

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE BENCH, CHENNAI**

**Original Application No. 229 of 2020 (SZ)**

**IN THE MATTER OF**

Tribunal on its own motion-SUO MOTU  
Based on the News item in the New Indian  
Express Newspaper, E-paper Edition dated 03.10.2020,  
"Gas turbine explodes at Power plant, 15 injured."

...Applicant

Versus

Union of India & Others

... Respondents

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**Place: Bengaluru**

**Date: April, 16<sup>th</sup>, 2021**

**Counsel for CPCB**



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16/4/2021

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**JOINT COMMITTEE REPORT SUBMITTED BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE, CHENNAI IN THE MATTER OF O.A. No. 229/2020 - Tribunal on its own motion-SUO MOTU based on the News item on Gas turbine explosion at Power plant:**

**1.0 Preamble:**

The Hon'ble NGT moved an application on its own taking SUO MOTU cognizance, based on the News item in the New Indian Express Newspaper, E-paper Edition dated 03.10.2020 "Gas turbine explodes at Power plant, 15 injured."

While hearing the matter on 20.09.2020 Hon'ble NGT has issued the following directions, which were uploaded at NGT website on **03.11.2020** (copy of the order is placed at **Annexure 1**):

*".....So, in order to ascertain the nature of damage caused, how far it has affected an environment and what are all the defaults committed by the 5th respondent in carrying out the project, violations if any, committed and what are all the action taken by the regulating authorities in respect of the incident and also giving suggestions and recommendations for avoiding such incident in future and if there is any violation, what is the action taken including the imposition of environmental compensation, we feel it appropriate to appoint a **joint committee** comprising of **1)** a Senior Scientist from Ministry of Environment, Forests and Climate Change, Regional Office, Bangalore, **2)** a Senior Scientist from Central Pollution Control Board (CPCB), Regional Office, Bangalore, **3)** a Senior Scientist from the Karnataka State Pollution Control Board (KSPCB), **4)** a Senior Engineer dealing boiler technology from Bharat Heavy Electricals Limited (BHEL), Bangalore, **5)** the District Collector, Bengaluru Urban District, Bengaluru or a Senior Officer not below the rank of Assistant Collector or Sub Divisional Magistrate deputed by the District Collector and **6)** a Senior Professor dealing with Boiler Technology Engineering from National Institute of Technology (NIT), Surathkal, Karnataka and **7)** a Senior Scientist from Central Power Research Institute (CPRI), Regional Office, Bangalore to inspect the area in question and submit a factual as well as action taken report, if there is any violation found."*

Since CPCB, Regional Directorate was identified as the Nodal agency by the Tribunal, in compliance to the directions as above, CPCB, R.D, Bengaluru vide letter No. F.Tech39/Legal/RDS/2020-21 dated 06/11.2020 requested the concerned

Departments/Authorities to nominate senior officials to the Committee for the completion of the task as directed by the Hon'ble Tribunal. A reminder was also issued on 13.11.2020 to follow up the matter with Departments/Authorities.

## **2.0 First meeting of the Joint Committee:**

Upon the receipt of nominations and confirmation over phone, a meeting of the Joint Committee members was convened on 23.11.2020 through Video Conferencing. The following members attended the meeting;

1. Sh. E. Thirunavukkarasu, Scientist E, Ministry of Environment, Forests and Climate Change, Integrated Regional Office, Bangalore.
2. Sh. Siddaramiah, Senior Environmental Officer, Bangalore North, Karnataka State Pollution Control Board.
3. Dr. R. K Kumar, Joint Director, Central Power Research Institute (CPRI), Bangalore.
4. Dr. Kumar G. N, Associate Professor, Mechanical Engineering Department National Institute of Technology Karnataka, Suratkal.
5. Sh. Madhusudan, Sr. DGM - GT ENGG, HPEP Division, Bharat Heavy Electricals Limited, Hyderabad.
6. Sh. Vivek. K, Scientist D, Central Pollution Control Board, Regional Directorate, Bangalore.

CPCB did not receive any communication in writing from the D.C Office, Bangalore regarding nomination. However as informed over phone, Asst Commissioner, North who has been nominated to represent D C, Bangalore Urban District, could not attend due to pre- occupation related to court.

The Committee had a preliminary discussion on the incident of gas turbine explosion which had happened in the gas-based power plant located at Yelehanka and the major tasks entrusted by the Hon'ble Tribunal. The status of regulatory actions, internal enquiries, casualties and damages incurred etc. were also discussed in the meeting and relevant details were shared by respective members.

The Committee further discussed about the design aspects of the gas turbine, standard safety and monitoring systems, possible causes of the incident and the way forward in completing the task assigned by the Hon'ble Tribunal. The Committee also decided to seek additional time from the Tribunal for completion of the task and submission of report, considering the delay in the receipt of the NGT order and coordination required between different offices/institutes. A copy of the minutes of the first meeting of the Joint Committee is placed at **Annexure 2**.

### **3.0 Site visit by the Joint Committee:**

As decided in the first meeting of the Committee, the Joint Committee members made a site visit at M/s KPCL Power Plant, Yelahanka on 04.12.2020. The following members of the Committee were present during the visit;

1. Sh. E. Thirunavukkarasu, Scientist E, MoEF&CC
2. Sh. Siddaramiah, RSEO, KSPCB
3. Dr. R. K Kumar, Joint Director, CPRI
4. Dr. Kumar G. N, Associate Professor, NITK
5. Sh. Madhusudan, Sr. DGM - GT ENGG, BHEL
6. Sh. Vivek. K, Scientist D, CPCB

The date of the visit was communicated to the Asst. Commissioner, North, representing D.C Office; however, there was no representation from his office during the visit of the Committee. A copy of the list of attendees is placed at **Annexure 3**. Apart from the Committee members, the following officials representing respective organizations were also present during the visit;

#### Officials of M/s. KPCL:

1. Sh. B Srinivasan, Superintending Engineer (M)Y
2. Sh. K Shankarappa, Superintending Engineer (M)
3. Shri Mahadevaprasad, Executive Engineer (M)
4. Shri C Pulakeshi, Executive Engineer (M)

#### Officials of M/s. BHEL:

1. Sh. E R Harikrishnan, GM
2. Sh. J Umamaheswar Rao, AGM
3. Sh. Ajith, Sr. DGM
4. Sh. Rammohan, Sr. Manager
5. Sh. Nipuldas, Sr. Manager

#### Officials of KSPCB, R.O, Yelehanka:

1. Sh. Shivappa Naik, R.O
2. Sh. Sunil V, DEO

During the visit, the Committee members had detailed deliberations with the project proponents, M/s. KPCL and M/s. BHEL on the causes and analysis of the fire accident, damages and casualties etc. followed by a site inspection of the turbine compartment and premises where the incident occurred. The details of the site visit and the discussions and inferences of the Joint Committee are given in the following sections.

### **3.1 Back ground on M/s. KPCL Power Plant, Yelahanka:**

Karnataka Power Corporation Ltd. (KPCL) is a State owned Public Limited Company and is in the business of generation and transmission of electric power. KPCL has a total installed capacity of about 6500 MW consisting of Hydro-Electric Stations, Thermal Power Plants (TPP), Windmills and Solar PV Plants.

KPCL was earlier operating a 128 MW power plant located at Yelahanka, Bangalore based on fuels such as Diesel/LSHS/LSFO and due to various operational & economic reasons, the power generation from this Diesel based plant had been discontinued since August, 2013. However, considering the proximity to the GAIL pipeline network, KPCL planned to implement a natural gas fired combined cycle power plant of 350+20%MW capacity by abandoning the existing DG plant and obtained approval from the Government of Karnataka vide its order no. EN 28 PPC 2014 dated 27.07.2014 for establishing first block of gas based Combined Cycle Power Plant of 350±20% MW capacity. M/s. BHEL was the EPC agency for the implementation of the project. M/s. KPCL had also obtained other regulatory clearances including Consent to establish by the KSPCB, Environment Clearance from SEIAA etc. for the establishment of the project.

As apparent during the visit, the installation of commissioning of the major plant equipment such as Gas Turbine Generator (GTG) and auxiliaries, Heat Recovery Steam Generator (HRSG) and auxiliaries including main stack, Steam Turbine Generator (STG) and auxiliaries, and gas forwarding station including gas booster station have been completed and trial run operations were going on during which the fire accident took place and hence the commencement of operations have been put on hold. During the visit, it was observed that the maintenance and repair/replacement works of the burnt equipment and accessories were going on in the turbine compartment, where fire accident had taken place.

### **3.2 Discussions with KPCL and BHEL representatives:**

The Committee Members had detailed deliberations with the representatives of M/s. KPCL and M/s. BHEL regarding the fire incident and the events leading to it and the steps taken to control the damages. The Committee decided to limit its scope of the visit and monitoring to the “fire incident and its impact” as directed by the Hon’ble Tribunal and also considering the fact that detailed report on the pollution control measures and environmental impact due to the installation and operation of the gas-based power plant has already been submitted by another Joint Committee in O.A No. 57 of 2020. The sequence of events which led to the incident, as per the information provided by the unit representatives are provided below;

- ❖ The commissioning activities of the power plant were going on and several dry run tests were also carried out by the commissioning team of BHEL in coordination with KPCL, M/s General Electric and several other equipment suppliers. All the commissioning activities were being carried out as per available written protocols of the equipment designer and supplier.
- ❖ The BHEL commissioning team had planned to achieve the rated maximum speed (Full Speed No Load) of 3000 rpm on the Gas Turbine and later to synchronise the Power Output to the grid which would have happened at least 6 hours after achieving the rated maximum speed (FSNL) of Gas turbine for conducting electrical tests.
- ❖ The activities were started at 14-30 hrs of 01-10-2020 and the maximum rated speed of 3000 rpm (FSNL) of Gas turbine was achieved at around 02-38 hrs on 02-10-2020. Later, at around 02-52 hrs on 02-10-2020, the Gas turbine got tripped on Fire protection in one of the bearing house (bearing no-2 tunnel) through automated safety instrumentation systems.
- ❖ The Fire alarm notification as indicating “Fire at bearing 2 tunnel of GT” appeared in the control room. The CO2 fire protection system was activated on auto due to sensing of fire. The inlet RLNG gas feed to the turbine has stopped and was vented out through the provided vents to atmosphere activated through automated instrumentation systems.
- ❖ Some of the commissioning personnel have gone near the exhaust compartment at around 03-00 hrs of 02-10-2020 to find out the ground reality of the fire. During this process, it is learnt that a flame jet has gushed out of the bottom ground level doors and the flame has hit several personnel who were standing in and around the GT south side area resulting in burn injuries to 15 people at that point of time. Personnel in the control room have further activated all the zone wise CO2 Fire Protection System as well as switched off the bearing lubrication oil systems as a precautionary measure.
- ❖ Later the plant personnel have observed lot of fire in the exhaust compartment due to burning of lube oil which had accumulated on the floor due to leakage from turbine oil system. It is estimated that around 10,000 litres of lube oil would have spilled on the floor due to this failure / leakage from bearing. The lube oil servo prime 32 has a flash point of around 200 degree C and there is every chance and possibility of this lube oil to ignite when it comes into contact with the exhaust gas from the Gas turbine, which was around 480 degree C at Full Speed No Load operation. It is learnt that there was only one flash of flame outside the exhaust compartment.
- ❖ The KPCL /BHEL staff observed that there was fire inside the compartment due to burning of spilled lube oil at ground level and flames found spreading up to

roof of the GT compartment. Later, the firefighting personnel from the factory as well those from GAIL and Karnataka Fire Services pressed into operation to put off the fire. In all, seven fire tenders were pressed into operation. The Fire was eventually doused off after fighting for 75 minutes by around 4.30 AM and cooling was continued till around 5.15 AM. It is also learnt that the fire alarm and hooter was on during the said incident.

As per the above sequence of events, it is evident that a fire accident broke out in the exhaust compartment of the Gas Turbine enclosure of the power plant during the commissioning/trial run operations, which lasted approximately for two hours and caused some fatal injuries to the personnel working in the plant.

### **3.3 Fire Protection and Safety systems in the unit:**

The Committee members also examined the safety features and systems, which were installed in the plant, especially in the Gas Turbine enclosure, as part of the standard practices and the highlights of the system are given below;

#### **3.3.1 Fire Protection System:**

The general fire protection system provided by the plant consists of hydrant system for different areas of the plant, high velocity water spray protection system for transformers, medium velocity water sprays system for cable galleries, portable extinguishers and hand appliances for extinguishing small fires in different areas of the plant, carbon dioxide flooding system for Gas Turbine and the local electrical containers/control cubicles room & turbine lube oil tanks and a mobile fire tender. Unit has also been provided adequate number of Heat rise detectors and smoke detectors at strategic locations including the gas turbine enclosure.

#### **3.3.2 Fire detectors and control system within the Gas turbine Chamber:**

The gas turbine enclosure of the unit is basically divided into turbine and exhaust compartments and a single-shaft gas turbine designed for operation in a combined steam and gas turbine cycle is installed. The gas turbine assembly contains six major sections, i.e, Air inlet, Compressor, Combustion System, Turbine, Exhaust & Support systems. Unit has been provided an Off Base enclosure, which is primarily meant to provide acoustic attenuation of Gas turbine noise, thermal insulation and containment of carbon dioxide or other fire protection media during fire protection system discharge.

Unit has been provided sufficient fire detectors and carbon dioxide fire protection system for the gas turbine unit, which extinguishes fire by reducing the equivalent oxygen content of the air in the compartment from an atmospheric normal of 21% to

below the level necessary to support combustion (normally 15%). To reduce the oxygen content, a quantity of carbon dioxide (CO<sub>2</sub>) is discharged into the compartment in one minute to bring the CO<sub>2</sub> concentration up to 34%. The system also provides an extended discharge to maintain an extinguishing concentration of 30% for a prolonged period to minimize potential re-flash conditions. The fire protection system design conforms to the requirements specified in NFPA 12 – Standard on Carbon Dioxide Extinguishing Systems.

The Gas turbine compartment is divided into different zones such as Turbine Compartment, Bearing Tunnel Compartment, Lube/Hyd Oil Compartment, Liquid/Gas Fuel Compartment, such that each zone will act independently and a fire in one zone will not initiate a discharge of CO<sub>2</sub> in the other zones. Protection / detection is achieved by using heat-sensitive fire detectors and each fire detector is wired into the fire protection control panel in such a way that a single detector will initiate the alarm and 2 detectors in same zone is required to initiate a CO<sub>2</sub> discharge. This setup avoids false detection due to single instrument failure. Strobes and horns, as well as CO<sub>2</sub> warning signs, are strategically positioned on the outside and/or inside of the appropriate compartments to warn personnel of detected fires / CO<sub>2</sub> discharges.

### **3.3.3 Lubricating system for Turbine and generator bearings:**

The unit has also been provided a separate, enclosed and forced-feed lubrication module for taking care of the lubricating and hydraulic oil requirements for the gas turbine unit. The lubrication module including the tank, pumps, coolers, filters, valves and various control and protection devices furnishes oil to the gas turbine bearings, generator bearings (absorbing the heat rejection load). The lubrication system is designed to supply filtered lubricant at the proper temperature and pressure for operation of the turbine and its associated equipment. The lube oil system is self-contained and after lubricating and removing heat from the rotating equipment, oil is returned to the lube oil tank. It is cooled by oil-to-water heat exchangers as it is pumped from the tank and re-circulated. Various sensing devices are included in the design to ensure adequate oil level in the tank, oil pressure, and oil temperature. Oil tank temperature is indicated by a temperature gauge on the side of the tank.

## **4.0 Deliberations of the committee:**

After the site visit, the Committee had detailed discussions and deliberations on the major directions given by the Hon'ble NGT, as reproduced below;

- a) to ascertain the nature of damage caused, how far it has affected an environment*
- b) what are all the defaults committed by the 5th respondent in carrying out the project, violations if any, committed*
- c) what are all the action taken by the regulating authorities in respect of the incident*

- d) giving suggestions and recommendations for avoiding such incident in future and  
e) if there is any violation, what is the action taken including the imposition of environmental compensation*

In order to deliberate on the above given Terms of References (ToR), the Committee, after inspection of the plant, had discussion with the officials of KPCL & BHEL and also examined various documents like EIA, EMP, On Site Emergency Plan, various permissions obtained, communications by other regulatory authorities, etc. Based on the above, each ToR has been deliberated in detail and the point wise observations/comments of the Committee is given below;

#### **4.1 To ascertain the nature of damage caused and how far it has affected an environment:**

The Committee is of the opinion that the incident, even though quite unfortunate, was a fire accident which happened during the commissioning activities of the power plant and was limited to the Gas Turbine compartment of the power plant. During the site visit, it was observed that most of the material damage has happened inside the gas turbine compartment and injuries were sustained by the personnel engaged in commissioning works, who had gathered near the door of the Gas Turbine compartment enclosure.

**Damage to material and property:** The fire accident has damaged many of the electrical equipment, auxiliaries and accessories in the gas turbine compartment and as per the estimations made by the project proponents, an approximate cost of Rs. 35.00 Crore shall be incurred for the replacement/maintenance cost for the damaged materials. The price estimate also includes the loss of lubricant oil for the turbine systems and CO<sub>2</sub> gas refilling cost for the fire protections systems. As observed during the visit of the Committee, maintenance works were being undertaken in the Gas Turbine compartment of the power plant.

**Loss of lives and injuries to people:** As per the information available, 15 personnel engaged in the commissioning activities of the plant sustained burn injuries, out of which three people succumbed to their injuries and lost their lives. Sh. Krishna Bhat, EE and Sh. Manjappa, AEE from M/s. KPCL and Sh. Balaraj, Field executive assistant from M/s. GE Ltd., lost their lives in the unfortunate incident. The list of injured and deceased personnel in the incident and updated status is placed at **Annexure 4**.

**Effect on surrounding environment:** The Committee estimates that the major effect of fire accident on the surrounding environment shall be largely limited to the emissions released to the environment by burning of materials and increase in the

ambient noise levels during the incident. As per the information provided by the project proponent and details examined by the Committee, following estimates are made with respect to effect on surrounding environment by the incident.

**Emission to environment:** As detailed in section 3.2 & 3.3 above, the fire incident had happened inside the Gas turbine & exhaust compartment of the power plant, which is provided with a metallic enclosure and fire protection systems. The fire was caused by the leakage of the lubricating oil used in the gas turbine bearings and generator bearings for absorbing the heat rejection load. Since the turbine was running at full speed no load condition at 3000 rpm, time was required to bring the rotor to stand still before the oil supply to the bearings could be cut off, which caused significant quantity of lubricant to get leaked and burnt inside the compartment. As per the details made available, approximately 10000 litres of lubricating oils was lost from the reservoir, out of which 3000 litres were approximately recovered from the floor after the fire was doused. The recovered oil along with debris has been kept in separate barrels. Hence it can be roughly estimated that 7000 litres of lube oil has been burned during the incident resulting in emissions to environment.

