveyor belts.

4. Except for those power stations where CISF fire team is deployed, Fire-fighting personnel in the coal/ lignite handling area were not fully trained to deal with fire emergencies.

   **Recommendation:** Proper training is required for fire-fighting personnel. Caution has to be exercised while applying extinguishing water jets on Lignite and Lignite handling equipment to avoid rising of a Lignite dust cloud which may result in a dust explosion.

5. In Bunker area, Dust extraction system has not been provided in Crusher house & coal/ lignite bunker area in some of the power stations.

   **Recommendation:** Dust extraction system must be installed to avoid accumulation of coal/ lignite dust.

**(G) Fuel Oil Storage & Handling System**

1. In some of the power stations, Fuel Oil pump house is not properly maintained. Oil spillage/ scrap material was seen in the F.O. pump

house. Fire hydrant system provided in Fuel oil storage area is in Manual Mode.

**Recommendation:**

i. Fuel Oil pump house must be maintained in proper healthy condition.

ii. There should be no obstructions in the pathways and approaches to equipment should be hindrance free.

iii. Wherever Fire hydrant systems are operating in Manual Mode, they must be replaced with Auto Mode of operation.

iv. In Fuel Oil pump house, Flame proof lighting and electrical fittings is to be ensured.

2. In some of the power stations, though Visual inspection is done daily for any oil leakage in fuel oil conveying pipelines & fuel oil feeding skid area, Inspection Register/ Log book for maintaining records of inspections is not available.

   **Recommendation:** Inspection register/ log book for any oil leakage in fuel oil conveying pipelines & fuel oil feeding skid area should be regularly maintained.

3. In some of the power stations, Electro-static charge discharge/ dissipater facility is not available in the Fuel Oil unloading area.

   **Recommendation:** Electro-static charge discharge/ dissipater facility should be made available in the Fuel Oil unloading area.

## (H) Safety Aspects of Ash Dyke Area

1. Ash Bund/ Dyke Maintenance Manual, Standard Operating Procedures (SOPs), Emergency Plan in case of Ash Dyke breach, Ash Dyke Maintenance Inspection Register were not available in some of the Plants/ Station.

   **Recommendation:**

   i. Ash Bund/ Dyke Maintenance Manual, Standard Operating Procedures (SOPs) should be prepared by Power Plant Authority.

   ii. Emergency Plan in case of Ash Dyke breach should be prepared and made available to the Site engineers.

iii. Ash Dyke Maintenance Inspection Register should be maintained and the periodicity of inspection should as per SOPs.

2. In some of the stations, Abandoned Ash bunds management plan has not been prepared.

   **Recommendation:** The abandoned ash bunds should be closed as per MoEF&CC norms. Abandoned ash dyke which has been stabilized must be reclaimed by putting suitable soil cover over the ash surface with green belts/ plantation.

## 5.2 Boiler Safety

1. It is found that in all cases, the certificates for use of Boilers have been obtained from Directorate of Boilers of respective state. However, in some cases, Remnant Life Assessment (RLA) of boilers have not been done on time.

   **Recommendation:** As per IBR Reg. 391A, Remnant Life Assessment (RLA) must be carried out after 1,00,000 hours of operation and every 6 years thereafter. RLA must be done on priority to ensure regulatory compliance and safe operation.

2. In some plants, annual overhauling and capital overhauling are not done on time to ensure healthiness of the boiler. Also, in some of the cases the quality of overhauling was not good.

   **Recommendation:** Annual overhauling, Capital overhauling and RLA work must be done on time as these prevent equipment failures. Overhauling work should be monitored comprehensively and SOPs must be followed to avoid the post-overhauling surprises.

3. In majority of cases, it is found that the boiler is not being operated under the supervision of Boiler Operating Engineers (BOE), either due to the shortage of BOE or any other reasons.

   **Recommendation:** It is recommended that the boilers must be operated under supervision of BOEs in compliance with the provisions of IBR. Utilities

with shortage of BOEs should make effort that their engineers should be qualified BOEs.

4. Though in majority of cases the boiler structure was found to be in good condition, in some cases, stairs, hand railing, chequered plates, gratings were found badly corroded which may lead to accidents.

   **Recommendation:** The boilers platforms should be checked regularly for these kind of damages and should be attended immediately. Regular cleaning should be ensured.

5. Boilers having box type column-beam type structure are prone to accumulation of coal/ash dust if there are opening in the boiler structure. As such, coal dust accumulated in such confined structure may lead to fire/explosion.

   **Recommendation:** All the opening in such kind of structure must be closed to stop the accumulation of coal dust. However, in case of any closing of such manholes/ hand-holes is done, cleaning must be ensured before closure.

6. In some cases, there was interference of steam lines with other components/structure of Boiler or adjacent civil structure. These kind of interference may cause a catastrophic effect during the thermal expansion/contraction of boiler/steam lines.

   **Recommendation:** The interference of steam lines with other components/structure of Boiler or adjacent civil structure because of thermal expansion/contraction must be avoided.

7. In some plants, insulation in Boiler areas such as Main furnace, Flue gas outlet ducts, hot air ducts, steam lines, Boiler drum, etc. was missing. The condition of Insulations was varying from plant to plant but in majority of cases, it was not good.

   **Recommendation:** Insulation of boiler and its auxiliaries must be ensured. Regular thermal survey for surface temperature must be done.

8. Pulverized Fuel (PF) leakages were observed in Mills, PF pipes joints in some power plants.

**Recommendation:** Pulverized fuel leakage in mills, joints etc. are to be arrested on immediate basis. In some of the leak prone areas, ceramic components may be put in place.

9. In some of the plants, the boiler lift was not working.

   **Recommendation:** For proper movement of personnel and material and to deal with emergency situation, boiler lift should be functional all time.

10. In some of the plants, various sub-systems of boilers such as furnace, fans (Primary, Forced, Induced), Air Pre Heaters, ESP were not found to be well maintained.

    **Recommendation:** For proper functioning of Boiler, functioning of all the subsystems must be maintained in healthy condition and associated instrumentations must be calibrated at regular interval.

11. In some cases, the housekeeping in boiler area was found to be very poor as loose materials/scraps were observed on different elevations of boiler. There was lot of scrap dumped in boiler area which was restricting the movement. This is quite dangerous. Also, in some cases ash accumulation in considerable quantity observed on boiler hanger area (Boiler roof and pent house).

    **Recommendation:** Scrap in all areas need to be cleared and stored at designated areas and removal of ash from hanger area should be done on priority wherever applicable.

12. In some of the plants, the illumination level in boiler areas was found to be very low.

    **Recommendation:** Illumination measurement to be carried out as per IS:6665 and it needs to be improved in the plants wherever necessary.

13. In some of the cases, furnace expansion indicators were not available in boiler.

    **Recommendation:** All Boiler expansion indicators must be fitted properly to measure vertical movement as well as horizontal movement.

14. In some of the plants, the Buckstays in some of the locations were found not clean. Buckstays of Boilers were having huge dust (coal/lignite/ash) deposits.

    **Recommendation:** The boiler buckstays need to be cleaned of dust deposits for smooth movement.

15. In ESP, the general observation includes the problems associated with ash hoppers evacuation system, dysfunctional hopper level indicators, dysfunctional heater etc. which may lead to accidents.

    **Recommendation:** Regular ash level monitoring in hoppers has to be ensured by providing Ash Level Indicators (ALI) in the ash hoppers and whenever the ash level is above the limit in the hopper, it has to be isolated. Further, wherever Ash level indicator (ALI) is not available in the ash hoppers, it has to be provided.

16. Leakage of steam/water was observed at some places.

    **Recommendation:** Steam /water leakages must be attended immediately.

17. The problem of vibrations of fans (Primary, Forced, Induced) were not being monitored and attended-to in some of the plants because the instrumentation for vibration monitoring was not being maintained in a healthy condition.

    **Recommendation:** Instrumentation provided for vibration monitoring must be maintained in healthy condition so that vibration of fans is kept within prescribed limits.

18. Hangers of critical piping were not loaded properly at different locations of some of the plants.

    **Recommendation:** Hangers should be kept clean and checked time to time for load distribution and distortions. Cold and Hot reading of Hangers must be taken and their proper functioning and proper loading must be ensured.

19. The condition of Bunker house in some of the stations need lot of improvement. There was lot of dust accumulation over the conveyer structure, instruments/cables.

**Recommendation:** Bunker house must be maintained to avoid any kind of fire hazard and emergencies.

20. In some power plants, Open electrical boxes/panels, old non-working electrical boxes were found at some places on boiler.

    **Recommendation:** Open electrical boxes are to be closed and non-working boxes are to be removed.

21. In some places, cables were found damaged and some junction boxes were found open. Cables were not organized in cable trays

    **Recommendation:** The Junction Boxes are to be kept closed. Unorganized electrical cables on boiler are to be organized properly in cable trays.

22. In some power plants, Chain guard and coupling guard of rotating equipment were missing at some places.

    **Recommendation:** Rotating parts may be covered with proper guards.

23. At some places, the Ammonia Cylinders were found without having caps and cylinders were not tied by chains. There is no safety shower near ammonia cylinders.

    **Recommendation:** In case of any cylinder containing the compressed gas, the nozzle must be covered with caps and cylinder must be tied with chains to avoid accidental falling of cylinders.

24. Safety Valves and Electromatic Relief Valves (ERV) of all units were checked for their functionality and it was observed in all plants that they were in service.

    **Recommendation:** All stations must maintain the safety valves and ERVs and must ensure that all of them are operative.

## 5.3 Turbine-Generator Safety

The sub-group on Turbine & Generator Safety during the audit process had following important observations/ recommendations.

1. In some thermal power plants, it was observed that the vibration levels of TG bearings were on higher side although they are within recommended limits of OEM.

   **Recommendation:** TG set vibration must be monitored on regular basis and machine should not be run beyond the recommended limit of the manufacturer. Also all other critical parameters of turbine must be regularly monitored and safe operation to be ensured.

2. In some thermal power plants, it was observed that turbine over speeding test was not carried out at regular intervals as per recommendations of OEM. In some plants it was carried out only during commissioning period.

   **Recommendation:** It is recommended that turbine over speeding test must be carried out as per OEM recommendations.

3. In most of the TPP's, Test certificates of Tool & Tackles were available. However, the tools were not marked with tags containing information regarding their capacity and last load test date. Further their storage and maintenance was not in proper condition.

   **Recommendation:**

   i. Tool tagging must be made mandatory and special emphasis on housekeeping is also recommended so that effective inventory management may be ensured along with timely availability of all tools & tackles.

   ii. Tagging and marking date of last load testing of all O&M tools & tackles must be ensured.

4. In some of the stations, it was observed that only manual firefighting systems were available in Cable Galleries, Battery Bank room, Diesel Generator (DG) room & Main Oil Tank (MOT) area in some power plants.

   **Recommendation:** Automated Firefighting system is recommended for Main Oil Tank (MOT) area, Cable Galleries.

5. Emergency exit points and fire extinguisher location charts were displayed in TG floor /UCB in most of the plants. However, the exit path marking was not done on the TG floors to facilitate easy and quick evacuation in case of emergency situations in some of the stations.

**Recommendation:** Emergency exit path marking should be made available for safe evacuation of working personnel during emergency conditions. It is also recommended that emergency telephone numbers must be prominently displayed in TG floor, UCB & emergency exit points.

6. Safety Audit committee observed that in some of the plants turbine floors are being used as store yard for dumping maintenance tools, scrap and spare equipment.

   **Recommendation:** It is recommended that all turbine floors should be cleared of scrap and unwanted/ unused equipment and power plant management should take immediate action to locate scrap/unused material & equipment at their designated space/store.

7. In some of the plants, non-sparking tools were not available for working in $H_2$ gas cylinders store room area.

   **Recommendation:** Mandatory use of non-sparking tools at all places where gases having potential of fire hazard are stored.

8. Insulation of Deaerator area pipes, BFP discharge lines, HP heaters and HP/LP BP lines were not in healthy condition in some of the plants.

   **Recommendation:** It is recommended to do insulation of all the critical equipment & lines that are exposed to the surrounding in the plant premises. Re-Insulation is recommended for all such pipelines/equipment so that no working personnel should be affected by the same.

9. In some of the plants, the standard operating procedure (SOP's) for TG operation & maintenance was not found in main plant control room.

   **Recommendation:** SOPs must be prepared and made available to all the concerned supervisors/operators.

10. In some of the plants, it was observed that few pipeline hangers are either loose or not taking load or broken at some points.

    **Recommendation:** It is recommended to take appropriate action for all such

pipeline support & hangers so that proper safe operation of plant can be ensured.

11. It has been observed that SOPs were not available in the DG set room and DG set is operated manually on telephonic information in most of the plants.

    **Recommendation:** It is recommended that SOPs must be made available to all working personnel associated with DG set room.

12. In some plants, it was observed that Protection & Interlock (P&I) checks were not being followed for TG areas as per requirement.

    **Recommendation:** It is recommended that Protection & Interlock (P&I) checks must be performed regularly in TG premises.

13. In some plants, it was observed that capital overhauling was not done as per the OEM Instruction.

    **Recommendation:** It is recommended to conduct capital overhaul as per OEM recommendations.

14. Noise level on various elevations on TG building was found very high in most of the plants.

    **Recommendation:** Noise level should be maintained within limits as per applicable standards.

15. In some power plants it was observed that Jacking oil system was not working due to leakages in system.

    **Recommendation:** It is recommended that Jacking oil system must be in healthy operating conditions.

16. Consumption of hydrogen gas used for cooling of generator has been high for some power plants.

    **Recommendation:** It is recommended that the possible cause of high

hydrogen gas consumption must be identified and same need to be rectified.

17. Emergency DO's & DON'Ts were not prominently displayed in control room of some power plants.

    **Recommendation:** Display of DO's & DON'Ts must be done in large fonts for better visibility. All such Display Boards should have a DC backlit display. CCTV monitoring of the TG area may also be ensured so that a closer watch on safety and maintenance activities can be kept.

18. In some of the plants, illumination in the TG hall and lower floors have been observed very low.

    **Recommendation:** It should be regularly measured and arrangement of proper brightness at all floors must be ensured. Further, DC light in TG area must be regularly checked.

# 6.0 Summary of Safety Concerns in Power Plants

The Committee analyzed the data available as per the response received on Checklist from various power plants (including those physically audited) and the summary of major discrepancies/ overall safety concerns with regard to prevalent O&M Practices vis-à-vis the suggestive measures are brought out below.

1. Safety is essential part of construction, operation & maintenance of plant for safety of human life, environment and property. However, it has not been given due importance in practice by some of the power plants. More emphasis by all stations needs to be given to ensure safe working practices to ensure a safe and sustainable operation of power plants.
2. There is a need to improve the awareness about the Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011. The above CEA Regulations specifies that the Owner shall make safety an integral part of work processes to ensure safety for employees including employees of contractor, sub-contractor as well as visitors and the Owner shall set up a sound and scientific safety management system. Provisions under CEA Safety Regulations related to plant owners are mentioned below for reference:
   - *(i) Written statement of policy in respect of safety and health of employees;*
   - *(ii) Defining and documenting responsibilities for all levels of functionaries to carry out safety related activities including responsibilities of the contractors;*
   - *(iii) Detailed safety manual complying with the statutory requirements and manufacturers' recommendations;*
   - *(iv) Establishing procedures to identify hazards that could give rise to the potential of injury, health impairment or death and measures to control impact of such hazards;*
   - *(v) Providing adequate human, physical and financial resources to implement the safety management system;*
   - *(vi) Providing safe working environment and evolving framework for occupational safety and health;*
   - *(vii) Providing and maintaining medical facilities;*
   - *(viii) Providing adequate training to all employees to keep them aware of safety related issues;*

(ix) *Establishing system for accident reporting, analysis, investigation and implementation of recommendations;*

(x) *Establishing system for proper communication, documentation and record management in relation to occupational safety and health;*

(xi) *Formulating emergency management plan for quickly and effectively dealing with probable emergencies that may arise on site as well as off-site;*

(xii) *Establishing methodology for internal and external audit of safety management system;*

(xiii) *Establishing system for periodic monitoring and review of the safety system by the management;*

(xiv) *Overseeing the safety performance of contractors*.

From the observations made above in **Para-5,** it may be seen that some of the deficiencies are falling in the above outlines of Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011. Therefore, the compliance of provision of CEA Regulations should be ensured to enhance the safety of the power plants.

3. It is found that in all cases, the certificates for use of Boilers have been obtained from Directorate of Boilers of respective state. As per IBR Reg. 391A, Remnant Life Assessment (RLA) must be carried out after 1,00,000 hours of operation and every 6 years thereafter. However, in some cases, Remnant Life Assessment (RLA) of boilers have not been done on time. RLA must be done on priority to ensure regulatory compliance and safe operation.

4. In majority of cases, it is found that the boilers are not being operated by Boiler Operating Engineers (BOE) either due to the shortage of BOE or any other reasons. It is suggested that the boilers must be operated with BOEs in compliance with the provisions of IBR. Utilities with shortage of BOEs should make effort that their engineers should be qualified BOEs.
5. Insufficient /Nil safety budget/ provision are made in the overall budget by various organizations. Allocation of a safety budget shall ensure expenditure on safety and the overall safety conditions shall improve.
6. Safety manuals are not available with some plants. The same need to be prepared and implemented by the power plants.
7. Requisite number of Safety Officers are not appointed as per statutory

requirement and output from Safety Committee meetings held in the power plants are not sufficient and exhaustive. The plants should hold Safety Committee meetings regularly and Head of Plant shall chair these meetings. Plants shall carry out regular internal and external safety audits.

8. There is very little awareness of Safety provisions in some stations as far as its compliance amongst the employees deployed by the Contractors in some power stations is concerned though CEA safety regulations clearly specify that "*the Owner shall incorporate the safety provisions in the contract document which are required to be complied by the contractor's employees during execution of the contract to facilitate safe working during execution of the work*." All power stations need to pay due attention to these safety provisions.

*9.* A well-established procedure for Reporting of accidents by the concerned Power Station to CEA is not found in place in many power stations though the safety regulations clearly specify that "*the cases of outage of an electrical plant or an electric line of following nominal rating due to any accident related to any equipment e.g. fire, explosion of pressure piping or pressure vessel, implosion, emission of hazardous chemicals, collapse of transmission tower, flooding of power house area, shall be reported to the Authority within twenty four hours, whether or not any death or disablement is caused to any person, for*

*(a) Thermal generating units: 200 MW and above*

*(b) Hydro-electric generating units: 50 MW and above;*

*(c) Electric lines/ sub-stations: 132kV and above*."

Hence, it is necessary that all power stations should ensure a proper accident reporting procedure.

10. No Emergency management plan is found in some of the stations. Therefore requisite emergency plan needs to be prepared and followed.

11. Medical facilities at some stations are found to be inadequate though the Safety regulations clearly specify that

"(1) The Owner shall provide medical facilities,

(a) to prevent and control occupational diseases;

(b) to prevent and reduce disability;

(c) to provide immediate relief to accident victims.

(2) An occupational health centre with the services and facilities as per the statutory requirement shall be provided for all electrical plants and electric lines and maintained in good order."

Therefore, requisite attention needs to be paid to provide desired medical facilities by all power plants.

12. Safety training and awareness to employee and contact workers is found inadequate in some of the plants. As such, safety training and awareness needs to be taken-up in right earnest by all plants.

13. General upkeep of the various areas of Balance of power plant system was not adequate in some of the power stations. In some of the vulnerable areas like Crusher house, coal/ lignite Bunker etc. accumulation of coal/ lignite dust was observed. Wild vegetation growth in Switchyard, corroded support structures of coal/ lignite conveyor system, large quantities of scraps/ dismantled machinery were observed in various areas of the power station. The general upkeep of different areas of the power plant need to be improved a lot.

14. Thermal insulation and noise level of Turbine-Generator, Boiler and its auxiliaries need to be improved.

15. Structural repairs at many of the equipment areas need proper attention.

16. Fire-fighting system, its operation, installations and upkeep of various sub-components need to be reviewed for proper response during emergencies.

17. It is also observed that there is no uniformity of safety practices being followed by Central Generating Utilities, State generating utilities, States PSUs. As such, Reliability & Safety of Thermal Power Plants operated by State Government Utilities/ State GENCOs need considerable improvement & catching up for enhanced safety of their plants.

## 7.0 The Way Forward

With around 600 units of coal/lignite based thermal generating capacity of 210 GW, operating in the country and likely increase in future capacities, it would be appropriate that the gaps/ deficiencies observed by the Safety Audit Committee, as brought out in the foregoing paragraphs, are given due emphasis by the power sector to address the Safety Concerns with regard to prevalent O&M Practices towards operating the stations in a safe, reliable and accident free manner.

Accordingly, based on the analysis of the discrepancies noted in the audit of the power plants and to bring a minimum uniform safety compliance by all the power generating stations, following are suggested for a safe working environment of Thermal Power Plants.:

A. The common deficiencies noted in the **Paras 5.0 and 6.0 above** may be complied on the urgent basis by all power plants. All stations must ensure conducting the Safety Audit (external as well as internal) at regular intervals.

B. Formation of Power Plant Safety Division under CEA/Ministry of Power (MoP) for Power Sector may be considered to formulate safety measures for power plants (Thermal, Hydro and Renewables etc.) from time to time and ensure the regular compliances for safe power plant operations.

C. All power stations should ensure a separate budget head in its overall budget provisions to adequately fund safety related activities.

D. Suitable advisory would be issued to all generating utilities by CEA based on the outcome of the above safety audits for needful compliances by the power plants.

********

**Exhibit-I**

A coal/lignite based thermal power plant consists of large number of integrated plants/systems and equipment having mechanical, electrical, instrumentation & control and civil components.

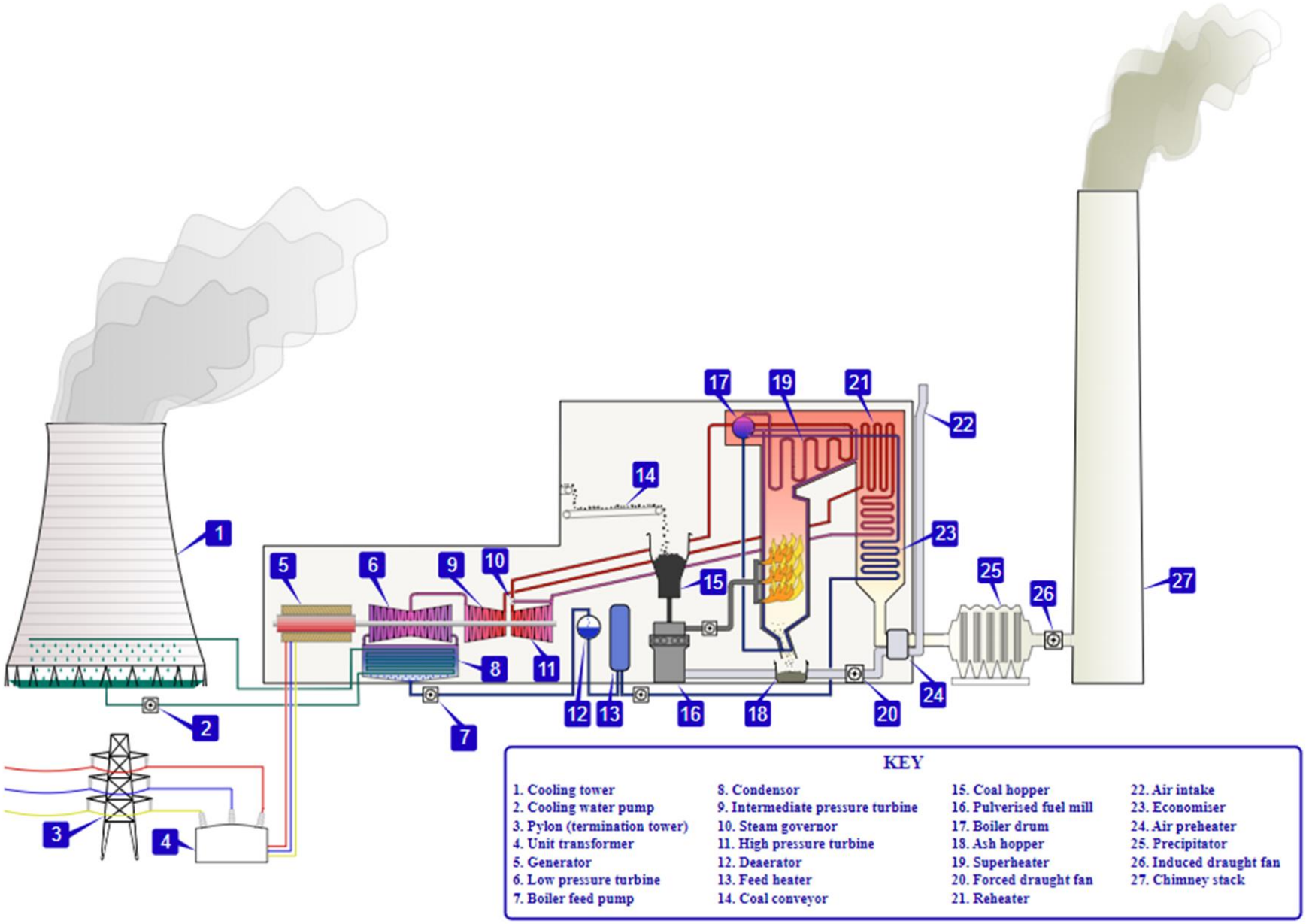
The plant systems and equipment can be broadly classified into following two categories: -

1. **Main Plant (BTG System)** comprising of steam generator (boiler), steam turbine and generator along with their associated auxiliaries such as:
    i. **Boiler and its auxiliaries** (comprises of Furnace, Water wall, Economizer, Super-heater, Re-heater, Mills, Air preheaters, Fans (PA, FD& ID), ESP etc.

    ii. **Turbine- Generator and its auxiliaries** (comprises of HP, IP, LP turbines, Boiler feed pumps, Deaerator, feed water heaters, Generator and Excitation System Condenser, HP-LP Bypass System etc.)

