



Fire Consultancy Report

Chittaranjan Locomotive Works, Chittaranjan, (W.B)



A
Report by the
Central Industrial Security Force

A
FIRE
CONSULTANCY REPORT BY CISF
IN RESPECT OF
CHITTARANJAN LOCOMOTIVE WORKS,
CHITTARANJAN (W.B)



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CERTIFICATE

The Central Industrial Security Force, Ministry of Home Affairs, Government of India, under the provisions of section 14-A of CISF Act, 1968 (as amended by Amendment Act:40 of 1999) and Rule:91 of CISF Rules 1969 has conducted a Fire Consultancy of premises of Chittaranjan Locomotive Works, Chittaranjan (W.B).

This report, besides identifying vulnerability & weaknesses of existing arrangements, offers solutions for strengthening the Fire prevention and protection of Chittaranjan Locomotive Works, Chittaranjan (W.B).

(Deepak Verma)
Deputy Inspector General/Consultancy
On behalf of CISF Consultancy Team

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**(Deepak Verma)
Deputy Inspector General/Consultancy
On behalf of CISF Consultancy Team**

Executive Summary

EXECUTIVE SUMMARY

This Fire consultancy Report compiles the details regarding fire risk analysis, existing fire protection arrangements, deficiencies and recommendations for further improvements of the Chittaranjan Locomotive Works, Chittaranjan, West Bengal. Details have been arranged systematically and a reference index has been provided.

A detailed fire survey was carried out with a view to study fire hazards, existing fire protection systems, fire preventive measures and to suggest ways and means to strengthen them. Critical studies of all the sections were conducted by physical visit by the audit team and assessed fire hazards, existing fire protection measures and further fire prevention & fire protection measures to be adopted.

Main Fire risk and associated hazards were examined and general details about the fire safety were gathered. Vital areas of the CLW premises from Fire safety point of view have been visited and potential fire hazards were assessed. Existing fire protection measures were observed. Their checking/ testing procedures are required to be formulated and such laid down procedures/ schedules of inspection/ checking/ testing of fire protection and prevention system shall be adopted to keep the fire fighting systems healthy.

Electrical fire hazards specifically in switchgear panels, cables etc., have been addressed and effective solutions based on different standards/ codes of practice have been recommended with reference to National Building Code of India-2016, Part-IV (Life & Fire Safety). Though sufficient fire preventive and protective measures are being practiced to the maximum extent and the legal/ statutory requirements are being fully addressed to; and at CLW, Fire hazards are medium in nature but it is always better to be prepared to improve fire safety of CLW to make fire protection, fire prevention and life safety of employees and associated workers more effective. This will require a commitment and investment of time and resources by the management.

A) Requirement of Fire Extinguishers

Clean Agent	4kg	-	105 Nos
CO2	4.5kg	-	416 Nos
DCP(ABC)	6 kg	-	662 Nos
Foam	9 Litre	-	25 Nos
Other Extinguishers		-	195 Nos

B) Assessment of Manpower

Though keeping in view of the CLW infrastructure, its use and relevant standards there is a requirement of a full-fledged and properly trained Fire Fighting Team and the same has been proposed to strengthen existing Fire and safety arrangement provided at CLW.

C) Hydrant Network

The present hydrant network of CLW as per norms, is not fulfilling the requirement hence a separate Hydrant network has been proposed.

D) Financial implications against recommendations

S.N.	Particulars	Estimated Approximate Expense in Rupees
01	Fire Extinguishers	1, 74, 43, 000
02	Other Firefighting appliances	23, 00, 000
03	Man Power (per annum)	95, 00, 000
04	Fire Detection and Alarm	1, 00, 000
05	Hydrant network	12, 00, 00, 000
	Total	14, 93, 43, 000

“The best way to start any program or effort is to start today. Do not delay or wait for a tragic fire incident. Each step you take puts you one step closer to a fire safe community and two steps farther from a tragedy. Bring your community together to solve the problem and not to mourn the tragedy”



Fire Consultancy Report

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Introduction

1. Introduction

CHITTARANJAN LOCOMOTIVE WORKS (CLW) has been named after the great freedom fighter, leader and statesman Deshbandhu Chittaranjan Das. On 26th January 1950, the day when India became Republic, production activity started at CLW Chittaranjan. The initial product of Chittaranjan Locomotive Works was Steam Locomotive. In the period 1950-1972 Chittaranjan Locomotive Works, turned out a total number of 2351 Steam Locomotives, from 1968 to 1993 CLW produced 842 Diesel Locomotives and from 1961 till Mar'2021 total 7575 Nos. of Electric Locomotives of different types.