The unit is using hydrocarbon based lubricating oil for turbines and the major emission parameter from its burning is CO<sub>2</sub>. Other emissions from the burning of the oil may be in smaller quantities and hence not estimated.

The approximate CO<sub>2</sub> emission from the burning of lube oil calculated as per the **IPCC Guidelines, 2006** for National Greenhouse Gas Inventories is provided below;

As per Chapter 5.2.2.1 of the above guidelines and the Tier 1 method prescribed, CO<sub>2</sub> emissions are calculated according to Equation 5.2 with aggregated default data for the limited parameters available and the ODU factor based on a default composition of oil and greases in total lubricant figures (in TJ units):

$$\text{EQ 5.2: "CO}_2 \text{ Emissions} = \text{LC} * \text{CC Lubricant} * \text{ODU Lubricant} * 44 / 12"$$

Where,

CO<sub>2</sub> Emissions = CO<sub>2</sub> emissions from lubricants in tonne CO<sub>2</sub>

LC = total lubricant consumption, TJ

CC Lubricant = carbon content of lubricants (default), tonne C/TJ (= kg C/GJ)

ODU Lubricant = Oxidised during use factor (based on default composition of oil and grease), fraction

44/12 = mass ratio of CO<sub>2</sub>/C

For calculation of CO<sub>2</sub> emissions w.r.t the lubricant oil burnt during the fire incident; The total lubricant consumption is estimated as 7000 litres (**6.132 T**, considering avg. specific gravity of 30°API or 0.876).

CC Lubricant - 20.0 kg C/GJ or to tonne C/TJ, the default carbon contents factor given for lubricants in the said guidelines.

ODU Lubricant = specified as **0.2** in the given method for normal lubrication uses; however considered as **1** in this case since the entire lubricant was burnt or oxidised. Hence the CO<sub>2</sub> emissions from the lube oil burning during the incident is estimated as, Tonne of CO<sub>2</sub> =  $6.132 \times 20 \times 1 \times (44/12) = \mathbf{449.68 \text{ Tonne}}$

Further, as described in section 3.3.2 above, the unit has installed a fire protection system which discharges CO<sub>2</sub> into the fire detected zones for arresting the fire. This system was activated during the fire incident and an estimated amount of **630 kg** of CO<sub>2</sub> was discharged through this safety system which also get released to the atmosphere. However, since this is part of a standard safety measure, normally adopted in such type of installations, it is felt inappropriate to consider this emission as an impact to the environment.

Apart from the above emission parameters, some minor quantity of other emissions related to the burning of insulations, piping hoses, rubber beadings etc. might also have been released into the atmosphere during the incident. However, considering the negligible quantities of such emissions, the Committee didn't work out the detailed estimates.

**Impact on ambient noise levels:** The fire incident would also have caused some impact on the ambient noise level. However, as detailed at section 3.2 earlier, the whole incident lasted for about two hours and was mainly confined in the gas turbine chamber, which is provided with acoustic enclosure. However, the siren/hooter noises would have created disturbances. As per the proceedings of the hearing held by the Karnataka State Pollution Control Board, based on the public complaint made on the incident, the major issues raised by the complainants were the noise pollution issues due to the commissioning activities/regular operation of the plant and mitigation measures have been suggested.

#### **4.2 What are all the defaults committed by the 5th respondent in carrying out the project, violations if any, committed:**

As per the records verified by the Committee, the unit had obtained all the regulatory compliances for carrying out the project including Consent to establish by the KSPCB, Environment Clearance from SEIAA etc. for the establishment of the project. Since the compliance aspects of the unit w.r.t other clearances has already been examined and detailed report submitted by another Joint Committee before the Hon'ble Tribunal in O.A No. 57 of 2020, the Committee decided to limit the scope to the fire incident and

related regulatory aspects. The unit had obtained license from the Department of Factories, Boilers, Industrial safety and Health, Govt. of Karnataka for the operation of the unit. An approved onsite emergency plan, as per the provisions of the Factory Act, 1948 by the Dept. of factories has also been put on practice by the unit, as per the records available. The onsite emergency plan, which also identifies such incidents of fire inside the gas turbine chamber and possible risks and safety precautionary measures to be taken.

After the incident, a high-level RCA Committee, comprising of representatives from BHEL, KPCL & GE under the chairmanship of former Member (Thermal)), CEA was constituted on 8<sup>th</sup> October 2020 to analyse the root cause of the accident and suggest remedial actions to avoid reoccurrence of such incidents in future. During the visit of the Committee, the RCA study was going on and after wards the details of the report were also provided to the Committee. The Gist of RCA report as provided to the Committee is placed below;

- ❖ The fire accident can be split into two distinct events:
  - Leakage of oil from bearing #2 of the Gas Turbine
  - Deflagration near the exhaust compartment doors causing injuries to personnel (1 BHEL person who was on duty to monitor the equipment in the vicinity of GT, 1 Contract supervisor engaged for safety supervision, 2 GE personnel & 11 KPCL personnel). Subsequently 1 GE and 2 KPCL personnel expired.
- ❖ Based on available evidence, the root cause of the oil leak from bearing #2 is non removal of mesh in the oil drain line which was temporarily used during oil flushing. The mesh choked and caused oil backup into the bearing and overflow into the tunnel and subsequently to the compartments. Since this overflowing oil passed through the hot gas path, it had picked up enough heat to cause a fire within the compartment.
- ❖ Based on eyewitness accounts the root cause of the deflagration near the south side of the exhaust compartment was due to accidental opening of the compartment doors while the automatic CO<sub>2</sub> fire protection system was operational, thus interfering with its efficacy in limiting oxygen supply to the fire.
- ❖ The actions of individuals who were injured from all three organizations indicate lack of adherence to safety procedures contributing to this incident.
- ❖ As part of corrective measures, M/s GE was consulted w.r.t design changes needed. They have reviewed with their design teams and confirmed that the design is adequate, and no modifications are necessary. All the units in the current fleet for BHEL & GE worldwide (100+) are operating with the same design philosophy without any issues.

- ❖ The committee has opined that site installation checklists and safety protocols & procedures need revisiting and upgrading. It is also felt that all the three organisations should ensure that their employees adhere to safety requirements and instructions.

A copy of the RCA report and action taken report provided to the Committee are placed at **Annexure 5 & 6**.

As the BHEL representative is a common member in both the RCA and this Joint Committee, the above findings are also supported by the Committee and the same may also be considered by the Hon'ble Tribunal with respect to the defaults and errors committed, which led to the incident.

The Committee feels that, even though completely eliminating the possibility of such accidents in large scale industrial and engineering installations might not be practically possible, the lack of following standard operating procedures, some of which are noted below, intensified the damage caused in the incident.

- ❖ The onsite emergency plan envisages marking of emergency exit path during a fire incident; however the fact that plant personnel gathered near the danger zone instead of safe assembly point led to the human injuries and loss of precious lives. Lack of proper awareness & strict adherence to the safety protocol have intensified the damage caused to human life by the incident.
- ❖ The fact that the gas turbine enclosure door, which was kept closed and latched during the operation of the unit, was opened due to manual interference has caused the deflagration outside the enclosure leading to human injuries. This also affects the efficiency of fire protection system by CO<sub>2</sub> discharge and limiting oxygen supply for arresting the fire.

#### **4.3 What are all the action taken by the regulating authorities in respect of the incident:**

Apart from the formation of the RCA Committee and its report, as detailed in above para, the following actions have been initiated by the regulating authorities w.r.t the fire incident;

- ❖ **Department of Factories, Boilers, Industrial safety and Health, Govt. of Karnataka 5.1.1 Air Pollution:** As per the records made available, the Deputy Director of factories, Bangalore Division and the Joint Director of Boilers, Bangalore had made preliminary enquiries into the matter, immediately after the incident. As informed, a notice has been issued to the project proponents based on the report and the matter is ongoing and the unit has submitted its reply to the

notice. Copy of the report and communications in this regard is placed at **Annexure 7**.

- ❖ A preliminary report has been filed before the police department and the fire department has also prepared a primary report; Since the representative from D.C office, Bangalore urban was absent from the Committee, further details on the actions taken by the local administration and departments could not be collected by the Committee.
- ❖ **Karnataka State Pollution Control Board:** Based on the incident and related public complaint, KSPCB had conducted a personnel hearing in the matter on 13.11.2021 and the incident and related complaints on the noise pollution issues were discussed. The presiding officer, Chairman KSPCB has issued certain directions to the industry for taking mitigation measures for noise control including taking up noise mapping study, providing additional measures such as enclosures and green belt development etc. A copy of the proceedings is placed at **Annexure 8**.

#### **4.4 Suggestions and recommendations for avoiding such incident in future:**

As submitted earlier, this Committee also supports the recommendations and suggestions made by the expert RCA Committee, which has the technical expertise in the field. Some of the suggestions and recommendations of the Committee for avoiding such incidents in are given below;

- ❖ The locking arrangement for the enclosure doors provided to the turbine and generator compartments shall be reviewed and modified, if required to ensure that the doors cannot be opened by unauthorized personnel from the outside during unit operation to ensure minimum manual interference affecting the system performance.
- ❖ The safety protocols shall be strictly maintained and dedicated exit paths and safe assembly area shall be identified in case any emergencies.
- ❖ The onsite emergency plan shall be revisited and based on the experience of the fire incident, additional safety protocols and control measures shall be incorporated.
- ❖ The possibilities of technical modifications in the lube oil circulation system, ensuring more leak and temperature detectors for early detection of such oil leaks shall be explored in consultation with the design team, so as to minimise the damages caused by such mishaps.
- ❖ During the visit, the Committee members observed that the exit path from the gas turbine chamber enclosure are not obstruction free and some pipelines are passing

across the same. An obstruction free exit path shall be identified by the unit for all such major installations where fire hazard is identified.

- ❖ Advanced Electronic Control Management system should be adopted in the plant including CCTV cameras and voice recording system.
- ❖ Unit shall explore feasibility in consultation with the design team to make provisions and install the necessary lube oil leakage sensors adjacent to all the bearings including the bearing no. 2, where the leakage occurred presently.

#### **4.5 If there is any violation, what is the action taken including the imposition of environmental compensation:**

The aspect of environmental compensations was considered in two aspects; the compensation to the victims of the incident and the cost incurred due to environmental damage.

**Compensation to victims:** As per the information made available to the Committee and records verified, the medical expenses of all the injured personnel has been taken care by the project proponents. Since KPCL is a Govt. of Karnataka owned entity, the compensation for the two deceased employees are governed by the existing rules and the proposal for the same is before the Govt. for taking appropriate decisions. Further, as informed, the process for giving appointment to close dependant family member of the two deceased employees of KPCL on compassionate appointment grounds have also been initiated and is under process. The details of compensation and other benefits provided to the deceased employee of M/s. GE Ltd. is not available.

**Environmental compensations:** As already detailed at section 4.2 earlier, the major impact on environment due to the incident is the estimated CO<sub>2</sub> emissions to the environment on account of the lubricating oil burnt during the incident. In the matter of OA 134/2020 (PB) in which CPCB was nodal agency, the Joint Committee appointed by the Tribunal had assessed environmental prices in INR for major environmental pollutants and report submitted before the Hon'ble NGT was accepted. The environmental prices in INR for the damage, as calculated in the said report is Rupees 0.0225 lacs per tonne of CO<sub>2</sub> emission. Hence the total environmental cost is estimated as given below;

CO<sub>2</sub> emission in tonne – **449.68 Tonne**

Environmental prices in INR - **Rupees 0.0225 lacs** per tonne of CO<sub>2</sub> emission

Total environmental price – **449.68 \* 0.0225 = Rupees 10.1178 lacs**

**Note:** The calculation of the Committee in OA 134/2020 (PB) was based on the UK-Defra values published in October 2018 are adopted for considering nature of impact. (Ref: Environmental Prices Handbook, 17 EU28 version.

<https://www.cedelft.eu/en/publications/2191/environmental-prices-handbook-eu28-version>)

The unit shall be liable to pay the environmental price of **Rupees 10.1178 lacs** as the environmental compensation estimated based on the CO<sub>2</sub> emissions made to the environment due to the fire incident.

## 5.0 Conclusions and recommendations:

The point wise conclusions and findings of the Committee with respect to the ToRs given by the Hon'ble Tribunal has already been provided in the above sections. The summary of the conclusions and recommendations are given below;

- ❖ The incident can be treated as fire accident which broke out in the Gas Turbine enclosure of the power plant during the commissioning/trial run operations and lasted approximately for two hours and caused some fatal injuries to the personnel working in the plant.
- ❖ A total of 15 personnel from M/s. KPCL, M/s. BHEL and M/s. GE Ltd, engaged in the commissioning activities of the plant sustained burn injuries, out of which three people succumbed to their injuries and lost their lives in the accident.
- ❖ The general fire protection system provided by the plant consists of hydrant system for different areas of the plant, high velocity water spray protection system for transformers, medium velocity water sprays system for cable galleries, portable extinguishers and hand appliances for extinguishing small fires in different areas of the plant.
- ❖ Unit has provided sufficient fire detectors and carbon dioxide fire protection system for the gas turbine unit, which extinguishes fire by reducing the equivalent oxygen content of the air.
- ❖ A high-level RCA Committee, comprising of representatives from BHEL, KPCL & GE under the chairmanship of former Member (Thermal)), CEA was constituted to analyse the root cause of the accident and suggest remedial actions to avoid reoccurrence of such incidents in future. The report has been submitted, as detailed in earlier sections.
- ❖ The unit shall comply with all the recommendations of the RCA report in a time bound manner.
- ❖ KPCL shall be asked to provide thick green belt consisting of tall growing trees (preferably Miyawaki method) towards residential areas around the plant to arrest sound nuisance/ any hazard including providing permanent high range sprinklers towards residential area all along the periphery of the plant.
- ❖ The concerned authorities such as Urban Development Authority, Town planning etc. shall strictly ensure that sufficient buffer in the form of green belt is available

while approving plan for residential apartment/layouts around already existing industries/units with probable accident hazard.

- ❖ The Committee feels that, even though completely eliminating the possibility of such accidents in large scale industrial and engineering installations might not be practically possible, the lack of following standard operating procedures intensified the damage caused in the incident.
- ❖ The onsite emergency plan envisages marking of emergency exit path during a fire incident; however the fact that plant personnel gathered near the danger zone instead of safe assembly point led to the human injuries and loss of precious lives. Lack of proper awareness & strict adherence to the safety protocol have intensified the damage caused to human life by the incident.
- ❖ The fact that the gas turbine enclosure door, which should have remained closed, was open due to manual interference has caused the deflagration outside the enclosure leading to human injuries. This also affects the efficiency of fire protection system by CO<sub>2</sub> discharge and limiting oxygen supply for arresting the fire.
- ❖ The safety protocols shall be strictly maintained and dedicated exit paths and safe assembly area shall be identified in case any emergencies.
- ❖ The onsite emergency plan shall be revisited and based on the experience of the fire incident, additional safety protocols and control measures shall be incorporated.
- ❖ The Committee estimates that the major effect of fire accident on the surrounding environment shall be largely limited to the emissions released to the environment by burning of materials and increase in the ambient noise levels during the incident.
- ❖ The CO<sub>2</sub> emissions from the lube oil burning during the incident is estimated as, **449.68 Tonne** of CO<sub>2</sub>.
- ❖ The unit shall be liable to pay the environmental price of **Rupees 10.1178 lacs** as the environmental compensation estimated based on the CO<sub>2</sub> emissions made to the environment due to the fire incident.

**Sh. E. Thirunavukkarasu**  
Scientist 'E',  
Integrated Regional Office,  
Ministry of Environment, Forest  
and Climate Change, Bangalore.

**Sh. Siddaramiah**  
Senior Environmental Officer,  
Bangalore North, Karnataka State  
Pollution Control Board.



**Dr. R. K Kumar**  
Joint Director,  
Central Power Research Institute  
(CPRI), Bangalore.



**Dr. Kumar G. N**  
Associate Professor, Mechanical  
Engineering Department National  
Institute of Technology Karnataka,  
Suratkal.



**Sh. Madhusudan**  
Sr. DGM - GT ENGG, HPEP Division,  
Bharat Heavy Electricals Limited,  
Hyderabad.



**Sh. Vivek, K**  
Senior Environmental Engineer/  
Scientist D, CPCB, Regional  
Directorate Bangalore.

.....

**Item No.34:****BEFORE THE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI****Original Application No. 229 of 2020 (SZ)**

(Through Video Conference)

**IN THE MATTER OF**

Tribunal on its own motion-SUO MOTU

Based on the News item in the New Indian Express Newspaper,  
E-paper Edition dated 03.10.2020, "Gas turbine explodes at  
Power plant, 15 injured."

...Applicant(s)

**Versus**

- 1) Union of India,  
Rep. by its Secretary,  
Ministry of Environment and Forests and Climate Change,  
Indira Paryavaran Bhawan,  
Jorbagh Road, New Delhi – 110 003.
- 2) Central Pollution Control Board,  
Rep. by its Chairman,  
'Parivesh Bhawan', East Arjun Nagar,  
Shahdara, Delhi – 110 032.
- 3) The Principal Secretary to Govt. of Karnataka,  
Forest, Environment and Ecology Department,  
Government Secretariat, Room No.708,  
7<sup>th</sup> Floor, Gate No.4, M.S. Building,  
Bangalore – 560 001.
- 4) Karnataka State Pollution Control Board,  
Rep. by its Chairman,

“Parisara Bhawan”, #49, 4<sup>th</sup> & 5<sup>th</sup> Floor,  
Church Street, Bangalore – 560 001.

- 5) Karnataka Power Corporation Limited,  
Rep. by its Managing Director,  
No.82, Shakti Bhavan,  
Race Course Road, Bangalore - 560 001.
- 6) The Deputy Commissioner & District Magistrate,  
Bengaluru Urban District,  
Kempegowda Road, Behind Kandaya Bhavana,  
Bengaluru Urban District, Bengaluru – 560 009.
- 7) Bruhat Bengaluru Mahanagara Palike,  
Rep. by its Commissioner,  
Head Office, Corporation Circle,  
Hudson Circle, Bangalore – 560 002.