2. **Balance of Plants (BOP) system** which includes all plants and equipment other than those included in main plant system. The major components of BOP system include Coal/Lignite Handling Plant(CHP/LHP), Ash Handling Plant (AHP), Fuel Oil Handling Plant, Water Treatment Plant (WTP), Circulating Water System, Fire Protection, Detection and Alarm System, Electrical, Control and Instrumentation System etc.

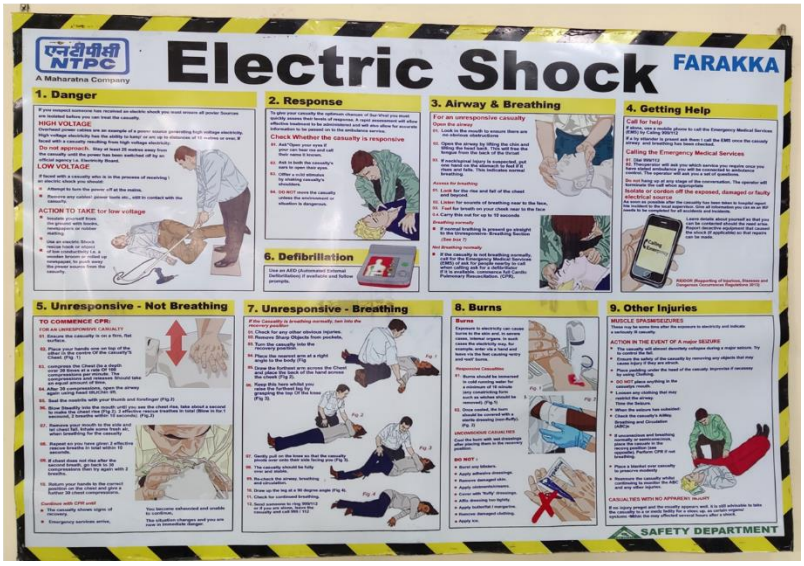
A typical set up of the coal/lignite based thermal power plant is outlined below.



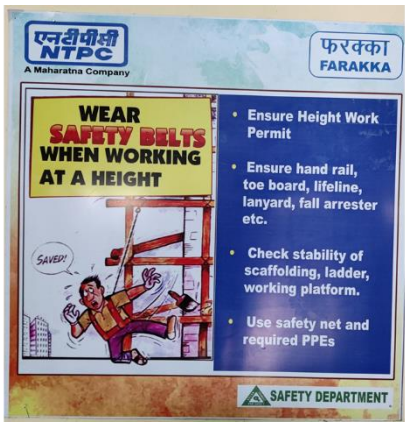

**A Typical Thermal Power Plant Setup**

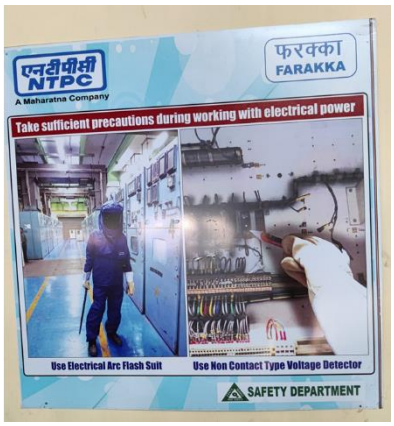
## Good Practices Observed at Various TPSs







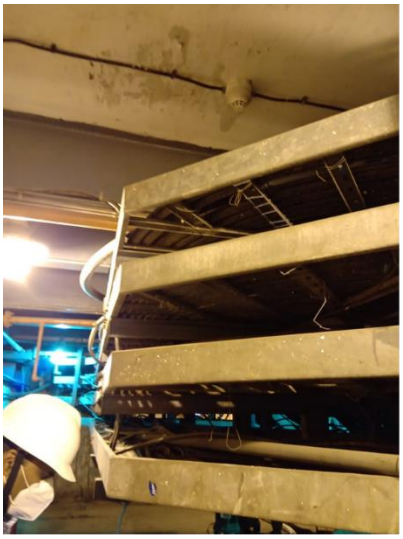

Good Safety practices followed, Safety instructions at different places, display of emergency numbers and safety mascot


Neat and well maintained Boiler of one of the TPS


Well maintained Turbine-Generator floor of one of the TPS


Neat and Clean house keeping near vacuum pumps in one of the TPS


Well maintained Battery Room in one of the TPS



Well maintained Cable Gallery in one of the TPS

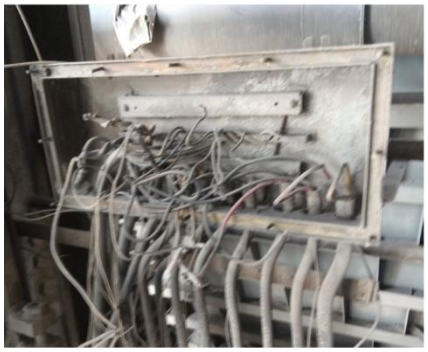
Testing of Fire Hydrant Pressure in Boiler Area at one of the TPS during Safety Audit

## Typical Gaps/Deficiencies observed w.r.t. to safety at few locations

Interference of steam lines with bunker roof and parapet wall

Interference of Steam line with LRSB


Pulverize fuel leakage from Mills



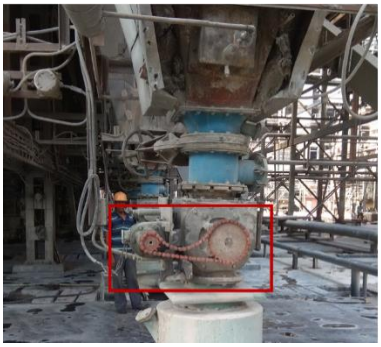
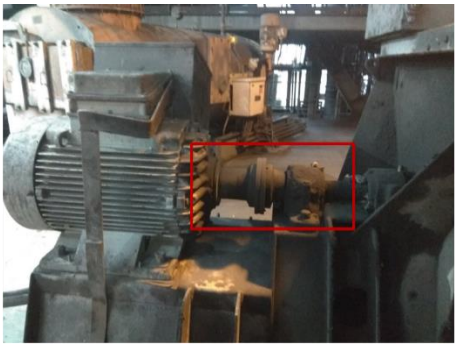
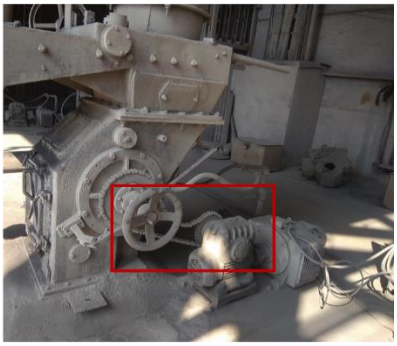
Open electrical boxes on boiler

Unorganized cables on boiler

Improper Sealing of Cables at entry/exit


Ash accumulation around hangers in boiler pent house area



Rotating equipment without guard

Corroded boilers structure at different locations

Corroded boilers structure and hand rails at different locations









Condition of Insulation in boilers

Vegetation growth in Switchyard Area

Poorly maintained Earth Pit in Generator Transformer Area

Obstructions for operator’s movement due to Scaffolding structure


Safety Audit team at NTPC Farakka STPS

Annexure - I
(National Green Tribunal order dated 22.12.2020 )

Item Nos. 07&08 Court No. 1

**BEFORE THE NATIONAL GREEN TRIBUNAL**
**PRINCIPAL BENCH, NEW DELHI**

Original Application No. 108/2020

(With report dated 23.10.2020)

News item published in the "Indian Express"
dated 01.07.2020 titled
"Tamil Nadu Neyveli boiler blast: 6 dead, 17 injured"

WITH

Original Application No. 130/2020
(Earlier Original Application No. 94/2020(SZ))
(I.A. No. 245/2020, I.A. No. 246/2020&
I.A No. 247/2020)

Meenava Thanthai K.R. Selvaraj Kumar
Meenavar Nala Sangam Applicant

Versus

Union of India & Ors. Respondent(s)

Date of hearing: 17.12.2020
Date of uploading of order: 22.12.2020

**CORAM: HON'BLE MR. JUSTICE ADARSH KUMAR GOEL, CHAIRPERSON**
**HON'BLE MR. JUSTICE SHEO KUMAR SINGH, JUDICIAL MEMBER**
**HON'BLE DR. SATYAWAN SINGH GARBYAL, EXPERT MEMBER**
**HON'BLE DR. NAGIN NANDA, EXPERT MEMBER**

**ORDER**

1. Proceedings in this matter were initiated on the basis of a news item in the "Indian Express" dated 01.07.2020 titled "Tamil Nadu Neyveli boiler blast: **6 dead, 17 injured**". Advance notice was issued to the Tamil Nadu Pollution Control Board (TNPCB), Central Pollution Control Board (CPCB), District Magistrate & Collector, Cuddalore, M/s Neyveli Thermal Power Station (NLCIL), Cuddalore and the Director of Industrial Safety and Health Department, Tamil Nadu.

2. The matter was considered on 08.07.2020 in light of report of the State PCB and response of the NLCIL, acknowledging the death of six persons and injury to 17 persons in the incident in question. The Tribunal considered the note filed by the CPCB based on preliminary report as follows:-

> *"4. The CPCB has filed a note based on a preliminary report of the unit in respect of incidents dated 07.05.2020 and 01.07.2020 as follows:*
>
> *" **Incident Happened on 01.07.2020***
>
> - *Unit-5 having capacity of 210 MW of Thermal Power Station-II (TPS-II) was shutdowned for maintenance work at 9.30 hrs on 30.06.2020.*
> - *Unit-5 boiler left for cooling.*
> - *Next day on 01.07.2020, at 7.00AM, cleaning activities with water was carried out on the boiler floor and structures.*
> - *At about 9.45 hrs suddenly explosion followed by fire occurred.*
> - *On site, 17 persons got injured and hospitalised. 6 persons were found fatal at the boiler zone at 28 metre level.*
> - *It is informed that the Directorate of industrial Safety & Health is carrying out inspection today i.e. 02.07.2020.*
>
> ***Incident Happened on 07.05.2020***
>
> 1. *Fire accident occurred in TPS-II, Unit-6*
> 2. *At 16:41 hrs Unit 6 got tripped due to high furnace pressure.*
> 3. *In meantime information was received from bunker area that there was fire in the conveyor belt and the vicinity at 32 ML. Bunker filling was being carried out at Unit 6 during that time.*
> 4. *At 16:47 hours, Unit 5 also got tripped followed by unit 7 due to drum level very low protection.*
> 5. *The lignite feeding conveyor belt caught fire and about 2 tonnes of lignite loaded in the belt was burnt along with 130 meters length of the belt.*
> 6. *8 persons were injured and they were rushed to hospital for treatment.*
> 7. *With great efforts the fire was quenched at about 18:30 hours.*
> 8. *A committee has been formed to investigate the incident and report yet to receive.*
> 9. *Directorate of Industrial Safety & Health has issued closure order on 08.05.2020 for unit 6.*

10. *The NLC Officer informed that on 14.05.2020, committee has carried out preliminary investigation through VC.*
11. *4 injured person admitted in hospital died during 08 to 14.05.2020 and remaining 4 persons are undergoing treatment."*

3. Apparent cause of accident was fire from the boiler. The Tribunal considered it necessary to require independent verification of facts and payment of interim compensation on the principle of absolute liability, pending further orders. Accordingly, an independent Committee comprising of the CPCB, TNPCB, District Magistrate, Cuddalore, NEERI and IIT Chennai was constituted to visit the site, ascertain facts taking into account the version of the industrial unit and other stake holders and the circumstances and give an independent report on following:

a. The sequence of events;
b. Causes of failure and persons and authorities responsible therefor;
c. The compliance of norms laid down in Technical Guidance Manual for Thermal Power Plants.
d. Compliance with statutory safety norms including hazard risk management.
e. Extent of damage to life, human and non-human; public health; and environment – including, water, soil, air;
f. Steps to be taken for compensation of victims and restitution of the damaged property and environment, and the cost involved;
g. Remedial measures to prevent recurrence;
h. Any other incidental or allied issues found relevant.

4. The Tribunal directed that the Committee may also prepare restoration plan and finally quantify the compensation required to be

paid. The Chief Secretary, Tamil Nadu was to identify and take appropriate action against person responsible for failure of statutory regulatory framework. The TNPCB was to ensure that the unit does not commence its operations unless all safety precautions are taken. The Committee constituted by the MoEF&CC in the said case was to take into account the present incident also in the course of preparing its report to be furnished in the said case.

5. Accordingly, the Committee has given its report dated 23.10.2020. The Committee held its meeting on 02.09.2020, visited the site on 09.09.2020 and 10.09.2020. It gave opportunity to the industry to present its view point. Victims were also given opportunity to place their view point. The Committee examined the relevant documents on record and interacted with the officials at the site. The Committee also looked into the background of the industry, statutory status, process details, status of compliance of pollution control norms and other significant facts.

6. The conclusion of the Committee are as under:-

***CONCLUSION AS PER SCOPE OF WORK BASED ON NGT DIRECTION***

***a. The sequence of events;***

*The following was the sequence of events revealed by the industry.*

- *On 30.06.2020 at 9.31 hrs.: Unit-5, stage - II of Thermal Power StationII (TS-II) was shut downed due to heavy slag discharge for maintenance work and boiler left for forced cooling by deploying ID & FD fans.*
- *On 01.07.20, fateful day and at the time of accident, forty-seven (47) persons belong to Boiler housekeeping group were working.*
- *On 01.07.2020, at 7.00 AM, under the supervision of Deputy Chief Engineer, E5 level executive in-charge of housekeeping, a team of 10 workmen reached the floor at 15 ML with an intention to remove the lignite dust from the girder. Found that*

*the work spot was so hot and found the red hot lignite dust (smoldering) inside the girder at front & right side opening. So dropped the plan of cleaning at 15 ML and decided to clean at 32 ML.*

- *On 01.07.2020, at 7.30 AM, started removing the accumulated lignite dust from the box type girders at 32ML front and rear side of boiler, by engaging 5 workmen on each side using scrappers made of mild steel and Iron pans*
- *Around 08:00 hours, four workmen entered inside the rear side girders through right opening and started removing the lignite dust at 32ML. About 100 steel Pans of lignite dust (about 200 kg total) were removed and after completing the work, four workmen came out around 09.30 hours and started taking rest at 28 ML floor. No water washing was carried out.*
- *Around 08:00 hours, five workmen were engaged at the front side of boiler for the job of removing the lignite dust from the girders at both the ends. About 30 Iron Pans of lignite dust (about 35 kg total) was removed and the work was going on.*
- *Around 09:45 hours, after completion of cleaning work at rear right side of girder at 32ML, housekeeping in-charge, who was overseeing the cleaning works on the same floor had sent one of the workmen, who was engaged in the cleaning work of the girder, inside the rear side girder at 32ML to check and ensure that the lignite dust was fully removed, so that follow-up action of closing of manhole door work can be given to Boiler Maintenance group. When he entered into the girder to carry out the inspection. DCE was near the opening*
- *Around 09:53 hours, all of sudden, an explosion took place resulting in fatal injuries to the individual along with 5 other workmen, who all were carrying out cleaning of front side girder at 32ML. Six workmen killed on the spot. The fireball that has leaped out of the girder caused severe burn injuries to those standing nearby box girders at 28ML floor. (Four workmen and Deputy Chief Engineer). 12 employees were also injured at different levels of 0, 15 & 32 ML.*
- *Around 09:55 hours, on hearing the blasting sound, fire wing of TS-II unit, Central Industrial Security Force (CISF), NLCIL comprising of 8 fire personnel along with fire tender reached the accident site. Found that fire was at different levels of boiler structures up to 32 ML. Ambulance was called for.*
- *By the time, Firefighting personnel from TS-II expansion unit also reached the accident site*
- *Immediately the fire personnel swing into action to put off the fire and searched for causalities*
- *The Assistant Commandant and three inspectors of Fire reached the accident site and assessed the situation. Requested the additional force from all the seven fire stations and pressed into the operation*
- *On receipt of request, fire crews from nearby station namely TS-I, TS-I Expansion, Mine-I, Mine-IA and Mine-II reached the accident site and started their operation*
- *DIG, Sr. Commandant, Deputy Commandant and Sector commanders of the industry reached the accident spot and started executing the fire fighting and rescue operation*

- *Security personnel of different unit also called and pressed into the operation particularly to control the crowd*
- *At around 10:08 hours, the accident was informed to the local administration*
- *At around 10:30 hours, CISF Fire personnel put off the fire completely. Eleven fire personnel from New Neyveli Thermal Power Plant (NNTPP) along with the fire tender reached the accident spot and joined the rescue operation*
- *Seventeen persons got injured and were sent to the Hospital of M/s. NLCIL for medical treatment*
- *After providing initial medical treatment at NLCIL hospital, sixteen persons were sent to Apollo Hospital, Chennai for further and better treatment. One injured person was admitted in NLCIL hospital for treatment of injury on left hand joint.*
- *Fire personnel continues the search operation of accident area and found six bodies as detailed below:*

***At the front side of boiler at 28ML:***

*All the five persons working inside and outside of the girder, killed on the spot. Two bodies were removed from inside of the girders one each at left and right side. Three bodies were removed from outside of the girders two at left and one from right side.*

***At the rear side of boiler at 28ML floor:***

*One person who gone inside the girder to check, died on the spot. The Executive, DCE approaching the openings got injured and expired at the Apollo hospital, Chennai on 03.07.20. Four workmen standing at a distance of twenty to twenty-five feet distance on 28 ML floor gratings got severe burn injury.*

- *At around 13:30 hours, the entire operation was completed and fire crews except TS-II and TS-II Expansion, returned to their respective station after a briefing by the Senior Commandant.*
- *At around 14:55 hours, after getting final clearance, Fire crews of TS-II and TS-II Expansion returned to their respective fire station.*
- *At around 12.30 hours a meeting was convened and discussed about the accident and related issues including the treatment, relief measures, compensation and employment on compassionate ground etc. and address the same. The meeting was attended by CMD, Functional Directors, District Collector, Sub Collector, Superintendent of Police, and Revenue Officials. The meeting was continued till evening and could not solve the issue. The meeting was continued on 02.07.20 too and with some local representatives. Finally decided a compensation of Rs. 30 (Rupees thirty lacs) and 5 (Rupees five lacs) lacs to the deceased and injured respectively and a regular job to one of the family member of each deceased.*

- *Out of sixteen person undergone treatment in Chennai, nine persons died during treatment on various date. Seven injured discharged after the treatment*
- *On 02.07.20 a closure notice was served by Directorate of Industrial Safety and Health to the Unit-V for the lapse of safety, which caused the death and injuries to the employees.*

***b. Causes of failure and persons and authorities responsible therefore;***

***Causes of failure***

- ***The openings provided in the Girders were not closed after the completion of structure erection work.***
- ***Due to lack of knowledge on SOP in carrying out cleaning activities in a confined area as well as technical knowledge about smoldering of accumulated fine lignite dust and probable formation of water gas.***
- ***Due to lack of knowledge on application of water to the red hot lignite, water gas will be generated. Water gas consists of Carbon monoxide and Hydrogen. When Hydrogen reaches the level of 4% in ambient air, gets exploded with the release of enormous energy spontaneously***
- ***SOPs for confined space are not followed.***
- ***Necessary training for the working in confined area was not imparted; awareness program was not conducted for the persons involved in the accident and also in the hazardous areas.***
- ***No work permit was issued before the girder cleaning***

***Persons and authorities responsible:***

***The following officers are mainly responsible for the accident***

- ***The Occupier of the unit no.: 5, TS-II, M/s. NLCIL***
- ***Divisional Head of Operation and maintenance of the unit***
- ***Safety Officer***

***c. The compliance of norms laid down in Technical Guidance Manual for Thermal Power Plants.***

***I. Environmental Legislations:***

***i. Under the Water Act***

*The industry has obtained consent of TNPCB under the Water (P&CP) Act, 1974 with validity up to 31.03.2020 vide Board's Proceeding dt. 01.08.2019 and subsequently extended up to*

*30.09.2020 vide TNPCB office orders dated 01.04.2020 and 01.07.2020 in view of the lockdown due to the pandemic Covid19.*

*The industry has been consented to discharge 100 KLD of sewage and 6225 KLD of trade effluent. The industry has provided septic tank/dispersion trench arrangements for the treatment and disposal of sewage.*
*The industry has also provided treatment plant for the waste water generated from the canteen and the treated waste water is disposed on land within the premises for gardening.*

*The trade effluent generated from Demineralization plant is neutralized in neutralization tank and then treated in a settling tank along with effluent from other sources such as boiler blow down, cooling tower bleed off, floor washings, etc. The settling tank overflow is discharged into an adjacent canal*

*The trade effluent generated from Demineralization plant is neutralized in neutralization tank and then treated in a settling tank along with effluent from other sources such as boiler blow down, cooling tower bleed off, floor washings, etc. The settling tank overflow is discharged into an adjacent canal.*

*The one sample of treated sewage (canteen waste water) and trade effluent were collected by Committee on 10.09.2020 and analyzed in TNPCB Lab. The details of analytical report are furnished below:*

*Test results of Treated Sewage (canteen waste water)*

| S No | Para meter | Test Results | Standards | Remarks |
|---|---|---|---|---|
| 1 | pH | 7.21 | 5.5 to 9.0 | All the parameters of the treated sewage adhere to the standards prescribed by the Board. |
| 2 | TSS | 12 | 30 | |
| 3 | BOD | 16 | 20 | |

## *Test results of Treated Trade Effluent*

| S. No. | Parameter | Test Results | Standards | Remarks |
|---|---|---|---|---|
| 1. | pH | 7.20 | 5.5 to 9.0 | All the parameters |
| 2. | TSS | 104 | 100 | |

| | | | | |
|---|---|---|---|---|
| 3. | TDS | 932 | 2100 | are within the Standards except TSS which is marginally above the standards. |
| 4. | Chlorides | 185 | 1000 | |
| 5. | Sulphate | 187 | 1000 | |
| 6. | Oil & Grease | < 2 | 10 | |
| 7. | BOD | 21 | 30 | |
| 8. | COD | 176 | 250 | |
| 9. | Total chromium | < 0.05 | 2 | |
| 10. | Lead | < 0.05 | 0.1 | |
| 11. | Mercury | < 0.003 | 0.01 | |
| 12. | Arsenic | < 0.01 | 0.2 | |

*The industry has provided online monitoring system at the outlet of the settling tank for the parameters such as Temperature, pH and TSS and the same has been connected to the Water Quality Watch, TNPCB, Chennai and CPCB server.*

*The status of compliance of the conditions of the latest consent order is detailed below:*

| Sl. No. | Condition | Compliance status |
|---|---|---|
| 1 | The unit shall ensure that the treated trade effluent shall satisfy the standards prescribed by the Board before disposal. | The test report of the sample collected on 10.09.2020 reveals that all the parameters are within the limits prescribed by the Board except the TSS (104 mg/litre) which is |
| 2 | The unit shall maintain the online sensor for pH, Temperature, TSS in the treated effluent disposal line in good condition and upload the data to Water Quality Watch, TNPC Board, Chennai. | The online monitoring system is maintained and the data are transferred to the Water Quality Watch, TNPC Board, Chennai |