CLW over the years has proved to be one of the most accomplished, promising and reliable locomotive manufacturers. It has transformed itself from being a manufacturer of Steam Locomotives to that of Diesel locomotives and finally to Modern, high power Electric Locomotives. The venture has paid off and at present CLW is proudly producing state-of-the-art, 3-phase locos with all modern features of latest "Insulated Gate Bipolar Transistor" (IGBT) technology.

Presently, CLW is playing a pivotal role in making Indian Railways self-reliant in the field of electric traction both for high speed and heavy hauling load and thus acting as a vehicle for strengthening Indian economy. Dedicated endeavor of CLW over the years resulted in rapid growth and development of this workshop in providing freight as well as passenger transport solutions.



Chittaranjan Locomotive Works (CLW) is located at Chittaranjan in the Asansol Sadar Sub-Division of West Bengal, with an ancillary unit in Dankuni. The CLW is 32 km from Asansol and 237 km from Kolkata. CLW has stores and offices in Kolkata, as well as inspection cells in New Delhi, Mumbai, Kolkata, and Bangalore. It is the largest locomotive manufacturer unit in the World and has produced 431 locomotives in 2019–20.

In the late 1930s, a committee consisting of M/S Humphries and Shrinivasan was created to consider the possibilities of establishing locomotive manufacturing facilities in India. The initial project at Chandmari, east of Kalyani in West Bengal, was found to be unsuitable. A new survey led to the present site at Chittaranjan being established, which was approved by

the Railway Board in 1947. A survey of the proposed area began on January 9, 1948, the rocky soil was an advantage in erecting structural foundations, and the undulating terrain solved the problem of drainage for the township. The Damodar Valley Corporation (DVC) envisioned Hydro-Electric and Thermal Power Stations in the area, assured adequate power availability for the project.

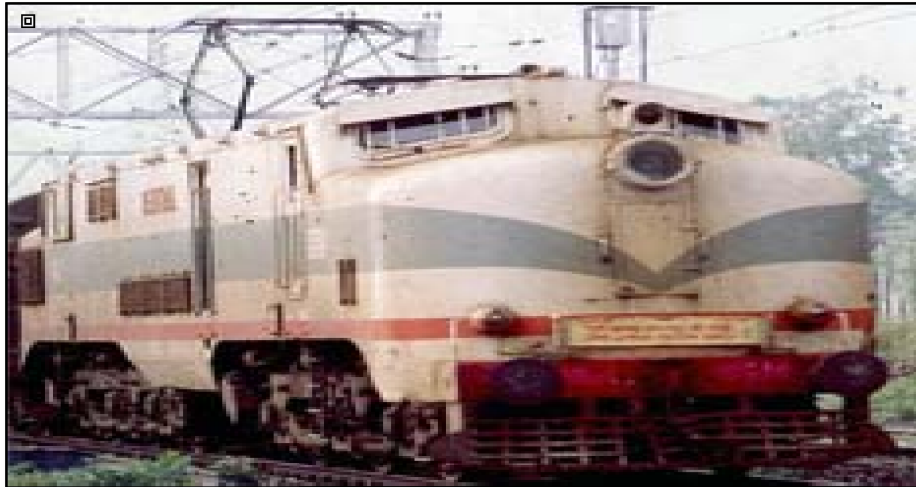
The project was launched as Loco Building Works in 1950 to produce 120 average-sized steam locomotives. It also had the capacity to manufacture 50 spare boilers. Production of steam locomotives commenced on January 26, 1950. The first President of India, Dr. Rajendra Prasad, dedicated the first steam locomotive to the nation on 1 November 1950, and on the same day, the Loco Building Works was renamed as Chittaranjan Locomotive Works after Deshbandhu Chittaranjan Das. The nearby Mihijam Station was also renamed as Chittaranjan.