...Respondent(s)

**Date of hearing: 20.10.2020.**

**CORAM:**

**HON'BLE MR. JUSTICE K. RAMAKRISHNAN, JUDICIAL MEMBER**

**HON'BLE MR. SAIBAL DASGUPTA, EXPERT MEMBER**

**For Applicant(s):** By Court.

**For Respondent(s):** Sri. Tirunavukarasu for R2  
Sri. Darpan for R3 and R6  
Sri Gokul Krishnan for R4  
Sri. Sathish Parasaran, Sr. Adv. along with  
Sri. Ajay Natalike for R5  
Sri. T.V. Sekar for R7

### ORDER

1. The above case has been Suo Motu registered by this Tribunal on the basis of the news paper report published in The New Indian Express, E-paper edition dated, 03.10.2020 under the caption **“Gas turbine explodes at power plant, 15 injured”**.
2. It is alleged in the paper report that an undetected oil leak caused a blast, leading to a fire, in the gas turbine chamber at Yelahanka Gas Power Plant of the Karnataka Power Corporation Limited (KPCL) in Yelahanka New Town around 03.30 A.M. on Friday. Fifteen Karnataka Power Corporation Limited (KPCL) employees, 11 of them ground engineers and an Executive Engineer, sustained burns.
3. The power plant was to start generating 20-30 MW of power on Friday and supply to the grid. The capacity of the plant is 370 MW and Bharat Heavy Electricals Limited (BHEL) was executing the project for which General Electric (GE) is supplying Compressed Natural Gas (CNG).
4. It is also alleged in the report that some criminal case has been registered in respect of this incident before Yelahanka Police Station and the investigation is going on.
5. It is also alleged that the Engineer-in charge of that project site said that although the damage is not yet assessed the site has been closed and they were not aware when it will be opened. It

is also alleged that a detailed enquiry into the matter has been ordered to ascertain how the incident occurred as well as the extent of damage caused and until then, the work on the site has been stopped delaying generation of the electricity from the unit.

6. When the matter came up for hearing for admission today through Video Conference, Sri. Tirunavukarasu entered appearance for 2<sup>nd</sup> respondent, Sri. Darpan entered appearance for respondents 3 and 6, Sri Gokul Krishnan represented 4<sup>th</sup> respondent, Sri. Sathish Parasaran, Senior Counsel along with Sri. Ajay Natalike represented 5<sup>th</sup> respondent and Sri. T.V. Sekar represented 7<sup>th</sup> respondent.
7. On going through the allegations in the paper report, we are satisfied that there arises a substantial question of environment which requires the interference of this Tribunal for resolving the same. So, the matter is admitted.
8. Since respondents 2 to 7 have entered appearance through standing counsel, we have dispensed with notice to them.
9. The office is directed to issue notice to respondents by e-mail along with the copy of this order and the paper report and the gist of the proceedings with full cause title, so as to enable them to appear and submit their independent response regarding the incident.

10. So, in order to ascertain the nature of damage caused, how far it has affected an environment and what are all the defaults committed by the 5<sup>th</sup> respondent in carrying out the project, violations if any, committed and what are all the action taken by the regulating authorities in respect of the incident and also giving suggestions and recommendations for avoiding such incident in future and if there is any violation, what is the action taken including the imposition of environmental compensation, we feel it appropriate to appoint a joint committee comprising of **1)** a Senior Scientist from Ministry of Environment, Forests and Climate Change, Regional Office, Bangalore, **2)** a Senior Scientist from Central Pollution Control Board (CPCB), Regional Office, Bangalore, **3)** a Senior Scientist from the Karnataka State Pollution Control Board (KSPCB), **4)** a Senior Engineer dealing boiler technology from Bharat Heavy Electricals Limited (BHEL), Bangalore, **5)** the District Collector, Bengaluru Urban District, Bengaluru or a Senior Officer not below the rank of Assistant Collector or Sub Divisional Magistrate deputed by the District Collector and **6)** a Senior Professor dealing with Boiler Technology Engineering from National Institute of Technology (NIT), Surathkal, Karnataka and **7)** a Senior Scientist from Central Power Research Institute (CPRI), Regional Office, Bangalore to inspect the area in question and submit a factual

as well as action taken report, if there is any violation found.

11. The Central Pollution Control Board (CPCB) will be the nodal agency for co-ordination and for providing all necessary logistics for this purpose.
12. The committee is directed to submit the report to this Tribunal on or before 26.11.2020 by e-filing along with required hard copies to be produced as per rules.
13. The Registry is directed to communicate this order to the members of the committee and also to all the respondents immediately by e-mail, along with the copy of the paper report and the gist of Suo – Motu proceedings with full cause title, so as to enable them to comply with the direction and also to file their independent responses regarding the allegations made in the paper report before the next hearing date without delay.
14. For appearance of parties, completion of pleadings and also for consideration of report, post on 26.11.2020.

.....J.M.  
**(Justice K. Ramakrishnan)**

.....E.M.  
**(Shri. Saibal Dasgupta)**

**O.A. No.229/2020**  
**20th October 2020. Sr.**

**Minutes of the Meeting held on 23.11.2020 by the Joint Committee constituted in  
O.A No. 229 of 2020 (SZ) by Hon'ble NGT:**

The Joint Committee constituted in O.A No. 229 of 2020 (SZ) by Hon'ble NGT held its first meeting on 23.11.2020 at 4.00 pm through Video Conferencing. The following members attended the meeting;

1. Sh. E.Thirunavukkarasu, Scientist E, MoEF&CC
2. Sh. Siddaramiah, RSEO, KSPCB
3. Dr. R. K Kumar, Joint Director, CPRI
4. Dr. Kumar G. N, Associate Professor, NITK
5. Sh. Madhusudan, Sr. DGM - GT ENGG, BHEL
6. Sh. Vivek. K, Scientist D, CPCB – Nodal officer

The representative from D.C Office, Bangalore in the Committee, Sh Dayanand Bhandari, A.C Blr North informed prior to the meeting that since he is attending a court matter, he will not be able to join the meeting.

Sh. Vivek welcomed all Committee members to the meeting and gave a brief description on the gas turbine explosion which had happened at gas based power plant located in Yelehanka and the major directives given by the Hon'ble NGT to the Committee. He further requested Sh. Siddaramiah, KSPCB and Sh. Madhusudan, BHEL to provide the preliminary assessments and findings made about the incident.

Sh. Siddaramiah informed that a notice has been served to KPCL by KSPCB based on the incident and an opportunity of personal hearing has been extended to confirm further actions.

Sh. Madhusudan informed the Committee that an internal enquiry, jointly by BHEL, GE Electrical and KPCL is going on in the matter and the report is yet to be finalised. He further gave a small presentation on the design aspects of the gas turbine, some of the actual site photographs and the sequence of events that led to the accident. He further explained in detail about the standard safety/control/monitoring systems such as feedback system for lube oil circulation, heat detectors and CO2 spraying arrangement for preventing such incidents.

Dr. R. K Kumar, CPRI and Dr. Kumar G. N, NITK took further details on the design aspects of the Turbine and the lube oil feedback system including thermo couple location, lube oil specification, possible routes of leakage of oil etc.

The Committee also opined that the environmental damage from the incident has to be assessed considering the quantity of lube oil which was burned and other aspects. It was further decided that any information required prior to the site visit shall be obtained from BHEL representative.

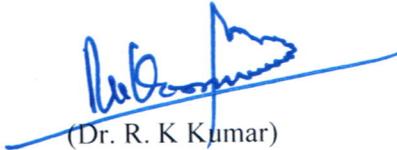
The Committee also decided to seek additional time of at least four weeks from the Tribunal, considering the 15 day delay in the receipt of the order and coordination required between seven different offices/institutes for completion of the task and submission of report.

The Committee decided to conduct the site visit of the power plant in the first week of December, 2020 on a mutually convenient date.

\*\*\*\*\*

  
(E.Thirunavukkarasu)

  
(Siddaramiah)

  
(Dr. R. K Kumar)

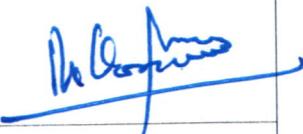
  
(Dr. Kumar G. N)

  
(Madhusudan)

  
(Vivek. K)

**Site Visit Conducted by the Joint Committee constituted in O.A No. 229 of 2020 (SZ) by NGT:**  
**Date of Visit: 04.12.2020**

**List of attendees:**

S. No	Name & Designation	Organisation	Contact no. & email	Signature
1.	E. Thirunavukkarasu, Scientist E	MoEF&CC, Blr	7290835157 e.thirun@nic.in	
2.	Siddaramiah, RSEO	KSPCB	9845311539 seon@kspcb.gov.in	
3.	Dr. R. K Kumar, Joint Director	CPRI	9449084549 rkumar@cpri.in	
4.	Dr. Kumar G. N, Associate Professor,	NITK	9481848572 gnkumar33@nitk.ac.in	
5.	Madhusudan, Sr. DGM	BHEL	9490191577 madhusudan@bhel.in	
6.		D.C Bengaluru Urban, Representative		
7.	Vivek. K, Scientist D	CPCB, Blr	9990300758 Vivek.cpcb@gov.in	

**Details of injured person in the fire accident occurred on 02.10.2020 at KPCL Yelahanka**

Sl. No.	Name	Designation /E.Code	Extent Injuries %	Hospital	Reported to duty on
1	Sh. Mariswamy	AEE(M)/2774	60% 2nd - Degree burn under treatment in ICU and shifted to ward, <b>Recovering well</b>	St.Johns Hospital, Bangalore	Not discharged from hospital
2	Sh. Srinivasa B	SE(E)/2026	9% 1 <sup>st</sup> -Degree burn & <b>Discharged on 03.10.2020</b>	M..S.Ramaiah Hospital,, Bangalore	27.10.2020
3	Sh. Srinivasa Murthy D.P	AEE(E)/2576	9% 1 <sup>st</sup> -Degree burn <b>Discharged on 05.10.2020</b>		17.11.2020
4	Sh. Akul Raghuram	JE(E)/2939	10% 1 <sup>st</sup> -Degree burn <b>Discharged on 05.10.2020</b>		19.11.2020
5	Sh. Krishna Bhat	EE(M)/1773	69% 2 <sup>nd</sup> - Degree burn <b>Expired</b> on 12/10/2020 at 1.30 AM	Medicare Hospital, , near KIMS, Bangalore	<b>Expired</b>
6	Sh. Manjappa	AEE(M)/1874	37% 2 <sup>nd</sup> - & 3 <sup>rd</sup> Degree burn <b>Expired</b> on 12/10/2020 at 8.30 AM		<b>Expired</b>
7	Sh. Ravi K.P.	EE(I)/2400	31 %2 <sup>nd</sup> & 3 <sup>rd</sup> -Degree burn <b>Discharged on 04.11.2020</b>		23.12.2020
8	Sh. Ashwathnarayana	EE(E)/2107	22% 2 <sup>nd</sup> &3 <sup>RD</sup> -Degree burn <b>Discharged on 26.10.2020</b>		09.12.2020
9	Sh. Harish	EE(I)/2401	25% 2 <sup>ND</sup> -Degree burn <b>Discharged on 14.10.2020</b>	Aster CMI Hospital, Bangalore	--
10	Sh. H.N. Srinivas	AEE(E)/2685	40% 2 <sup>nd</sup> Degree super facial burn Recovering and likely to be discharged in 7-10 days from Aster CMI, Bangalore <b>Discharged on 05.11.2020</b>		--
11	Sh. Narasimha Murthy	EE(M)/2020	16% 2 <sup>nd</sup> Degree super facial burn <b>Discharged on 10.10.2020</b>		26.11.2020

**General Electric**

12	Sh. Ashok Kumar	Field Executive Assistant	14% 2 <sup>nd</sup> Degree Superficial-burn <b>Discharged on 09.11.2020</b>	M..S. Ramaiah Bangalore	<b>Discharged from Hospital.</b>
13	Sh. Balaraj	Field Executive Assistant	36% 2 <sup>nd</sup> - Degree deep thermal burn <b>Expired</b> on 05.10.2020 at 4.00AM	Victoria Hospital	<b>Expired</b>

**BHEL**

14	Sh. Manoj	Safety Engineer BHEL	24% 2 <sup>nd</sup> -Degree burn <b>Discharged on 29.10.2020</b>	Aster CMI, Bangalore	Discharged from Hospital.
15	Sh. Nitesh	Senior Engineer BHEL	30% 2 <sup>nd</sup> -Degree Superficial burn and 10% 2 <sup>nd</sup> degree burn <b>Discharged on 29.10.2020</b>	Aster CMI, Bangalore	04.01.2021

**The report on compensation to victims and medical status of injured personnel in the Fire Accident that occurred on 02.10.2020 at Yelahanka Combined Cycle Power Plant is submitted as follows:-**

1. KPCL Management already sanctioned the leave for all the injured KPCL staff (9 personnel) during their stay at hospital till discharge and paid the full salaries.
2. KPCL Management sanctioned special leave for 6 KPCL staff (who reported for duties) for the period from date of discharge from the hospital till date of reporting to duties (rest period).
3. KPCL Management sanctioned special leave for 3 KPCL staff (who are advised rest at home) for 180 days and 1 KPCL staff for 90 days from date of discharge from the hospital respectively.
4. KPCL Management has made the payment towards medical expenditure in full (100%) in respect of all the KPCL staff (11 Personnel) who met with accident.
5. KPCL will provide jobs for dependents of deceased staff (2 Personnel) on compassionate grounds as per KPCL Service rules and the same is under process. The Monetary Compensation for deceased KPCL staff is being processed by KPCL and this information will be furnished once it is finalized.
6. The employees of BHEL who met with the accident have been granted leave and salary for the period and his medical expenditure has been met with.

Office Order

Ref. PS: MSX: COMM: RCA:2020/01

Date: 8<sup>th</sup> Oct. 2020**Sub: Formation of Cross Functional Task Force (CFT) for Root Cause Analysis (RCA) of the fire incident at KPCL Yelahanka CCPP.**

A Fire incident occurred during the pre-commissioning activity of Gas Turbine at KPCL, Yelahanka Combined Cycle Power Plant (CCPP) in early hours of 2nd October 2020. A CFT with the following members is hereby constituted for RCA to ascertain the cause of the incident and recommend remedial measures:

Sl No.	Name (S/Shri)	Designation	Role
1.	P D Siwal	Former Member (Thermal), CEA	Chairperson
2.	Surojit Mandal	GM/Quality & HSE (PSSR)	Convener
3.	Y M Babu	GM (PSTS)	Member
4.	P Manojkumar	AGM (CQ Hyderabad)	Member
5.	Madhusudhan	Sr. DGM GT Engg (HPEP, Hyderabad)	Member
6.	Representative from KPCL	KPCL (to be coordinated by PSSR/ISG)	Member
7.	Representative from GE	GE (to be coordinated by PSSR)	Member
8.	Tapas Kumar Roy	Sr. DGM (PSER)	Member

Additional members can be co-opted by the CFT as required

Terms of reference: Ascertain the cause of fire incident and recommend remedial measures.

CFT to submit report within two weeks.

This has the approval of competent authority.



A.K.Mehta  
AGM (PSHQ-MSX)

CC:

1. Chairperson & Members
2. SA to Director (Power) / Director (E, R&D)
3. ED - PSER
4. GM & Head- CQ&BE / PSSR / HPEP Hyderabad / PSTS / ISG / PSHQ
5. AGM(Finance) /PSHQ

For kind information



**9F.05 Gas Turbine Fire Incident Root Cause Analysis**

**KPCL – Yelahanka, GT-1 (#GT247)**



RCA committee approval vide PS:MSX:COMM:RCA:2020/01 Dtd 8<sup>th</sup> Oct 2020

Name (S/Shri)	Designation	Role	Signature
P D Siwal	Former Member (Thermal), CEA	Chairperson	<i>[Signature]</i>
Surojit Mandal	GM/ Quality & HSE (BHEL, PSSR)	Convener	<i>[Signature]</i>
Y M Babu	GM (BHEL, PSTS)	Member	<i>[Signature]</i>
P Manojkumar	AGM (BHEL, CQ Hyderabad)	Member	<i>[Signature]</i>
Madhusudan	Sr. DGM/ GT Engg (BHEL, HPEP)	Member	<i>[Signature]</i>
Tapas Kumar Roy	Sr. DGM (BHEL, PSER)	Member	<i>[Signature]</i>
Satyanarayana	TA to MD KPCL	Member	<i>[Signature]</i>
Jagdish Rao	Senior Service Director, GE *	Member	<i>[Signature]</i>

Bharat Heavy Electricals Limited  
India

28<sup>th</sup> December 2020

**\*GE DISAGREES WITH SOME ASPECTS OF THIS RCA REPORT AND RESERVES ITS RIGHT TO SHARE COMMENTS/CHANGES IN AN ADDENDUM TO THIS RCA IN THE FIRST WEEK OF JAN 2021.**



## Executive Summary

BHEL has supplied and erected 1 x 9F.05 Gas Turbine based power plant at KPCL, Yelahanka, Bengaluru. The unit was under commissioning since the last week of September 2020. Various commissioning steps involving cranking, "false-fire", water wash and "first-fire" had been completed by 1<sup>st</sup> October 2020. The unit was being run to full speed no load (FSNL) in the intervening night of 1<sup>st</sup> & 2<sup>nd</sup> October 2020. At around 02:52 Hrs in the early hours of 2<sup>nd</sup> October 2020, fire incident occurred, resulting in damage to equipment and injuries to personnel. Subsequently three persons lost their lives during treatment for burn injuries at hospitals. RCA committee comprising of representatives from BHEL, KPCL & GE under the chairmanship of former Member (Thermal)), CEA was constituted on 8<sup>th</sup> October 2020 to analyse the root cause of the accident and suggest remedial actions to avoid repeat. This report summarizes the findings of the committee based on evidences collected.

The fire accident can be split into two distinct events:

- 1) Leakage of oil from bearing #2 of the Gas Turbine
- 2) Deflagration near the exhaust compartment doors causing injuries to personnel (1 BHEL person who was on duty to monitor the equipment in the vicinity of GT, 1 Contract supervisor engaged for safety supervision, 2 GE personnel & 11 KPCL personnel). Subsequently 1 GE and 2 KPCL personnel expired.

Based on available evidences the root cause of the oil leak from bearing #2 is non removal of mesh in the oil drain line which was temporarily used during oil flushing. The mesh choked and caused oil back-up into the bearing and overflow into the tunnel and subsequently to the compartments. Since this overflowing oil passed through the hot gas path, it had picked up enough heat to cause a fire within the compartment.

Based on eyewitness accounts the root cause of the deflagration near the south side of the exhaust compartment was due to accidental opening of the compartment doors while the automatic CO2 fire protection system was operational, thus interfering with its efficacy in limiting oxygen supply to the fire.

The actions of individuals who were injured from all three organizations indicate lack of adherence to safety procedures contributed to this incident.

Quality of supervision from GE under the TDI services also appeared inadequate. All activities and communications were not logged and escalated properly.