***ii. Under the Air Act***

*The industry has been issued with consent of the Board under the Air (P&CP) Act, 1981 up to 31.03.2020 vide Board's Proceeding dated 01.08.2019 and extended up to 30.09.2020 vide Board office orders dated 01.04.2020 and 01.07.2020.*

*The industry has been consented to let out emission as follows.*

| **Stack No.** | **Point of emission sources** | **Air Pollution Control measures** | **Height of stack (in m)** |
|---|---|---|---|
| 1 | Boiler furnace of unit - I | Electrostatic Precipitator with stack | 170 |
| 2 | Boiler furnace of unit – II | Electrostatic Precipitator with stack | 170 |
| 3 | Boiler furnace of unit – III | Electrostatic Precipitator with stack | 170 |
| 4 | Boiler furnace of unit – IV | Electrostatic Precipitator with stack | 220 |
| 5 | Boiler furnace of unit – V | Electrostatic Precipitator with stack | 220 |
| 6 | Boiler furnace of unit - VI | Electrostatic Precipitator with stack | 220 |
| 7 | Boiler furnace of unit - VII | Electrostatic Precipitator with stack | 220 |

*The industry has provided Electro Static Precipitators (ESP) with stacks of suitable height as air pollution control measures to the boilers. The industry has also provided water sprinkler system/ dust suppression system/ fogging system to suppress fugitive emission*

*The industry has provided online stack monitoring system for parameters PM, $SO_2$ and NOx and connected the same to the Care Air Centre (CAC), TNPCB, Chennai and CPCB.*

*The NLC has installed Continuous Ambient Air Quality Monitoring Stations at the following 5 locations near Thermal Power Station-II and the ambient air quality is monitored by the IIT-M, Chennai/ NLC Lab (NABL accredited) for $PM_{10}$, $PM_{2.5}$, $SO_2$, and NOX. Samples are being collected from each location on alternate days and analyzed.*

i. *Block No 29*
ii. *Umangalam*
iii. *Mudanai village*
iv. *Chinna Kappankulam*
v. *Vadakkuvellur*

*The report of analysis of Ambient Air Quality for the period of June 2020 to August 2020 is furnished below.*

### *The AAQM data for the month of June, 2020*

| Sl.No. | Station | $PM_{10}$ ($\mu g/m^3$) | $PM_{2.5}$ ($\mu g/m^3$) | $SO_2$ ($\mu g/m^3$) | $NO_x$ ($\mu g/m^3$) |
|---|---|---|---|---|---|
| 1. | Block 29 | 50.6 to 57.9 | 18.2 to 26.7 | 2.8 to 5.0 | 14.0 to 28.2 |
| 2. | Umangalam | 45.6 to 67.4 | 21.9 to 32.5 | 1.87 to 3.18 | 16.1 to 22.4 |
| 3. | Mudanai | 44.6 to 55.7 | 19.6 to 29.3 | 2.56 to 4.04 | 15.3 to 21.4 |
| 4. | Chinna | 41.1 to 69.6 | 21.4 to 36.2 | 2.14 to 3.26 | 16.6 to 26.6 |
| 5. | Vadakku vellur | 65.1 to 76.5 | 27.3 to 38.4 | 3.98 to 5.68 | 24.9 to 36.7 |
| | **Standards** | **100** | **60** | **80** | **80** |

### *The AAQM data for the month of July, 2020*

| S. No | Station | $PM_{10}$ ($\mu g/m^3$) | $PM_{2.5}$ ($\mu g/m^3$) | $SO_2$ ($\mu g/m^3$) | $NO_x$ ($\mu g/m^3$) |
|---|---|---|---|---|---|
| 1. | Block 29 | 41.5 to 54.4 | 19.1 to 29.9 | 4.1 to 6.0 | 18.3 to 25 |
| 2. | Umangalam | 49.8 to 69.6 | 20.2 to 33.7 | 1.98 to 3.25 | 15.0 to 31.5 |
| 3. | Mudanai | 48.8 to 69.1 | 20.2 to 28.6 | 2.46 to 3.72 | 16.2 to 23.6 |
| 4. | Chinna | 45.7 to 57.2 | 20.5 to 29.4 | 2.16 to 3.7 | 16.3 to 26.5 |
| 5. | Vadakku vellur | 60.9 to 74.3 | 28.7 to 36.8 | 3.78 to 4.95 | 23.2 to 33.9 |
| | **Standards** | **100** | **60** | **80** | **80** |

### *The AAQM data for the month of August, 2020*

| S. No | Station | $PM_{10}$ ($\mu g/m^3$) | $PM_{2.5}$ ($\mu g/m^3$) | $SO_2$ ($\mu g/m^3$) | $NO_x$ ($\mu g/m^3$) |
|---|---|---|---|---|---|
| 1. | Block 29 | 42.5 -52.2 | 19.7 to 29.9 | 2.1 7.5 | 14.3 - 24.2 |
| 2. | Umangalam | 58.1 - 68.6 | 21.3 - 33.7 | 2.19 - 3.12 | 16.1 - 30.1 |
| 3. | Mudanai | 43.2 -58.2 | 20.2 - 29.8 | 2.15 - 3.19 | 15 - 22.6 |
| 4. | Chinna Kappankulam | 42.6 - 56.5 | 21.1 - 29.1 | 2.13 - 3.1 | 17.3 - 26.6 |

| | | | | | |
|---|---|---|---|---|---|
| 5. | Vadakku vellur | 59.6 - 69.1 | 21.1 - 35.1 | 3.69 - 4.76 | 21 - 30.6 |
| | **Standards** | **100** | **60** | **80** | **80** |

*The above data shows that $PM_{10}$, $PM_{2.5}$, $SO_2$ and NOx in the ambient air are within the standards prescribed by the Board*

*The CPCB vide its Letter dated 11.12.2017 has given time limit from March 2021 to Dec 2022 for the implementation of Flue Gas Desulphurization (FGD) to control the emission of $SO_2$ (in the units 1 to 7 of TPS II) and for the unit 5, the time limit is up to June 2022.*

*The status of compliance of the conditions of the latest consent order is detailed below:*

| **Sl. No.** | **Condition** | **Compliance status** |
|---|---|---|
| 1 | The unit shall operate and maintain the Air Pollution Control measures efficiently and continuously so as to satisfy the Emission / Ambient Air Quality standards prescribed by the Board. | The unit has provided air pollution control measures for the point and fugitive sources of emission. |
| 2 | The unit shall comply with the emission Standards for Thermal Power Plants as per Ministry's Notification S.O. 3305(E) dated: 07.12.2015, G.S.R. 593(E) dated: 28.06.2018 and as amended from time to time. | The online stack emission data from January to April 2020 shows that PM (67 to 70 mg/ $m^3$), $NO_x$ (197 to 253 mg/ $m^3$) were within the standards (100 & 600 mg/ $m^3$ respectively). The $SO_2$ (1336 to 1945 mg/$m^3$) was above the standards (600 mg/$m^3$). For the control of $SO_2$ emission, the CPCB has given time limit up to June 2022 for providing Flue Gas Desulphurization (FGD). [The full month details for May and June 2020 are not available due to server problem.] |
| 3 | The unit shall comply with the MoEF & CC Notifications on Fly Ash Utilization S.O, 763(E) dated14.09.1999, S.O. 979(E) dated 27.08.2003, S.O. 2804(E) dated 3.11.2009, S.O. 254(E) dated 25.01.2016 as amended from time to | The industry has provided dry fly ash collection system. The fly ash is disposed to cement industries and brick manufacturers. The bottom ash is sent to Mine-II of NLC India Ltd for back filling in the mined area. |

| | | |
|---|---|---|
| 4 | The unit shall install Flue Gas Desulphurization (FGD) System based on Lime/Ammonia dosing to capture Sulphur in the flue gases to meet the $SO_2$ emissions standard of 100 mg/Nm3 by December 2021, September 2021, June 2021, March 2022, June 2022, September 2022, & December 2022 in unit 1, 2, 3, 4, 5, 6 & 7 respectively so as to comply $SO_2$ emission limit as reported. | The industry has initiated action to install FGD system and has informed that tendering process is in progress. |

***iii. Solid Waste Management:***

*The industry has provided dry fly ash collection system. The industry generates 3150 Tonnes per day of fly ash. The fly ash is disposed to cement industries and brick manufacturers. The bottom ash/slag is sent to Mine-II of NLC India Ltd for back filling in the mined area*

*The industry is generating 175 Tonnes per Annum of used/spent oil (Hazardous Waste). The industry has obtained authorization under the Hazardous Waste (Management, Handling and Transboundary Movement) Rules 2008 vide Board's proceeding dated 09.02.2017 with validity up to 08.02.2022.*

***iv) Environmental Clearance:***

*NLC Thermal Power Station II was commissioned in two stages from 1986 to 1993. The industry has obtained Environmental Clearance in two stages. The Environmental Clearance for the stage II of the TPS-II (units 4,5,6 & 7 – 4 x 210 MW) was obtained on 05.01.1983 from the Ministry of Environment, GoI., New Delhi. The status of the compliance of the conditions of the environmental clearance is detailed below:*

| Sl.No. | Conditions | Compliance |
|---|---|---|

| | | |
|---|---|---|
| 1. | Adequate control equipment would be installed to contain the emissions of pollutants from the stacks in such a way that the ambient concentration of $SO_2$ and particulate matters remain within the desirable limits of 60µg/m3 and 150µg/$m^3$ respectively. | The industry has provided Electrostatic Precipitator with stack of suitable height for the boiler. As per the latest CPCB Notification, the AAQ standards prescribed is $PM_{10}$ - 100 µg /$m^3$ $PM_{2.5}$ – 60 µg / $m^3$ $SO_2$ - 80 µg / $m^3$ NOx - 80 µg / $m^3$ |
| 2. | Appropriate monitoring system should be set up to have regular sampling and analysis of the pollutants in the ambient air. This will help in ascertaining the efficient of the equipment and useful in taking suitable measures to maintain the desired ambient standard. | The industry has installed 5 numbers of Continuous Ambient Air Quality monitoring stations near the TPS II And the ambient air quality is monitored by IIT-M, Chennai/NLC Lab (NABL accredited). |

***d. Compliance with statutory safety norms including hazard risk management.***

*M/s NLCIL is a public sector enterprise conferred with status of Navratna Company by Government of India. The following statutes are applicable to this organization:*

1. *The Factory Act, 1948*
2. *The Tamil Nadu Factory Rules, 1950 and*
3. *Manufacture, Storage, Import of Hazardous Chemicals Rules, 1989.*

*The general safety awareness among the workforce and managerial staff found to be satisfactory during the field visits. In addition to that some of the sections of the factories act needs to be looked into, which were one of the contributory factors for the cause of this accident and they are listed as -*

***Sec 7A General Duties of Occupier*** *(1) Every occupier shall ensure, so far as is reasonably practicable, the health, safety and welfare of all workers while they are at work in the factory.*

***Sec 11 Cleanliness*** *(1) Every factory shall be kept clean and free from effluvia arising from any drain, privy or other nuisance, and (a) in particular- accumulations of dirt and refuse shall be removed daily by sweeping or by any other effective method from the floors*

*and benches of workrooms and from staircases and passages, and disposed of in a suitable manner.*

***Sec 14 Dust and Fumes*** *(1) In every factory in which, by reason of the manufacturing process carried on, there is given off any dust or fume or other impurity of such a nature and to such an extent as is likely to be injurious or offensive to the workers employed therein, or any dust in substantial quantities, effective measures shall be taken to prevent its inhalation and accumulation in any workroom, and if any exhaust appliance is necessary for this purpose, it shall be applied as near as possible to the point of origin of the dust, fume or other impurity, and such point shall be enclosed as far as possible.*

***Sec 33 Pits, sumps, openings in floors, etc.****- (1) In every factory fixed vessel, sump, tank, pit or opening in the ground or in a floor which, by reasons of its depth, situation, construction or contents, is or may be a source of danger, shall be either securely covered or securely fenced.*

***Sec 36. Precautions against dangerous fumes, gases, etc.****- (1) No person shall be required or allowed to enter any chamber, tank, vat, pit, pipe, flue or other confined space in any factory in which any gas, fume, vapour or dust is likely to be present to such an extent as to involve risk to persons being overcome thereby, unless it is provided with a manhole of adequate size or other effective means of egress. (2) No person shall be required or allowed to enter any confined space as is referred to in sub-section (1), until all practicable measures have been taken to remove any gas, fume, vapour or dust, which may be present so as to bring its level within the permissible limits and to prevent any ingress of such gas, fume, vapour or dust and unless- (a) a certificate in writing has been given by a competent person, based on a test carried out by himself that the space is reasonably free from dangerous gas, fume, vapour or dust; or (b) such person is wearing suitable breathing apparatus and a belt securely attached to a rope the free end of which is held by a person outside the confined space.*

***Sec.37. Explosive or inflammable dust, gas, etc.****- (1) Where in any factory any manufacturing process produces dust, gas, fume or vapour of such character and to such extent as to be likely to explode on ignition, all practicable measures shall be taken to prevent any such explosion by-*

*(b) Removal or prevention of the accumulation of such dust, gas, fume or vapour.*
*(c) Exclusion or effective enclosure of all possible sources of ignition.*
*(2) Where in any factory the plant or machinery used in a process such as is referred to in sub-section (1) is not so constructed as to withstand the probable pressure which such an explosion as aforesaid would produce, all practicable measures shall be taken to*

*restrict the spread and effect of the explosion by the provisions in the plant or machinery of chokes, baffles, vents or other effective appliances.*

***Sec.38. Precautions in case of fire.*** *- (2) Effective measures shall be taken to ensure that in every factory all the workers are familiar with the means of escape in case of fire and have been adequately trained in the routine to be followed in such cases.*

***Site observations:***

1. *SOPs for confined space are not followed.*
2. *Necessary training for the working in confined area was not imparted; awareness program is not conducted for the persons involved in the accident and also in the hazardous areas.*
3. *No work permit was issued before the girder cleaning.*
4. *Proper maintenance schedules are to be prepared.*
5. *Boiler startup and shutdown procedures shall be developed and followed strictly.*
6. *Hazard Identification and Risk Assessment shall be renewed.*
7. *Periodicity of the Mock Drills and frequency shall be enhanced.*
8. *Safety audit was carried out by National Safety Council in the year 2018. The same may be carried out at the earliest.*
9. *NLC has prepared onsite emergency plans in 2020 as per Rule 13 of MSIHC Rules 1989. Whereas no evidence was found with regard to full fledged rehearsals on onsite emergency plan. Also, up-dating of telephone numbers in case of superannuation of employees, transfers, promotions shall be carried out as and when required.*
10. *Off-site Emergency Plan and rehearsals shall be carried out in coordination with the District Collector to mitigate offsite emergency situations arises, if any.*

***Extent of damage of life, human and non-human; public health; and environment including water, soil, air;***

*The Committee studied the various short and long-term effects of the fire accident on the surrounding areas. The Committee also examined the immediate impacts of the blast and release of high energy on humans, other non-living beings, environment and their likely impact in the short and longterm.*

***Extent of damage to life and human****:*

i. *Data obtained from the NLC officials and survived witness reveals that, during this incident, 17 personnel were injured and all were sent to NLC GH for medical treatment, after providing initial medical treatment at NLC GH, 16 injured personnel were further sent to Apollo Hospital Chennai for further treatment and one person with minor injury remained admitted at NLC GH for treatment.*

ii. *CISF Fire Wing personnel searched the entire affected area of the Boiler and recovered six dead bodies which were trapped at inaccessible/congested and dark areas inside the girders with rigorous efforts.*

iii. *The accident took place within the industry premises, no loss or damage to other life except the following.*

***Extent of damage to life and human***

| S. No. | Stages | Dead | Injured |
|---|---|---|---|
| 1. | At the time of accident | 6 | 17 |
| 2. | First aid given at NLC Hospital | -- | 17 |
| 3. | Treated at Apollo Hospital for further treatment | -- | 16 |
| 4. | Treated at NLC hospital itself and discharged | -- | 01 |
| 5. | Number of persons dead at later stages during treatment | 09 | -- |
| 6. | Number of persons treated at Apollo hospital and discharged | -- | 07 |
| | Total | 15 | 08 |

***Extent of damage to the property;***

***Material damages due to the accident and its estimated cost***

| S. No. | **Material damages** | **Estimated Cost, lacs** |
|---|---|---|
| 1. | Girder material | 151 |
| 2. | Girder works | 153 |
| 3. | Refractory material | 21 |
| 4. | LT cables and Automatics | 10 |
| 5. | Control & Instrumentation | 21 |
| 6. | Boiler Lift | 128 |
| 7. | Civil work including removal of debris | 170 |
| | Total | 654 |
| | | (Rupees six and half crore) |

*Nonoccurrence of damage to non-humans has been ascertained.*

*As far as environmental issue is concerned there was no visible damage to the environment including air, water and soil. Observations is based on the following facts:*

1. *As the incident occurred almost in a confined enclosure type i.e., girder.*

2. *Within 30-40 minutes fire was engulfed, contained within the work area and did not spread to open environment*
3. *Incident occurred at 32 M height (within 20-meter radius), flooring of all levels is steel gratings and entire plant area is covered with concrete flooring.*
4. *From the Online data of five Ambient Air Quality stations located surrounding the unit for the month of June and July, 2020 it is observed that the amount of emission discharged due to the accident is not quantifiable and below the detection limit.*
5. *Occurrence of healthy vegetation around the plant justifying no damage to vegetation due to this fire accident.*
6. *No smoke strain is observed on any of the surfaces*

***f. Steps to be taken for compensation of victims and restitution of the damaged property and environment and the cost involved;***

*In accordance with the Employee Compensation Act, 1974, the mechanism of calculating the Compensation is*

***Compensation = 50% of Monthly wages * Relative factor***

*Ministry of Labour and Employment, GoI has notified Rs.15000/- ( Rupees fifteen thousand only ) as monthly wages with effect from 3rd January, 2020 vide Notification S.O.71(E) dt.: 3rd January, 2020. The amount of compensation to be paid to the deceased and injured as per the Employee Compensation Act, 1974 is detailed below:*

| Sl. No. | Name | Nature of Employment | Date of Birth | Age As On 01-07-2020 | Wages | Employee Compensation |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **Deceased** | | | | | | |
| 1 | Sivakumar.G | NLCIL Employee | 04-10-1967 | 53 | 140363 | 10,70,100 |
| 2 | Ravichandran C | NLCIL Employee | 15-5-1970 | 50 | 65380 | 11,48,175 |
| 3 | Vaithiyanathan A M | NLCIL Employee | 01-04-1972 | 48 | 92249 | 11,98,500 |
| 4 | Jothiramalingam V | NLCIL Employee | 07-10-1972 | 47 | 100641 | 12,23,025 |
| 5 | Suresh R | NLCIL Employee | 26/12/1970 | 49 | 89274 | 11,73,525 |
| 6 | Ravichandran K* | NLCIL Employee | 05-02-1964 | 56 | 73107 | 9,89,625 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | Selvaraj G | Indcoserve Society | 05-04-1969 | 51 | 15501 | NE |
| 8 | Elangovan T | Howsicos Society | 04-05-1971 | 49 | 15501 | NE |
| 9 | Anandapadmanabhan T | Indcoserve Society | 01-01-1976 | 44 | 15501 | NE |
| 10 | Ramanathan D | Private Contract | 04-07-1974 | 46 | 15501 | NE |
| 11 | Nagaraj P | Private Contract | 05-07-1978 | 42 | 15501 | NE |
| 12 | Silambarasan S | Private Contract | 09-07-1995 | 24 | 15501 | NE |
| 13 | Arunkumar S | Private Contract | 06-09-1994 | 26 | 15501 | NE |
| 14 | Venkatesaperumal K | Private Contract | 04-05-1992 | 28 | 15501 | NE |
| 15 | Padmanaban K | Private Contract | 11-04-1991 | 29 | 15501 | NE |
| **Total** | | | | | | **68,02,950** |

**It is reported that Shri. K. Ravichandran, a regular employee also eligible for the Employee Compensation and all other benefits as other deceased. Payment is kept pending since there is a dispute in identifying the legal heir due to dispute within the family. Once it is resolved, the payment will be released to the legal heir/s.*

*Whereas Co-operative Society and Private Contract workers are covered under Employee State Insurance (ESI). Under ESI Act, monthly pension at the rate of 90% of last drawn wages, are admissible to them. The industry extended their service in filing the return for the monthly pension and the same is under process. Whereas Statutory, Non statutory and Total compensation paid by the industry is placed at A8, A9 and A10.*

*The Hon'ble Minister of Coal, GoI has ordered the payment of compensation of Rs.15 lacs to the deceased and regular employment to one of the family members of the deceased.*

*The Government of Tamilnadu also announced a compensation of Rs.3.0 lacs to fourteen deceased under Chief Minister's Relief Fund and released. Copy of the Order issued to this effect is placed at A11. Thus a sum of Rs.42 lacs has been distributed as a compensation to the fourteen deceased under Chief Minister's Relief Fund by Government of Tamilnadu. A proposal has been sent*

*for sanction of compensation for fifteenth deceased one (Shri. K. Ravichandran) and injured too.*

*A sum of Rs. 5,17,73,013/- (Rupees five crores seventeen lacs seventy three thousand thirteen only) and Rs. 40 lacs (Rupees forty lacs only) have been distributed to the deceased and injured by M/s. NLCIL towards the compensation respectively. Thus a total of Rs. 5,57,73,013/- (Rupees five crore fifty seven lacs seventy three thousand thirteen only) have been distributed towards the compensation.*

*In addition, M/s. NLCIL has deposited an amount of Rs.5 crores (Rupees five crore only) in the SB account of District Collector, Cuddalore on 21st July, 2020 in compliance with the Order dt.8th July, 2020 issued by Hon'ble NGT, Principal Bench, New Delhi.*

***In light of above, the Committee is of the opinion that the amount of Compensation paid by the industry is satisfactory. The process of providing regular employment to one of family members of the victims shall be completed within a period of one year.***

*Relief measures extended to the victims by the industry:*

***Restitution of the damaged property and the cost involved;***

| S. No. | Material damages | Estimated Cost, lacs |
|---|---|---|
| 1. | Girder material | 151 |
| 2. | Girder works | 153 |
| 3. | Refractory material | 21 |
| 4. | LT cables and Automatics | 10 |
| 5. | Control & Instrumentation | 21 |
| 6. | Boiler Lift | 128 |
| 7. | Civil work including removal of debris | 170 |
| | Total | 654 |
| | | (Rupees six and half crore) |

***Restitution of Environment and the cost involved;***

*From the Online data of five Ambient Air Quality stations located in the vicinity of the unit for the month of June and July, 2020, it is observed that there is no abnormal data during this period may be due to the discharge of meagre quantity (Below Detection Level) of emission due to the accident. Thus the impact on the Ambient Air quality is not quantifiable may be due to the combustion rather than a fire accident.*

*Occurrence of healthy vegetation around the plant justifying no damage to vegetation due to this accident. No smoke strain is observed on any of the surfaces of the plant, within as well as*

*outside of the industry premises. Further it is observed that no chance of impact on the soil and water, since the accident occurred within the girder structure from 15 to 32 m elevation, flooring of all levels is steel gratings and entire plant area is covered with concrete flooring.*

***Relief measures taken by the industry to the victims of the accident:***

- *Rs.10 lacs through cheque and Rs.50,000/- in cash paid to the dependents of six deceased regular employees*
- *Rs.5 lacs through cheque and Rs. 50,000/- in cash paid to the dependents of nine deceased Contract workmen/ Supervisor.*
- *Hon'ble Minister of Coal, Government of India announced Compensation of Rs.15 lacs to the deceased and regular employment to one of the family member of the deceased*
- *Counseling session and motivation programs are organized for the family of the deceased to lead the normal life, in association with "Art of Living"*
- *Special cell comprising members from the deceased earlier in M/s. NLCIL is formed to extend moral, psychological support, speed up the settlement process of Statutory and non-Statutory benefits and lead a normal life.*
- ***Medical treatment** was given at Super Specialty Apollo Hospital, Chennai to the injured. Free Accommodation, food and transportation were extended to all the family members/attendees during the treatment period*
- *NLC doctors and HR executives were deputed to Apollo Hospital, Chennai to supervise, co-ordinate and extend all possible support to the family members/attendees during the treatment period. Spared one number of ambulance for the use of injured persons.*
- *Visit to the house of bereaved and injured persons on weekly basis to provide relief measures, assistance in getting certificates from respective agencies and created awareness about various benefits and compensation applicable to them.*
- *One Nodal officer was identified to meet the needs of the family members of deceased.*
- *Fruit baskets and Health Supplement were provided*
- *A special cell has been constituted to support, meet the requirements, coordinate Art of Living program, console, and provide solace*
- *As a policy, M/s. NLCIL extend the following facilities to the family of deceased*
- *Allotment of quarter as per their choice*
- *Posting in the desired units of M/s. NLCIL., Neyveli*
- *Arranging well being program*
- *Creating avenues for improving their livelihood*
- *In claiming compensation from the Authorities*