In 1962-63, a steel foundry was set up to manufacture cast steel locomotive parts. Production of diesel-hydraulic locomotives began in 1968. After manufacturing 2351 steam locomotives of 5 types and 842 diesel-hydraulic locomotives of 7 types, production of both of these classes was discontinued from 1950 to 1972 and 1968 to 1993, respectively. Electric locomotive production commenced in 1961. The first Prime Minister of India, Pandit Jawaharlal Nehru, commissioned the first 1500 V DC Locomotive named "*Lokmanya*" on 14 October 1961. The production of 25 kV AC DC locomotives commenced on 16 November 1963, with the WAG-1 series, a broad-gauge 25 kV A.C. freight locomotive with 2840 hp and a maximum speed of 80 km/h. The first WAG-1 locomotive was named "*Bidhan*".

CLW gradually began upgrading their locomotives to produce 6000 hp and achieve 160 km/h, and also started building the 25 kV AC/1500 V DC, AC/DC WCAM-1 series for hauling mail/express trains on the Western Railway. Additionally, production of DC traction motors and control equipment commenced in April 1967. CLW became the first manufacturer in India (as well as the second in Asia and fifth in the world) to manufacture a 3-phase GTO Thyristor- controlled electric locomotive.

At present, CLW's current Electric Locomotive production consists of only three phase locomotives namely WAP-5, WAP-7 & WAG-9. The first WAG-9 series locomotive which was also the first indigenous 6000 hp freight electric locomotive was rolled out on 14 November 1988, and christened "*Navyug*". On 10th May'2000 "*Navodit*", the first passenger version of the WAP-5 series with a service speed of 160 km/h and the potential to reach 200 km/h, was manufactured. Today, India is one of the select brand of countries that alone have the capability to manufacture the 3 phase Electric Locomotive.

CLW has in-house facilities for machining and assembly of wheel sets, fabrication, bogies, etc. The facilities include modern CNC machines, plasma cutting machines, and inert gas welding sets. The factory obtains its iron & steel from SAIL, RINL and MDN, and sometimes from private steel plants like TATA, Jamshedpur, and Jindal Steel. Hydroelectric power comes from PGCIL and the DVC Maithon.



WCM 5

River Ajay flows past CLW along its northern side. Workshops, offices and quarters are spread over the whole area with ample space in between, surrounded by greenery and trees. There are several water bodies in CLW exhibiting a lush green environment which attract a large number of migratory birds every year. A variety of flora and fauna can be seen here all the year round.

WAP-5, 5400 HP 25 KV 3-Phase Passenger Electric Locomotive is 5400 HP 25 KV AC 3-Phase 4 Axle, Broad Gauge (BG) WAP-5, main line electric locomotive for hauling of passenger trains. Its speed potential on IR tracks is up to 160 km/h, with designed speed potential of 200 km/h. This loco has an axle load 19.5 ton having Disk Brake suitable for hauling Mail/ Express and other super-fast trains. This is a state-of-art locomotive having 3-phase technology with computerized control system.

WAP-7, 6000 HP 25 KV 3-Phase Passenger Electric Locomotive is 6000 HP variant of WAG-9 to operate 24/26 coach trains at 130 km/h. Designated as WAP-7 Class, this locomotive is a clear preferred choice of operators for running long passenger trains. This loco has an axle load of 20.5 tons suitable for hauling Mail/ Express and other superfast trains.

WAG-9, 6000 HP 25 KV AC 3-Phase Freight Electric Locomotive is 6000 HP AC freight Loco with crew friendly AC cab and energy regeneration features. This loco has an axle load of 21.5 tons suitable for hauling heavy goods trains. This class of locomotive has a starting tractive effort of 51T and can attain a max. speed of 90 kmph.