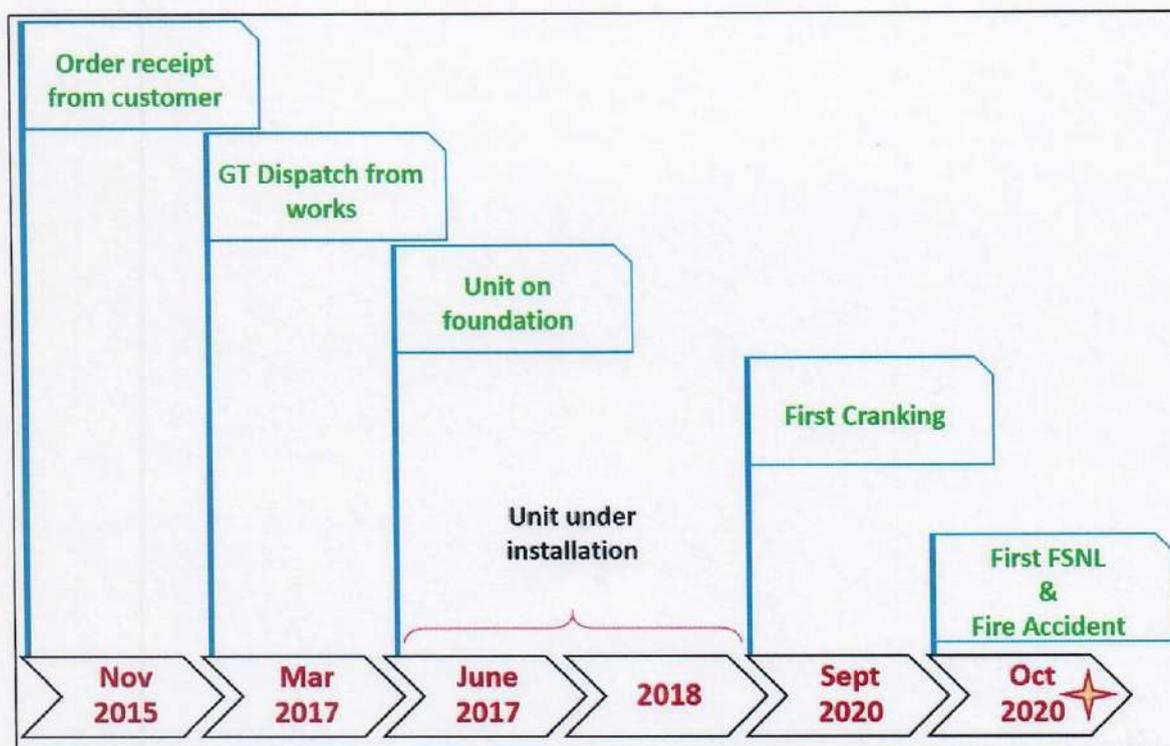
As part of corrective measures, M/s GE was consulted w.r.t design changes needed. They have reviewed with their design teams and confirmed that the design is adequate and no modifications are necessary.

The committee has opined that site installation checklists and safety protocols & procedures need revisiting and upgrading. It is also felt that all the three organisation should ensure that their employees adhere to safety requirements and instructions. Better coordination between them is essential to avoid such events in future.

*Sumit M. V.*



### Project timelines



### Event report

<b>BHEL PSSR, YCCPP 1x370 MW.</b>	
<b>Event report from 25.09.2020 to 02.10.2020</b>	
Date	Activity Carried out
25.09.2020	<ul style="list-style-type: none"> <li>System mechanical walk down was carried out along with GE TFA. No non-conformities were found based on visual observations.</li> <li>Gas turbine (GT) was put on barring gear prior to Cranking activity. Barring gear speed is 6 RPM. No abnormality was found during the activity.</li> <li>H2 filling was done in generator &amp; generator casing pressurized to 3.56 KSC.</li> </ul>
26.09.2020	<ul style="list-style-type: none"> <li>Cranking of gas turbine was done @19.20 hr for the first time under the advisory of M/s GE TFA. Higher officials of KPCL were present during cranking activity.</li> <li>The cranking speed reached to 704 RPM. No abnormality was observed.</li> <li>After Cranking, machine is kept on barring gear.</li> </ul>
27.09.2020	<ul style="list-style-type: none"> <li>GT compressor offline water wash activity preparation in progress.</li> <li>GT lube oil level in tank was normal.</li> </ul>
28.09.2020	<ul style="list-style-type: none"> <li>Red flag Review (RFR) meeting conducted with GE &amp; BHEL HYD team for GT-FSNL &amp; Synchronisation activity. Clearance given to site for Cranking and FSNL</li> <li>Gas booster compressor - A was run and fuel gas was charged up to Gas valve module with discharge pressure of 35 Kg. System was checked with soap solution &amp; found no leakages.</li> <li>GT - Compressor Offline Water wash activity completed in presence of GE TFA.</li> </ul>

*Handwritten signature*

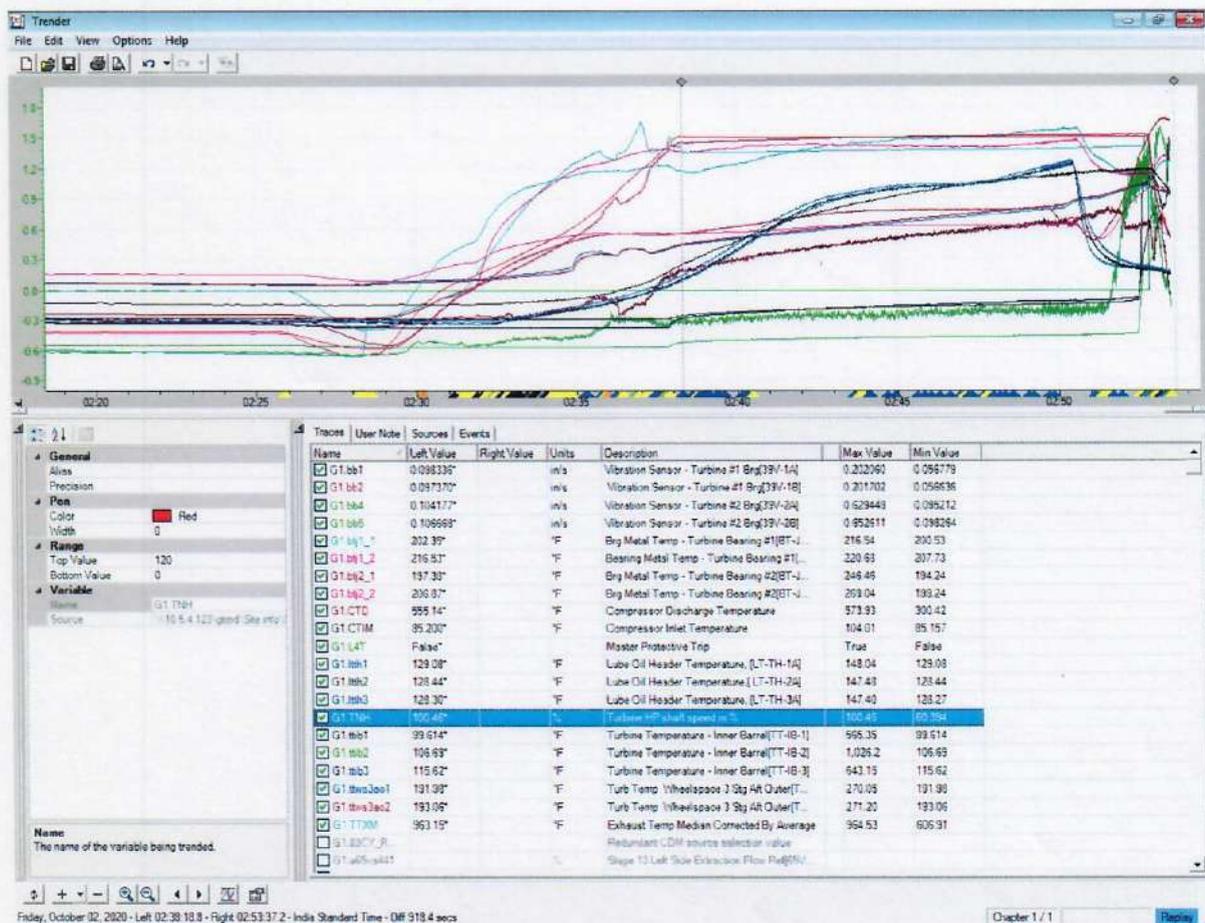


Date	Activity Carried out
29.09.2020	<ul style="list-style-type: none"> <li>• FSNL preparatory works in progress. GT was kept on turning gear. Final mechanical walk down with GE TFA carried out. No non-conformities were found based on visual observations.</li> <li>• Bus transfer system (BTS) checking completed.</li> <li>• Gas turbine start up checks completed.</li> </ul>
30.09.2020	<ul style="list-style-type: none"> <li>• GBC was put on service and Safety shut off valve (SSOV) leak test carried out. Verification of all gas control valves tests has been carried out by GE TFA. P2 Cavity test was again conducted before GT test fire.</li> <li>• GT – Generator Rotor &amp; Stator 100 % earth fault protection checks completed.</li> <li>• GT false firing test conducted and after that GT test firing was done at 20:08 hr. No abnormalities were noticed.</li> </ul>
01.10.2020	<ul style="list-style-type: none"> <li>• GT was on barring gear. Lube oil level was checked along with GE TFA, found normal. Gas booster compressor A put on service.</li> <li>• GT- Generator Circuit breaker (GCB) remote operation checked with customer.</li> <li>• During FSNL attempt activity, turbine was tripped twice on CPD sensor fault in-between 14:08 to 15:30 Hrs. Again at 16:30 hrs, GT was tripped on Generator protection (dead machine trip).</li> <li>• Subsequently, GT was started at around 18:00. GT tripped at ~95% speed (2672 RPM) on HAZ gas detection in Gas valve module at 18:21 hrs.</li> <li>• After that GT was started again. It tripped on HAZ gas detection in Gas turbine compartment at 21:01 hrs, Speed 1061 RPM. Leaks were found in Gas turbine compartment. All leaks were attended and checked with soap solution.</li> </ul>
02.10.2020	<ul style="list-style-type: none"> <li>• At 00:24 hrs GT started again, GT trip at 1610 RPM on EGD protection at 02.00 hrs.</li> <li>• GT was started again at 02:12 hrs and achieved FSNL (3000 RPM) at 02:38 hrs.</li> <li>• GT was operating at FSNL. At 02:52 hrs, Bearing #2 load tunnel over heating detected and machine shut down initiated. Followed by that, fire is detected in bearing # 2 tunnel area. Immediately CO2 was released automatically in that zone.</li> <li>• After five minutes, fire broke out in GT exhaust compartment area. Some people who were near to the fire area, got injured and were immediately taken to hospital.</li> <li>• Other zone CO2 was released manually from Control room on fire panic and instruction from field.</li> <li>• At zero speed of turbine, GT Lube oil system switched off and H2 was released from Generator. MCC powered off.</li> <li>• Fire was extinguished by fire tenders in next one to one and half hrs.</li> </ul>

*Tanjit M...*



## Trip Log

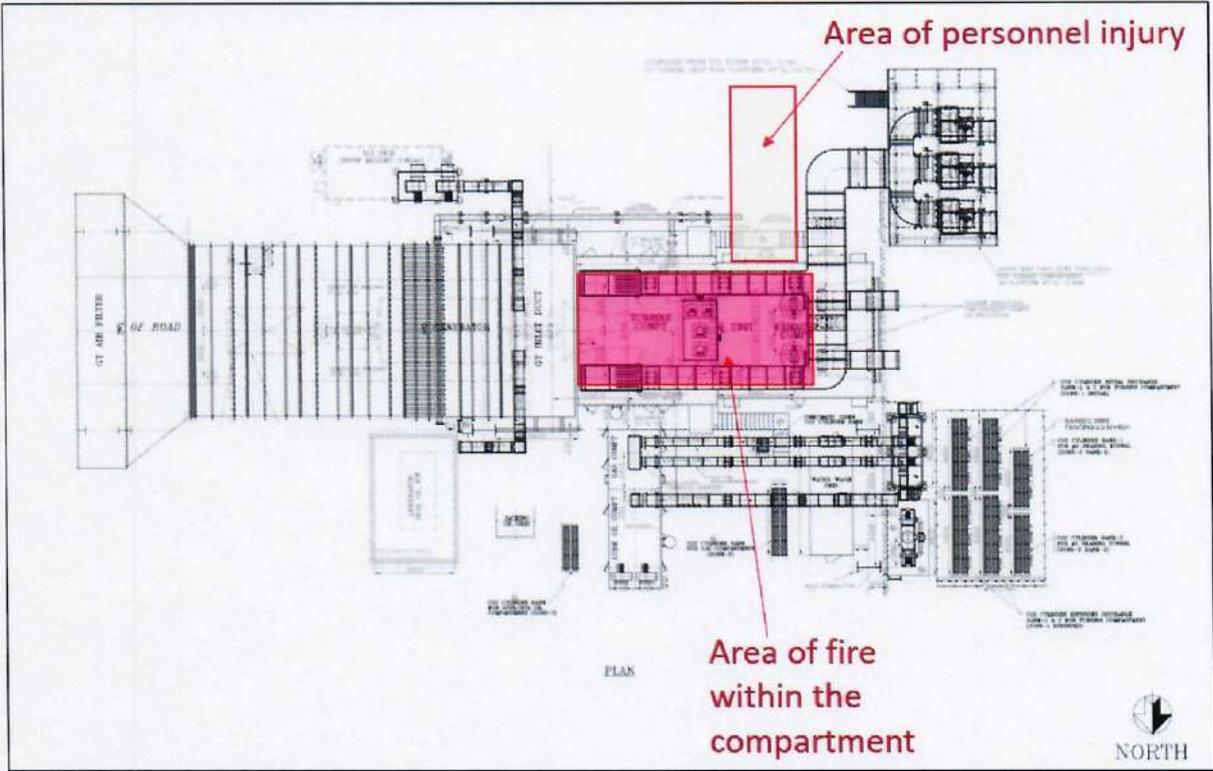


## Site Inspections

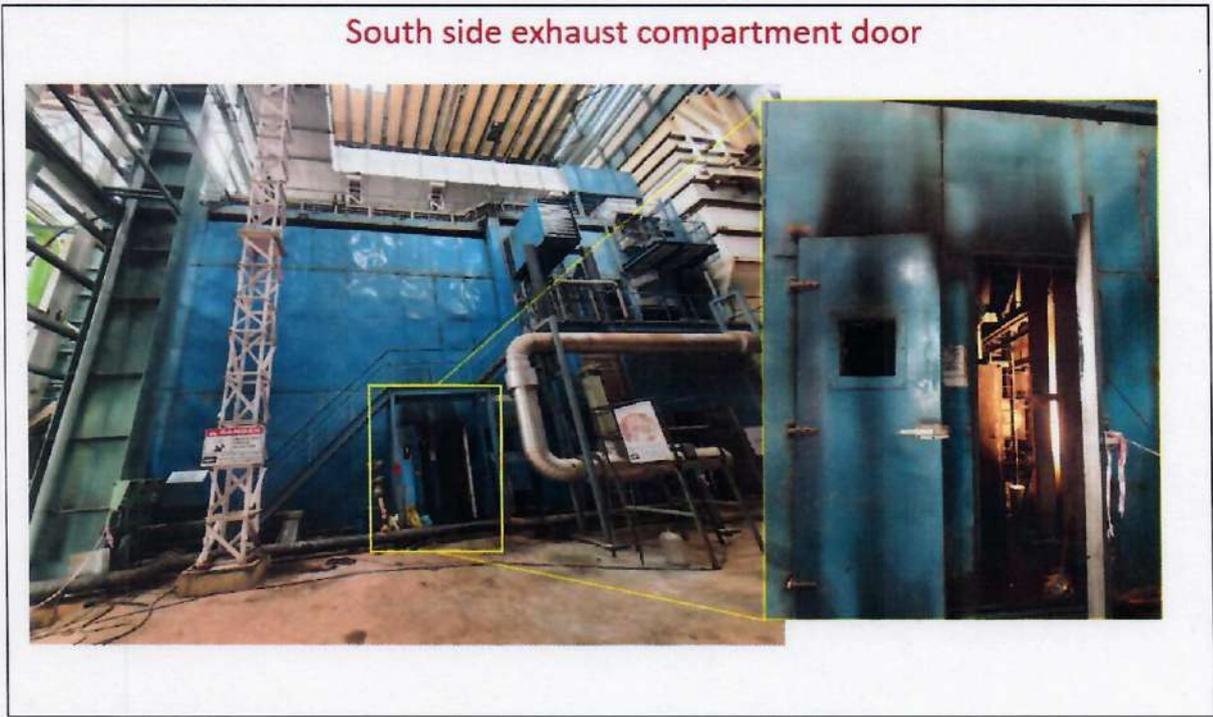
- The fire was localized only in exhaust and turbine compartments. No damages observed to components outside these two compartments.
- Deflagration occurred near the south side door and was visible from the north side of the exhaust compartment
- Personnel injuries occurred during the deflagration (1 BHEL, 1 Contract, 2 GE & 11 KPCL personnel). Subsequently 1 GE and 2 KPCL personnel expired.
- Significant amount of foam + water + oil was observed on the floor in the exhaust and turbine compartments. No oil seen outside the compartments.
- Components damaged due to fire exposure:
  - Instrumentation and cables inside the exhaust and turbine compartment
  - Insulations on compressor casing, exhaust frame & diffuser are partially damaged
  - Enclosure inner partition walls in intermediate compartment
  - Fire detectors & thermocouples in the bearing tunnel
  - Exhaust compartment vent fan (88BD) duct
- Components in the load compartment & accessory compartment are in good condition
- Components on the roof top of the enclosure are in good condition (except a ruptured bellow & soot affected filter in the 88BN fan)

*Amjith M. Murali*

➤ The pictorial representation of the area of fire is below:



➤ The photographs depicting the damages is below:



*Vijay Kumar*

South side turbine compartment door



Inside exhaust compartment



*Transit my mind*



Bearings



Bearing #1



Bearing #2

Turbine roof top



88TK&BN module



88BD discharge duct



Damaged bellow



88BD vent outlet

Inside turbine compartment



Buckled partition wall



Combustion chambers



Axial vent assembly

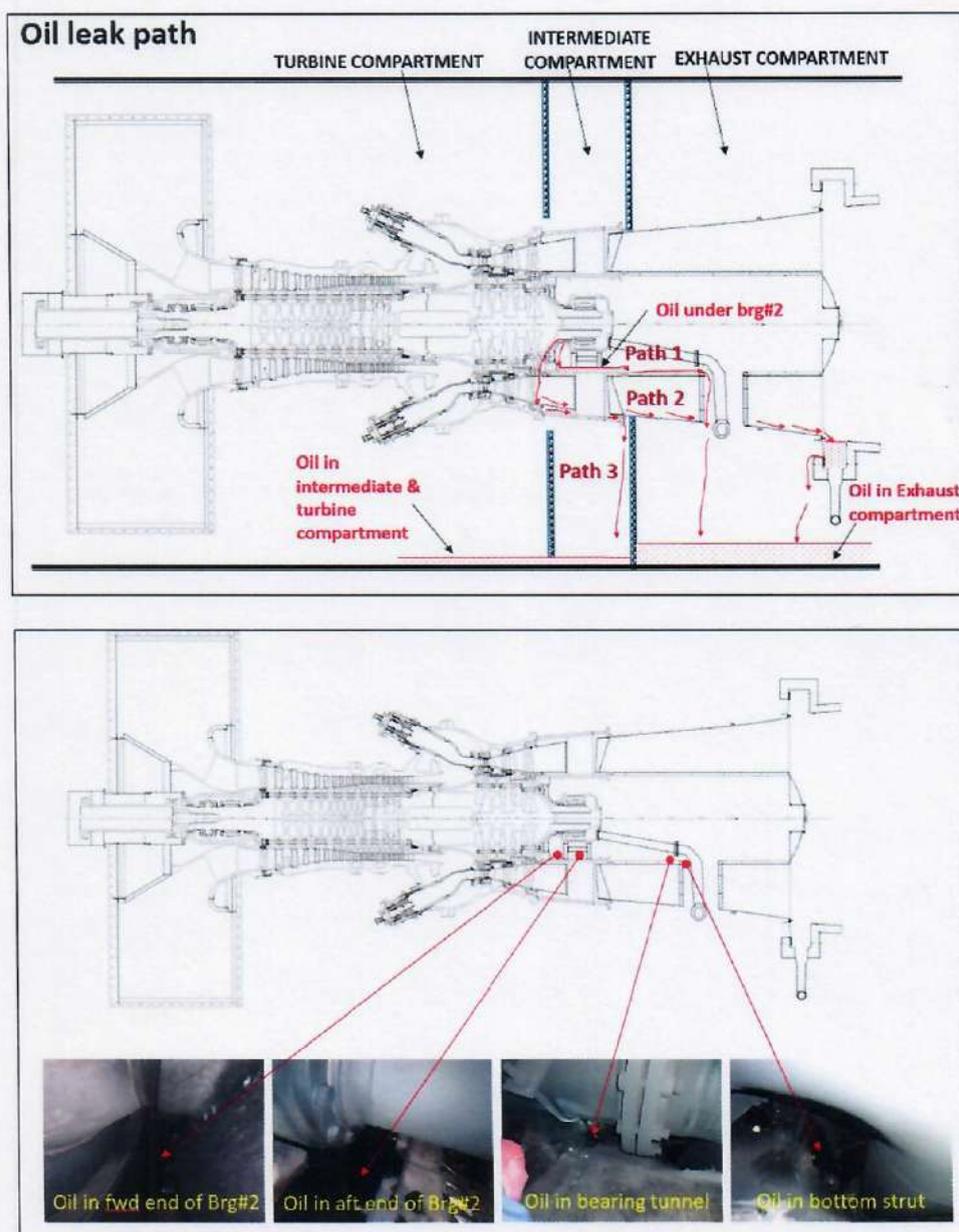
*Final report*

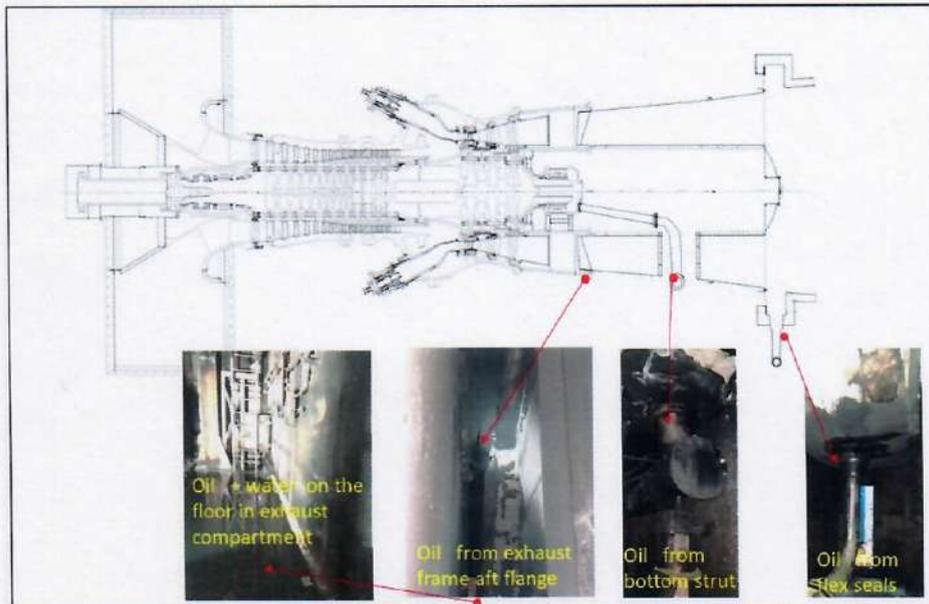
## Observations

### Oil leak path

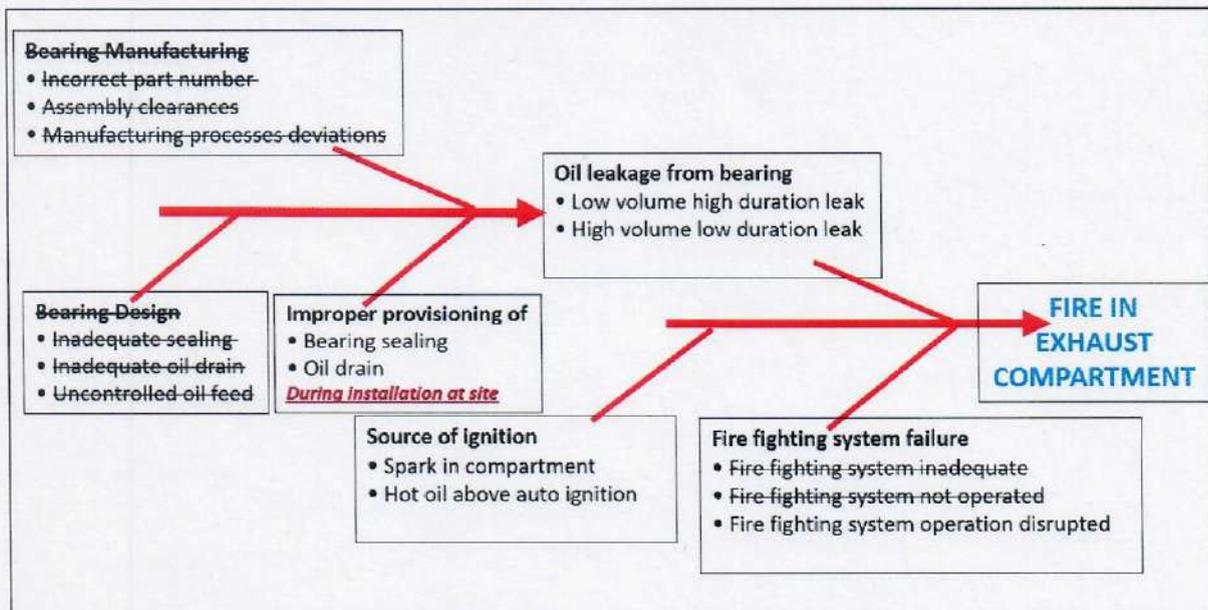
Oil has leaked from the forward seal of bearing #2. This oil has taken three paths to reach the compartment floors.

- Path 1: Oil accumulated under the bearing housing has flown aft in the bearing tunnel, wet the insulation and leaked from the bottom strut of bearing tunnel into the exhaust compartment
- Path 2: Oil has leaked over the stage-3 bucket into the exhaust flow path and flow aft into the flex seal cavity of the diffuser duct. Oil has then leaked across the flex seal into the exhaust compartment.
- Path 3: Oil has leaked over the stage-3 bucket into the exhaust frame cooling air annular space. This oil has leaked from the aft flange of the exhaust frame into the intermediate compartment. Subsequently this oil has found a path into the turbine compartment.





### Analysis – Fish bone



Following causes from the Fish bone taken up for further evaluation

- Improper provisioning of Bearing sealing / Oil drain during installation at site
- Oil leakage from bearing : Low volume high duration leak / High volume low duration leak
- Source of ignition: Spark in compartment / Hot oil above auto ignition
- Firefighting system failure : Firefighting system operation disrupted

*Final report*



Oil drain system stress test was carried out to try and recreate the conditions during the accident and identify malfunctions. Following were carried out:

- Piping system
  - Checked with boroscope & externally
  - Mist eliminator run to find large leaks
  - Windows and level indication installed at #2 bearing
- Methods
  - Run system as found
  - Run system at increased oil flow using
  - Lift oil system
  - Second AC oil pump ( 1.9 kg/cm<sup>2</sup> to 2.1 kg/cm<sup>2</sup>)
  - Increase regulator valve to limit (in stages to 2.68 kg/cm<sup>2</sup>)
  - Run fans (88TK and 88BN blowers)
  - Mist eliminator run up to 600 mm H<sub>2</sub>O
  - Oil up to 175-180 F (180 F drain temp at trip)
  - Stop mist eliminator and drop vacuum to zero
- Results
  - **Leak could not be recreated**
  - Drain line does not reach 50% level ( 10-15 cm max, 30.5 cm ID)
  - Some drops at 3rd stage bucket seen only at the end of the test with increased oil temperature and pressure

#### Evaluation of possible causes

- Improper provisioning of Bearing sealing during commissioning at site
  - Mist eliminator vacuum from operational data is very low
  - However during lube oil system checks the mist eliminator performance found satisfactory
  - Bellow in bearing tunnel cooling fan is found damaged
  - Both the above can result in Low volume high duration leak
- Improper provisioning of Oil drain during installation at site
  - Detailed site simulation study undertaken by GE
  - Picture taken on 01.10.2020 10:45 AM by KPCL engineer indicate presence of strainer mesh in the drain line during operations on 1st & 2nd October 2020
  - Choking of this mesh during operation can lead to backing up of oil causing overflow from bearing seal. This will result in High volume low duration leak



*Tomjit M. M.*



- Low volume high duration leak
  - Damaged bellow and low mist eliminator vacuum can lead to Low volume high duration leak
- High volume low duration leak
  - Retaining a mesh used during lube oil flushing during operation resulting in restricted drain
  - Restricted drain can lead to backing up of lube oil level in the bearing housing and cause High volume low duration leak
- Spark in compartment
  - All instrumentation in the exhaust compartment are certified for EX-d
  - All junction boxes, conduit fittings and cables in this compartment are explosion proof
  - Possibility of sparking is very minimal
- Hot oil above auto ignition
  - Oil flow path to the exhaust compartment identified at site passes through the exhaust flow path
  - At FSNL, the exhaust flue gas temperature is 480 Deg C which is significantly above the auto ignition temperature of lube oil
  - The possibility of auto ignition of lube oil is very high
- Firefighting system operation disrupted
  - Statements given by GE & BHEL Engineers have confirmed opening of the enclosure door to inspect the oil leak.
  - Due to lack of CCTV footage, it not possible to ascertain the personnel who opened the door. The statements given to the committee are contradictory on this aspect. However opening of the doors is consistent in the statements given.
  - Opening the enclosure door when the CO2 firefighting system is limiting the oxygen availability by suppressant release and ventilation cut-off disrupts the functioning of the system
  - Supply of fresh oxygen can lead to a deflagration
  - From the available evidences, it is conclusive that the deflagration occurred due to opening of the door.
- Human factor and procedures followed at site
  - Elaborate quizzing of the engineers involved in commissioning from BHEL & GE has brought out the following:
    - Communications between GE TFA, BHEL & KPCL Engineers on “mesh in drain line” was not clear, predominantly verbal and contradictory statements were given. It appears to be one of the following is true ( Committee is of the view first point is more likely)
      1. Concerned officials of all the three agencies have forgotten about the mesh in return line and did not remove it (Most Likely)
      2. All the three agencies agreed to keep the mesh in position for some time to avoid contamination of lube oil tank, without analyzing its consequences. (Less Likely)
    - This issue was either not communicated or not adequately communicated to site engineers by GE TFA. The issue was neither escalated by him to GE engineering team nor does it find a mention of it in RFR report and also not brought to the notice of senior



officers of BHEL site. It is said that the consequences of this mesh in the drain line was not understood by him.

- Safety signage were not in place on the enclosure.
- The personnel from all the three organization assembled near the GT, chose not to follow the emergency procedures which indicates the inadequacy in the safety training imparted to them.
- The doors were opened by someone out of inquisitiveness to investigate rather than allow the automatic firefighting systems to fight the fire.
- Some important parameters like lube oil level and lube oil level low alarm was not properly configured.
- No record of commissioning meetings were kept severely hampering the investigations.
- After the incident the mesh in oil drain lines were found removed.
- Adequate level of supervision from paid TDI services of GE, was not evidenced from the events discussed.

### Conclusion

- Inadequacy of evidence (lack of CCTV footage, incorrect operating data due to uncalibrated / unconnected instruments, inconclusive and inconsistent dispositions by eye witnesses, Incomplete RFR report made available by GE (only the summary of RFR was given), etc.) from the day of event severely constrains the RCA evaluations. The committee is forced to rely on circumstantial evidence.
- From the quantum of oil leak (close to 10,000 lit) only during the last run (disposition by site engineers confirming that no leaks were seen in the prior runs is considered) indicates that it was a High volume low duration leak. This is possible only by a restriction in the drain line. Photographic evidence found, points to this as the prime reason for the oil leak.
- Site management to investigate about the removal of mesh in oil drain line after the incident.
- Since the unit was run at FSNL for 20 min prior to fire detection, adequate temperatures were available in the exhaust flue gas flow path to cause auto ignition of the lube oil and resultant fire in the bearing tunnel and exhaust compartment.
- Disruption to the operation of the fire suppression system by opening of doors led to a deflagration.
- Quality of supervision from GE under the TDI services appeared inadequate. All activities and communications were not logged and escalated properly.
- BHEL site engineers should ensure systematic commissioning of the unit with proper documentation and protocols.
- Inability to grasp the consequences of leaving the mesh in the drain line by the GE TFA and BHEL engineers mistake of not removing the mesh after oil flushing appears to be the main reason for this incident.
- Inadequate EHS standard followed at site and the inadequate safety training to personnel involved at site (including Customer personnel).
- GE to again relook at the adequacy of the system philosophy to address the high oil leakage in a very short span of time leading to such incidents. BHEL to incorporate any changes / improvement, if suggested by GE

*Sumit M. V.*

ANNEXURES

1.	Annexure - 1	Statements made to the committee
2.	Annexure - 2	GE Mech TFA final checklist 26 <sup>th</sup> Sept 2020
3.	Annexure - 3	Details of RFR call – 28 <sup>th</sup> Sept 2020
4.	Annexure - 4	KPCL Yelahanka 9FB_RFR_Summary_18Nov'20 by GE
5.	Annexure - 5	Borescope inspection comments by M/s GE
6.	Annexure - 6	List of CFT meetings

*Pranav Kumar*

ANNEXURE-1Statements made to the committeeBHEL Personnel

1. Mr. E R Harikrishnan, GM KPCL projects, BHEL provided the background on the methodology being followed for installation and commissioning of the plant at Yelahanka.

Following is the brief:

- a. Gas Turbine was being installed and commissioned by M/S BHEL with intermittent technical assistance by M/s General Electric Field Engineers.
- b. GE Field Engineers were either witnessing the various installation activities at site or reviewing the BHEL protocols for works done in their absence at site, as requested
- c. A Red Flag Review (RFR) was done as per GE new unit start-up protocol relying on inputs from BHEL site team and reviewed by GE Field Engineers and Engineering team to ascertain the completeness of systems necessary for commissioning of the unit. Inputs for non-GE supply scope were provided by BHEL. GE's Field Engineers carried out checks and obtained inputs from BHEL site for checks done by BHEL & KPCL and uploaded these into GE's portals. Mr. Ashwin from GE, JFTC, Bangalore was coordinating the RFR calls.
- d. Clearance for "first-fire" (i.e. starting the unit with fuel injection and ignition) was accorded in the RFR after ascertaining that all necessary pre-requisites are met as per the received information from BHEL.
- e. As part of unit commissioning to FSNL, the unit experienced multiple starts due to various events and could achieve FSNL on the seventh attempt. A detail of the chronology is placed in ANNEXURE-1
- f. Only a handful of BHEL, GE and KPCL engineers (about six) were in the field when unit reached FSNL and were monitoring the unit from safe distance. Rest of the persons were in the control room.
- g. At field, it came to the notice of persons that Unit tripped and CO2 fire suppression system had activated from the noise made by venting of fuel gas and the blaring of CO2 system hooters.
- h. Mr. Harikishnan was on the north side of the unit and was at a safe distance due to CO2 release happening into the compartments. Suddenly a bright light was noticed which made the personnel on the north side to jump the window and move out of the GT hall. Visible Fire had then broken out in the exhaust and turbine compartments.
- i. It appears that it was during this time between the unit trip and the appearance of the bright light on the north side that a group of personnel had come from control room and gathered on the south side of the enclosure. These personnel had then experience burn injuries. Mr. Harikrishnan didn't witness the events on the south side as he was on the north side and there is no clear view between the two sides.
- j. Immediately on realizing the tragedy that had taken place on the south side, actions were taken to shift the injured personnel to hospitals. Fire tenders were called for fighting the fire inside the GT compartments. It took about 2 hrs. to douse the fire.

*Handwritten signature in blue ink*

2. Name: Aman Saini (Dy. Manager /6138098)  
 Department: Mechanical Commissioning (BHEL)  
 I was there to take care of Generator and seal oil system. GT tripped and CO2 was released. I was near to H2 dryer system. Suddenly I heard a sound of blast and I ran toward the main road. I went back to Gas room to vent out the H2 for safety.
  
3. Name: Kasaiah (Dy. Manager/6101488)  
 Department: Electrical (BHEL)  
 Location: Static Excitation room.  
 I was at static excitation room during FSNL, I heard venting sound and came out of the excitation room and moved towards the GT North side and was standing. In few minutes' time I heard sound with fire from GT and immediately jumped along the end wall
  
4. Name: Binu Krishnan PK (Dy.Engineer/2768356)  
 Department: Mechanical Commissioning (BHEL)  
 During GT FSNL, I was assigned to monitor HRSG. I was on top of HRSG, steam was coming out of HP drum vent & HP MS vent & that time pressure was 5 Kg/cm2. Informed control room to close HP drum vents & MS vents. After closing heavy sound came, understood from control room that GT tripped on fire protection. I came down to HRSG North, after few minutes' heavy sound came with lot of smoke.
  
5. Name: Nipul Das (Sr. Manager / 2208954)  
 Department: Mechanical Commissioning (BHEL)  
 After the final walk down there was no communication from GE about removal of the mesh. The mesh was removed in September 2020.
  
6. Name: Nitish Kumar Behera (Junior Executive / 6210643)  
 Department: Mechanical Erection (BHEL)  
 During GT FSNL, I was assigned to monitor GT field. I was on the north side of the GT when the unit tripped on fire protection. We saw CO2 being released. I prevented personnel on the north side from going near the enclosure as CO2 release was happening. I moved to the south side of the GT to check and prevent personnel from coming near the enclosure. On reaching the south side, I saw that the GE mechanical TFA had opened the door of the exhaust compartment and was viewing inside. He then left towards the turbine compartment leaving the door open. I closed the compartment door. The entire compartment was filled with white smoke because of which it could not be seen if oil was leaking on the floor. I stood slightly away from this door to prevent others from opening / entering. At this time, a group of personnel came down the stairs from the control room. These personnel reached near the door and opened it in spite of my repeated requests not to open the door. When the door opened, there was a deflagration and I was thrown aside by 3-4 meters. I have suffered 40% burns and an injury to my fingers. Was in hospital for more than a month and am recovering at home now. Physiotherapy is being done to regain movement to the fingers damaged during the accident.