***g. Remedial measures to prevent recurrence;***

1. *Safety study, safety audit, HAZOP study and risk assessment shall be carried out by competent agencies.*
2. *Girders structural stability study shall be conducted by reputed authorities, like IIT, Structural Engineering Research Institutes, etc.,*
3. *All the unwanted openings to be closed completely to prevent lignite dust entering into the box girder, except for maintenance or specific work. It is also essential that before closing the openings, complete removal of lignite deposits by proper cleaning inside the girders (following all the safety norms) is advised.*
4. *To avoid spreading lignite dust from furnace, mill house, re-suction duct, suitable dust control, dust extraction and dust suppression system shall be provided to check the fugitive emission.*
5. *Suitable and appropriate explosion vent shall be provided in vertical column in consultation with the designers.*
6. *Endoscopic camera shall be used to measure the dust level inside the girder to ensure the safety of the unit.*
7. *For repair of box girder inside and outside by welding, adequate safety measures to be taken before allowing persons into the girders.*
8. *Thermal scanner shall be used to check the hotness and temperature of the girders both inside and outside before carrying out any work inside the girders to remove the lignite dust only with the supervision of NLCIL staff with the safety clearance.*
9. *Only trained persons and contract labours shall be allowed.*
10. *No person shall be allowed inside the box girder without taking adequate safety procedures like confined space work permit.*
11. *The points of origin of lignite dust leakage shall be identified and suitable engineering measures shall be taken to arrest the spillages and the discharge of emission.*
12. *SOP shall be modified for the periodic inspection of girder and other structures for the deposition of lignite dust and periodical removal of the same. Without work permit, no work in any nature shall be carried out.*
13. *Periodic rigorous housekeeping shall be carried out.*

***h. Any other incidental or allied issues found relevant***

***Earlier Incidence of fire in boiler of Unit 6 on 07.05.2020 and conclusion of the committees:***

*A fire incident in Unit-6 Boiler of TS-2 was occurred on 07-5-2020 at 16.41 hrs. In order to analyze the root cause of the incidence and suggest remedial measures to prevent reoccurrence of such incident in future, a committee was constituted which has suggested*

*The committee thoroughly enquired with respective responsible officials and inspected Boilers in Units 5, 6 & 7 and assessed the damages and observed all evidences. All DCS historical data of*

*Critical Measurements, Trends and SOE print outs of Units 5, 6 & 7during the incident on 07-05-2020 were collected and analyzed in depth. Reports of six similar incidents occurred earlier in the Units 5 & 6, since 2001 were collected and reviewed critically.*

*After complete analysis of data and evidences, the committee held detailed deliberations on the 2 possibilities for the Fire Incident (i) either due to localized pressurization inside the Boiler Furnace (ii)Explosion inside the horizontal box type girder at 42ML right side. As all the evidences were supporting the theory of Explosion inside the horizontal box type girder, the committee concluded that explosion inside the girder Box, outside the Boiler Furnace as root cause for the fire incident.*

*Accordingly, recommendations were given to various working areas viz. Boiler Structural Maintenance, House Keeping, Boiler Maintenance, Lignite Handling System, Operation, Technological Up gradation (Control and Instrumentation) to avoid both possibilities of Boiler Furnace Inside Explosions as well as Boiler Outside Girders Explosion in order to operate the Units safely, without any untoward similar incidents in future.*

*In addition, the committee strongly recommended the complete Healthiness Survey of all 07 Units with respect to Boiler Main Structures by Structural Specialist agencies like `Structural Engineering Research Centre"(SERC, CSIR-Chennai). The committee also suggested that extra care should be taken during cleaning by following strict house-keeping measures at all locations especially in the areas of Boiler and Lignite Handling System so that Lignite Dust accumulation is avoided.*

## *14. CONCLUSION OF THE REPORT:*

***The Accident;***

*On 1st July 2020, a fire incident referred to as "Tamilnadu Neyveli Boiler Blast: 6 dead and 17 injured", occurred at the 15 ML girder of the Boiler supporting structure of unit – V of Thermal Power Station – II (TS-II), M/s. NLC India Limited, Village Ammeri, Neyveli, Viruthachalam Taluk, Cuddalore District.*

*The accident took the life of six persons on the spot and subsequently nine persons while undergoing treatment at Super Specialty Hospital i.e., Apollo Hospital, Chennai. Sixteen persons were hospitalized at Apollo Hospital, Chennai and one person treated at NLC hospital itself. Besides causing damage to the industry's properties viz., boiler supporting structure, lift and cable.*

*Fire fighting, Rescue and evacuation operations during the accident were carried out by the Fire wing of Central Industrial Security Force (CISF) unit, NLC, Neyveli. On hearing the blast sound, fire wing of*

*TS-II reached the spot immediately without waiting for an emergency call and swing into action.*

*The Hon'ble Minister of Coal, GoI has ordered payment of compensation of Rs.15 lacs to the deceased and regular employment to one of the family members of the deceased.*

*The Government of Tamilnadu also announced a compensation of Rs.3.0 lacs to fourteen deceased under Chief Minister's Relief Fund and released. Thus a sum of Rs.42 lacs has been distributed as compensation to the fourteen deceased under Chief Minister's Relief Fund by Government of Tamilnadu. A proposal has been sent for sanction of compensation for fifteenth deceased one and injured too.*

*A sum of Rs. 5,17,73,013/- (Rupees five crores seventeen lacs seventy three thousand thirteen only) and Rs. 40 lacs (Rupees forty lacs only) have been distributed to the deceased and injured by M/s. NLCIL towards the compensation respectively. Thus a total of Rs.5,57,73,013/- (Rupees five crore fifty seven lacs seventy three thousand thirteen only) have been distributed towards the compensation.*

*In addition, M/s. NLCIL has deposited an amount of Rs.5 crores (Rupees five crore only) in the SB account of District Collector, Cuddalore on 21st July, 2020 in compliance with the Order dt.8th July, 2020 issued by Hon'ble NGT, Principal Bench, New Delhi.*

*Hon'ble NGT, Principal Bench, New Delhi constituted an Independent Committee to submit a report with a detailed term of reference.*

*The Committee visited the accident site with and without witnesses, heard the version of the industry, examined the records and had extensive discussions with all the stakeholders.*

***Reasons for the Fire Accident/Blast***

***The Committee has identified the following as the main causes behind the blast followed by the fire accident:***

- ***No separate SOP was created for the periodic housekeeping including cleaning of girders.***
- ***No work permit was issued***
- ***The safety protocols were not followed. The Process Safety Management (PSM) systems were not implemented.***
- ***Trained manpower was not deployed***
- ***Safety awareness program was not conducted***

- ***Failure to submit HAZOP & Risk Assessment Reports***

- ***The Onsite Emergency plan did not take into account any likely scenario of hydrogen gas generation on applying water to smoldering (lignite dust in hot condition) and such a case was never considered for emergency mock drill.***

***Root Cause: In the light of the above, the Committee is of the view that the root causes of the accident in the girder of boiler supporting structure can be attributed to insufficient knowledge amongst staff, insufficient knowledge of the chemical properties of lignite, especially formation of water gas when water is applied on the lignite in hot conditions, poor safety protocol, poor safety awareness, inadequate risk assessment and response, poor process safety management systems and failure in conducting awareness programs among all the employees and workers about handling the smoldering.***

***Possible root cause of Analysis has been represented through Fish Bone Diagram. The diagram is placed at A12.***

***Onsite Emergency Plan:***

***Lack of awareness for water gas generation: The Onsite emergency plan prepared by NLC lacked any measures to combat smoldering but only provided for fire occurrences and other accident scenarios. The NLC had no Emergency Plan to tackle the smoldering and water gas generation.***

***To avoid recurrence of such incidences in future, M/s NLCIL is advised to take the following preventive measures.***

1. *Carry out HIRA study of processes to assess the inherent risk associated with the different activities in process.*
2. *HAZOP study shall be conducted.*
3. *Strict Safety precautions to be taken before resuming operation of the units in accordance with the advisory issued by the Chairman, CPCB vide L.No.: B-29014/IPC-I/MSIHC/2020 dt 8th May, 2020 (A13)*
4. *SOPs and SMPs of all the processes may be prepared or revised and strict adherence to the standing procedures must be ensured.*
5. *SOP for handling of lignite and lignite dust in hot condition, is silent. The procedures of handling lignite and lignite dust in the hot condition may be incorporated in the SOP.*
6. *Training to workforce should be further strengthened on need-based requirements.*
7. *Safety Audit should be done strictly at prescribed intervals.*
8. *Approved emergency plan should be regularly updated and followed*
9. *Awareness program shall be conducted to the workforce before commencing the activity*

*10. Rigorous Housekeeping protocol shall be followed."*

7. An affidavit has been filed on behalf of the MoEF&CC on 23.11.2020 covering eight matters of incidents arising out of the leakage of hazardous gases, relating to different such incidents in the last six months[1]. The affidavit refers to the regulatory framework for enforcement of Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 [MSIHC Rules, 1989] and Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 [CAEPPR Rules, 1996]. Under MSIHC Rules, 1989, Petroleum and Explosives Safety Organization (PESO) is the nodal agency to approve the sites of industrial installation and isolated storage. The PESO and CIFs while giving site-specific

---

[1] i. Present matter AND
ii Order dated 01.06.2020, relating to incident of gas leak dated 07.05.2020 in **LG Polymers India Pvt. Limited** at Vishakhapatnam, resulting in death of 11 persons and injuries to more than 100, apart from other damage (OA No. 73/2020, In re: Gas Leak at LG Polymers Chemical Plant in RR Venkatapuram Village Visakhapatnam in Andhra Pradesh);
iii. Order dated 08.06.2020, relating to incident dated 03.06.2020 in a chemical factory, **Yashyashvi Rasayan Pvt. Ltd**. at Dahej, District Bharuch, Gujarat resulting in deaths and injuries and other damage (OA No. 22/2020(WZ) (Earlier OA 22/2020)(WZ), Aryavart Foundation through its President vs. Yashyashvi Rasayan Pvt. Ltd. & Anr.);
iv. Order dated 02.07.2020, in relation to incident of **oil well blow out on 27.05.2020 at Baghjan in the Tinsukia District of Assam** resulting in deaths, injuries and damage to the environment (OA No. 43/2020(EZ), Bonani Kakkar vs. Oil India Limited & Ors.).
v. Order dated 06.07.2020, relating to incident dated 30.06.2020 on account of gas leakage at **Sainor Life Sciences** factory at Parawada in industrial area on the outskirts of Vishakhapatnam (OA No. 106/2020, News item published in the local daily "Economic Times" dated 30.06.2020 titled "Another Gas Leakage at Vizag Factory kills two, critically injures four..."));
vi. Order dated 06.07.2020, relating to **accident of Ammonia gas leakage** at **Nandyal in Kurnool District, Andhra Pradesh in Spy Agro Industry on 26.06.2020** resulting in death of one person and injury to three workers. (OA No. 107/2020, In Re: News item published in the local daily "Indian Express Sunday Express" dated 28.06.2020 titled "Gas Leak in Agro Company Claims life of one")
vii. Order dated 23.07.2020, in relation to incident of **fire engulfed the chemical plant** of **Visakha Solvents Ltd**, Vizag on 13.07.2020 at Ramky CETP Solvents building in Pharma City resulting in injuries (OA No. 134/2020, News item published on 13.07.2020 in the local daily named "India Today" titled "Massive fire engulf Vizag chemical plant, explosions heard, injuries reported").
viii. Order **dated 18.12.2020**, in relation to incident of **explosion in a plastic recycling factory at Sujapur in Malda on 1.12.2020** resulting in death of six persons, including two minors and serious injuries to four persons (OA No. 272/2020, News item published in the "Times of India" dated 20.11.2020 entitled "Six killed as blast tears through Malda Plastic recycling factory").
ix. Order dated **18.12.2020**, in relation to incident of **methane gas leak in a sugar factory** called Lokenete Bapurao Patil Agro Industries Ltd. in Mohol Taluka of Solapur District, Maharashtra on 21.11.2020 resulting in deaths and injuries and other damage (OA No. 274/2020, News item published in the "Indian Express" dated 23.11.2020 entitled "Maharashtra: Two Killed, eight injured in methane gas leak in sugar factory").

approvals to industrial units and isolated storage are expected to ensure preparation of onsite emergency plans and safety reports by units, review the details of mock-drills conducted and implementation of Standard Operating Procedures (SOPs) of industrial operation by the unit from industrial safety point of view. The MoEF&CC is undertaking the following actions, in compliance with the Tribunal's directions on the matter in M/s LG Polymers case, OA 73/2020 and other connected matters:

- Committees have been constituted for 'Preparation of Restoration Plan' through CPCB and District Administration, and 'Finalization of Compensation'.
- Action is being taken for revamping of industrial monitoring mechanism, in line with the previous directions of Hon'ble NGT O.A. No. 73/2020, Gas Leak at LG Polymers Chemical Plant in RR Venkatapuram Village, Visakhapatnam in Andhra Pradesh.
- Consideration of the Technical and Administrative / Regulatory Framework Recommendations given by the High-Power Committee (HPC), which also include general recommendations on operation of hazardous industries/industries handling hazardous chemicals as well as industries operating in residential areas is under examination.

8. We have heard learned Counsel for the parties and perused the record before us. The question for consideration is whether there is violation of environmental safety norms and further course of action required.

9. The report shows that the cause of the incident is failure of the staff handling the situation which did not have the knowledge of the

SOPs and of the process. The staff was not given due training and requisite work permits. Thus, the Occupier, the Head of the Operation and Maintenance and the Safety Officer are mainly responsible for the accident. There is violation of safety norms under Section 38 of the Factories Act, 1948. There is also violation of the Manufacture, Storage, Import of Hazardous Chemicals Rules, 1989. In the process, the hazardous gases are generated, attracting the said Rules. It is mandatory to prepare on-sight and off-sight emergency plan and holding of mock drills once in six months. Standard operating procedure has not been followed nor appropriate training given to the staff handling the process. Safety protocols have not been followed. It would have been desirable that the standards operating procedures were duly explained to the handling staff in vernacular language as a part of process of awareness.

10. We are informed that the compensation has been paid as follows:

*Statement of Compensation so far paid as on 16.12.2020 for incidents on 01.07.2020*

| Deceased | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sr. No. | Name | Nature of Employment | Gratuity (In Rs.) | Employee Compn. (In Rs.) | EDLI (In Rs.) | DRF (In Rs.) | Funeral (In Rs.) | Solatium-1 (In Rs.) | Solatium -2 (In Rs.) | GPA | Grand Total Subject to aximum of Rs. 30.0 Lakh (In Rs.) |
| 1 | Sivakumar. G | Regular | 2000000 | 1070100 | 602000 | 1050000 | 17000 | 0 | 0 | 1200000 | 5939100 |
| 2 | Vaithiyanathan A M | Regular | 2000000 | 1198500 | 602000 | 1050000 | 17000 | 0 | 0 | 600000 | 5467500 |
| 3 | Jothiramalingam V | Regular | 2000000 | 1223025 | 602000 | 1050000 | 17000 | 0 | 0 | 600000 | 5492025 |
| 4 | Ravichandran C | Regular | 980700 | 1148175 | 602000 | 1050000 | 17000 | 0 | 0 | 600000 | 4397875 |
| 5 | Suresh R | Regular | 2000000 | 1173525 | 602000 | 1050000 | 17000 | 0 | 0 | 500000 | 5342525 |
| 6 | Ravichandran K | Regular | 1425587 | 989625 | 301000 | 1050000 | 17000 | 0 | 500000 | | 4283212 |
| 7 | Selvaraj G | Society | 241461 | 0 | 224922 | 550000 | | 272076 | 1500000 | | 2788459 |
| 8 | Anandapadmanabhan T | Society | 232518 | 0 | 458179 | 550000 | | 264887 | 1500000 | | 3005584 |
| 9 | Elangovan T | Society | 250404 | 0 | 412603 | 550000 | | 291189 | 1500000 | | 3004196 |
| 10 | Padmanaban K | Contract | 0 | 0 | 390494 | 550000 | | 624190 | 1500000 | | 3064684 |
| 11 | Venkatesaperumal K | Contract | 0 | 0 | 0 | 550000 | | 740139 | 1500000 | | 2790139 |
| 12 | Arunkumar S | Contract | 0 | 0 | 409070 | 550000 | | 493688 | 1500000 | | 2952758 |
| 13 | Silambarasan S | Contract | 0 | 0 | 378584 | 550000 | | 531756 | 1500000 | | 2960340 |
| 14 | Nagaraj P | Contract | 0 | 0 | 0 | 550000 | | 627407 | 1500000 | | 2677407 |
| 15 | Ramanathan D | Contract | 0 | 0 | 365804 | 550000 | | 547273 | 1500000 | | 2963077 |
| Sub Total –A | | | | | | | | | | | 57128881 |
| Injured | | | | | | | | | | | |
| Sr. No. | Name | Nature of Employment | Gratuity (In Rs.) | Employee Compn. (In Rs.) | EDLI (In Rs.) | DRF (In Rs.) | Funeral (In Rs.) | Solatium-1 (In Rs.) | Solatium -2 (In Rs.) | GPA | Grand Total Subject to maximum of Rs. 5.0 Lakh (In Rs.) |
| 16 | Selvakumar.S | Contract | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| 17 | Sengamalai G. | Indcoser | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| 18 | Jayaseelan K | Indcoser | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| 19 | Velmurugan J. | Indcoser | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| 20 | Govindan | Indcoser | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| 21 | Vekatesan A R | Indcoser | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| 22 | Manikandan S | Contract | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| 23 | Mohan Raj P | Contract | 0 | 0 | 0 | 0 | 0 | 0 | 500000 | | 500000 |
| Sub Total-B | | | | | | | | | | | 4000000 |
| Grant Total (A+B) | | | | | | | | | | | 61128881 |

11. Further amount of Rs. 5 crores stands deposited with the Collector, in compliance of order of this Tribunal.

12. We direct further action in terms of the Report, including the remedial measures to be adopted for future. If there is any excess amount available in deposit, after due compliances on the subject, the same may be refunded to the company. We place on record our appreciation for the task executed by the Committee. This observation may be conveyed to the members of the Committee by the CPCB. The report of the Committee may be placed on the websites of the CPCB and the State PCB for the purposes of reference for atleast six months.

13. We also direct the Secretaries, Ministries of Power and Coal, Government of India, in coordination with such other Departments/Institutions as may be necessary, to undertake safety audit of similarly placed thermal power stations, throughout the country expeditiously, preferably within six months, to avoid recurrence of such incidents in future.

The application is disposed of.

## Original Application No. 130/2020

1. This application is on the same subject and was first filed before the Southern Zonal Bench, NGT and then transferred to the Principal Bench. On 08.07.2020, the Applicant was required to serve the affected parties.

2. The Applicant has stated that the Environmental Clearance (EC) did not have a provision for carrying out Human Health/Occupational assessment Risk and safety management, as has been subsequently

mandated in the Technical Guidance document of MoEF, 2010 and the Standard EC conditions for Thermal Power Plants dated 19.11.2018. There is negligence, as similar incidents had earlier also happened. The National Electricity Plan, 2018 shows that Units 1 to 7 of the Thermal Power Plant-II are nearing retirement by 2022. The Old and obsolete technology used in these Units, which are more than 25 years old now, has aggravated safety and environmental issues more so when in last few years there have been numerous accidents. If the Unit 1 to 7 of Thermal Power Plant –II are not shut down, there is likelihood of many more incidents which could jeopardise the safety and human/occupational health of the Community members be it those who are working in the Plant or those who are residing nearby. The purpose of hazard identification and risk assessment in thermal power plant is to identify physical, chemical, biological and environmental hazards in the plant, analyse the event sequences leading to those hazards and calculate the frequency and consequences of hazardous events. Therefore, no Thermal Power Plant should be allowed to run without its risk, hazard as well as safety auditing. The overall regulatory framework is under the Ministry of Environment, Forest and Climate Change which has to ensure that Thermal Power Plants, which have outlived their respective lives, need to be shut down. Frequent blasting incidents show that there are serious lacunae in the monitoring of Environmental Parameters of Respondent No. 1's units specially those related to emergency preparedness, occupational health, risk management, safety norms and Human Health Environment issues.

3. Reply has been filed to the application by the NLCIL. It is stated that FGD has been installed. The recommendation of the Central Electricity Authority about retirement of the units is recommendatory.

The technology is not obsolete. The internal and external teams have ensured that the entire Risk assessment processes are foolproof. Hence, there is enhanced risk management at the plant. The unit is operating consistent with occupational health, risk management assessment and safety or workmen parameters. It carries out audits and to ensure compliance of all the aforementioned parameters, it is certified ISO: 45001-2018, superseding the earlier certification of OHSAS 18001-2007. Our attention has also been drawn to the letter of the PWD, Director of Boilers as follows:-

> *"With reference to the above and based on the final report of RLA study carried out by M/s. IRC Engineering Services India Pvt. Ltd., New Delhi and the report submitted by M/s. NLC Ltd., Neyveli on the Remnant Life Assessment of Boiler Ry. No. T-4977,* ***your boiler is considered fit for further continued operation for a period of six years, provided all the operating parameters and chemical regime are kept within standard/design condition.***
>
> *You are requested to make necessary arrangement to carry out next RLA Study on or before the completion of the validity period (i.e. Oct, 2024) as per the latest proviso of Regulation 391 A of Indian Boiler Regulations, 1950."*

4. In view of above, while we refrain from directing retirement of the unit, all safety measures may be duly adopted which may be regularly monitored and audited by teams of Experts on the subject and also by the Regulators.

The application is disposed of. All pending IAs will also stand disposed of accordingly.

A copy of this order be forwarded to the Secretaries, MoEF&CC, Ministries of Power and Coal, Government of India, the Chief Secretary, Tamil Nadu, the CPCB, TNPCB and District Magistrate, Cuddalore by e-mail for compliance.

Adarsh Kumar Goel, CP

S.K. Singh, JM

Dr. S.S. Garbyal, EM

Dr. Nagin Nanda, EM

December 22, 2020
Original Application No. 108/2020
and connected matter
SN

# Annexure-II
# ( MoP letters dated 04.01.2021 and 22.02.2021)

**No. 5/2/2019-S.Th.**

Government of India

भारत सरकार

Ministry of Power

विद्युत मंत्रालय

Shram Shakti Bhawan, Rafi Marg,

श्रम शक्ति भवन, रफी मार्ग,

New Delhi dated 04.01.2021

नई दिल्ली दिनांक 04.01.2021

**To,**

Chairperson, CEA,
Sewa Bhawan, RK Puram,
New Delhi.

**Sub** - Hon'ble NGT Orders dated 22.12.2020 in OA No. 108/2020 and OA 130/2020 - reg.

**Sir,**

I am directed to forward a copy of Hon'ble NGT Orders dated 22.12.2020 in OA No. 108/2020 and OA 130/2020 (copy enclosed) regarding fire incident that occurred on 07.05.2020 (in Unit-5 of 210 MW of NLC Thermal Power Station-II (TPS-II)) and on 01.07.2020 (Fire accident occurred in TPS-II, Unit-6).

2. In view of the above, CEA is requested to take necessary action on the NGT Orders dated 22.12.2020 (as per timelines mentioned in the NGT order), on behalf of this Ministry and also as per Central Electricity Authority (Safety requirements for Construction, Operation and Maintenance of Electrical Plants and electric lines) Regulations 2011.

**Enclosed:** as stated.

Yours faithfully,

(Nishat Kumar)
Under Secretary to the Govt. of India
Tel: 23715507, Ext: 212

**No. 5/2/2019- S.Th.**
Government of India
Ministry of Power

Shram Shakti Bhawan, Rafi Marg
New Delhi dated 22.02.2021

**To,**

Chairperson, CEA,
Sewa Bhawan, R.K Puram,
New Delhi.

**Sub**- Hon'ble NGT Orders dated 22.12.2020 in OA No. 108/2020 - reg.

**Sir,**

I am directed to refer to Ministry of Power OM of even number dated 04.01.2021 on the above mentioned subject (**copy enclosed**).