Product of Chittaranjan Locomotives



WAP-9



WAP-7



WAP-5

Vision & Mission of CLW

VISION

- To become a renowned global leader in the business of developing and manufacturing of Electric Locomotives, Traction Equipment and Rolling Stock Casting.

MISSION

- To emerge as a unique global centre for design, development and manufacturing of its products through continuous improvement by upgrading design, quality, reliability, dependability and value addition in a deliberate and proactive manner.
- To perennially endeavour to sustain excellence in customer satisfaction by consistently exceeding their expectation.
- To develop human capital by constant enhancement of its technical, managerial & Innovative capabilities.
- To promote ethical business practices and values in the true spirit of corporate governance.

CLW is playing a pivotal role in making Indian Railways self-reliant in the field of electric traction, both for high speed and heavy hauling load, and thus acting as a vehicle for strengthening Indian economy. Dedicated endeavor of CLW over the years resulted in rapid growth and development of this workshop in providing freight as well as passenger transport solutions.

The project's highest-priority items are the development of material sourcing, indigenization and cost reduction. Development of sources, indigenization and cost reduction of three-phase loco have been the highest priority items with safety policy that aims to ensure 100% safety for all workers working in Chittaranjan Locomotive Works.

Awards & Accolades

2. Awards and Accolades

- The Golden Peacock award for Environment Management 2006.
- CLW is the proud recipient of the Safety innovation award 2006 and 2009. The award was conferred on CLW by the Safety and Quality forum of the Institute of Engineers (India).
- Otabu Certification of registration for Traction Motor Shop of CLW with 5S “Work Place Management System”
- Certification of registration for ISO 9001: 2015
- Certification of registration for ISO 14001: 2015
- Certification of registration for ISO 45001: 2018
- Certification of registration for ISO 3834-2:2005

Methodology

3. Methodology of Consultancy

- **Preliminary meeting**

The Consultancy Board had a preliminary meeting with Shri Satish Kumar Kashyup, General Manager (CLW), Shri R P Mishra, Principal Chief Electrical Engineer, Shri Amit Agarwal, Secretary to GM, Shri P K Das, Principal Chief Engineer, Shri R S Sinha, Principal Chief Material Manager, Shri Tariq Ahmed, Inspector General, RPF cum Principal Chief Security Commissioner, Shri R Yadav, Sr. Dy. General Manager & Chief Vigilance Officer, Shri A K Bhoumik, Shri A K Keshari, Chief Electrical Engineer and other associated senior officials of CLW at the GM Building's conference hall to discuss the purpose of the consultancy and to know their concerns and expectations. Later the Consultancy Board also had a meeting with all the officials of CLW middle management and works to explain them about expected support from them.

- **Present status of Fire prevention and Protection**

Detailed discussion held with Mr. Shankar Sharma, Safety Officer CLW, Mr. Rajesh Kumar Sharma Inspector In-charge RPF CLW and Mr. P K Dutta, SI/RPF In-Charge of Fire Service, for collection of all relevant information relating to various aspects of Fire hazards, various processes, firefighting preparedness and Fire prevention & protection systems. They further briefed about the available fire preventive facilities.

- **Visits & Inspection of various facilities**

Board has gone through all the processes, facilities, layout/ site plans and associated works to understand fire hazards in CLW. During the visit, Fire prone areas, other vital areas and available fire preventive arrangements were seen.

- **Study and discussion**

The board also carried out study of fire safety procedures, processes, capability and attitude of personnel. Discussions were also held with officials, employees and support staff to know the present procedure and practices.

- **Practical Firefighting preparedness**

To check the Firefighting preparedness of personnel and fire protection systems, simple problems were given to few concerned staff engaged for various area of responsibility, like how to operate first aid firefighting equipment and their actions in case of fire emergency, knowledge about DM Plan, siren code and operation of fire protection systems, conducting mock Fire drill for evaluating the preparedness to deal major fire emergencies and procedures etc. Performance Mock Drills were held at Electric Locomotive Fabrication shop and a store of S ward Depot-07 with a task of fire on consumables. Response mechanism and time of firefighting team/ turnout was also checked.