*Tanjit my name*

KPCL Personnel

7. Name: B Srinivas (SE - Acting CE)

Department: Electrical (KPCL)

During GT FSNL I was in the control room. After the unit tripped we as a group went down near the GT enclosure. Normally when such events occur a gathering of people happens and things get discussed. We were also doing the same. My back was to the enclosure. Suddenly I felt searing heat at my back. Instinctively I put my hands behind my head to protect it. I was then thrown away. I don't remember events after that. I have burn injuries to my hand and back of head. I am recovering.

8. Name: Mahadeva Prasad (EE)

Department: Turbine & HRSG (KPCL)

During GT FSNL I was on the upper floors of the HRSG concentrating on the steam generation and the lineup of vents. Suddenly we heard the sound made by venting of Gas and understood that the GT had tripped. I climbed down the stairs. I saw lot of smoke coming out from the vent duct outlet for the exhaust compartment ventilation fans. On reaching the ground floor, I walked from the north side towards the generator with an intention of reaching the south side. As soon as turned around the generator and reached near the LCI compartment, I saw a ball of flame shoot out for an instant from near the compartment door. Fearing for further such events, I jumped out of the building and ran away. After some time I returned and picked the injured personnel including GE Mechanical TFA and took them to hospital in my personal car. We had to move around three to four hospitals before all personnel in my car could be admitted. It was a scary experience.

9. Name: Shekhar Rao (AEE)

**[The person who provided the images of gas turbine lube oil drain pipeline of Bearings No.1 & 2 as existing on 01.10.2020]**

Department: Turbine (KPCL)

The photograph provided by me is taken by me on my mobile phone. It was taken on 1<sup>st</sup> October 2020 at around 10:45 hrs. I have a habit of taking pictures whenever I visit site. This picture was also taken as part of this habit. I am a novice in Gas Turbines and did not realize the significance of this picture. Later when on site during the lube oil tests being conducted, I showed these pictures to the GE engineers on site. Now my management has directed me to share the actual picture to GE and I have complied.

*Shekhar Rao*

GE Personnel

10. Name: P Ashok Kumar (TFA)

Department: Mechanical (GE)

At the time of the GT trip, I was in field. The fire alarm sounded in the field. I looked into the exhaust compartment through the window and saw CO2 smoke coming into the compartment. Since CO2 release would take at least 30 min, I called the controls TFA Mr. Venkatesh Pala on phone to find what happened. He told that the tunnel temperature was high and CO2 had released. He enquired if the unit could be put on turning gear for which I replied in the affirmative. All this time I was facing the generator. When I turned towards the GT compartment saw two persons (one from BHEL and one from KPCL) had opened the turbine compartment door. They dipped their hand into the leaked substance on the floor and said "This is oil not water". I then turned my face towards the exhaust compartment, at this instant the fire ball hit me with searing heat. I then turned around and started running. A KPCL engineer who was also injured in the fire ball was also running. I just followed him. He jumped into a civil water tank, I too jumped into a tank just besides that. I dipped myself two to three times completely in the water to douse my burning face and hair. After some time BHEL commissioning engineer came and called me out for taking to hospital. I was taken to hospital in KPCL engineers personal vehicle. There were no beds in the first two hospitals we went. Was admitted into the third hospital and treatment was started. It took more than one hour to reach emergency in hospital. Initially because of dousing in water my skin looked OK. However, in this one hour blistering and bun indications started surfacing. Have been treated and am continuing treatment at home. GE doctors are regularly in touch. Am recuperating, but keep getting back pain from time to time.

I had observed the mesh in the drain line on the final walk down. I had intimated to the BHEL team participating in the walk down (Mr. Shankar Narayana, Mr. Nipul Das , Mr. Binu, Mr. Uma Maheshwar Rao, Mr. Ajit KK). They said they want to retain the mesh in place. While making e-mail listing the pending list after the walk down I have missed mentioning this point as there were lot of activities going on at site. I have also not escalated this our engineering. When quizzed by the committee on why this issue was nor escalated adequately, Mr. Jagdish Rao Sr. Service Director of GE answered on behalf of Mr. Ashok and mentioned that the consequences of this mesh in the drain line was not understood by him.

*P. Ashok Kumar*

From: Periathambi, Ashok Kumar (FieldCore) <AshokKumar.Periathambi@ge.com>  
To: Shankar Narayan (sn@bhel.in) <sn@bhel.in>, 'NIPUL DAS-PSSR' <nipul@bhel.in>  
Cc: J Umamaheswar Rao <jumrao@bhel.in>, ajitkk@bhel.in, Alaawar, Samer (GE Gas Power) <samer.alaawar@ge.com>, Pala, Venkatesh (FieldCore) <Venkatesh.Pala1@ge.com>, Bawra, Balraj (FieldCore) <Balraj.Bawra1@ge.com>  
Sent: Sat, 26 Sep 2020 12:43:13 +0530 (IST)  
Subject: Remainder: Balance activity before GT first fire.

Dear Sir,

As discussed earlier, before GT first fire the following activity completion required.

1. Gas valve module final strainer box up with original gasket.
2. GT compartment inside IGV accumulator charging completion.
3. Fuel gas header pipe line flexible hose coupling lock wash locking and tightening.
4. GT compartment door locking.
5. GT compartment inside cleaning.
6. RFR completion.
7. GT Co2 system inline.

Regards,  
P. Ashokkumar  
+91 7708361769

*Periathambi*

From: Wilson, Ashwin (GE Gas Power) <Ashwin.Wilson@ge.com>  
 To: Periathambi, Ashok Kumar (FieldCore) <AshokKumar.Periathambi@ge.com>, Pala, Venkatesh (FieldCore) <Venkatesh.Pala1@ge.com>, Dhayalan, Balaji (FieldCore) <Balaji.Dhayalan@ge.com>, Rao, Jagdish (GE Gas Power) <Jagdish.Rao@ge.com>, Rayaprolu, Srinivas (GE Gas Power) <Srinivas.Rayaprolu@ge.com>, Pothula, Suresh Babu (GE Gas Power) <suresh.babu.pothula@ge.com>, Rout, Susanta Kumar (GE Gas Power) <susantakumar.rout@ge.com>, Krovvidi, S r kali prasad (GE Gas Power) <Srkaliiprasad.Krovvidi@ge.com>, Chandrashekar, R (GE Gas Power) <rchandrashekar@ge.com>, Amanaganti, Sandeep (GE Gas Power) <sandeep.amanaganti@ge.com>, Desu, Swathi (GE Gas Power) <Swathi.Desu@ge.com>, Das, Jaydeep (GE Gas Power) <jaydeep.das@ge.com>, Mathan, Radhakrishnan (GE Gas Power) <Mathan.R@ge.com>, Kulkarni, Rahul (GE Gas Power) <Rahul.Kulkarni@ge.com>, Alaawar, Samer (GE Gas Power) <samer.alaawar@ge.com>, Ghizzawi, Farouk (GE Gas Power) <Farouk.Ghizzawi@ge.com>, bhisatya@bhel.in, madhusudan@bhel.in, Raman Anoop Kumar <anoop.kumar@bhel.in>, 'SUSHILA XESS-EDN' <sushila@bhel.in>, 'ajitkk@bhel.in', 'sn@bhel.in', 'jumrao@bhel.in', nipul@bhel.in, 'CHANDRASEKHAR E' <shekharec@bhel.in>, Bawra, Balraj (FieldCore) <Balraj.Bawra1@ge.com>, Shetty, Shanath (GE Gas Power) <Shanath.Shetty@ge.com>  
 Cc: Gupta, Nitinkumar (GE Gas Power) <Nitinkumar.Gupta@ge.com>, Thangaraj, S (GE Gas Power) <S.Thangaraj@ge.com>  
 Sent: Mon, 28 Sep 2020 16:26:07 +0530 (IST)  
 Subject: RE: KPCL SN 900107 - RFR Call

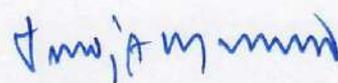
Participants:

BHEL: J Umamaheshwar Rao, Shankar Narayan, Ajith K K, Anoop Kumar, Madhusudan.  
 GE: Ashok Kumar, Balraj Bawra, Venkatesh Pala, Srinivas Rayaprolu, Shanath Shetty, Swathi Desu, Susanta Rout, Jaydeep Das, Samer Alaawar, Ashwin Wilson, Jagdish Rao, Kali Prasad.

Notes:

- Unit cranking performed on 26 September.
- Offline water-wash planned for 28 September.
- Unit first fire planned for 29 September.
- GT synchronisation planned for 30 September.
- Unit borescope inspection completed.
- OSM configuration completed.
- Fuel gas chromatography submitted; parameters are within specifications.
- 9x FGPA cards require replacement.
  - Site plans to proceed with existing cards.
  - Risk of alarms, or unit trip, or unit not being able to ramp-up with these cards.
  - Replacement cards are expected to be at site next week.
- Additional TILs (post February 2019) review completed; GE to share TIL list to BHEL.
- BHEL to provide excitation SAC list to GE TA.
  - Completed; SAC uploaded to RFR portal.
- Unit overspeed test planned after GT synchronisation.
  - Green rotor run in and overspeed test completed in BHEL factory.
  - Site team to ensure the control system functionality by means of overspeed simulation.
  - Refer guidelines in TIL 1345-R4 for overspeed test.
- GT will be operated in part load until HRSG and steam turbine commissioning.
- DLN tuning request submitted.
- BHEL to submit schedule for HRSG and ST commissioning to allow planning for TA availability and DLN tuning during GT full load.
- All SACs in portal are complete; to update RFR and release unit for first fire.

Regards,  
 Ashwin



-----Original Appointment-----

**From:** Wilson, Ashwin (GE Gas Power)

**Sent:** 28 September 2020 09:26

**To:** Periathambi, Ashok Kumar (FieldCore); Pala, Venkatesh (FieldCore); Dhayalan, Balaji (FieldCore); Rao, Jagdish (GE Gas Power); Rayaprolu, Srinivas (GE Gas Power); Pothula, Suresh Babu (GE Gas Power); Rout, Susanta Kumar (GE Gas Power); Krovvidi, Sriraj Prasad (GE Gas Power); Chandrashekar, R (GE Gas Power); Amanaganti, Sandeep (GE Gas Power); Desu, Swathi (GE Gas Power); Das, Jaydeep (GE Gas Power); Mathan, Radhakrishnan (GE Gas Power); Kulkarni, Rahul (GE Gas Power); Alaawar, Samer (GE Gas Power); Ghizzawi, Farouk (GE Gas Power); bhisatya@bhel.in; madhusudan@bhel.in; Raman Anoop Kumar; 'SUSHILA XESS-EDN'; 'ajitkk@bhel.in'; 'sn@bhel.in'; 'jumrao@bhel.in'; nipul@bhel.in; 'CHANDRASEKHAR E'; Bawra, Balraj (FieldCore); Shetty, Shanath (GE Gas Power)

**Cc:** Gupta, Nitinkumar (GE Gas Power); Thangaraj, S (GE Gas Power)

**Subject:** KPCL SN 900107 - RFR Call

**When:** 28 September 2020 11:00-12:00 (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi.

**Where:** Microsoft Teams Meeting

Team – requesting you time for the subject prior to the unit first fire and FSNL.

- Site status:
  - GT cranking on 26 September.
- Activities for 28 September:
  - GT false fire test.
  - GT offline water-wash.
  - GT first fire.
- FSNL on 29 September, GT synchronisation on 30 September.
- Fuel sample analysis complete and in specification.
- Unit borescope inspection completed.
- Open ER case review.
- OSM configuration completed.
- Final review of system audits checklists.
- Record any incomplete audits for follow-up after FF.
- Updated TIL list.
- If all necessary steps are completed, release the unit to FF.

Thanks,  
Ashwin

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## Join

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*Tanjit my number*

*1. This summary report has been provided on specific request of BHEL and nothing in this summary shall vary any contractual relationship in existing contracts between GE and BHEL.*

*2. Please note that this summary report is subject to confidentiality terms between GE and BHEL and is being issued for limited purposes of providing information of the overall RFR checks and does not amount to any opinion or views on the ongoing Root Cause Analysis being conducted in relation to the fire incident at KPCL site, Bengaluru.*

*Trust it is in order*

*Swijamund*

Reference	Title	Item	Section	Checks Completed	Inputs provided by BHEL	Date Completed	GETA Present Onsite
SAC-GT-001	Gas Turbine Foundations	1	Walk-down Pre-work Foundations	Y	Y	9/17/2020	Y
		2	Anchor Bolts, Nuts, and Washers	Y	Y	9/17/2020	Y
		3	Foundation Base Plates and Horizontal Restraints and Fixators	Y	Y	9/17/2020	Y
		4	Fixators and Baseplates	Y	Y	9/17/2020	Y
		5	Comments	Y	Y	9/17/2020	Y
SAC-GT-002	Gas Turbine	1	Alignment	Y	Y	9/17/2020	Y
		2	Coupling installation	Y	Y	9/17/2020	Y
		3	Enclosure	Y	Y	9/17/2020	Y
		4	Instrumentation	Y	Y	9/17/2020	Y
		5	Inlet Guide Vanes	Y	Y	9/17/2020	Y
		6	Variable Stator Vanes	N/A	-		
		7	Comments	Y	Y	9/17/2020	Y
SAC-GT-0701	System Audit Checklist - Combustion Arrangement	1	First stage Wheelspace Thermocouples	Y	Y	9/17/2020	Y
		2	DLN2+ PM1 & PM4 Orifice Plates	N/A	-		
		3	Hardware Installation Checks	Y	Y	9/24/2020	Y
SAC-GTACC-0416	System Audit Checklist - Oil Systems	1	Walk-down Pre-work	Y	Y	9/20/2020	Y
		2	Pre-flush Walk-down - MLI 0416 Lube Oil system	Y	Y	9/20/2020	Y
		3	Pre-flush Walk-down - MLI 0418 Trip Oil system	Y	Y	9/20/2020	Y
		4	Pre-flush Walk-down - MLI 0434 Hydraulic Oil system	Y	Y	9/20/2020	Y
		5	System Walk-down post flushing	Y	Y	7/30/2018	Y
		6	Functional testing	Y	Y	9/20/2020	Y
		7	Comments	N/A	-		
SAC-GTACC-0417	System Audit Checklist - Cooling and Sealing Air Systems	1	Walk-down Pre-work	Y	Y	9/20/2020	Y
		2	System Walk-down: Air Extraction	Y	Y	9/20/2020	Y
		3	System Walk-down: Cooling Fan Module	Y	Y	9/20/2020	Y
		4	Functional testing	Y	Y	9/20/2020	Y
		5	Comments	-	-		
SAC-GTACC-0420	System Audit Checklist - Cooling Water Systems	1	Walk-down Pre-work	Y	Y	9/25/2020	Y
		2	System Walk-down	Y	Y	9/25/2020	Y
		3	Cooling water to Generator Final Assembly	Y	Y	9/25/2020	Y
		4	Cooling water to Gas Turbine Flame and lube oil coolers	Y	Y	9/25/2020	Y
		5	Cooling water to Atomizing Air system [Dual Fuel units only]	N/A	-		
		6	Cooling Water to Fuel Gas Purge Air Cooler (9FB.01)	Y	Y	9/25/2020	Y
		7	Cooling Water Module (A076)	Y	Y	9/25/2020	Y
		8	Functional testing	Y	Y	9/25/2020	Y
		9	Comments	-	-		
SAC-GTACC-0422	System Audit Checklist - Fuel Gas Systems	1	Walk-down Pre-work	Y	Y	9/25/2020	Y
		2	Fuel Gas System Walk-down	Y	Y	9/25/2020	Y
		3	Gas Supply	Y	Y	9/25/2020	Y
		4	Gas Conditioning	Y	Y	9/25/2020	Y
		5	Fuel Gas Heating	Y	Y	9/25/2020	Y
		6	Fuel Gas Filtration	Y	Y	9/25/2020	Y
		7	Fuel Gas Metering	Y	Y	9/25/2020	Y
		8	Fuel Gas Module	Y	Y	9/25/2020	Y

*Tanjit Manna*

Reference	Title	Item	Section	Checks Completed	Inputs provided by BHEL	Date Completed	GE TA Present Onsite
SAC-GTACC-0426	System Audit Checklist - Fire Protection Systems	9	Fuel Gas Piping	Y	Y	9/25/2020	Y
		10	Fuel Gas Purge System Walk down	Y	Y	9/25/2020	Y
		11	Functional testing	Y	Y	9/25/2020	Y
		12	Strainer runs	N	-		
		13	Comments	-			
		1	Walk-down Pre-work	Y	Y	9/25/2020	Y
		2	System Walk-down prior to Pressure Testing	Y	Y	9/25/2020	Y
		3	Tank Filling	N/A			
		4	Tank & Cylinders	Y	Y	9/25/2020	Y
		5	System Walk-down post Pressure test	Y	Y	9/25/2020	Y
		6	System Walk-down post Pressure test	Y	Y	9/25/2020	Y
		7	Functional testing	Y	Y	9/25/2020	Y
		8	Comments	-			
SAC-GTACC-0432	System Audit Checklist - Inlet Air Heating Systems	1	Walk-down Pre-work	Y	Y	9/25/2020	Y
		2	System Walk-down	Y	Y	9/25/2020	Y
		3	Interconnecting Piping	Y	Y	9/25/2020	Y
		4	Inlet Heating Control Valve(s) (MLI A037)	Y	Y	9/25/2020	Y
		5	Functional testing	Y	Y	9/25/2020	Y
		6	Comments	-			
SAC-GTACC-0436	System Audit Checklist - Heating and Ventilation Systems	1	Walk-down Pre-work	Y	Y	9/25/2020	Y
		2	System Walk-down MLI 0436	Y	Y	9/25/2020	Y
		3	Functional testing	Y	Y	9/25/2020	Y
		4	Comments	-			
SAC-GTACC-0471	System Audit Checklist - Inlet and Exhaust Systems, Performance Monitor	1	Inlet Plenum	Y	Y	9/25/2020	Y
		2	Exhaust System	Y	Y	9/25/2020	Y
		3	Inlet System	Y	Y	9/25/2020	Y
		4	Walk-Down Pre-work	Y	Y	9/25/2020	Y
		5	System Walk-Down - 0471	Y	Y	9/25/2020	Y
		6	System Walk-down - 0492	Y	Y	9/25/2020	Y
		7	Anti-Icing / Heating or Chilling Heat Exchanger / Coil	N/A			
		8	Functional testing	Y	Y	9/25/2020	Y
		9	Comments	-			
SAC-GTACC-0461	System Audit Checklist - Waterwash	1	Walk-down Pre-work	Y	Y	9/25/2020	Y
		2	Water Wash Piping system walk-down	Y	Y	9/25/2020	Y
		3	False Start Drain Lines walk-down	Y	Y	9/25/2020	Y
		4	Water wash Skid walk-down	Y	Y	9/25/2020	Y
		5	Functional testing	Y	Y	9/25/2020	Y
SAC-CTRL-HAZG	System Audit Checklist - Hazardous Gas Detection	1	Walk-down Pre-work	Y	Y	9/9/2020	Y
		2	Hazard Gas Detection	Y	Y	9/9/2020	Y
		3	Functional testing	Y	Y	9/9/2020	Y
		4	Comments	Y	Y	9/9/2020	Y
		1	Control Panel / Field Devices	Y	Y	9/25/2020	Y
		2	Controller Software	Y	Y	9/24/2020	Y
		3	Human Machine Interface	Y	Y	9/23/2020	Y