2. In this regard, Ministry of Coal vide OM No. MPS-51022/2/2020-MPS dated 02.02.2021 (**copy enclosed**) has requested to organize the safety audit of thermal power plants by constituting a Committee consisting members from all concerned, to undertake the **safety audit throughout the country** to avoid recurrence of such incidents in future. One technical officer nominated from Ministry of Coal and a fire expert (Shri Hirak Datta, former ED, OISD) may be included for the plants of NLCIL considering the recent fire incidences in NLCIL.

3. CEA is requested to take necessary action on the same and inform the action taken in this regard urgently, to this Ministry.

4. This issues with the approval of Secretary (Power).

**Yours faithfully,**

**Enclosed**: as stated.

(Nishat Kumar)
Under Secretary to the Govt. of India
Tel: 2371 5507, Ext: 212

# Annexure-III
# ( MoC letter dated 02.02.2021)

File No.MPS-51022/2/2020-MPS

F. No. MPS-51022/2/2020-MPS
**Government of India**
**Ministry of Coal**
***

**Room No. 622-A, Shastri Bhawan,**
**New Delhi, Date: 2nd February, 2021**

**OFFICE MEMORANDUM**

**Subject: Order dated 17.12.2020 passed by the NGT, PB in Original Application No. 108/2020 Meenava Thanthai K.R. Selvaraj Kumar Meenavar Nala Sangam Versus Union of India & Ors - reg.**

The undersigned is directed to forward herewith a copy of the order dated 17.12.2020 passed by the NGT, PB in Original Application No. 108/2020 Meenava Thanthai K.R. Selvaraj Kumar Meenavar Nala Sangam Versus Union of India & Ors.

2. Vide above order dated 17.12.2020, the Tribunal had directed the Secretaries, Ministries of Power and Coal, Government of India, in coordination with such other Departments/Institutions as may be necessary, to undertake safety audit of similarly placed thermal power stations, throughout the country expeditiously, preferably within six months, to avoid recurrence of such incidents in future.

3. As the power plants are under the functional control of Ministry of Power, it is requested to organise the audit by constituting a Committee consisting members from all concerned, to undertake the safety audit throughout the country to avoid recurrence of such incidents in future. One technical officer nominated from Ministry of Coal and a fire expert (Shri Hirak Datta, former ED, OISD) may be included for the plants of NLCIL considering the recent fire incidences in NLCIL.

This issues with the approval of the Secretary, Coal.

-sd-

**(Hitlar Singh)**
**Under Secretary to the Govt. of India**
**e-mail id: hitlar.singh85@nic.in**

**To,**

**The Secretary,**
**Ministry of Power,**
**Shramshakti Bhawan,**
**New Delhi**

O/o SECY. (P)
Dy. No. 41290
Date. 23/02/2021

# Annexure-IV
(CEA Office Order dated 16.03.2021 for constitution of Safety Audit Committee)

File No.CEA-SY-13-31/11/2021-Administration Coordination

भारत सरकार

**Government of India**
**Ministry of Power**
**Central Electricity Authority**
Sewa Bhawan, R.K. Puram,
New Delhi-110001

**F.No.21/7/2021-Adm.(Coord.)** 130 **Dated** 1 **March, 2021**

## OFFICE ORDER

**Subject : Constitution of Safety Audit Committee to Undertake Safety Audit of Thermal Power Plants in coordination with concerned Departments/ Institutions as per Hon'ble National Green Tribunal (NGT) Order dated 22.12.2020– reg.**

In pursuance of Ministry of Power letter No.5/2/2019.S.Th. dated 22.02.2021 and on the basis of instructions issued by Hon'ble NGT order dated 22.12.2020 on the subject mentioned above, a Committee to undertake Safety Audit of Thermal Power Plants in coordination with concerned Departments/ Institutions has been constituted as under :-

| | |
|---|---|
| (i) Chief Engineer (TETD), CEA | -Chairman of the Committee |
| (ii) Representative from MoP at DS/ Director Level | -Member |
| (iii) Representative from Ministry of Coal at DS/ Dir. Level | -Member |
| (iv) Representative from Central Boiler Board, DPIIT at DS/Dir. Level-Member | |
| (v) Representative from TCD Division, CEA at Dir.Level | - Member |
| (vi) Representative from Director General Fire Services, MHA at DS/Dir. Level- Member | |
| (vii) Shri Hirak Datta, Former ED, OISD for plants of NLCIL | - Member |
| (viii) Representative from NTPC at GM Level | - Member |
| (ix) Representative from NLCIL of GM Level | - Member |
| (x) Representative from BHEL of GM Level | - Member |
| (xi) Director (TETD), CEA | - Member |

Terms of Reference :

i. To undertake safety audits of similarly placed units of Thermal Power Stations throughout the country expeditiously preferably within six months to avoid recurrence of such incidents in future as per Hon'ble NGT order dated 22.12.2020, in coordination with such other Departments/ Institutions / Organizations, as may be necessary;
ii. Safety Audit Committee will deliberate and decide the similarly placed units for carrying out the Safety Audit;
iii. The necessary methodology / procedure / Check List for above Safety Audit shall be decided by this Safety Audit Committee;
iv. The Safety Audit Committee may co-opt other members as deemed necessary from other Department/ Institution/ Organisation;

v. The expenditure towards TA/ DA of the members of the Safety Audit Committee in connection with the above safety audit would be borne by their respective Ministries / Departments / Organisations.

3. This issues with the approval of the Competent Authority.

(Tulsi Dass)
Under Secretary (P)
Phone: 011-26732506

To,

All Members of the Committee

Copy forwarded for information to :-

i. Technical Adviser (Boiler), CBB, DPIIT;
ii. CMD, NTPC;
iii. CMD, NLCIL;
iv. CMD, BHEL;
v. JS(Coal), Ministry of Coal;
vi. Fire Adviser, Fire Service, Civil Defence and Home Guards, MHA;
vii. CE(Thermal), MoP;
viii. CE(TCD), CEA

Copy for kind information to :

1. SA to Chairperson, CEA;
2. PPS to AS(Thermal), MoP;
3. PPS to all Members, CEA;
4. PPS to PCE-I/ II and Secretary, CEA;
5. PS to CE(Legal), CEA;
6. Director (Adm.), CEA;
7. Director (IT) with the request to upload on CEA website.

# Annexure - V
# (Safety Audit Checklist)

## General Information on using the checklist

| S.No. | Areas | Sheet Name |
|---|---|---|
| 1 | Plant Biodata | Biodata |
| 2 | General Aspects of Safety | GA |
| 3 | Emergency Management Plan (EMP) | Annex A |
| 4 | Fire Protection | Annex B |
| 5 | Boiler Area | Boiler |
| 6 | Turbine Generator Area | TG |
| 7 | Balance of Plant Area | BoP |

**Please note :-**

1 Question that require answering in Yes/No may be answered accordingly.
2 Details may be provided in questions wherever asked.
3 Remarks column may be used for providing clarification/ additional information, if any.
4 Questions shall be answered based on documentary evidence supporting the arguments.
5 The relevant documents may be asked to be reproduced at the time of safety audit.

## Plant Biodata

| Sl No. | Item | Values |
|---|---|---|
| 1 | Name of Utility | |
| 2 | Sector *(Central/State/Private)* | |
| 3 | Region *(NR/WR/ER/SR/NER)* | |
| 4 | Name of the Plant | |
| 5 | Location *(District, State)* | |
| 6 | Capacity of Plant *(No. Of units x Unit size)* | |
| 7 | Plant configuration and unit-wise CODs | |
| 8 | Area of the plant *(Premise of the plant)* | |
| 9 | General Arrangement/ Layout of the plant | Attach plant layout drawing |
| 10 | Coal Proximate Analysis & GCV | |
| 11 | Main Steam Parameters | |
| 12 | Details of Boiler | type, capacity etc. |
| 13 | Details of Steam Turbine | type, capacity etc. |
| 14 | Details of Generator and its cooling system | type, capacity etc. |
| 15 | Details of Coal Handling Plant *(CHP)* | |
| 16 | Details of method of transit of coal, fuel oil, chemicals/ hazardous materials etc. to the power plant | Safety aspects related to these methods? |
| 17 | Details of source of cooling water | |
| 18 | Details of Cooling tower | |
| 19 | PLF & PAF for last two years | |
| 20 | Total Strength/ No. Of Employees | indicate category-wise (Skilled/ semi-skilled/ unskilled) |
| 21 | Name of the Agency/ person, if any, awarded for O&M jobs of the power plant | |
| 22 | No. of persons/ workers hired by the Agency/ | |
| 23 | Name of the Security Agency hired by the power plant, if any | |
| 24 | Name and Contact details of Nodal officer for Safety Audit *( not below the rank of GM)* | |

### 7. Plant configuration

| S.N. | Stage | Unit Number | Installed Capacity | Date of Commissioning |
|---|---|---|---|---|
| | 1st (e.g.) | 2 (e.g.) | 250 (e.g.) | 31-02-1991 (e.g.) |
| 1 | 1st | 1 | | |
| 2 | | 2 | | |
| 3 | | ... | | |
| 4 | 2nd | 3 | | |
| 5 | | 4 | | |
| 6 | | ... | | |
| | Total no. Of units | | 0 | |

### 10. Coal Proximate Analysis

| S.N. | Item | Value (%) |
|---|---|---|
| | Coal GCV (kcal/kg) | |
| 1 | Fixed Carbon | |
| 2 | Moisture | |
| 3 | Volatile Matter | |
| 4 | Ash | |
| | Total | 100.00% |

### 19. Plant Schedule

| S.N. | Year | Plant Availability Factor (PAF) (%) | Plant Load Factor (PLF) (%) |
|---|---|---|---|
| 1 | Year 1 | | |
| 2 | Year 2 | | |

## A. General Aspects of Safety

| Sl No. | Items to be Checked / verified | Status | Remarks, if any |
|---|---|---|---|
| **A. Statutory Compliance** | | | |
| **1** | Compliance of **CEA (Measure relating to Safety and Electric Supply) Regulations 2010** | Yes/ No | |
| **2** | Whether the plant is certified with **Occupational Health & Safety management System like OHSAS 18001 : 2007 or, ISO: 45001 : 2018?** | Yes/ No | |
| **3** | Whether the procedure of **IS 14489 - 2018** or latest version **'Code of Practice on Occupational Safety and Health Audit** followed? | Yes/ No | |
| **4** | Whether Compliance of **Factory Act 1948** | Yes/ No | |
| **4.1** | Whether factory license is available and updated? Please confirm that all additions and deletions in structures / equipments are revised in the drawing and updated? | Yes/ No; If Yes, give value | |
| **4.2** | Whether the Factory inspectorate / directorate officials have visited and if so, when was the last visit? | give value | |
| **4.3** | Whether all the points / observations of the concerned officials visit have been attended to / complied? | Yes/ No | |
| **4.4** | Whether all licenses are available to run the plant? Is it monitored through a dashboard? | Yes/ No | |
| **4.5** | whether approval available for Lifts/ Escalators? | Yes/ No | |
| **4.6** | whether CCE approval obtained for storage? | Yes/ No | |
| **4.7** | whether building stability Certificates available? | Yes/ No | |
| **5** | **Compliance of CEA (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations 2011**. This shall include but shall not be limited to the following | Yes/ No | |
| **5.1** | **Safety Policy** | | |
| 5.1.1 | Is the Safety Policy in place? | Yes/ No | |
| 5.1.2 | Is the Safety policy displayed prominently and is it known to all employees and contractors, their workmen? | Yes/ No | |
| 5.1.3 | Periodicity of policies review and when it was last reviewed? | give value | |
| **5.2** | **Safety manual** | | |
| 5.2.1 | Whether an updated safety manual maintained and made available to all employees and workers till the shop floor level. | | |
| **5.3** | **Safety Officer** | | |
| 5.3.1 | Whether Safety Officers deployed as per Factory Act | Yes/ No | |
| 5.3.2 | How many safety officers are there? Safety organogram to be submitted? | give value | |
| 5.3.3 | Whether there is a safety plan to implement the safety policy? If so, how is it implemented and monitored? | give details | |

| | | | |
|---|---|---|---|
| **5.4** | **Safety committee** | | |
| 5.4.1 | Whether there is a Plant Level Safety Committee and date of its constitution? | Yes/ No; give value | |
| 5.4.2 | Is the role and responsibility of each member communicated to them? | Yes/ No | |
| 5.4.3 | What is the frequency of meeting of the safety committee? How many meetings were conducted in last two years? Who chairs the meeting? What are the management objectives? | give detail in brief | |
| 5.4.5 | Status of participation of workmen and status of implementation of suggestions / issues raised by the safety committee members. | give detail in brief | |
| 5.4.6 | Is there any cross functional safety team? | Yes/ No | |
| 5.4.7 | How is safety ensured on 24x7 basis? | give detail in brief | |
| 5.4.8 | Whether safety performances KPA for managers are linked with annual performance assessment? | Yes/ No | |
| **5.5** | **Reporting of accidents** | | |
| 5.5.1 | Whether an accident reporting system in place and adhered to. | give detail in brief | |
| 5.5.2 | What is the investigation system of all accidents? | give detail in brief | |
| 5.5.3 | Are the investigation report recommendations implemented? Is it conveyed to all the concerned and senior executives? | give detail in brief | |
| 5.5.4 | Give the accident details of last 5 years. Both fatal and reportable cases. | give detail in brief | |
| 5.5.5 | How many fire incidences are reported in last 5 years. | give value | |
| **5.6** | **Emergency Management Plan** | | |
| 5.6.1 | Is Emergency Response Disaster Management Plan (ERDMP) - (both On-Site & Off-Site) in place | Yes/ No | |
| | Is it approved by the Appropriate Authority (like Director/ Chief Inspector of Factories) | Yes/ No; give designation | |
| 5.6.2 | **Please fill Annexure-A on EMP.** | Link to Annexure-A on EMP | |
| | | | |
| **5.7** | **Medical Facilities** | | |
| 5.7.1 | How many Ambulances are available? Are they well equipped? Details thereof. | give value | |
| 5.7.2 | Is there a First Aid Center available. How is the first aid center equipped? Details thereof including the no. of first aiders. | give value | |
| 5.7.3 | Whether Mutual Aid Partners are available to fight major emergencies? | give brief detail | |
| **5.8** | **Safety training and awareness** | | |
| 5.8.1 | What is the status of safety training? Is there any safety training matrix for the contract workers and employees? | give detail in brief | |
| 5.8.2 | How many safety training programmes are conducted in a year? | give value | |
| 5.8.3 | What is the mode of training? | | |
| 5.8.4 | How many participants have participated? | **give value** | |
| 5.8.5 | Whether a general Induction Training is imparted to all before joining or issue of gate pass? | Yes/ No | |

| | | | |
|---|---|---|---|
| 5.8.6 | Is there any job specific training programme for specific people identified for a job? | Yes/ No | |
| 5.8.7 | Is any pep talk* conducted on a daily basis? | Yes/ No | |
| 5.8.8 | Is any Tool box talk done by the teams before the jobs? | Yes/ No | |
| 5.8.9 | Is there any first aid training programme conducted? | Yes/ No | |
| 5.8.10 | Is there any firefighting training conducted? | Yes/ No | |
| 5.8.11 | Is there emergency handling training conducted? | Yes/ No | |
| **5.9** | **Safety Promotional Activities** | | |
| 5.9.1 | Is mechanism in place for Safety Promotional activities | Yes/ No | |
| 5.9.2 | What are the safety promotional activities done in a year? | give value | |
| 5.9.3 | What are the safety celebrations done in a year? | give value | |
| 5.9.4 | Is there any reward system for the Employees? | Yes/ No | |
| 5.9.5 | Is there any reward system for the Contractors? | Yes/ No | |
| 5.9.6 | Is there any reward system for the Contract workers? | Yes/ No | |
| 5.9.7 | Is there any penalty system also? | Yes/ No | |
| **5.10** | **Safety Metrics & Incident Control Measures** | | |
| 5.10.1 | Are Safety Metrics & Incident Control Measures in place? | Yes/ No | |
| 5.10.2 | What are the measurements done for safety performance assessment? | give value | |
| 5.10.3 | Is there measurement of Incident Rate, Frequency Rate, Severity rate? | give value | |
| 5.10.4 | Give the accident details of last 5 years. Both fatal and reportable cases. | give detail in brief | |
| 5.10.5 | How many fire incidences are reported in last 5 years. | give value | |
| 5.10.6 | What are the top five causes of Fatal accidents. Give yearwise for last five years. | give value | |
| 5.10.7 | What are the top five causes of reportable accidents. Give yearwise for last five years. | give detail in brief | |
| 5.10.8 | How many first aid cases have been reported in last five years? What are the major causes? | give detail in brief | |
| 5.10.9 | How many near miss incidents have been reported in last five years. | give values | |
| **5.11** | **Hazard Identification and Control** | | |
| 5.11.1 | Whether **Hazard Identification Study (HAZID) done** | Yes/ No | |
| 5.11.2 | Whether Quantitative Risk Assessment (QRA) Study was done for the plant? | Yes/ No | |
| 5.11.3 | When was the last QRA Study done? | give date | |
| 5.11.4 | Whether **HAZOP study** done for the plant | Yes/ No | |
| 5.11.5 | Status of implementation of HAZOP Study recommendations | give brief detail | |
| **6** | **Boilers Act 1923** | | |
| 6.1 | Whether all provisions of Boilers Act 1923 complied with. | Yes/ No | |
| 6.2 | Whether Boilers are under the incharge of sufficient no. of boiler operation engineers (BOEs) | Yes/ No | |
| **7** | **Compliance w.r.t environmental provisions/regulations** | Yes/ No | |
| 7.1 | Whether CTO under Air Act,1981 and water Act 1974 obtained & valid? | Yes/ No | |

| | | | |
|---|---|---|---|
| 7.2 | Whether adequate Environment Protection measures especially for waste water, chemicals and dust suppression system are provided | Yes/ No | |
| | | | |
| **B. Maintenance Safety Management** | | | |
| **1** | **Maintenance Safety Management System** | | |
| 1.1 | Is Maintenance Safety Management System in place? | Yes/ No | |
| 1.2 | Is the Gate pass issue system for the contract labours in place? | Yes/ No | |
| 1.3 | Are trainings imparted before the gate pass? | Yes/ No | |
| 1.4 | What is the frequency of periodic health check up of workers? | indicate numbers | |
| 1.5 | Do you conduct audiometry test, X-ray, ECG etc. What are the tests done and is any record maintained thereof? | indicate details | |
| 1.6 | Is any Vertigo test done to check for any person's height phobia? | Yes/ No | |
| 1.7 | Is area specific PPEs are issued to the Operation Staff and contract workmen? | Yes/ No | |
| 1.8 | Is there use of Arc Flash suits/Chlorine and chemical handling suits / High heat suits for use in Bottom ash areas? | Yes/ No | |
| 1.9 | Is site specific safety signage in place? | Yes/ No | |
| 1.10 | Is there any process in place to control people before entering hazardous zone? | Yes/ No | |
| 1.11 | Are the contractors evaluated for their safety performance? | Yes/ No | |
| 1.12 | Whether Illumination in all areas of the power plant proper or not? | Yes/ No | |
| 1.13 | Whether scrap/ waste material stored at designated location? | Yes/ No | |
| 1.14 | Whether handrails are provided at all places where required? | Yes/ No | |
| 1.15 | Is there proper barricading of pits, covering on floor cavities? | Yes/ No | |
| 1.16 | Are there safety related sign board throughout the power plant premises? | Yes/ No | |
| 1.17 | Is there a system of inspection of tools and tackles? | Yes/ No | |
| 1.18 | What methodology has been adopted for testing of lifting tools and tackles, Elevators, Cranes etc. and the validity of such tests for lifting tools? | indicate details | |
| 1.19 | Is electrical safety checking carried out of all electrically operated tools and welding equipments? | Yes/ No | |
| 1.20 | Is the coal dust accumulation monitored? | Yes/ No | |
| 1.21 | Whether the dust extraction systems and duct suppression systems are provided and properly functioning? | Yes/ No | |
| 1.22 | Is the Illumination level in various places adequate as per requirement? | Yes/ No | |
| 1.23 | Is the noise level monitored? | Yes/ No | |
| 1.24 | Whether inspection and necessary painting of Structures done? | Yes/ No | |
| 1.25 | Do you have special safety task force for Unit Overhauls? | Yes/ No | |
| 1.26 | What is the compliance status of safety deviation observations, reportable and fatal accident recommendations? | indicate status | |

| | | | |
|---|---|---|---|
| 1.27 | What specialized job training conducted like use of electric and pneumatic tools, rigging works, gas cutting, welding safety etc.? | indicate details | |
| 1.28 | Is there any system of summer preparation and monsoon preparation action plan? Is it implemented and monitored? | Yes/ No | |
| 1.29 | Is Safety precautions for chemical handling systems in place? | Yes/ No | |
| 1.30 | Is the periodic Inspection of insulations being done? | Yes/ No | |
| | | | |
| **2** | **Permit to Work (PTW) System** | | |
| 2.1 | Is there any PTW system? If so any handbook / manual for PTW system? | Yes/ No | |
| 2.1.1 | Is computerised PTW system available? | Yes/ No | |
| 2.2 | What are the types of permits? Is there any special permits like height work permit, confined space permit, hot work permit etc.? | give details | |
| 2.3 | What is the competence level of persons authorized to issue permits and competence level of persons execute the works? Is there any periodical assessment? | give brief detail | |
| 2.4 | Who are authorized to take permits? | name/ designation | |
| 2.5 | Who supervises the works? What is his competency? Is he competent to take decisions? | brief detail | |
| 2.6 | How is the competency of supervisor assessed? | give brief detail | |
| 2.7 | Is there any PTW audit system? If yes, when was it conducted? What are the significant observations of last two audits? How many are complied? | Yes/ No; give detail | |
| 2.8 | Is any random PTW checking carried out? | Yes/ No | |
| 2.9 | Is there any format for **Job Safety analysis**? Please enclose one. Is it followed for each permit? Is there any format for **Job Safety analysis**? Please enclose one. Is it followed for each permit? | give detail | |
| 2.10 | Is any random checking of Isolation/ Normalisation records done? | | |
| 2.11 | Is there **LockOut/ TagOut (LOTO)** system? | Yes/ No | |
| 2.12 | Any training or refresher training programme conducted on PTW system? | Yes/ No | |
| **3** | **Whether an ERP solution implemented in the unit?** | Yes/ No | |
| 3.1 | Whether the maintenance tasks carried out using the ERP system? | Yes/ No | |
| 3.2 | Whether the PTW system linked to the ERP system? | Yes/ No | |
| **4** | **Operation of Plant** | | |
| 4.1 | Whether Operation Review Team (ORT) meeting taking place regularly? | Yes/ No | |
| 4.2 | Whether equipment changeover schedule being discussed in ORT meetings? | Yes/ No | |
| 4.3 | Whether equipment changeover schedule being followed? | Yes/ No | |
| | | | |
| **C. Fire Detection, Protection and Maintenance system** | | | |
| 1.0 | Is Fire Detection, Protection and Maintenance System in place? | indicate details | |

| | | | |
|---|---|---|---|
| 2.0 | **Please fill Annexure-B on Fire Protection.** | Link to Annexure-B on Fire Protection | |
| | | | |
| **D. Performance Monitoring of Safety Protocols** | | | |
| 1.0 | **Internal Safety Audit** | | |
| 1.1 | Is there any Internal safety audit system? Who conducts it? What is its frequency? | Yes/ No; give detail | |
| 1.2 | How many internal safety audits conducted till date? | indicate numbers | |
| 1.3 | Are the employees trained to conduct Internal Safety Audit? | Yes/ No | |
| 1.4 | Status of Internal Safety Audit recommendations liquidated/ complied? | indicate | |
| 1.5 | How many Internal Safety Audit recommendations pending for more than 3 months? | indicate numbers | |
| 2.0 | **External Safety Audit (ESA)** | | |
| 2.1 | Is there any External safety audit system? Who conducts it? What is its frequency? | Yes/ No; give detail | |
| 2.2 | Status of External Safety Audit recommendations liquidated? | indicate | |
| 2.3 | How many External Safety audit recommendations noted by the external audit team and complied with for last 3 years? Give details yearwise. . | indicate numbers | |
| 2.4 | When was the last external safety audit conducted? | indicate date | |
| 2.5 | Who are the agencies conducted External safety audit? | indicate names | |
| 3.0 | **ISO 45001: SAFETY AUDIT** | | |
| 3.1 | Whether the plant is ISO 45001 certified? Who audits it? What is its frequency? | Yes/ No; indicate details | |
| 3.2 | How many ISO 45001: Safety Audit recommendations noted by the Auditee/ team & its liquidation/ compliance status for the last three (03) years? Give yearwise details. | indicate details | |
| 3.3 | When was the last ISO 45001: Safety Audit conducted? | indicate date | |
| 3.4 | What is the frequency of ISO 45001: Safety Audit? | indicate periodicity | |
| 3.5 | Who are the agencies conducted ISO Safety Audits? | indicate names | |