- Meeting with concerned officials and discussion on the observations noted.
- Closing meeting with management officials and discussion on the observations noted.
- Submission of report.

Consultancy Overview

4. Consultancy Overview

The consultancy team visited different locations/ installations of the Chittaranjan Locomotive Works and worked for the following: -

- To evaluate fire hazards pertaining to the areas, processes and facilities.
- To inspect & review the available fire prevention system and suggest ways and means to strengthen the same.
- To inspect & review existing fire protection system and need to improve/ augment the same.
- To provide procedures and action plan to deal with contingencies arising out of fire.
- To examine the existing procedures, systems and measures being followed for control of fire and saving precious lives.
- To recommend improvements for better effectiveness of system and control measures for the identified Fire hazards.
- Check the extent of the compliance with relevant standards and recommend the corrective action to be taken in case of non-compliance.

Area Covered

The board visited the following shops/ places

1. Electrical Loco Bogie shades
2. Electrical Loco Fabrication Shades
3. Manufacturing group of shops
4. Shops under plant department
5. Electrical Loco Assembly group of shops
6. Traction motor group of shops
7. All the stores godowns of Material Stores Department, Central Stores Department, 3 phase depot, Traction motor Depot, Steel foundry depot, General Stores Depot and adjoining office buildings, office building of Dy. CMM depot and adjoining area including receipt branch, fuel station at General Stores Department and near New godown (C-ward),
8. General Manager office building and its annexes (Electronic Data Processing Centre, Civil Engineering dept., and Telephone exchange),
9. Design & Development Office
10. Filter plant, SSE/ W/ WD office, Works office,
11. Central Power House, Technical Training Centre with hostel
12. Kasturba Gandhi Hospital,
13. Steel Foundry Shop and
14. Rest house and officer club

Management Attitude towards Fire Safety

All the plant employees, workers, RPF Fire staff, RPF security personnel and associated staff of Chittaranjan Locomotives Works have positive attitude towards fire safety & protection of their esteemed Organization. They seemed to be concerned about the safe, secure and efficient working environment of the organization. They openly discussed all points relating to

fire safety and did not hide any lacuna to improve/ plug the gaps. The Organization is having Electric Loco Bogie building shops, Electric Loco Fabrication shops, Manufacturing group of shops, Electric Loco Assembly shops, Traction Motor machining shop, TM coil shop, TM Vacuum Pressure Impregnation shop, TM assembly shop, TM stator coil forming shop, TM stator winding shop, TM dispatch shop, TM stores, Material Store Department, Central Stores Department of various consumable items, 3 phase depot, General Stores Depot for scraps, Steel Foundry depot of foundry material, LPG stores, Oxygen stores, Acetylene stores, paint shop and paint stores, Acid stores, Lube stores, Inert Gas stores, Electrical repair shop and store, High Speed Diesel & Motor Spirit storage and pumping facility, Payload lifter vehicle charging house, MT shop, Offices, Laboratories, Rest Houses with kitchen facilities, TTC with class room/ seminar hall and hostel facilities, conference hall, telephone exchange, vital computer installations (EDP) etc.

Fire Hazards & Risk Analysis

5. Main Fire Hazards and Risk Analysis

There are many common fire hazards available at Chittaranjan Locomotives works, which is engaged in producing Electric Locomotives. CLW is having many stores of combustible and non-combustible materials. At few places, it is in isolated places and somewhere it is in congested areas. Transformers, electric panels & cables, switch gears, large quantities of combustibles, hydraulic oil, HSD/ MS, chemicals like HCL/ H₂SO₄, LPG cutting, grinding, machining, painting, oxy-cutting, acetylene cutting, compressors, chlorination, solar panel etc possess fire hazard. Further common fire hazards include hot work, smoking, electric short circuit, general storage, overhauling materials. Areas and processes which can cause fire accidents are enumerated below: -

Electric Loco Bogie Assembly Shops:

The CLW is mainly engaged in bogie shell assembling, wheel assembling, oxy-acetylene cutting, bogie machining, bogie frame fabrication, bogie assembling. These shops are hazardous from fire safety point of view due to presence of electrical transformers, storage and use of lubricating oil/ grease/ consumables, pressurized LPG & Oxygen pipe line, Acetylene cylinders, electrical cables, panels and presence of many combustible materials. Apart from these, few small offices and stores of ancillary items are also there and possesses fire hazard. The explosion of gas cylinder, transformers and major fire at these shops cannot be ruled out. The risk normally extends to the floor areas where consumables are stored and at few places it is scattered. The hydraulic oil used in the CNC machine also poses a high risk of fire.