Reference	Title	Item	Section	Checks Completed	Inputs provided by BHEL	Date Completed	GE TA Present Onsite
SAC-CTRL-TCP	System Audit Checklist - Turbine Controller	4	Combustion Dynamic Monitoring (CDM)	Y	Y	9/23/2020	Y
		5	Blade Health Monitor (BHM)	N/A			
		6	Network	Y	Y	9/23/2020	Y
		7	Housekeeping	Y		9/9/2020	Y
		8	Commissioning - MBC	Y		9/23/2020	Y
		9	Commissioning	Y		9/23/2020	Y
		10	Comments	-			
		1	Initial Software Checks	Y		9/19/2020	Y
		2	Applicability of PSB, TIL & ETC	Y		9/19/2020	Y
		3	Pre-power Checks	Y		9/21/2020	Y
SAC-CTRL-LCI	System Audit Checklist - Load Commutated Inverter Controller	4	Power-On Checks	Y	Y	9/23/2020	Y
		5	Running Checks	Y		9/23/2020	Y
		6	Housekeeping	Y	Y	9/23/2020	Y
		7	Comments	-		9/19/2020	Y

*Final M and*

#	TA	Skill	Mobilization Date	Demobilization Date	# of Days
1	Sinoj Nair	GT Mechanical TA	13-Mar-17	17-Mar-17	4
2	Jafar Ali	GT Mechanical TA	28-Mar-17	2-Apr-17	5
3	Ashokkumar Periaithambi	GT Mechanical TA	19-Jun-17	30-Jun-17	11
4	Ashokkumar Periaithambi	GT Mechanical TA	11-Jul-17	22-Jul-17	11
5	Ashokkumar Periaithambi	GT Mechanical TA	9-Oct-17	18-Oct-17	9
6	Ashokkumar Periaithambi	GT Mechanical TA	17-Jan-18	2-Sep-18	228
7	Ashokkumar Periaithambi	GT Mechanical TA	30-Oct-18	23-Nov-18	24
8	Ashokkumar Periaithambi	GT Mechanical TA	10-Jan-19	22-Jan-19	12
9	Ashokkumar Periaithambi	GT Mechanical TA	15-Oct-19	25-Oct-19	10
10	Syed Akhiluddin	Borescope TA	18-Oct-19	19-Oct-19	1
11	Avinash Gajjar	GT Controls TA	20-Oct-19	25-Oct-19	5
12	Venkatesh Pala	GT Controls TA	7-Sep-20	2-Oct-20	25
13	Ashokkumar Periaithambi	GT Mechanical TA	16-Sep-20	2-Oct-20	16
14	Balraj Bawra	LCI/Electrical TA	18-Sep-20	2-Oct-20	14
15	Syed Akhiluddin	Borescope TA	21-Sep-20	22-Sep-20	1

*Final report*

## Annexure 5



General Electric International Inc.

Date: 4 November 2020

**Mr. ER Harikrishnan**  
 General Manager - Karnataka Projects  
 BHEL PSSR  
 KPCL Yelahanka Site

Dear Sir,

Please find below the comments on the Borescope inspection report of 9F.05 KPCL Yelahanka Unit (SN# 900107) for the Compressor section, Combustion & Turbine sections conducted during 21<sup>st</sup> to 23<sup>rd</sup> October 2020

**Compressor section:**

1. Inlet Guide Vanes appear to be in good condition.
2. One rotating blade, stage-0 (R0) is seen with a minor edge damage. The damage looks smooth. Site is advised to perform a red dye inspection to ensure there is no indication at the damage before startup.
3. Compressor blades and vanes from stage-1 thru stage-14 appear to be in good condition.
4. Two rotating blades of stage-15 (R15) are seen with impact damage on edge. Minor impact damages are also seen on one rotating blade of stage-16 (R16) and three rotating blades of stage-17(R17). These appears to be minor damage and can be addressed in next opportunity when component is exposed. Site is advised to inspect inlet per PSIB 20130813 A for any breach or leaks to avoid such impact damage.
5. Minor Surface oxidation is seen on the rotor surface and on casings. Adhere to GEK 28156 for preservation if unit is not being operated for long durations.

**Combustion section:**

Overall combustion section appears to be in good condition.

**Turbine section:**

1. Stage-1 Nozzles /stage-1 Shrouds /stage-1 buckets appear to be in good condition
2. Stage-2 Nozzles /stage-2 Shrouds /stage-2 Buckets appear to be in good condition. Soot like deposit observed on stage-2 nozzles and buckets.
3. Oil/deposits observed on Stage-3 Nozzles /stage-3 Shrouds and stage-3 buckets. Black soot like deposits are also seen on stage-3 nozzles and stage-3 buckets

Please note that this report is subject to confidentiality terms between GE and BHEL and is being issued for limited purposes of sharing the BI observations and does not amount to any opinion, findings or views on the ongoing Root Cause Analysis being conducted in relation to the fire incident at KPCL site, Bengaluru.

**Issued by: GE Gas Power Inspection & Life Extension Services Team**

General Electric International Inc.

*Handwritten signature in blue ink*

## ANNEXURE-6

**1<sup>st</sup> RCA committee meeting on Fire accident on 9F.05 Gas Turbine at KPCL Yelahanka site on  
12.10.2020 & 13.10.2020**

**Members Present**

<b>Chairman RCA Committee</b> Mr. P D Siwal, Former Member (Thermal), CEA	<a href="mailto:pdsiwal@yahoo.com">pdsiwal@yahoo.com</a>
<b>BHEL</b> Mr. Surojit Mandal, BHEL PSSR Mr. Y M Babu, BHEL PSTS Mr. E R Harikrishnan, BHEL KPCL Site (Coopted to the committee) Mr. J U M Rao, BHEL KPCL Site (Coopted to the committee) Mr. P Manoj Kumar, BHEL Corp Quality (Couldn't attend due to health reasons) Mr. Madhusudan, BHEL HPEP Mr. Tapas Kumar Ray, BHEL PSER Mr. Kamaldeep Gupta, BHEL HPEP (Coopted to the committee) Mr. Abhiram Thatavarthy, BHEL HPEP (Coopted to the committee) Mr. Anoop Kumar R, BHEL EDN (Coopted to the committee)	<a href="mailto:surojit@bhel.in">surojit@bhel.in</a> <a href="mailto:yimbabu@bhel.in">yimbabu@bhel.in</a> <a href="mailto:erh@bhel.in">erh@bhel.in</a> <a href="mailto:jumrao@bhel.in">jumrao@bhel.in</a> <a href="mailto:pmanoj@bhel.in">pmanoj@bhel.in</a> <a href="mailto:madhusudan@bhel.in">madhusudan@bhel.in</a> <a href="mailto:tkray@bhel.in">tkray@bhel.in</a> <a href="mailto:kamaldeep@bhel.in">kamaldeep@bhel.in</a> <a href="mailto:abhiram@bhel.in">abhiram@bhel.in</a> <a href="mailto:anoop.kumar@bhel.in">anoop.kumar@bhel.in</a>
<b>KPCL</b> Mr. Satyanarayana, TA to MD KPCL	<a href="mailto:pctpkpcl@gmail.com">pctpkpcl@gmail.com</a>
<b>GE Gas Power</b> Mr. Jagdish Rao, Senior Service Director, Mr. Mathan Radhakrishnan, Engineering Manager, Fleet management Mr. Sudhakar Todeti, Principle Engineer, Systems Engineering	<a href="mailto:jagdish.rao@ge.com">jagdish.rao@ge.com</a> <a href="mailto:mathan.r@ge.com">mathan.r@ge.com</a> <a href="mailto:sudhakar.todeti@ge.com">sudhakar.todeti@ge.com</a>

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**2<sup>nd</sup> RCA committee meeting on Fire accident on 9F.05 Gas Turbine through VC on 20.10.2020**

**Members Present**

<b>Chairman RCA Committee</b> Mr. P D Siwal, Former Member (Thermal), CEA	<a href="mailto:pdsiwal@yahoo.com">pdsiwal@yahoo.com</a>
<b>BHEL</b> Mr. Surojit Mandal, BHEL PSSR Mr. Y M Babu, BHEL PSTS Mr. P Manoj Kumar, BHEL Corp Quality Mr. Madhusudan, BHEL HPEP Mr. Tapas Kumar Ray, BHEL PSER Mr. Kamaldeep Gupta, BHEL HPEP (Coopted to the committee) Mr. Abhiram Thatavarthy, BHEL HPEP (Coopted to the committee)	<a href="mailto:surojit@bhel.in">surojit@bhel.in</a> <a href="mailto:yimbabu@bhel.in">yimbabu@bhel.in</a> <a href="mailto:pmanoj@bhel.in">pmanoj@bhel.in</a> <a href="mailto:madhusudan@bhel.in">madhusudan@bhel.in</a> <a href="mailto:tkray@bhel.in">tkray@bhel.in</a> <a href="mailto:kamaldeep@bhel.in">kamaldeep@bhel.in</a> <a href="mailto:abhiram@bhel.in">abhiram@bhel.in</a>
<b>KPCL</b> Mr. Satyanarayana, TA to MD KPCL	<a href="mailto:pctpkpcl@gmail.com">pctpkpcl@gmail.com</a>
<b>GE Gas Power</b> Mr. Jagdish Rao, Senior Service Director, Mr. Mathan Radhakrishnan, Engineering Manager, Fleet management Mr. Sudhakar Todeti, Principle Engineer, Systems Engineering	<a href="mailto:jagdish.rao@ge.com">jagdish.rao@ge.com</a> <a href="mailto:mathan.r@ge.com">mathan.r@ge.com</a> <a href="mailto:sudhakar.todeti@ge.com">sudhakar.todeti@ge.com</a>

*Surojit Mandal*

**3<sup>rd</sup> RCA committee meeting on Fire accident on 9F.05 Gas Turbine at KPCL Yelahanka site on  
06.11.2020**

**Members Present**

<b>Chairman RCA Committee</b> Mr. P D Siwal, Former Member (Thermal), CEA	<a href="mailto:pdsiwal@yahoo.com">pdsiwal@yahoo.com</a>
<b>BHEL</b> Mr. Surojit Mandal, BHEL PSSR Mr. Y M Babu, BHEL PSTS Mr. P Manoj Kumar, BHEL Corp Quality Mr. Madhusudan, BHEL HPEP Mr. Tapas Kumar Ray, BHEL PSER (Could not attend due to engagement at Namrup) Mr. Kamaldeep Gupta, BHEL HPEP (Coopted to the committee)	<a href="mailto:surojit@bhel.in">surojit@bhel.in</a> <a href="mailto:yimbabu@bhel.in">yimbabu@bhel.in</a> <a href="mailto:pmanoj@bhel.in">pmanoj@bhel.in</a> <a href="mailto:madhusudan@bhel.in">madhusudan@bhel.in</a> <a href="mailto:tkray@bhel.in">tkray@bhel.in</a> <a href="mailto:kamaldeep@bhel.in">kamaldeep@bhel.in</a>
<b>KPCL</b> Mr. Satyanarayana, TA to MD KPCL Mr. Narendra Prasad, ED BTPS, KPCL	<a href="mailto:pctpkpcl@gmail.com">pctpkpcl@gmail.com</a>
<b>GE Gas Power</b> Mr. Jagdish Rao, Senior Service Director, Mr. Mathan Radhakrishnan, Engineering Manager, Fleet management Mr. Sudhakar Todeti, Principle Engineer, Systems Engineering	<a href="mailto:jagdish.rao@ge.com">jagdish.rao@ge.com</a> <a href="mailto:mathan.r@ge.com">mathan.r@ge.com</a> <a href="mailto:sudhakar.todeti@ge.com">sudhakar.todeti@ge.com</a>

=====

**4<sup>th</sup> RCA committee meeting on Fire accident on 9F.05 Gas Turbine through VC on 24.11.2020**

**Members Present**

<b>Chairman RCA Committee</b> Mr. P D Siwal, Former Member (Thermal), CEA	<a href="mailto:pdsiwal@yahoo.com">pdsiwal@yahoo.com</a>
<b>BHEL</b> Mr. Surojit Mandal, BHEL PSSR Mr. Y M Babu, BHEL PSTS Mr. P Manoj Kumar, BHEL Corp Quality Mr. Madhusudan, BHEL HPEP Mr. Tapas Kumar Ray, BHEL PSER Mr. Kamaldeep Gupta, BHEL HPEP (Coopted to the committee) Mr. Abhiram Thatavarthy, BHEL HPEP (Coopted to the committee)	<a href="mailto:surojit@bhel.in">surojit@bhel.in</a> <a href="mailto:yimbabu@bhel.in">yimbabu@bhel.in</a> <a href="mailto:pmanoj@bhel.in">pmanoj@bhel.in</a> <a href="mailto:madhusudan@bhel.in">madhusudan@bhel.in</a> <a href="mailto:tkray@bhel.in">tkray@bhel.in</a> <a href="mailto:kamaldeep@bhel.in">kamaldeep@bhel.in</a> <a href="mailto:abhiram@bhel.in">abhiram@bhel.in</a>
<b>KPCL</b> Mr. Shekhar Rao, KPCL	
<b>GE Gas Power</b> Mr. Jagdish Rao, Senior Service Director, Mr. Mathan Radhakrishnan, Engineering Manager, Fleet management Mr. Sudhakar Todeti, Principle Engineer, Systems Engineering	<a href="mailto:jagdish.rao@ge.com">jagdish.rao@ge.com</a> <a href="mailto:mathan.r@ge.com">mathan.r@ge.com</a> <a href="mailto:sudhakar.todeti@ge.com">sudhakar.todeti@ge.com</a>

*Surojit Mandal*

**5<sup>th</sup> RCA committee meeting on Fire accident on 9F.05 Gas Turbine through VC on 26.11.2020**

**Members Present**

<b>Chairman RCA Committee</b> Mr. P D Siwal, Former Member (Thermal), CEA	<a href="mailto:pdsiwal@yahoo.com">pdsiwal@yahoo.com</a>
<b>BHEL</b> Mr. Surojit Mandal, BHEL PSSR Mr. Y M Babu, BHEL PSTS Mr. P Manoj Kumar, BHEL Corp Quality Mr. Madhusudan, BHEL HPEP Mr. Tapas Kumar Ray, BHEL PSER Mr. Kamaldeep Gupta, BHEL HPEP (Coopted to the committee) Mr. Abhiram Thatavarthy, BHEL HPEP (Coopted to the committee)	<a href="mailto:surojit@bhel.in">surojit@bhel.in</a> <a href="mailto:yimbabu@bhel.in">yimbabu@bhel.in</a> <a href="mailto:pmanoj@bhel.in">pmanoj@bhel.in</a> <a href="mailto:madhusudan@bhel.in">madhusudan@bhel.in</a> <a href="mailto:tkray@bhel.in">tkray@bhel.in</a> <a href="mailto:kamaldeep@bhel.in">kamaldeep@bhel.in</a> <a href="mailto:abhiram@bhel.in">abhiram@bhel.in</a>
<b>KPCL</b> Mr. Satyanarayana, TA to MD KPCL	<a href="mailto:pctpkpcl@gmail.com">pctpkpcl@gmail.com</a>
<b>GE Gas Power</b> Mr. Jagdish Rao, Senior Service Director, Mr. Mathan Radhakrishnan, Engineering Manager, Fleet management Mr. Sudhakar Todeti, Principle Engineer, Systems Engineering Mr. P Ashok Kumar, GE Mech TFA	<a href="mailto:jagdish.rao@ge.com">jagdish.rao@ge.com</a> <a href="mailto:mathan.r@ge.com">mathan.r@ge.com</a> <a href="mailto:sudhakar.todeti@ge.com">sudhakar.todeti@ge.com</a>

====

**6<sup>th</sup> RCA committee meeting on Fire accident on 9F.05 Gas Turbine at BHEL PSTS Noida on 28.12.2020**

**Members Present**

<b>Chairman RCA Committee</b> Mr. P D Siwal, Former Member (Thermal), CEA	<a href="mailto:pdsiwal@yahoo.com">pdsiwal@yahoo.com</a>
<b>BHEL</b> Mr. Surojit Mandal, BHEL PSSR Mr. Y M Babu, BHEL PSTS Mr. P Manoj Kumar, BHEL Corp Quality Mr. Madhusudan, BHEL HPEP Mr. Tapas Kumar Ray, BHEL PSER	<a href="mailto:surojit@bhel.in">surojit@bhel.in</a> <a href="mailto:yimbabu@bhel.in">yimbabu@bhel.in</a> <a href="mailto:pmanoj@bhel.in">pmanoj@bhel.in</a> <a href="mailto:madhusudan@bhel.in">madhusudan@bhel.in</a> <a href="mailto:tkray@bhel.in">tkray@bhel.in</a>
<b>KPCL</b> Mr. Satyanarayana, TA to MD KPCL (Joined through VC)	<a href="mailto:pctpkpcl@gmail.com">pctpkpcl@gmail.com</a>
<b>GE Gas Power</b> Mr. Jagdish Rao, Senior Service Director (Joined for 1 hr, registered that GE will provide comments by 4 <sup>th</sup> Jan 2021, which can be added as addendum)	<a href="mailto:jagdish.rao@ge.com">jagdish.rao@ge.com</a>

*Surojit Mandal*

### **Remedial measures to prevent the recurrence of such fire accident based on the recommendations of RCA report and findings**

1. Implementation of standard protocol and pre-checks prior to restart of pre-commissioning and commissioning of Gas Turbine and its accessories as per Original Equipment Manufacturer (OEM) recommendations.
2. Implementation of Standard Operation Procedure (SOP) for all types of operations pertaining to Gas Turbine as per GE and BHEL recommendations.
3. The awareness has been created among all the working staff about “On site Emergency Plan of the plant and safe evacuation measures in case of fire ”by giving safety training.
4. Safety Training has been given to all employees to mitigate the situation in case of emergency by conducting onsite emergency mock drill.
5. Implementation of Standard Maintenance Procedure (SMP) as per the recommendation of Original Equipment Manufacturer (OEM).
6. Relevant Safety precaution boards mainly pertaining to fire occurrence inside Gas Turbine enclosure will be displayed.
7. Trained operating staff will be deployed for regular operation of the plant.
8. The vital safety tools such as Safe Assembly Point and Emergency Exit Path depicting in pictorial view of plant has been displayed at conspicuous places at plant to create awareness on safe evacuation measures in case of fire.
9. Access control at specified places like Gas Turbine, Gas Booster Compressor, Gas Conditioning Skid, Turbine Generator hall, control room.
10. Restriction in usage of mobiles at the above specified area.
11. Workers are trained in handling firefighting equipment.