* Peptalk: Safety awareness talk

## Annex- A Emergency Management Plan

| Sl No. | Items to be Checked / verified | Status | Remarks, if any |
|---|---|---|---|
| | **Emergency Management Plan** | | |
| 1.1 | Is Emergency Response Disaster Management Plan (ERDMP) - (both On-Site & Off-Site) in place | Yes/ No | |
| 1.1a | Is an Emergency Preparedness Plan available (including fire prevention and emergency response) and prominently displayed? | Yes/ No | |
| 1.2 | Is it approved by the Appropriate Authority (like Director/ Chief Inspector of Factories) | Yes/ No; indicate designation | |
| 1.3 | Is there a proper system available to communicate emergency? (PA System / Fire Detection And Alarm System (FDA) / Emergency alarm) | Yes/ No | |
| 1.4 | Is Emergency Response Team (Fire Fighting / Rescue Teams) available 24×7? | Yes/ No | |
| 1.5 | Is there a Safety Control Room? Is it equipped for emergencies? | Yes/ No | |
| 1.6 | Are (i) Fire Tenders, (ii) Foam generating systems, (iii) Breathing apparatus available? | Yes/ No | |
| 1.7 | Is emergency contact numbers including name & no. of nearest police station, fire-brigade station and hospital displayed on the board | Yes/ No | |
| 1.8 | Are employees familiar with emergency evacuation procedures, particularly evacuation routes? | Yes/ No | |
| 1.9 | Assembly point available at safe location away from stores? | Yes/ No | |
| 1.10 | Details of number of assembly points, awareness of these assembly points amongst workers and staff? | indicate details | |
| 1.11 | Is the system of conducting Mock drills in place? Are mock drills conducted at least once in 6 months and records of the mock drills conducted in last 2 years? | Yes/ No; indicate numbers | |
| 1.12 | Are the roles and responsibility of the individuals known to each of the person identified in the EMP/ DMP? | Yes/ No | |
| 1.13 | Proper "First Aid Fire Fighting" training given to Security personnel or operators? | Yes/ No | |
| 1.14 | Is there a Siren available? Is it tested regularly? What is its audible distance? | Yes/ No; indicate distance | |
| 1.15 | Are adequate numbers of Wind Socks/ Cones available and their locations? | Yes/ No; indicate locations | |
| 1.16 | Whether Emergency exit meets the requirement of the standard? Are the emergency exit doors having minimum width? | Yes/ No | |
| 1.17 | whether Access and Exit ways large enough to allow a man wearing breathing apparatus to pass through? | Yes/ No | |
| 1.18 | Is exits clearly visible and the route to reach the exits shall be clearly marked in green colour and signs posted to guide the occupants of the floor concerned as per IS 9457? | Yes/ No | |
| 1.19 | Is Signs illuminated and wired to an independent electrical circuit on an alternative source of supply? | Yes/ No | |

| | | | |
|---|---|---|---|
| 1.20 | Is every exit, exit access or exit discharge is continuously maintained free of all obstructions? | Yes/ No | |
| 1.21 | Is separate circuits for fire fighting pumps, lifts, staircases and corridor lighting and blowers for pressurizing system provided directly from the main switch gear panel and these circuits laid in separate conduit pipes, so that fire in one circuit will not affect the others? | Yes/ No | |
| 1.22 | Is Air-conditioning and ventilating systems circulating air to more than one floor or fire area is provided with dampers designed to close automatically in case of fire and thereby preventing spread of fire or smoke and is in accordance with IS 659? | Yes/ No | |
| 1.23 | Whether AC system is provided with automatically switched off mechanism before the extinguishing system is put into operation? | Yes/ No | |
| 1.24 | Is alternate source of power supply provided for a fire lift through a Automatic change over switch? | Yes/ No | |
| 1.25 | Is each fire lift shall be equipped with suitable inter-communication equipment for communicating with the control room? | Yes/ No | |
| 1.26 | Is emergency lighting powered from a source independent of that supplying the normal Lighting? | Yes/ No | |
| 1.27 | Whether the oil storage tanks is provided with fixed foam fire extinguishing system? | Yes/ No | |
| 1.28 | whether On and Off type sprinkler system, CO2 or Halon system is provided in the control room? | Yes/ No | |
| 1.29 | Whether control room of class I & II of power generating units have fire barriers/ separation walls between the main TG hall or any other rooms? | Yes/ No | |
| 1.30 | Whether control room have 2 hours fire resistance with smoke stock fire check doors or the same rating? | Yes/ No | |
| 1.31 | Whether Smoke detectors is provided in the control room on cross zoning principle with suitable time delay device incorporated? | Yes/ No | |
| 1.32 | Whether Fire safety aspects of the boiler plant and auxiliary equipment is in accordance with IS 8633? | Yes/ No | |
| 1.33 | Whether electrical equipment and installation of power station conform to the relevant Guidelines given in IS 1646? | Yes/ No | |
| 1.34 | Whether Electrical equipment is kept free of deposits of oil, grease, carbon dust etc.? | Yes/ No | |
| 1.35 | whether Fire protection equipment for cable galleries, cable runs etc. conform to the provisions contained in IS 12459? | Yes/ No | |
| 1.36 | Whether all transformer installations have safety provisions as per IS 1646? | Yes/ No | |
| 1.37 | Whether for effective fire fighting purpose the minimum illumination provided for all working places such as turbine houses etc. is 100 lux and for control rooms is 150 lux as per IS 1646? | Yes/ No | |
| 1.38 | whether the turbo generator and supporting structure have fixed water spray type protection system? | Yes/ No | |

| | | | |
|---|---|---|---|
| 1.39 | whether provision of fixed CO2 or dry chemical system backed by water spray systems are there to stop the spread of fire? | Yes/ No | |
| 1.40 | Fixed high velocity water spray system designed to discharge a flow of 10 Lt. per minute per Sq. meter shall be provided for oil systems, oil piping pumps etc.? | Yes/ No | |
| 1.41 | whether Fire barrier wall is provided between transformer where there are less than 15 meters apart or where the oil capacity exceeds 2000 liters? | Yes/ No | |
| 1.42 | whether Gas filled circuit breakers and vacuum breakers are the least fire hazard as compared to the oil breakers or air blast breakers? Therefore, hydrant protection system shall be provided. | Yes/ No | |
| 1.43 | whether enclosed switch gear room automatically provided with CO2 flooding system? | Yes/ No | |
| 1.44 | whether fire barriers provided in accordance with IS 12459 to limit the spread of fire along cable ways? | Yes/ No | |
| 1.45 | Whether cable entries in the switch gear room is sealed by use of fire stops? | Yes/ No | |
| 1.46 | whether Cable galleries or runs is provided with automatic fixed fire fighting installations using water, CO2, halon or high expansion foam? | Yes/ No | |
| 1.47 | Whether all the cable trenches in entire plant are properly covered with slabs. | Yes/ No | |
| 1.48 | whether Boiler furnaces (BBF) is protected with automatic sprinkler systems covering the burner from oil hazard. | Yes/ No | |
| 1.49 | whether Boiler furnaces and boiler front areas is provided with automatic fire detection systems in accordance with IS 2175? | Yes/ No | |
| 1.50 | whether the water supply for fire fighting for power stations conform to the provisions contained in IS 9668 and internal hydrant system to IS 3844 and external hydrant system to IS 13039? | Yes/ No | |
| 1.51 | whether the water supply is planned on the basis of the requirement of the largest fixed fire extinguishing system demand plus the maximum demand from the hydrant mains of not less than 3600 liters per minute for minimum of 4 hours duration for power stations falling under the category of class I & II and for a minimum of 3 hours duration for the lower category? | Yes/ No | |
| 1.52 | whether Pumping capacity of the water supply system for fire fighting is based on the requirements mentioned at 5.6.50 above and no tapping is done from the fire fighting mains to meet the requirements of other units? | Yes/ No | |
| 1.53 | whether the fire fighting pumps shall be of automatic starting with manual stopping and in conformity with IS 12469? | Yes/ No | |
| 1.54 | whether the entire station area provided with manual fire alarm system with call boxes conforming to IS 2189? | Yes/ No | |
| 1.55 | whether Lightning protection for the power station buildings, outdoor bulk Oil Storage Tanks and Switchyard areas provided? | Yes/ No | |

| | | | |
|---|---|---|---|
| 1.56 | whether provision of emergency power supply for the fire fighting system is provided? | Yes/ No | |
| 1.57 | whether major fire fighting appliances/ equipment maintained all the time to meet the emergency requirements in accordance with IS 3034? | Yes/ No | |
| 1.58 | whether minimum man power is maintained in all the shifts to maintain and operate the firefighting equipment/appliances? | Yes/ No | |
| 1.59 | whether Power Stations authorized for full time fire brigades with major fire fighting appliances with trained fire fighting staff? Give status. | indicate details | |
| 1.60 | whether power plant Owner provided the information to concerned District Collector as per the requirement mentioned under Para 9 sub para (5) of the CEA (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations 2011. | Yes/ No | |
| **2** | **Any other issues in Emergency Management Plan** | | |
| | | | |

**Annexure – B on Fire Protection**

| Sl No. | Items to be Checked / verified | Status | Remarks, if any |
|---|---|---|---|
| **Fire Detection, Protection and Maintenance System** | | | |
| 1.0 | How many fire pump houses are there? How many pumps are installed and their types? | indicate details | |
| 1.2 | Are fire hydrant pumps adequately available and their frequency of testing? | Yes/ No; indicate periodicity | |
| 1.3 | Are fire hydrant jockey pumps adequately available and their frequency of testing? | Yes/ No; indicate periodicity | |
| 1.4 | What is the fire water pressure availability at the farthest point and at the highest point? | indicate value | |
| 1.5 | What is the periodicity of fire tenders inspection? When they were last inspected? | indicate periodicity and date | |
| 1.6 | Is the water refilling arrangement in the fire tenders properly maintained? | Yes/ No | |
| 1.7 | Is availability of all consumables like Fire hose, branches, nozzles, wheels etc properly maintained? | Yes/ No | |
| 1.8 | How many fire crew/ personnel available (in numbers) | indicate numbers | |
| 1.9 | How many portable pumps are available? | indicate numbers | |
| 1.10 | How many foam generators are available? | indicate numbers | |
| 1.11 | How many portable DG sets are available? | indicate numbers | |
| 1.12 | Is availability of emergency lights, breathing apparatus, portable foam generators properly maintained? | Yes/ No | |
| 1.13 | Please mention about Healthiness of the following: | | |
| 1.13.1 | Hydrant systems | Yes/ No | |
| 1.13.2 | Fire water pipelines | Yes/ No | |
| 1.13.3 | Sprinkler systems | Yes/ No | |
| 1.13.4 | Sprinkler system pipelines | Yes/ No | |
| 1.13.5 | Water monitors | Yes/ No | |
| 1.14 | whether adequate fire protection system deployed/adopted in different equipment/systems of the power plants? | Yes/ No | |
| 1.15 | Is Internal and external Public Address system in place and properly functioning? | Yes/ No | |
| 1.16 | What is the periodicity of checking of Fire Detection system? | indicate periodicity | |
| 1.17 | What is the periodicity of checking of Fire Protection system? | indicate periodicity | |
| 1.18 | Is the transformer meant for Fire fighting system in healthy condition? | Yes/ No | |
| 1.19 | Is fire fighting system for Main Oil Tank in healthy condition? | Yes/ No | |
| 1.20 | Is fire fighting system for Turbine in healthy condition? | Yes/ No | |
| 1.21 | Is fire fighting system for Burners in healthy condition? | Yes/ No | |
| 1.22 | Is the fire fighting system for Fuel Oil Tanks in healthy condition? | Yes/ No | |

| | | | |
|---|---|---|---|
| 1.23 | Is the foam system in Fuel Oil Tank area tested? What is the periodicity of testing and when it was last tested? | Yes/ No; indicate date | |
| 1.24 | Is the fire fighting system of coal conveyors & the linear heat sensors in healthy condition? | Yes/ No | |
| 1.25 | Periodicity of inspections of fire fighting system of coal conveyors system? When was it last inspected? | indicate periodicity and date | |
| 1.26 | Is the fire fighting system in Cable galleries in healthy state? What is the effectiveness of smoke detectors? | Yes/ No | |
| 1.27 | Are the exhaust fans in cable gallery functional and in healthy state? | Yes/ No | |
| 1.28 | Periodicity of inspections of fire fighting system in Cable gallery? When was it last inspected? | indicate periodicity and date | |
| 1.29 | Is Fire fighting system in Main Control Room, CHP control room, Switchyard control room, Ash handling control room in healthy state? | Yes/ No | |
| 1.30 | When was the sprinkler systems last inspected? Please give details area wise? | indicate details | |
| 1.31 | Is any firefighting mock drill carried out? | Yes/ No | |
| 1.32 | What are the observations of fire mock drills for the last 6 months and their compliance status? | indicate details | |
| 1.33 | Is there any accumulation of Scraps, flammable materials, oil spillage, cotton wastes, empty oil drums, wild vegetation growth in the power plant area? | Yes/ No | |
| 1.34 | Are portable fire extinguishers installed and maintained as per IS 2190? | Yes/ No | |
| 1.35 | Are all the PFEs (Portable Fire Extinguishers) accessible? Are the PFEs obstructed by storage of materials and numbered for easy identification? | Yes/ No | |
| 1.36 | Is use of Fire extinguishers training given to Staff including security guards? | Yes/ No | |
| 1.37 | whether small bore hose reel is provided in the facility? | Yes/ No | |
| 1.38 | whether sprinkler system is provided as per the requirement? | Yes/ No | |
| 1.39 | whether sprinkler valve and gong bell or flow switch are available and tested? | Yes/ No | |
| 1.40 | whether Sprinkler heads are missing / plugged? | Yes/ No | |
| 1.41 | whether Sprinkler piping and heads spacing are as per the requirement of IS 15105? | Yes/ No | |
| 1.42 | Are the trained personnel available at all times for operating the hydrant system and fire-fighting system? | Yes/ No | |
| 1.43 | Is fire alarm system installed in the building as per the requirement of NBC / IS 2189? Spacing of detector is properly designed? | Yes/ No | |

| | | | |
|---|---|---|---|
| 1.44 | whether the space above the false ceiling and the space under the raised flooring are provided with smoke detectors? Are the response indicators provided for these detectors? Access available for detectors provided above false ceiling? | Yes/ No | |
| 1.45 | whether FDA system is interlocked with HVAC blower, Fire dampers and access control system? | Yes/ No | |
| 1.46 | whether FDA alarm hooter is provided in all areas? | Yes/ No | |
| 1.47 | whether Manual Call Point is provided in all Entry / Exit at 1.4 m elevation? | Yes/ No | |
| 1.48 | whether Gas suppression system is provided for the server room / critical facility? Suppression cylinders are kept outside the room protected? Back up battery / UPS supply provided for Gas suppression system? | Yes/ No | |
| 1.49 | whether Manual release and Abort switches are provided at the facility entry and easily accessible? | Yes/ No | |
| 1.50 | whether adequate pressure available in the cylinder and Audio visual alarm provided? | Yes/ No | |
| 1.51 | whether Smoke extraction system is provided and interlocked with FDA system? | Yes/ No | |
| 1.52 | Are the fire protection and detection system maintained as per the standard requirement? Mention the last date of maintenance and servicing agency name - Fire Hydrant system - Sprinkler system - Gas suppression system - Fire detection and alarm system - Smoke extraction system | Indicate dates and details | |
| 1.53 | whether internal staircase is constructed outside of Lifts lobby? | Yes/ No | |
| 1.54 | The electrical shafts/AC ducts or gas pipes, etc., should not pass through or open in the staircases? | Yes/ No | |
| 1.55 | whether Fire doors are provided for Electrical panel room and AHU room in each floor? Fire doors are provided for Emergency Exits and Duct inspection doors? | Yes/No | |
| 1.56 | whether false floor and ceiling are made of fire retardant material? | Yes/ No | |
| 1.57 | whether vertical and horizontal opening between floors of a building and rooms are sealed to prevent spread of smoke and fire? | Yes/ No | |
| 1.58 | Whether Diesel fire water pumps are provided on standby | Yes/ No | |
| 1.59 | Whether Electrical Panels / Cabinets are protected by adequate detection and suppression system ? | Yes/ No | |
| 1.60 | Whether Cable trenches / Cable ducts / Cable Cellar are protected with detection and suppression system ? | Yes/ No | |
| 1.61 | Whether Gas Detection System is provided as per requirement ? | Yes/ No | |

| | | | |
|---|---|---|---|
| 1.62 | Whether Clean Agent System is provided in Control Rooms Viz Main Control Room, CHP Control Room, Switchyard Control Room, Ash Handling Room ? Also to ensure that as per latest MOEF Regulation, all the Halon 1301 system has to be replaced with Environmental free Inert Gas Fire Extinguishing System. | Yes/ No | |
| 1.63 | Whether Conveyor Belts are provided with Linear Heat detection system integrated with Extinguishing system. if yes please check the suitability and the healthiness of the system installed | Yes/ No | |
| 1.64 | Whether adequate Fire Prevention / Suppression system is provided for Oil filled Transformers ? | Yes/ No | |
| | | | |
| | | | |
| | | | |
| **2** | **Any other issues in Fire Detection, Protection and Maintenance System** | | |

| B. Safety Aspects of Boiler | | | |
|---|---|---|---|
| Note: Please attach additional sheets for elaboration wherever necessary | | | |
| **S. NO.** | **Items to be Checked / verified** | **Status** | **Remarks, if any** |
| **1** | **General/Statutory Requirements** | | |
| 1.1 | What is the Boiler Rating? Please mention for each Boiler. | Give details | |
| 1.2 | What is the working pressure and design pressure of boilers? Please mention for each Boiler. | Give details | |
| 1.3 | Whether Statutes, Regulations, Safety codes which are applicable as per boiler location/place, are followed? | Yes/No | |
| 1.4 | When was the boiler inspected for registration as per IBR? Please provide a copy of Boiler inspection Report made by Boiler inspector. | Give details | |
| 1.5 | If the boiler inspection was done in stages, please provide the inspection details of each stage with relevant reports made. | Yes/No, If yes, give details | |
| 1.6 | Whether the certificate to operate the Boilers under Boilers Act is valid. | Yes/No | |
| 1.7 | Whether Remnant Life Assessment (RLA) of the Boilers has been done as per IBR act? | Yes/No | |
| 1.8 | When was the RLA of Boilers done? Please give for each Boiler. | Give details | |
| 1.9 | Please mention the Periodicity of external inspections. | Give details | |
| 1.10 | Recording of Inspection findings & Action Taken Report (ATR). | Give details | |
| 1.11 | Whether (piping & Instruments) P&I diagrams are regularly updated apropos any plant modification / changes. | Yes/No | |
| 1.12 | Whether Operating Manuals have been updated upon any changes. | Yes/No | |
| 1.13 | Whether Standard Operating procedures (SOPs) have been revised. | Yes/No | |
| | | | |
| **2** | **Steam Generator Structure (Incl. Walk Ways, Platforms and Stairs) & Enclosure** | | |
| 2.1 | Comment on the structural condition of each Boiler. | Satisfactory/Unsatisfactory | |
| 2.2 | Comment on the Gratings, Hand railings of each boiler. | Satisfactory/Unsatisfactory | |
| 2.3 | What is the condition of stairs, ladders? | Satisfactory/Unsatisfactory | |
| 2.4 | What is the condition of buckstays? | Satisfactory/Unsatisfactory | |
| 2.5 | What is the condition of Hangers & Supports? Any plan of replacement of some of the hangers & supports? | Satisfactory/Unsatisfactory, Yes/No | |
| 2.6 | What is the frequency of inspection of hangers and supports? | Give details | |
| 2.7 | Comment on Overall condition of waterwall. | Satisfactory/Unsatisfactory | |
| 2.8 | What is the condition of seal trough and the seal plates? | Satisfactory/Unsatisfactory | |
| 2.9 | Are the boiler expansion indicators available? | Yes/No | |
| 2.10 | Is the boiler expansion reading taken during start ups and during regular inspections? | Yes/No | |

| | | | |
|---|---|---|---|
| 2.11 | What is the condition of Manholes and peepholes? Are they completely sealed? | Satisfactory/Unsatisfactory, Yes/No | |
| 2.12 | Is Boiler lift available? Is it functional? | Yes/No,Yes/No, | |
| 2.13 | What is the condition of stairs? | Satisfactory/Unsatisfactory | |
| | | | |
| **3** | **Furnace** | | |
| 3.1 | Comments on the overall condition of furnace. | Satisfactory/Unsatisfactory | |
| 3.2 | What is working pressure of furnace? | Give details | |
| 3.3 | Condition of Furnace observation and tapping points provided for instruments/gauges etc. | Satisfactory/Unsatisfactory | |
| 3.4 | Whether PLC based Interlock System available for Furnace protection. | Yes/No | |
| 3.5 | Is Burner tilt mechanism in auto operation? | Yes/No | |
| 3.6 | Is the performance of Secondary Air Damper Control (SADC) satisfactory? | Yes/No | |
| 3.7 | Are the interlocks always available in line. | Yes/No | |
| 3.8 | Any other layers of protection incorporated for Furnace / Boiler Operations. | Yes/No | |
| 3.9 | Comments on Furnace Draft Pressure monitoring system. | Satisfactory/Unsatisfactory | |
| | | | |
| **4** | **Superheaters & Reheaters** | | |
| 4.1 | Comments on condition of tubes. | Satisfactory/Unsatisfactory | |
| 4.2 | Is there any sign of local erosion on Superheater, reheater tubes? | Yes/No, If yes, give details | |
| 4.3 | What is the frequency of inspection carried out on tubes? | Give details | |
| 4.4 | How many Safety Valves are installed in Boiler as per design. | Give details | |
| 4.5 | Are all the Safety Valves in line? | Yes/No | |
| 4.6 | Test schedule of Safety Valves. | Give details | |
| 4.7 | Number of Safety Valves in Superheater coils as per design. | Give details | |
| | | | |
| **5** | **Economiser** | | |
| 5.1 | Comment on overall condition of economiser. | Satisfactory/Unsatisfactory | |
| 5.2 | Whether Safety Valve is provided in economiser? Its working condition? | Yes/No, Satisfactory/Unsatisfactory | |
| 5.3 | What is the frequency of inspection carried out on tubes? | Give details | |
| | | | |
| **6** | **Drum/Separator & Steam Headers** | | |
| 6.1 | Comments on condition of Drum/Separator. | Satisfactory/Unsatisfactory | |

| | | | |
|---|---|---|---|
| 6.2 | What is the condition of drum tappings? | Satisfactory/Unsatisfactory | |
| 6.3 | What is the condition of drum instrumentations? Frequency of calibration? | Satisfactory/Unsatisfactory, Give details | |
| 6.4 | What is the condition of drum internals? | Satisfactory/Unsatisfactory | |
| 6.5 | What is the frequency of inspection carried out on drum internals? | Give details | |
| 6.6 | Is there any header located in the flue gas path? | Yes/No, If yes then (Qus.-6.7 & 6.8) | |
| 6.7 | What is the condition of headers located in FG path? | Give details | |
| 6.8 | What is the frequency of inspection carried out on headers located in FG path? | Give details | |
| | | | |
| **7** | **Air Pre Heaters & Steam Coil Air Pre Heaters (SCAPH)** | | |
| 7.1 | How many air preheaters are available per boiler? Bisector type / Trisector type / tubular type? | Give details | |
| 7.2 | Is the fire detection system available? Is fire alarm system available? | Yes/No,Yes/No, | |
| 7.3 | Is fire water available in each air preheater? | Yes/No | |
| 7.4 | Is the Oil Carryover Probe (OCP) available in each air preheater? | Yes/No | |
| 7.5 | Is the air preheater soot blower available and functional in each air preheater? | Yes/No,Yes/No, | |
| 7.6 | Is Air preheater maintenance carried out by experienced supervisors and fitters? | Yes/No | |
| 7.7 | Condition of structures of Air preheater? | Satisfactory/Unsatisfactory | |
| 7.8 | Condition of floor gratings and handrails in Air preheater area. | Satisfactory/Unsatisfactory | |
| 7.9 | Condition of connecting ducts and its support structure? Please mention for each air preheater. | Satisfactory/Unsatisfactory | |
| 7.10 | Condition of expansion bellows in the ducts? Please mention for each air preheater. | Satisfactory/Unsatisfactory | |
| 7.11 | Is the connecting dampers and gates functional? Please mention for each air preheater. | Yes/No | |
| 7.12 | Is service water system available for APH water washing? | Yes/No | |
| 7.13 | What is the frequency & criteria for doing APH water washing? | Give details | |
| 7.14 | What is the condition of APH instrumentations? Frequency of calibration? | Satisfactory/Unsatisfactory, Give details | |
| | | | |
| **8** | **Coal/Lignite Preparation and Firing System** | | |
| 8.1 | How many Mills are there per unit? | Give details | |
| 8.2 | What is the type of Mills? | Give details | |
| 8.3 | What is the condition of mills? | Satisfactory/Unsatisfactory | |
| 8.4 | Condition of Primary Air fan and associated accessories. | Satisfactory/Unsatisfactory | |