Electric Loco Fabrication Shop:

The electric loco bogie fabrication shop is engaged in mainly shell fabrication, side wall, shell & roof fabrication, under frame fabrication, bending, shearing, metal inert gas arc welding, metal arc welding, Oxy-acetylene cutting. These shops are hazardous from fire safety point of view due to presence of electrical transformers, storage of lube oil/ grease/ consumables, pressurized oxygen line, acetylene cylinders, high voltage cables and panels and presence of many combustible materials. The explosion of gas cylinder, transformers and major fire at these shops cannot be ruled out. The risk normally extends at the floor areas and there are chances of spreading to adjacent facilities.



Manufacturing Group of Shop

The manufacturing shops are engaged in mainly wheel grinding and fitting. The shops are hazardous from fire point of view due to presence of electrical transformers, storage of lube oil/ grease/ consumables, pressurized oxygen line, acetylene cylinders, electrical cables and panels and presence of many combustible materials. The explosion in LPG, gas cylinders, transformers and major fire at these shops cannot be ruled out. The risk normally restricts to shop's floor area.



Smithy & Forge Shop

This manufacturing shop is engaged in fabrication, surfacing and heat treatment. The shop is hazardous from fire point of view due to presence of electrical panels, switch board, pressurized oxygen, acetylene cylinders, electrical cables, panels and presence of many combustible materials. The explosion of gas cylinder and major fire at these shops cannot be ruled out.



Shops Under Plant Department

Transport Department

Transport department is engaged in facilitating different trucks and other vehicles inside the shop floors and factory premises only. The fire risk and hazards in the garage is due to stock of diesel and lubricants, spare parts, Battery charging facility and electrical wiring. Air compressor for inflating tyres possesses explosion hazard.



Electrical Repair Shop

The electrical repair shop provides services for maintenance and repair of electrical parts, wiring. ERS also houses stores of spare parts, testing labs, offices etc. The shops are hazardous from fire safety point of view due to presence of electrical spares, storage of lube oil/ grease/ consumables, petrol, electrical cables, panels and presence of many combustible materials. Storing of waste/ defective cable also poses fire hazard as kept adjacent to the shop's wall.



Maintenance Shop

Fire hazard in maintenance shops is due to presence of various machine, lube oil, grease, maintenance processes and other combustible materials.



Cutting Shop

This shop facilitates cutting thick iron sheets to make small parts for bogie assembly and fabrication, with the use of LPG. The main fire hazard is leakage and fire in LPG. Electrical fire hazards also cannot be ruled out.



Plain Lifter Truck Charging Station:

Plain Lifter Truck, PLT are being used for transporting materials from one place to another within the workshop. PLT charging station is generally used for charging of battery of PLT. Main fire hazards are battery, electrical cables and its connection. Acid in small quantity is also stored at one place which can cause fire and toxic hazard.



Compressor Houses

The main fire hazards in this area are lube oil fire, diesel oil fire, electrical fire as Substation “A” is situated just near to it. Explosion hazard is also present due to presence of compressor as well as transformers. In case of fire, HT Electrical cables can propagate the same to nearby area.



Transport Shop (Garage)

Transport Garage mainly deals with parking, maintenance of 50 FLT, 40 PLT and 06 tractors. The vehicles are parked inside the shops and sent to outside as per the demands. The main fire hazards are stored diesel, grease lube oil inside the shop, electrical short circuit, vehicle fire.



Electrical Repair Shop (Lab)

The electrical repair shop/ lab is engaged in maintenance and repair of electrical parts, wiring. It also stores some of spare parts, testing labs, offices etc. The shops are hazardous from fire safety point of view due to presence of electrical spares, storage of lube oil/ grease/ consumables, electrical cables and panels.