**Gas turbine and its accessories have been provided with following safety features and in built fire protections systems.**

1. The Gas Pipe Lines have been earthed to respective earth circuit of buildings at the entrance and exit .The inter plant Gas Pipe line from GBC to Gas Turbine has been earthed to the respective supportive structures.
2. All electrical motors and lightings are flame proof
3. The safe auto /manual tripping of Gas Turbine /unit will be envisaged in the control system during emergencies.
4. Heat detectors mounted in all the compartments of Gas turbine.
5. Automatic Audio Visual Fire Alarm Notification System in the field as well as in the control room have been provided in case of fire within the Gas Turbine compartment to caution the staff to evacuate to the safety assembly point.
6. Full-fledged Carbon dioxide flooding system provided at all the compartment of Gas turbines as fire protection system in the event of fire.
7. Gas leakage detectors have been provided in case of detection of gas leakage within the Gas Turbine compartment.
8. Fire hydrants system has been provided in and around the area.
9. Workers are provided with applicable Personnel protective Equipment (PPE's)
10. Fire hydrants system has been provided in and around the area
11. CO2, DCP and Foam Fire Extinguisher has been provided near GT area.
12. Relevant Safety precaution boards have been displayed.

**M/s KPC Gas Power Corporation Ltd,  
S.N.Halli Post, Doddaballapura Road.  
Yelahanka, Bangalore-64.**

License No-MYB-9086

Date of Inspection- 02.10.2020 ; 03.10.2020 ;05.10.2020; 09.10.2020

**DETAILED ACCIDENT INVESTIGATION REPORT**

**About the factory**

M/s KPC Gas Power Corporation Ltd, located at Doddaballapura road, Yelahanka, is a registered factory under the purview of the Factories Act 1948 and the Rules made there under, bearing License no MYB-9086. Manufacturing of electricity is being carried out at the premise with the aid of power ordinarily employing around 200 workers. Sri Krishnamurthy S is the Occupier and Sri Shankarappa K is the Manager of the Factory.

**About the Accidents**

Sri. Pulikesh. C Executive Engineer Environment and Safety called the undersigned over phone at around 5.15 am on 02.10.2020 and informed that there had been a fire accident in the factory at around 3.20 am where in around 15 personnel had sustained burn injuries.

**Visits, Inquiry and Investigation**

In pursuant to this information the undersigned visited the Factory on 02.10.2020 to enquire into the matter and interalia conduct inquiry and investigation into the said serious accident in subject. A report was issued on the same day covering the details of inquiries conducted and a copy of the same was delivered to the management personnel against their acknowledgement. Consequent to the accident, the undersigned visited the factory again on 03.10.2020, 05.10.2020 and 09.11.2020 and had discussions with concerned personnel about the fire accident. Deliberations were also held in the office of the undersigned with the

EC(m)/EECSafety

concerned personnel. Combined statement of BHEL personnel to the undersigned was recorded on 09-10-2020.

#### **Methodologies followed in the Inquiry and Investigation**

1. Visit to the accident spot.
2. Inquiries with the concerned personnel.
3. Interrogation and recording of the written statement of the concerned personnel.
4. Collecting documents connected to the accident.
5. Photographs of the accident spot.
6. Post Mortem report of three personnel who died in the said fire incident.

This detailed investigation report is drawn in continuation to the spot inspection remarks dated 02.10.2020 made during the course of investigation and inquiry into the accidents that occurred in the factory premises on 02.10.2020 at around 03.20am.

#### **Relied Documents**

1. Spot Inspection remarks dated 02.10.2020.
2. Accident report in form-17.
3. Combined Statements of concerned personnel
4. Post Mortem report of three personnel who died in the said fire incident.
5. Photographs of the accident spot.
6. Drawings of the gas turbine plant.

#### **Details about the accident**

From my visit to the accident spot, enquiries made, statements and documents obtained the following facts are revealed.

The gas turbine commissioning activity has started at around 2.00 pm on 01.10.2020. From there on the speed of the turbine has been increased steadily with a number of checks and tests being carried on

simultaneously for ensuring the fitness of the gas turbine. At around 2.30am on 02.10.2020 the gas turbine has attained a speed of 3000 rpm. At this rpm which is the full speed, the full speed no load operations of the gas turbine has commenced and the turbine was required to be at full speed for the next 6 to 7 hours. At around 3.20 am the gas turbine has tripped on CO<sub>2</sub> fire alarm protection being actuated at bearing no.2 tunnel. The CO<sub>2</sub> jet has been activated due to sensing of fire. The alarm display at control room indicated activation of CO<sub>2</sub> jet at bearing no.2 tunnel within the turbine.

Personnel from KPC, BHEL and GE spread out around the gas turbine plant area have rushed to the exhaust compartment area to ascertain the same.

The exhaust compartment enclosing the turbine exhaust has doors on the northern and southern side of the compartment. The turbine axis is east to west and the exhaust is towards west. The door towards west on the southern side of the compartment has suddenly given way. Fire ball of high intensity has gushed out of this door. Of all the personnel spread out around the gas turbine, 15 of them were around this door that has given way. These personnel have been exposed to the fire ball gushing out of the said door and interlia have sustained burn injuries in the process. The personnel injured were as follows.

1. Sri. Krishna Bhat EE KPC
2. Sri. Mariswamy AEE KPC
3. Sri. Ashwathnarayana AEE KPC
4. Sri. Ravi K P EE KPC
5. Sri. D P Srinivas Murthy AEE KPC
6. Sri. Srinivasan B SE KPC
7. Sri. H N Srinivas AEE KPC
8. Sri. Manjappa AEE KPC
9. Sri. Narasimhamurthy EE KPC
10. Sri. Harish EE KPC

11. Sri. Raghuram JE KPC
12. Sri.Nitish Kumar JE BHEL
13. Sri.Manoj Safety Officer BHEL
14. Sri.Ashok --GE
15. Sri.Balaraj Singh Bawra GE

All the injured have been rushed to various hospitals in the city for treatment. **Sri. Balaraj Singh Bawra has succumbed to burn injuries on 5th Oct.2020 at around 4.00am while Sri Krishna Bhat and Sri Manjappa died on 12.10.2020.**

### Cause

The detailed inquiry and investigation into the accident clearly confirms the following:

1. Lube oil has leaked in bearing no.2 tunnel.
2. The lube oil has gained temperature due to exchange of heat from the fuel gases.
3. This hot lube oil has discharged into the exhaust compartment through the open cut out duct on one side of the diffuser tunnel.
4. On entry into the exhaust compartment, it has caught fire due to the presence of air.
5. Sufficient quantity of hot lube oil ingress into the exhaust compartment has created a fire ball as the said compartment does not have CO<sub>2</sub> flooding system.
6. The gravity dampers have failed to open to relieve pressure built up in the exhaust compartment.
7. The exhaust compartment being under pressure due to the lube oil fire has given way at the door towards west on the southern side of the compartment.
8. The fire ball has gushed out of this door and caused burn injuries to all those who have come in line with it.

### Causes and Contravention leading to the accident

The prudent examination of the facts leading to the accident in subject in the premise of the factory reveals the following deficiencies that finally resulted in fatality.

1. The gravity operated dampers have failed to open to relieve pressure in the exhaust compartment on account of the lube oil fire ball.
2. Absence of rupture disc to relieve pressure in the exhaust compartment on account of the lube oil fire ball.
3. The door towards west on the southern side of the compartment has given way before the gravity operated dampers could open to relieve pressure in the exhaust compartment on account of the lube oil fire ball.
4. Knowing fully well that the CO<sub>2</sub> system has been actuated as a result of fire inside the exhaust compartment personnel around the gas turbine plant should have moved out to safety rather than approaching the exhaust compartment for checking. Checking could have been done at a later stage. This is a totally unsound engineering practice. This clearly manifests poor appreciation of hazards before execution of job.

The unsafe conditions and acts noted supra conjointly have resulted in this gruesome fatal accident at the factory on 02.10.2020. ***Therefore on careful analysis of the above facts it is apparent that in the instant case there exist positive omissions on the part of the Occupier and Manager in ensuring chokes, baffles, vents or rupture disc in such a manner as to relieve pressure in the exhaust compartment as envisaged under Section 37(2) of the Factories Act 1948. And further in ensuring proper method of work so as to***

**ensure the safety of one and all as envisaged under Rule 84 of the Karnataka Factories Rules 1969.**

In view of the above, the Occupier and Manager are hereby required to offer their remarks as to why the said omissions on their part shall not be viewed appropriately. Their explanation should reach the office of the undersigned in writing within seven days from the date of receipt of this note of inspection.

*NN Mohan*  
 (Navaneeth Mohan N) 10/12/2020

Deputy Director of Factories  
 Bengaluru Division-5, Bengaluru.

**Government of Karnataka  
 Department of Factories, Boilers, Industrial  
 Safety and Health**

No. DDFBNG-5/ INS/SR-95/2020-21  
 102.

Office of the Deputy Director of  
 Factories  
 Bengaluru Division-5, Bengaluru  
 IInd Floor Karmik Bhavan,  
 Bannerughatta Road, Bengaluru  
 560029

Date:- 10.12.2020

To,

✓ Sri Krishnamurthy S  
 Occupier

M/s KPC Gas Power Corporation Ltd,  
 S.N.Halli Post, Doddaballapura Road.  
 Yelahanka, Bangalore-64.

Sri Shankarappa K  
 Factory manager  
 M/s KPC Gas Power Corporation Ltd,  
 S.N.Halli Post, Doddaballapura Road.  
 Yelahanka, Bangalore-64.

SECMDY  
 for needful

EE(E, P&S)

for prepare reply  
 15/12

15/12

Office of the CE (P&S), YCCPP KPC GFCL, Yelahanka, Bangalore-64.		
Inward No.: 949		
Date: 15/12/2020		
OM	SE/EE	JCE
	<i>[Signature]</i>	<i>[Signature]</i>



ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಕಾರ್ಖಾನೆಗಳು, ಬಾಯ್ಲರುಗಳು, ಕೈಗಾರಿಕಾ ಸುರಕ್ಷತೆ ಮತ್ತು ಸ್ವಚ್ಛತೆ ಇಲಾಖೆ  
ಕಾರ್ಖಾನೆಗಳ ಉಪ ನಿರ್ದೇಶಕರ ಕಛೇರಿ, ವಿಭಾಗ-5, ಕಾರ್ಮಿಕ ಭವನ, 2ನೇ ಮಹಡಿ, ಬನ್ನೇರುಘಟ್ಟ ರಸ್ತೆ, ಬೆಂಗಳೂರು-29.  
ಸಂಖ್ಯೆ: ಕಾಲನಿ/ಬೆಂ.ವಿ5/ಐಎನ್‌ಎಸ್/ಎಸ್‌ಆರ್-95/2020-21  
ದಿನಾಂಕ: 07.01.2021

ಹಿಂಬರಹ

ವಿಷಯ: ಕಾರಣ ಕೇಳಿ ನೋಟೀಸು ಜಾರಿ ಮಾಡಿರುವ ಬಗ್ಗೆ

ಉಲ್ಲೇಖ: ತಮ್ಮ ಅನುಸರಣಾ ಪತ್ರ ದಿನಾಂಕ: 06.01.2021

\*\*\*\*\*

ಮೇಲಿನ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ತಮಗೆ ಕಾರಣ ಕೇಳಿ ಜಾರಿ ಮಾಡಿದ ನೋಟೀಸ್‌ನಲ್ಲಿ ಸೂಚಿಸಿದ ಕಾಲಾವಧಿಯಲ್ಲಿ ತಾವು ತಮ್ಮ ವಿವರಣೆ ಸಲ್ಲಿಸಿರುವುದಿಲ್ಲ. ಈಗ ತಾವು ಸಲ್ಲಿಸಿರುವ ಉತ್ತರವನ್ನು ಈ ಹಂತದಲ್ಲಿ ಪರಿಗಣಿಸಲು ಬರುವುದಿಲ್ಲ. ಸದರಿ ಪ್ರಕರಣ ಕುರಿತು ಈಗಾಗಲೇ ನ್ಯಾಯಾಲಯದಲ್ಲಿ ಮೊಕದ್ದಮೆ ದಾಖಲು ಮಾಡಿದ್ದು, ಸಿ ಸಿ ಸಂಖ್ಯೆ: 181/2021 ಆಗಿದ್ದು, ಮಾನ್ಯ 30ನೇ ಎಪಿಎಂಎಂ ನ್ಯಾಯಾಲಯದಲ್ಲಿ ದಿನಾಂಕ: 20.03.2021 ರಂದು ಮುಂದಿನ ವಿಚಾರಣೆಗೆ ಬರಲಿದೆ. ಅದರಂತೆ, ತಮ್ಮ ವಾದವನ್ನು ನ್ಯಾಯಾಲಯದಲ್ಲಿ ಮಂಡಿಸಬಹುದಾಗಿದ್ದು, ತಾವು ಸಲ್ಲಿಸಿರುವ ಉತ್ತರವನ್ನು ಒಪ್ಪಲು ಬರುವುದಿಲ್ಲವೆಂದು ಹಿಂಬರಹ ನೀಡಲಾಗಿದೆ.

*NNMohan*

(ಎನ್.ನವನೀತಮೋಹನ್) 11/21

ಕಾರ್ಖಾನೆಗಳ ಉಪ ನಿರ್ದೇಶಕರು,  
ವಿಭಾಗ-5, ಬೆಂಗಳೂರು.

ಇವರಿಗೆ,

ಶ್ರೀ ಕೃಷ್ಣಮೂರ್ತಿ ಎನ್

ಮೆ: Karnataka Gas Power Corporation Ltd,

120 MW DG Plant, S.N.Halli Post,

Doddaballapura Road,

Yelahanka, Bangalore-64.

*SE/11/21*  
*85*  
*12/1/21*

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 25588151, 25588270  
 25588142, 25586520

## ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ Karnataka State Pollution Control Board

"ಪರಿಸರಭವನ", 1 ರಿಂದ 5ನೇ ಮಹಡಿಗಳು, ನಂ.49, ಚರ್ಚ್‌ಸ್ಟ್ರೀಟ್, ಬೆಂಗಳೂರು - 560 001, ಕರ್ನಾಟಕ, ಭಾರತ  
 "Parisara Bhavana", 1st to 5th Floor, # 49, Church Street, Bengaluru - 560 001, Karnataka, INDIA

No: KSPCB/117/HPI/ KPC Yelahanka/ 2020-21/

3786

Dated: 04 DEC 2020

THE PROCEEDINGS OF THE PERSONAL HEARING HELD WITH M/S. KARNATAKA POWER CORPORATION LIMITED (KPCL), YELAHANKA, COMBINE CYCLE POWER PLANT AT BOARD OFFICE ON 13.11.2020.

Presiding Officer : Sri. Vijayakumar Gogi, IFS  
 Chairman, KSPCB.

Officers Present on behalf of the Board : 1. Dr. A Ramesh ,  
 CEO-1, 17 Cat, Head Office.  
 2. Sri Shivappa Nayak  
 Regional Officer, Yelahanka.  
 3. Dr. D. R. Ravi.,  
 Environmental Officer, Board Office.

Representative from the industry : 1. Krishna Murthy. S  
 Chief Engineer, KPCL.  
 2. Shankrappa  
 Superdent Engineer, KPCL.  
 3. Pulikeshi  
 Executive Engineer, KPCL.

Representitive of M/S Heritage Apartment : 1. Balasundaram Atreya

### Preamble:

M/s. Karnataka Power Corporation Limited (KPCL), Yelahanka have established a CNG gas based Power Generating Plant of capacity 370 MW. The project proponent had obtained Environment Clearance for establishing & operating Combined Cycled power plant on 01.09.2015 vide SEIAA 20 IND 2014 and Board has issued CFE & CFO for the period up to 30.06.2023 with conditions.

DEO Jwala

5/12



USE OF PLASTICS- BE 'ECO' FRIENDLY

During Oct-2020, an accident was occurred resulting in death of 3 people during the trial run of the Plant. In this regard a complaint from the residence of M/s Heritage Estate Apartment was received regarding disturbed in loud noise from Pressure Pumps and cooling tower during the trail run of the industry. The Regional Officer has submitted latest inspection report on 14.10.2020 and recommended to call the industry for personal hearing. The Board has received a letter from CPCB regarding the grievances registered on their PG portal by Yelahanka Puttenahalli lake and Bird Conservation Trust. Hence the industry authorities along with the complaint called i.e. M/s Heritage Estate Apartment for personal hearing 13.11.2020

During the personal hearing, the compliant has explained that, the apartment residents are getting hissing sound from the industry premises and a continuous water falling sound which is disturbing and creating problems to the residents especially the old age people and children's, who cannot study and sleep. He is requested to resolve this issue by relocating the cooling towers to far off distance (at the premises of old furnace oil plant) from the apartment. He also informed that the issue is pending at Hon'ble NGT.

In reply, the industry authorities have informed that the hissing sound is the result of release of accumulated gas during the trial run, which will be dissipated after sometime, but the regular sound is from the cooling towers, situated within 150ft from the apartment. They have provided barricades for these cooling towers and they cannot house within a building, as cooling tower requires Aeration. They are planning to provide additional acoustic enclosure to most of the noise producing equipments and the same will be submitted to Board after discussing with the Managing Director. He also informed that, he will explore the possibility of shifting cooling towers. He informed the complainant, that once the plant is commissioned, most of the equipments will be stabilized and can reduce the noise.

After the detailed deliberation, the Presiding Officer has directed the industry to carryout the following and submit an action taken report to the Board.

- To conduct Noise Mapping within the industry premises and identify different sources of noise generation during day time and also during the night time and take a mitigative measures.
- Take up additional three layer green belt development all-round the industry, more so towards the apartment.
- Automatic alarm system shall be provided , where ever there is an excedance of noise level.
- Provide additional acoustic enclosure (where ever possible) to all the high noise producing equipments.
- Explore the possibility of providing continuous noise monitoring equipments near the compound wall facing towards the apartments.

- Appoint an adviser to get consultation to bring down the noise level to the residential standards within the premises.
- Submit long term and short term action plans with time bound commitment to reduce the noise levels.
- Verify the noise generation within the GAIL terminal premises and advice them to take proper action for mitigating the noise (if any) generated from the premises.

**Sd/-  
PRESIDING OFFICER  
CHAIRMAN**

To:

The Chief Engineer,  
M/s. Karnataka Power Corporation Limited (KPCL),  
Sy. Nos. 44, 45, 46, 48, 24, 25, 263, 282 of Kenchanahalli village,  
Doddaballapur Main road,  
S N Halli post, Yelahanka, Bengaluru-5600642

Copy to:

1. The Regional Officer, Regional Office, Yelahanka for information and necessary action.  
He is directed to carry out noise level and submit a report to the Board.
2. Case file.

  
**CHIEF ENVIRONMENTAL OFFICER**