| | | | |
|---|---|---|---|
| 8.5 | What is the condition of seal air system including fans and filters? | Satisfactory/Unsatisfactory | |
| 8.6 | Condition of Cold Air Gates/dampers? | Satisfactory/Unsatisfactory | |
| 8.7 | Condition of Hot Air Gates/dampers? | Satisfactory/Unsatisfactory | |
| 8.8 | Condition of Coal piping, bends? Are all the bends ceramic tiled? | Satisfactory/Unsatisfactory, Yes/No | |
| 8.9 | Condition of Hot air and cold air ducts? | Satisfactory/Unsatisfactory | |
| 8.10 | Condition of duct support structures? | Satisfactory/Unsatisfactory | |
| 8.11 | What is the mill outlet temperature maintained? | Give details | |
| 8.12 | Availability and operation of Mill Reject Handling system? | Comment | |
| 8.13 | Availability of Mill firefighting systems? | Comment | |
| 8.14 | Is there any raw coal leakage? | Yes/No | |
| 8.15 | What is the healthiness of Coal Feeders and shut off valves? | Satisfactory/Unsatisfactory | |
| 8.16 | Condition of feeder instrumentations? Calibration frequency? | Satisfactory/Unsatisfactory, Give details | |
| 8.17 | Availability of Mill instruments and their correctness in functioning. | Comment | |
| 8.18 | Availability of Mill feedbacks in control room. | Comment | |
| 8.19 | Status of Auto control in Mills. | Comment | |
| | | | |
| **9** | **Fuel Oil Preparation and Firing System** | | |
| 9.1 | Overall condition of fuel storage tanks/area, fuel heating system, fuel oil condensate and fuel oil drain system. | Satisfactory/Unsatisfactory | |
| 9.2 | Condition of relief valves, Isolating valves, pressure gauges, thermocouples. | Satisfactory/Unsatisfactory | |
| 9.3 | Comments on working of Fuel Oil system with the Furnace Safeguard Supervisory System (FSSS). | Satisfactory/Unsatisfactory | |
| 9.4 | Is there any leakage of oil, steam in Fuel oil system? | Yes/No, If yes, give details | |
| 9.5 | Is interlock provided for automatic purge? | Yes/No | |
| | | | |
| **10** | **Steam Generator Integral Piping, Valves, Fittings and Mountings** | | |
| 10.1 | Are all safety valves in service? Please mention for each boiler. | Yes/No | |
| 10.2 | Condition of flanges, isolating valves, safety valves, control valves | Satisfactory/Unsatisfactory | |
| 10.3 | Frequency of calibration of instruments such as pressure gauges, Thermocouple, RTDs, Flow sensors etc? | Give details | |
| | | | |
| **11** | **Duct Work, Dampers & Insulation** | | |
| 11.1 | What is the Condition of Flue Gas Ducts? | Satisfactory/Unsatisfactory | |

| | | | |
|---|---|---|---|
| 11.2 | Are the flue gas ducts replaced? Is there any plan of replacement of flue gas ducts? | Yes/No, give details | |
| 11.3 | What is Condition of Secondary Air Ducts? | Satisfactory/Unsatisfactory | |
| 11.4 | What is Condition of Primary Air Ducts? | Satisfactory/Unsatisfactory | |
| 11.5 | What is condition of expansion joints? | Satisfactory/Unsatisfactory | |
| 11.6 | What is the periodicity of replacement of Metallic expansion joints? | Give details | |
| 11.7 | What is the periodicity of replacement of Non-Metallic expansion joints? | Give details | |
| 11.8 | Is there any ash deposit issue in dead zones of ducts? | Yes/No | |
| 11.9 | What is the condition of duct bracing pipes, duct support beams? | Satisfactory/Unsatisfactory | |
| 11.10 | What is the condition of support structures of ducts? | Satisfactory/Unsatisfactory | |
| 11.11 | What is the condition of Duct support hangers? | Satisfactory/Unsatisfactory | |
| 11.12 | What is the condition of flue gas side gates and dampers? | Satisfactory/Unsatisfactory | |
| 11.13 | What is the condition of air side gates and dampers? | Satisfactory/Unsatisfactory | |
| 11.14 | Whether Boiler is insulated properly? | Yes/No | |
| 11.15 | Are steam lines, flanges, valves and condensate lines adequately insulated? | Yes/No | |
| 11.16 | Is there any sign of plastic deformation of insulation anywhere? | Yes/No, If yes, give details | |
| | | | |
| **12** | **Soot Blowing System** | | |
| 12.1 | Is there any evidence of soot buildup on the fireside surface of the boiler? | Yes/No, If yes, give details | |
| 12.2 | Is there any mechanism for inspecting and removing soot and scale from heat transfer surfaces of boiler? | Yes/No | |
| 12.3 | Status of availability of all wall blowers? | Comment | |
| 12.4 | Status of availability of Long Retractable Soot Blowers (LRSBs)? | Comment | |
| 12.5 | Comments on working of Local and remote automatic operation of Soot Blowers? | Comment | |
| 12.6 | What is the frequency of soot blower operation? | Give details | |
| | | | |
| **13** | **Draft System** | | |
| 13.1 | How many Fans are available per boiler? What type of fans are the ID, FD and PA Fans? | Give details | |
| 13.2 | Is the dampers and gates functional in auto for ID Fans? | Yes/No | |
| 13.3 | Is the dampers and gates functional in auto for FD Fans? | Yes/No | |
| 13.4 | Is the dampers and gates functional in auto for PA Fans? | Yes/No | |

| | | | |
|---|---|---|---|
| 13.5 | What is the condition of support structure? | Satisfactory/Unsatisfactory | |
| 13.6 | Are all the fan protections available and in service? | Yes/No | |
| 13.7 | Are all the vibration pick ups healthy? Do you have tripping of fans on high vibration? | Yes/No,Yes/No, | |
| 13.8 | What is the condition of fan foundations? | Satisfactory/Unsatisfactory | |
| 13.9 | What is the status of availability of all feedbacks of temperature,Pressure and vibration in control room? | Satisfactory/Unsatisfactory | |
| 13.10 | Is the furnace draft system interlocked with boiler emergency through PLC based system? | Yes/No | |
| | | | |
| **14** | **Auxiliary Steam Pressure Reducing and Desuperheating Stations (PRDS)** | | |
| 14.1 | What is the condition of PRDS and associated instruments, Pipe lines, flanges and valves | Satisfactory/Unsatisfactory | |
| 14.2 | Working Pressure and Temperature of PRDS? | Give details | |
| 14.3 | Is auxiliary steam system of all units interconnected? | Yes/No | |
| | | | |
| **15** | **Electrostatic Precipitator (ESP)** | | |
| 15.1 | Design pressure and temperature of ESP casing? | Give details | |
| 15.2 | How many fields are there in each ESP? | Give details | |
| 15.3 | What is the dust emission level (SPM level) in each ESP? | Give details | |
| 15.4 | Are all the ESP fields available? | Yes/No | |
| 15.5 | What is dust collection efficiency of each ESP? Please mention for each ESP. | Give details | |
| 15.6 | When was the dust collection efficiency tested last? Please mention for each ESP. | Give details | |
| 15.7 | Are the hopper level indicators available? Are they healthy? Please mention pass-wise no. of dysfunctional Ash level Indicators. | Yes/No,Yes/No,Give details | |
| 15.8 | How many Collecting Electrode Rapping Mechanism (CERM) available? Are they all healthy? | Give details | |
| 15.9 | How many Emitting Electrode Rapping Mechanism (EERM) available? Are they all healthy? | Give details | |
| 15.10 | Are the opacity monitors available? | Yes/No | |
| 15.11 | What is the spark rate maintained? | Give details | |
| 15.12 | What is the condition of ESP support structure? | Satisfactory/Unsatisfactory | |
| 15.13 | What is the condition of roof of ESP? | Satisfactory/Unsatisfactory | |
| 15.14 | What is the condition of Transformers of ESP? | Satisfactory/Unsatisfactory | |
| 15.15 | What is the condition of sliding bearings of ESP? | Satisfactory/Unsatisfactory | |
| 15.16 | Is there any restriction in the movement of ESP? | Yes/No | |
| 15.17 | Are suitable safety interlocks provided for maintenance purpose? | Yes/No | |

| | | | |
|---|---|---|---|
| 15.18 | Condition of Ash removal system? | Satisfactory/Unsatisfactory | |
| | | | |
| **16** | **Operation and Maintenance Aspects** | | |
| 16.1 | Is Standard Operating Procedure (SOP) followed for boiler maintenance. | Yes/No | |
| 16.2 | Is Standard Operating Procedure (SOP) followed for firing the boiler. | Yes/No | |
| 16.3 | Whether the boiler is operated by Boiler Operation Engineers/Boiler Attendants? | Yes/No | |
| 16.4 | What is the procedure for bypassing any Instrumentation / Safety Interlock system / Relief Valves etc. | Give details | |
| 16.5 | What is the procedure for taking permit of an equipment for maintenance? | Give details | |
| 16.6 | What is the procedure for releasing an equipment from permit? | Give details | |
| 16.7 | How do you ensure isolation of an equipment taken into permit? | Give details | |
| 16.8 | How do you ensure that there are no combustible gases in Boiler before starting any maintenance? | Give details | |
| 16.9 | For each Boiler please mention when was the operational performance test done? | Give details | |
| 16.10 | What is the designed efficiency? | Give details | |
| 16.11 | What is the achieved efficiency ? | Give details | |
| 16.12 | Do you have temperature excursions? | Yes/No | |
| 16.13 | How many times the units have tripped due to Boiler operational issues? Please mention for each boiler. | Give details | |
| 16.14 | Are you able to operate at the designed pressure? | Yes/No | |
| 16.15 | What about the protection systems in service? Are all of them in Service in all units? | Comment | |
| 16.16 | When was the Boiler Overhauling last done? Please mention for each boiler. What is the frequency of Boiler overhauling? | Give details | |
| 16.17 | How many tube leakages have occurred between last two overhauls? Please mention for each boiler. | Give details | |
| 16.18 | Whether OEM's recommendation on tube replacement based on thickness reduction being followed? | Give details | |
| 16.19 | Do you carry out Boiler preservation? | Yes/No | |
| 16.20 | What type of Boiler preservation procedure is followed? | Give details | |
| 16.21 | Do you have Ash loading in the Pent house? | Yes/No | |
| 16.22 | Whether the repair of boiler is carried out by Special class repairers? | Yes/No | |
| 16.23 | Whether all the HP welders deployed are certified by state boiler directorate? | Yes/No | |
| 16.24 | Do you conduct 100% radiography of the weld joints? | Yes/No | |
| 16.25 | What is the residual life of boiler assessed as per RLA study? | Give details | |
| 16.26 | What is the procedure of safe shutdown of unit? | Give details | |
| | | | |
| **17** | **Any Other System Associated With Steam Generator or any other issue related to safety of boiler** | | |

## C. Safety Aspects of Turbine Generator

| Sl No. | Items to be Checked / verified | Status | Remarks, if any |
|---|---|---|---|
| **1** | **General Aspects** | | |
| 1.1 | Whether emergency numbers are displayed at TG floor? | Yes/ No | |
| 1.2 | Status of Various awareness programs conducted on safety for Turbine manpower? | Yes/ No | |
| 1.3 | What is the competency level of manpower? Are they aware about safety at workplace? | Yes/ No; give details | |
| 1.4 | Whether Non-sparking tools are available & used to work in hydrogen related area? | Yes/ No | |
| 1.5 | Whether Illumination of the TG & auxiliary area is proper or not? What is the frequency of measurement? | Yes/ No | |
| 1.6 | Availability of ventilation fans of TG Hall, MOT room. | Yes/ No | |
| 1.7 | Whether there is proper display of Exit path & Exit door used for emergency situation? | Yes/ No | |
| 1.8 | Whether any scrap material stored on the TG floor? | Yes/ No | |
| | | | |
| **2** | **Upkeep of TG Hall (Floor, structures etc)** | | |
| 2.1 | Overall Healthiness of Turbine Floor: Poor / Satisfactory / Excellent | Give details | |
| 2.2 | Whether handrails are provided at all places where required? Is there proper baricading of pits, floor cavities? | Yes/ No | |
| 2.3 | Are there any missing floor gratings? Ensure if all floor cavities are covered. | Yes/ No | |
| 2.4 | Any structure deformation / abnormality in TG hall structures | Yes/ No | |
| 2.5 | What about the hangers and supports of all critical piping? Is any replacement required? | Yes/ No | |
| 2.6 | Condition of Deaerator floor, support systems, pipings? | Yes/ No | |
| 2.7 | Whether Pressure testing of air receiver tank has been done? | Yes/ No | |
| 2.8 | Whether proper platform around TG deck springs are available for maintenance work? | Yes/ No | |
| 2.9 | Whether proper platform around Condenser springs are available? | Yes/ No | |
| 2.10 | Proper platform & approach available to LP diaphragm replacement? | Yes/ No | |
| 2.11 | What is the condition of piping hangers and support? Any physical looseness observed to be marked and corrected during next shutdwon. | Yes/ No | |
| 2.12 | Condition of housekeeping in Turbine hall and turbine area. Is any survey on 5S conducted? | Yes/ No | |
| | | | |
| **3** | **Steam Turbine Protection** | | |
| 3.1 | Is ATRS (Automatic Turbine Run Up System) available in the unit? Is it taken into service during start ups? Please mention for each unit. | Yes/ No; give details | |
| 3.2 | Recent incidents of Turbine Tripping and reason of tripping? Any rectification work needed to overcome the problem? | Yes/ No; give details | |
| 3.3 | When was the Main turbine Actual Overspeed test conducted? Please mention for each unit. | Yes/ No; give details | |

| | | | |
|---|---|---|---|
| 3.4 | What is the frequency of ATT (automatic turbine tester) checking? Please mention for each unit. | Yes/ No; give details | |
| | | | |
| **4** | **Turbine Vibrations** | | |
| 4.1 | What are the Main Turbine Vibration readings? Please give Unit wise readings. | Yes/ No; give details | |
| 4.2 | Is Main Turbine vibration protection available in each unit? Please mention brief about the Main Turbine vibration protection. | Yes/ No; give details | |
| 4.3 | Is Main Turbine vibration protection kept in service? | Yes/ No | |
| 4.4 | Recent incidents of high turbine vibration. Provide list of occurrences & vibration levels. | Yes/ No; give details | |
| | | | |
| **5** | **TG Foundation & Civil works** | | |
| 5.1 | Healthiness of TG Deck, Foundation & Column Structure | Give details | |
| 5.2 | Whether TG deck NDT test has been carried out through any agency? What are findings of the report? | Yes/ No; give details | |
| 5.3 | Whether healthiness of Secondary Grouting is satisfactory | Yes/ No | |
| 5.4 | Any physical cracks observed in the TG civil structure. | Yes/ No | |
| | | | |
| **6** | **Turbine casing** | | |
| 6.1 | Heathiness of turbine casing | Yes/ No | |
| | | | |
| **7** | **Turbine rotor & blades** | | |
| 7.1 | Record of turbine failure due to blade failure | Give details | |
| 7.2 | Whether any tests are conducted for estimating rotor toughness | Yes/ No | |
| 7.3 | Signs of major rubbing or high vibration of turbine rotor | Give details, if any | |
| 7.4 | Signs of solid particle erosion on blades | Give details, if any | |
| | | | |
| **8** | **Generator** | | |
| 8.1 | Whether Generator seal oil system is in good condition? | Yes/ No | |
| 8.2 | Is the D.C. Seal Oil System healthy? | Yes/ No | |
| 8.3 | When was the battery bank capacity test conducted? | Give details | |
| 8.4 | Is the DG system available? What is the periodicity of checking? | Yes/ No; give details | |
| 8.5 | Whether Eyewash System is available in Battery Room | Yes/ No | |
| | | | |
| **9** | **Hydrogen & Generator Cooling** | | |
| 9.1 | Is hydrogen room is kept locked? | Yes/ No | |
| 9.2 | Whether hydrogen and CO2 cylinders tied, capped and stored separately in storage area? | Yes/ No | |
| 9.3 | During filling of H2 cylinders, are the cylinders mounted on rack? | Yes/ No | |
| 9.4 | Are CO2 cylinders mounted on rack for emergency use?<br>Availability of Spare CO2 Cylinders for Emergency Purge out | Yes/ No | |
| 9.5 | Hydrogen leak detector available in control room? | Yes/ No | |
| 9.6 | Any signs of hydrogen embrittlement in the generator rotor/stator? | Yes/ No | |
| 9.7 | Instruction to hydrogen purge out mentioned near rack in local language? | Yes/ No | |

| | | | |
|---|---|---|---|
| 9.8 | What is the Daily H2 gas consumption status? Please confirm unit wise gas consumption. | Give details | |
| 9.9 | Whether Generator Bearing Exhaust Fan is in service. | Yes/ No | |
| 9.1 | Whether Hydrogen Drier is in Service. | Yes/ No | |
| | | | |
| **10** | **Valves & NRVs** | | |
| 10.1 | Is there any passing of Stop Valves? Please mention for each unit. | Yes/ No | |
| 10.2 | Is there any passing of control valves? Please mention for each unit. | Yes/ No | |
| 10.3 | When safety valve of heaters, Deaerator and FST were pressure tested? | Yes/ No; give details | |
| 10.4 | Healthiness of valves | Yes/ No | |
| 10.5 | a. Regular checkup of valves required for smooth operation. What is the frequency of these checkups? | Yes/ No | |
| 10.6 | b. Are any deposits observed at valve seats? | Yes/ No | |
| 10.7 | Are all valves (including NRV) tested, inspected, and overhauled on a frequent basis | Yes/ No | |
| | | | |
| **11** | **Turbine HP-LP Bypass System** | | |
| 11.1 | Availability of HP Bypass and LP bypass system? Is it available in auto? Please mention for each unit. | Yes/ No; give details | |
| | | | |
| **12** | **Turbine lubricating oil & jacking oil system** | | |
| 12.1 | What is the healthiness of Lubricating Oil system? Please mention for each unit. | Yes/ No; give details | |
| 12.2 | Is hydro test of lube oil system carried out? What is the periodicity of checking? | Yes/ No; give details | |
| 12.3 | Periodicity of inspection of Oil pipe line? | Yes/ No | |
| 12.4 | What is the healthiness of Jacking oil system? Please mention for each unit. | Yes/ No; give details | |
| 12.5 | Availability and healthiness of centrifuge? Please mention for each unit. | Yes/ No; give details | |
| 12.6 | Healthiness of Oil Tanks from fire protection point of view? | Yes/ No | |
| 12.7 | Healthiness of Tripping system provided for low lubricating-oil pressure | Yes/ No | |
| | | | |
| **13** | **Feed Water Heating Plant & BFP** | | |
| 13.1 | What about the LP and HP heater support structures? Any sign of corrosion may please be recorded also. Please mention for each unit. | Yes/ No; give details | |
| 13.2 | Protection against water ingress from feed heating plant to turbine tappings | Yes/ No | |
| 13.3 | Oil below grating floors is cleaned regularly from oil room and TDBFP oil console? | Yes/ No | |
| | | | |
| **14** | **Turbine control fluid system** | | |
| 14.1 | Healthiness of governor control valves, camshaft etc | Yes/ No | |
| 14.2 | Whether valves are cycled regularly to ensure no sticking. | Yes/ No | |
| | | | |
| **15** | **Unloading devices** | | |
| 15.1 | Presence of high exhaust pressure unloading gear? | Yes/ No | |
| 15.2 | LP exhaust temperature sprays present? | Yes/ No | |

| | | | |
|---|---|---|---|
| **16** | **Turbine Bearings and Turning Gear** | | |
| 16.1 | Periodic lubrication and maintenance of turbine bearings and turning gear done | Yes/ No | |
| | | | |
| **17** | **Gland sealing system** | | |
| 17.1 | Any leakages observed in turbine gland sealing system | Yes/ No | |
| | | | |
| **18** | **Steam Condensing Plant** | | |
| 18.1 | Confirm the working condition of Dewatering pumps of condenser pit. Please mention unit wise. | Yes/ No; give details | |
| | | | |
| **19** | **Insulation** | | |
| 19.1 | Critical piping/Heat exchangers insulation healthiness? | Yes/ No | |
| | | | |
| **20** | **Fire Protection in TG Area** | | |
| 20.1 | Is Turbine fire protection system healthy? Please mention for each unit. | Yes/ No | |
| 20.2 | Availability with location chart of fire extinguishers? | Yes/ No | |
| 20.3 | Availability of fire extinguishers as defined for TG area at designated place in TG hall (Like TG Floor, MOT room etc)? | Yes/ No | |
| 20.4 | Whether there is any well-defined escape route in case of Fire/Gas/oil leakages? | Yes/ No | |
| 20.5 | Is there any Overhead electric cables/live wire height especially on TG area roads/passages crossings? | Yes/ No | |
| 20.6 | Is firefighting system of MOT room, FRF room, TDBFP oil console or COPU is in charged condition? | Yes/ No | |
| 20.7 | Whether Cable galleries fire protection system in place? | Yes/ No | |
| | | | |
| **21** | **Electric Overhead Traveling (EOT) Crane** | | |
| 21.1 | When was the Load Testing of EOT crane, checking of Limit switches etc. last conducted. | Give details | |
| 21.2 | Is handrail provided besides walking platform (Beside rails) approach to EOT? | Yes/ No | |
| 21.3 | Is designated place marked for EOT Crane marking? | Yes/ No | |
| 21.4 | Is SWL for each hook is mentioned over crane and hooks? | Yes/ No | |
| 21.5 | Is anti-collision device of both EOT crane functional? | Yes/ No | |
| 21.6 | Is limit switches of both hooks tested? | Yes/ No | |
| 21.7 | Is designated crane operator is available for operation of EOT crane? | Yes/ No | |
| 21.8 | Are the Hooters & lights of EOT crane functional? | Yes/ No | |
| | | | |
| **22** | **O&M Aspects** | | |
| 22.1 | Is there any oil leakage? | Yes/ No | |
| 22.2 | Is there any leakage of FRF? | Yes/ No | |
| 22.3 | Is any cotton waste or, miscellaneous debris lying in the turbine and its vicinity? | Yes/ No | |

| | | | |
|---|---|---|---|
| 22.4 | Do you ensure availability of Load test / fitness certificates of various T&Ps especially slings & D-shackles used during load handling? | Yes/ No | |
| 22.5 | Whether the presence of qualified and experienced rigger during load shifting is ensured? | Yes/ No | |
| 22.6 | Is there any Loose/ hanging cladding sheets / plate on structure / piping / equipments? | Yes/ No | |
| 22.7 | Availability of sign/instruction boards on safety in TG area? | Yes/ No | |
| 22.8 | Is any safety drill conducted in TG area? | Yes/ No | |
| 22.9 | Availability of arrangements for proper covering / barricading of various opening in TG area made during work or left out jobs? | Yes/ No | |
| | | | |
| **23** | **Miscellaneous** | | |
| 23.1 | Is Air washer system in service in switchgear rooms? Whether Auto logic to stop with fire alarm is in service? | Yes/ No | |
| 23.2 | What is the healthiness of Air washer system? | Yes/ No | |
| | | | |
| **24** | **Any other system associated with Turbine Generator or any other issue related to safety of TG** | | |
| | | | |

## D. Safety Aspects of Balance of Plant

| Sl No. | Items to be Checked / verified | Status | Remarks, if any |
|---|---|---|---|
| **A. COAL HANDLING PLANT AND ASSOCIATED SUB-SYSTEM** | | | |
| **1** | **Railway Siding & Track Hopper** | | |
| 1.1 | Is Signalling system of the track is in healthy condition? | Yes/ No | |
| 1.2 | Is regular supervision of track is done by trained gangmen to ensure its healthiness? | Yes/ No | |
| 1.3 | Is cautioning for speed limits at different locations ensured? | Yes/ No | |
| 1.4 | Checking of uniform spreading of required number of blast / stones for strengthening of tracks done regularly? | Yes/ No | |
| 1.5 | Are Fish plates, bolts and pendrol checked for its tightness regularly? | Yes/ No | |
| 1.6 | Exchange of token system for single line operation? | | |
| 1.7 | Are points and curves checked periodically? | Yes/ No | |
| 1.8 | Is inspection of bridges and culverts, if any, done regularly specially during monsoon period? | Yes/ No | |
| 1.9 | Are Limit switch(es) available at plough feeder? | Yes/ No | |
| 1.10 | Availability of Stopper at both end of each rail of plough feeder | Yes/ No | |
| 1.11 | Is Insulation condition of power cables for plough feeders healthy? | Yes/ No | |
| 1.12 | Are Fire extinguishers at Plough feeders available? | Yes/ No | |
| 1.13 | Do you have Wagon Tipplers? | Yes/ No | |
| 1.14 | What precautions do you take while working at Wagon Tipplers? | indicate | |
| 1.15 | Are the people working in Wagon Tippler specifically trained or not? | Yes/ No | |
| 1.16 | Are the SAC operators competent? Are they able to handle emergencies? | Yes/ No | |
| 1.17 | Is there emergency push buttons available to stop SAC by the people working in the wagons? | Yes/ No | |
| 1.18 | Are the protections available in SAC in service? | Yes/ No | |
| 1.19 | Whether Maintenance of wagons carried out as per schedule? | Yes/ No | |
| 1.20 | Ensured that loose shunting of wagons not to be done? | Yes/ No | |
| 1.21 | Whether maintenance of locos carried out as per schedule? | Yes/ No | |
| 1.22 | Is proper braking system and head light in locos ensured? | Yes/ No | |
| 1.23 | Ensure that Idle Loco should not be left unmanned? | Yes/ No | |
| 1.24 | When was the last audit of MGR conducted? | indicate date | |
| 1.25 | Whether all the points of MGR audit complied? | Yes/ No | |
| 1.26 | Is regular training provided for MGR staff? | Yes/ No | |
| 1.27 | Is spray system above wagon at whole length of Track Hopper in healthy condition? | Yes/ No | |
| 1.28 | Whether Track Hopper Service Bay checker plate is in good condition? | Yes/ No | |
| 1.29 | Is Ventilation system of Track hopper in healthy condition? | Yes/ No | |
| 1.30 | Is PA system at Top and Bottom of Track Hopper is in healthy state? | Yes/ No | |
| 1.31 | Are Fire extinguishers inside Track hopper available? | Yes/ No | |
| 1.32 | Is Emergency lighting arrangement at Bottom level for both wall sides provided? | Yes/ No | |
| | | | |
| **2.0** | **Crusher House** | | |
| 2.1 | What is the condition of crusher house building? | indicate condition? | |

| | | | |
|---|---|---|---|
| 2.2 | Is the vibration of crushers within limit? | Yes/ No | |
| 2.3 | Is tightness of inspection gate of crushers ensured? | Yes/ No | |
| 2.4 | Is dust extraction system provided and in healthy condition? | Yes/ No | |
| 2.5 | Is dust leakage observed at different floors, if leakage observed, name of equipment to be mentioned? | Yes/ No | |
| 2.6 | What is the condition of Chutes? | indicate condition? | |
| 2.7 | Is Emergency Stop Button at crusher floor available? | Yes/ No | |
| 2.8 | Is Emergency Stop Button at Vibro feeder floor available? | Yes/ No | |
| 2.9 | Is Pull cord at both sides of belt feeder available? | Yes/ No | |
| 2.10 | Ensured healthiness of Pull cord at both sides of belt feeder? | Yes/ No | |
| 2.11 | Is cleanliness of cable tray ensured? | Yes/ No | |
| 2.12 | Are fire extinguishers available at different floors? | Yes/ No | |
| 2.13 | Is healthiness of fire hydrant line at different locations ensured? | Yes/ No | |
| 2.14 | What is the required pressure in fire hydrant lines at different locations? | indicate pressure? | |
| 2.15 | Is 24 volt supply arrangement provided at crusher house floor? | Yes/ No | |
| 2.16 | Is 24 volt supply arrangement provided at Vibro feeder floor? | Yes/ No | |
| 2.17 | Statutory testing and date of testing of Lift? | indicate date? | |
| 2.18 | Statutory testing and date of testing of Hoists? | indicate date? | |
| 2.19 | Is PA System at different floors in working condition? | Yes/ No | |
| 2.20 | Is illumination level of different floors in good condition? | Yes/ No | |
| 2.21 | Is approach to different floors of crusher house is in good condition? | Yes/ No | |
| | | | |
| **3.0** | **Coal Yard and Stacker & Reclaimer** | | |
| 3.1 | Is coal compactness in stack yard done in proper condition? | Yes/ No | |
| 3.2 | Is Water sprinkler/ Dust suppression system available for coal piles in healthy condition? | Yes/ No | |
| 3.3 | Is the arrangement of water sprinkler system for coal piles adequate? | Yes/ No | |
| 3.4 | Is the water sprinkler system in good working condition? | Yes/ No | |
| 3.5 | Is Fire hydrant system provided for coal piles in healthy condition? | Yes/ No | |
| 3.6 | Is Sufficient / required water pressure available in hydrant line? | Yes/ No | |
| 3.7 | what is the condition of drainage system in piles? | indicate | |
| 3.8 | Is Emergency stop button at lower level of Stacker / Reclaimer available? | Yes/ No | |
| 3.9 | Is Phone / PA System at Stacker/ Reclaimer available in healthy condition? | Yes/ No | |
| 3.10 | Is approach to Stacker/ Reclaimer up to Operator’s cabin is trouble free? | Yes/ No | |
| 3.11 | Is Hand Rails where ever required at Stacker/ Reclaimer in healthy condition? | Yes/ No | |
| 3.12 | Is Fire Extinguishers at Stackers/ Reclaimers available? | Yes/ No | |
| 3.13 | Is stopper at both end of each Rail available? | Yes/ No | |
| 3.14 | Is illumination level inside CHP buildings and near equipments are in proper condition? | Yes/ No | |
| 3.15 | Is firefighting system in CHP adequate? | Yes/ No | |
| 3.16 | Do you conduct any training programme on CHP for the workers? | Yes/ No | |
| 3.17 | What is the skill level of workers? | | |
| 3.18 | Is there any underground water seepage / leakage? | Yes/ No | |
| 3.19 | Is the working condition of Sump pump healthy? | Yes/ No | |
| 3.20 | Is sump pit provided with fencing/ covering to avoid falling of man and materials? | Yes/ No | |

| | | | |
|---|---|---|---|
| 3.21 | Is the condition and accessibility of Approach roads proper? | Yes/ No | |
| | | | |
| 4.0 | **Coal Conveyor System** | | |
| 4.1 | What is the condition of Support structures of Conveyors? | indicate | |
| 4.2 | What is the periodicity of painting of structures and when last painted? | indictae | |
| 4.3 | Is Pull cord available at whole length of conveyor at both sides in healthy condition? | Yes/ No | |
| 4.4 | Are the Pull cord switches working satisfactorily? | Yes/ No | |
| 4.5 | Is sway switches in different location along the conveyor available in healthy condition? | Yes/ No | |
| 4.6 | Is Guard for Head pulley, Tail pulley and coupling of conveyors available? | Yes/ No | |
| 4.7 | Is the side guard of the conveyor belt in position? | Yes/ No | |
| 4.8 | Is there any projected material on the belt? | Yes/ No | |
| 4.9 | Is the dust concentration with in the limit? | Yes/ No | |
| 4.10 | Are the head end/Tail end drum guards in position? | Yes/ No | |
| 4.11 | Are the emergency switch working ? | Yes/ No | |
| 4.12 | Is the protection guard of ramp/platform in position? | Yes/ No | |
| 4.13 | Are the coupling guards of the chutes in position? | Yes/ No | |
| 4.14 | Are the guards for movable pulleys in position? | Yes/ No | |
| 4.15 | Is the siren/hooter in working condition for belt operation? | Yes/ No | |
| 4.16 | Whether the condition of Cable trays are in good condition? | Yes/ No | |
| 4.17 | Is the surrounding illumination adequate? | Yes/ No | |
| 4.18 | What is the condition of Counterweight Guides? | | |
| 4.19 | Are the workmen wearing PPE's? | Yes/ No | |
| 4.20 | Are the workmen deployed are in loose dress? | Yes/ No | |
| | | | |
| **B. ASH HANDLING PLANT AND ASSOCIATED SUB-SYSTEM** | | | |
| 1.0 | **Bottom Ash System** | | |
| 1.1 | what type of Bottom Ash handling system provided and is properly maintained? | Yes/ No; Indicate type | |
| | | | |
| 2.0 | **Fly Ash Collection & Conveying System** | | |
| 2.1 | whether ESP Fly Ash hoppers temperature is maintained to avoid choking? | Yes/ No | |
| 2.2 | whether fly ash conveying system choking is checked regularly? | Yes/ No | |
| 2.3 | whether fly ash conveying compressor is of adequate capacity and properly working? | Yes/ No | |
| | | | |
| 3.0 | **Fly Ash Silo** | | |
| 3.1 | Is fly ash silo structure is in healthy condition? | Yes/No | |
| 3.2 | Is dry air pressure is maintained in the silo to keep fly ash in fluidised condition? | Yes/No | |
| | | | |
| | | | |
| 4.0 | **Ash Bund / Dyke** | | |
| 4.1 | Indicate type of Ash transportation system to the Ash Pond? | Dry/ Wet | |

| | | | |
|---|---|---|---|
| 4.2 | Whether Ash Dyke raising done, if yes, provide the details? | Yes/ No ; provide details | |
| 4.3 | Whether drawings of Ash Dyke raising is approved, if yes, provide details of approving authority? | Yes/ No ; provide details | |
| 4.4 | Is Ash Dyke maintenance manual available, if yes, provide a copy of the manual? | Yes/ No | |
| 4.5 | What is the periodicity of maintenance inspection of Ash Dyke? When it was last inspected? | provide details | |
| 4.6 | Is there Emergency Plan in case of Ash Dyke breach, if yes, provide the details? | Yes/ No; provide details | |
| 4.7 | Is there any Ash Dyke failure occurred till date, if yes, provide details? | Yes/ No; provide details | |
| 4.8 | What is accident reporting system in case of ash dyke failure, provide details? | provide details | |
| 4.9 | Is there any enquiry system, provide details? | Yes/ No | |
| 4.10 | Provide Ash utilisation during the last 3 Financial Year wise? | in % | |
| 4.11 | Indicate the quantity of Legacy ash available in Ash Pond, if any? | indicate | |
| | | | |
| **C. FUEL OIL STORAGE & HANDLING PLANT AND ASSOCIATED SUB-SYSTEM** | | | |
| 1.0 | **Fuel Oil Unloading System** | | |
| 1.1 | whether Electro static charge discharge procedure is available? | Yes/ No | |
| 1.2 | whether the drivers are trained in discharging static electricity? | Yes/ No | |
| | | | |
| 2.0 | **Fuel Oil Storage Tanks** | | |
| 2.1 | How many HFO tanks are provided? | indicate numbers | |
| 2.2 | How many LDO tanks are provided? | indicate numbers | |
| 2.3 | Whether Hydrant system provided is in Auto mode? | Yes/ No | |
| 2.4 | Whether Foam flooding system is available in all the Tanks? | Yes/ No | |
| 2.5 | Whether sufficient oil dyke is provided for each tank? | Yes/ No | |
| 2.6 | whether Linear heat sensing type/ Quartzoid bulb type (with pneumatic detection pipe network) heat detectors are provided? | Yes/ No | |
| | | | |
| 3.0 | **Fuel Oil Conveying / Pipelines System** | | |
| 3.1 | Is fuel oil pipelines is checked regularly for any leakage? | Yes/ No | |
| | | | |
| 4.0 | **Fuel Oil Feeding Skid** | | |
| 4.1 | Is fuel oil skid is kept clean and checked for oil leakage? | Yes/No | |
| | | | |
| | | | |
| **D. RAW WATER SYSTEM AND ASSOCIATED SUB-SYSTEM** | | | |
| 1.0 | **Raw Water Intake House** | | |
| 1.1 | Is raw water intake structure is in healthy condition? | Yes/ No | |
| 1.2 | Is maintenance of raw water intake pumps and trash screens done periodically? | Yes/ No | |
| | | | |
| 2.0 | **Raw Water Reservoir** | | |
| 2.1 | Is raw water reservoir is provided with sturdy handrails along the periphery? | Yes/ No | |

| | | | |
|---|---|---|---|
| 3.0 | **D M Plant** | | |
| 3.1 | What is the conditions of vessels? | indicate | |
| 3.2 | What is the conditions of pipings? | indicate | |
| 3.3 | Is there any leakage from valves, piping, tanks? | Yes/ No | |
| 3.4 | What is the condition of neutralizing pits? | indicate | |
| 3.5 | What is the periodicity of inspection of the acid and alkali storage tanks? | provide details | |
| 3.6 | When were the acid and alkali tanks last inspected? | date | |
| 3.7 | Whether the chemicals are stored in proper place? | Yes/ No | |
| 3.8 | Whether safety showers in all nearby locations are available or not? | Yes/ No | |
| 3.9 | What is the condition of drainage? | indicate | |
| 3.10 | What is the arrangement of unloading of chemicals from tankers? | | |
| 3.11 | Are the people handling chemicals qualified? | Yes/ No | |
| 3.12 | Is there any storage of dangerous chemicals together? | Yes/ No | |
| 3.13 | Whether wind socks are available? | Yes/ No | |
| | | | |
| 4.0 | **Chlorination Plant** | | |
| 4.1 | Is Tonner condition free from rust/damage & leak? | Yes/ No | |
| 4.2 | Is condition of trunion wheels healthy? | Yes/ No | |
| 4.3 | what is the condition of Copper tube? | | |
| 4.4 | what is the condition of Absorbtion system? | indicate | |
| 4.5 | what is the conditions of PPM monitor? | indicate | |
| 4.6 | Is ventilation (condition of exhaust fan) system for atleast 15 air changes per hour ensured? | Yes/ No | |
| 4.7 | Is Chlorine equipment free from moisture? | Yes/ No | |
| 4.8 | How many chlorine gas cylinders are stored? | numbers | |
| 4.9 | Is license for storing of chlorine gas available? | Yes/ No | |
| 4.10 | Is the chlorine gas leakage kit available or not? | Yes/ No | |
| 4.11 | Is chlorine gas leak alarm functional? | Yes/ No | |
| 4.12 | what is the condition of Eye wash fountains? (water flow and pressure) | indicate | |
| 4.13 | what is condition of Blower and level of caustic soda tank? | indicate | |
| 4.14 | Are fire extinguishers available in proper condition? | Yes/ No | |
| 4.15 | Is condition of entry / exit during emergency free of obstructions? | Yes/ No | |
| | | | |
| 5.0 | **Effluent Treatment Plant** | | |
| 5.1 | whether Handrails around the ETP provided? | Yes/ No | |
| 5.2 | whether different colour codes provided for acid and Alkali Handling vessels? | Yes/ No | |
| 5.3 | Is chemical unloading system provided and maintained properly? | Yes/ No | |
| | | | |
| **E.** | **CIRCULATING WATER SYSTEM AND ASSOCIATED SUB-SYSTEM** | | |
| 1.0 | **CW Pump House** | | |
| 1.1 | Is the Forebay guarded with sturdy Handrails? | Yes/ No | |
| 1.2 | Is trash screen cleaned periodically? | Yes/ No | |
| 1.3 | Are CW pumps operations checked regularly? | Yes/ No | |
| 1.4 | Are EOT crane/ Hoists provided and in healthy condition? | Yes/ No | |

| | | | |
|---|---|---|---|
| 2.0 | **Cooling Tower** | | |
| 2.1 | What is the condition of concrete structure? | indicate | |
| 2.2 | what is the condition of concrete structure and frills in NDCT? | indicate | |
| 2.3 | What is the periodicity of concrete structure inspection? When was the inspection carried out last? | indicate date | |
| 2.4 | Is there any structure committee responsible for regular inspections? | indicate | |
| 2.5 | What is condition of Gearbox support structures? | indicate | |
| 2.6 | Is the vibration of fans within limit? | Yes/ No | |
| 2.7 | What is the condition of Drain slabs? | indicate | |
| 2.8 | What is the condition of OAC? Any condition of wall collapse? | indicate | |
| 2.9 | What is the condition of switchgear? | indicate | |
| | | | |
| 3.0 | **Pre- Treatment Plant** | | |
| 3.1 | What is the concrete condition of Clarifloculators and Aerators? | indicate | |
| 3.2 | What is the condition of pipings? | indicate | |
| 3.3 | What is the condition of approach to the sludge pits? | indicate | |
| 3.4 | Is Ventilation while working underground in proper condition? | Yes/ No | |
| 3.5 | What is the condition of storage of chemicals? | indicate | |
| | | | |

**F. ELECTRICAL AND CONTROL & INSTRUMENTATION SYSTEM AND ASSOCIATED SUB-SYSTEM**

| | | | |
|---|---|---|---|
| 1.1 | whether Main power cut-off is identified and easy to access? | Yes/ No | |
| 1.2 | Whether the operators are well trained in PLC operation? | Yes/ No | |
| 1.3 | Are adequate protective devices (MCBs, High Rupture Capacity (HRC) Fuses) used for Short circuit and overloads, Earth leakage and Surge protection? | Yes/ No | |
| 1.4 | whether Earth Leakage Circuit Breakers (ELCB) is provided in the facility? | Yes/ No | |
| 1.5 | Are the wiring done in steel conduit /armoured cable/ PVC conduit with PVC insulated wire? | Yes/ No | |
| 1.6 | whether Flame Retardant Low Smoke (FRLS)/ Halogen Free Flame Retardant (HFFR) insulated cables are used? | Yes/ No | |
| 1.7 | whether Electrical panels/ Relays/ interlocks/ Lights maintained and inspected within regular maintenance programme? | Yes/ No | |
| 1.8 | whether qualified personnel employed for maintenance and modifications to electrical system? Are they having valid electrician license? | Yes/ No | |
| 1.9 | Does the building and other facilities have lightning protection system installed as per IS 2309 / international standards? | Yes/ No | |
| 1.10 | Is the electrical panel rooms are segregated? Is Air Handling Unit (AHU) room segregated from the remaining facilities? | Yes/ No | |
| 1.11 | Are all MCC and switchgear rooms (HT/ LT) provided with Ionization type smoke detectors and fire extinguishers? | Yes/ No | |
| 1.12 | Is cable vault in control room (above false ceiling and below false flooring) is provided with Linear heat sensing cable type heat detectors and photoelectric type smoke detectors? | Yes/ No | |
| 1.13 | Is Unit control Building, UPS, Inverter room & Marshalling Cabinet area provided with Ionization and photoelectric type smoke detectors? | Yes/ No | |
| 1.14 | Are all 3 pin plugs & sockets provided with earth connections? | Yes/ No | |

| | | | |
|---|---|---|---|
| 1.15 | Is there a clear space of 1 m in front of main switchboard? | Yes/ No | |
| 1.16 | Is the transformer maintained as per IS:10028 part-3? | Yes/ No | |
| 1.17 | whether Battery Bank room is properly ventilated? | Yes/ No | |
| 1.18 | whether Eye wash shower is provided near Battery Bank Room? | Yes/ No | |
| 1.19 | Whether the floors are made of acid resistant tiles? | Yes/ No | |
| | | | |
| **G. AIR CONDITIONING AND VENTILATION SYSTEM AND ASSOCIATED SUB-SYSTEM** | | | |
| 1.1 | Whether Air conditioning unit maintained in healthy condition? | Yes/ No | |
| 1.2 | Whether any leakage of coolant observed? | Yes/ No | |
| 1.3 | Is insulation of ducting system is regularly inspected? | Yes/ No | |
| | | | |
| **H. CHEMICAL LABORATORY AND ASSOCIATED SUB-SYSTEM** | | | |
| 1.1 | Whether the chemicals are clearly labelled and stacked? | Yes/ No | |
| 1.2 | Is Material safety data sheet (MSDS) of Hazardous chemicals is available? | Yes/ No | |
| 1.3 | Is ventilation system is provided and in healthy condition? | Yes/ No | |
| | | | |
| **I. EOT Cranes** | | | |
| 1.1 | Whether the rails of longitudinal travel and cross travel checked regularly? | Yes/ No | |
| 1.2 | whether any wear/ damages to wheels & flanges of longitudinal travel and cross travel checked? | Yes/ No | |
| 1.3 | Is wear of hook block & its safety latch checked regularly? | Yes/ No | |
| 1.4 | whether play, damage and smooth rotation of hook block & transmission pulleys checked? | Yes/ No | |
| 1.5 | Is motors for lifting, longitudinal travel & cross travel working in healthy condition? | Yes/ No | |
| 1.6 | Is brakes and braking distances of lifting, longitudinal travel & cross travel properly checked? | Yes/ No | |
| 1.7 | Are electrical push buttons and switches functioning checked? | Yes/ No | |
| 1.8 | whether functional checks for limit switches done? | Yes/ No | |
| 1.9 | whether wear and damage to the rope drum and rope guide checked? | | |
| 1.10 | whether general cleanliness & lubrication of rope, hook, gear boxes etc checked? | Yes/ No | |
| 1.11 | Is there any oil leakages checked? | Yes/ No | |
| 1.12 | whether load test certificates checked and available? | Yes/ No | |
| 1.13 | whether auxiliary hoist, main hoist, cross travel & longitudinal travel operation is in healthy condition? | Yes/ No | |
| 1.14 | whether the operation of brake drum and thrusters brakes checked? | Yes/ No | |
| 1.15 | whether the tightness of clamping bolts of main hoist drum and Auxiliary hoist drum checked? | Yes/ No | |
| | | | |
| **J. Compressor House** | | | |
| 1.1 | What is the type of compressor and how many are available? | indicate numbers | |
| 1.2 | Whether the compressors vibrations within limit? | Yes/ No | |
| 1.3 | Whether the receiver tanks are hydraulically tested periodically? | Yes/ No | |
| 1.4 | When were the receiver tanks tested last? | indicate date | |
| **K. D.G. Sets** | | | |

| | | | |
|---|---|---|---|
| 1.1 | How many DG sets are there? | indicate numbers | |
| 1.2 | When the DG system was mock tested? | indicate date | |
| 1.3 | Whether the DG set rooms have proper ventilation? | Yes/ No | |
| 1.4 | Whether the fuel tank is kept separated? | Yes/ No | |
| 1.5 | Is earthing provided for DG sets, Diesel storage tank and stack? | Yes/ No | |
| 1.6 | Is the diesel day tank located away from the DG cooling fan exhausts? whether spare diesel storage drums are stored inside the building? | Yes/ No | |
| 1.7 | Is the level indicator of Diesel storage tank made of glass and is mechanically protected? | Yes/ No | |
| 1.8 | Whether the people carrying out DG set maintenance and operations are adequately trained? | Yes/ No | |
| | | | |
| **L.** | **Transformers, Switchyard and Sub stations** | | |
| 1.1 | Is Mulsifier system for Transformers in Auto mode? | Yes/ No | |
| 1.2 | Is Transformer and Switch yard area free from vegetations? | Yes/ No | |
| 1.3 | whether any Oil CTs are used in the Swichyard and what is their age? | Yes/ No | |
| 1.4 | Is there any program/ decision to change Oil CTs to SF6 CTs? | Yes/ No | |
| 1.5 | Is there any recent incidence of fire/ Oil CT burst? | Yes/ No | |
| 1.6 | Are Lightening Arrestors (Masts) provided in Switchyard area as per design requirement? | Yes/ No | |
| 1.7 | Whether Clean Agent System is provided in Control Rooms Viz Main Control Room, CHP Control Room, Switchyard Control Room, Ash Handling Room? | Yes/ No | |
| | | | |
| **M.** | **General Upkeep** | | |
| 1.1 | Whether all rotating equipment are properly covered?(Hoods/ cage like structures) | Yes/ No | |
| 1.2 | Whether the vibration monitoring of rotating equipment done regularly? | Yes/ No | |
| | | | |
| **N.** | **Any other system/subsystem worth mentioning or any other issue related to Balance of Plant** | | |
| | | | |
| | | | |