Pneumatic Testing Shop

The facility is hazardous from fire safety point of view due to presence of compressor, paint, thinner, varnish etc.



Crane Section

The crane section is for maintenance and repair of various cranes. The shops are hazardous from fire safety point of view due to crane repairing process and available facilities including flammable material.

Paint Shop

At paint shop, a small quantity of paint, thinner are stored, locos are sand blasted, spray and manually painted. The process and store makes the area Fire prone. Electrical cables, equipment, LPG bank and LPG supply line also add to the vulnerability.



ELECTRIC LOCO ASSEMBLY SHOPS

These shops are engaged in assembling and fitting of various equipments in Electric Locomotives. Testing and fitting of transformer, Battery, Roof, Electrical Panel, Traction motor is also a function of this shop. These shops are hazardous from fire safety point of view due to presence of electrical transformers, storage and use of lubricating oil/ grease/ consumables, pressurized LPG & Oxygen pipe line, Acetylene cylinders, electrical cables and panels and presence of many combustible materials. Apart from these few small offices and stores of ancillary items and flammable oil are also there and possesses fire hazard. The explosion of gas cylinder, transformers and major fire at these shops cannot be ruled out.

VPI (Vacuum Pressure Impregnation) Shop:

The shop is engaged for VPI of stator with varnish and thinner. The shops are hazardous from fire point of view due to presence of Varnish, Thinner, electrical cables and panels, electric heater for baking the stator, storage of other flammable material.



Coil Shop & Three Phase Insulation & Coil Forming Section

The shop is engaged for coil forming of traction motor. The shops are hazardous from fire safety point of view due to presence of High voltage electrical cables and testing facility. Three phase insulation section is engaged for coil forming of traction motor. The shops are hazardous from fire safety point of view due to presence of electrical wiring, electrical cables and panels etc. As this room is air conditioned and combustible material is available, chances of spread of fire is more.



Traction Motor Machining Shop

The shop is engaged for machining work of traction motor. The shops are hazardous from fire safety point of view, due to presence of machining processes, electrical cables, motors

and panels, storage of paint, consumable, gas cylinders etc. Fire and explosion hazards cannot be ruled out as acetylene gas cylinders are being used there.



Three Phase Stator Winding Section

The shop is engaged for winding work of traction motor. The shops are hazardous from fire point of view due to presence of electrical wiring, electrical cables, motors and panels, use and storage of paint, consumables, gas cylinders etc.



Petrol and Diesel Store

There are two fuel Refilling facilities inside the plant. One is situated at the entrance of General Stores Department GSD. At GSD, 15,000 liters Diesel (HSD) and 15,000 liters of Petrol (MS) can be stored in two separate underground tanks with pump. Another diesel pump is situated near new three-phase depot having an underground Diesel tank of 20,000 liters capacity.

The storage of flammable liquids is fire prone due to presence of large quantity of Diesel/ Petrol. Explosion hazard also cannot be ruled out at those areas.

General Store Depot

General store department is generally being engaged to store used/ scrap materials. Non-ferrous and ferrous materials/ scrap cables, empty drums, old machines including computer, printers etc, are stored in various shades. Wood and iron scraps are stored in open area also. Wood and other combustible material can pose a fire threat. At entrance of GSD Petrol and Diesel store and refilling station make this area vulnerable.

Central Store Depot

This department consists of offices (at receiving branch), works and various stores. It handles material receiving and issue to concerned departments. Stores of stationary, plastic & jute material, high-value spares, tools equipment and accessories, electrical spares, computer peripherals, metallic pipes and sections, fitting and fixtures for bogies etc. These stores are located in different areas of the plant and presents fire hazards due to stored material, stacking pattern, electrical fitting, fixtures, transportation arrangement and presence of energized equipments. To store spares and accessories, extra care and attention is required. CLW is having few Air Conditioned stores also. In such stores air conditioning system, electrical wiring, flammable/ combustible material and pattern of stacking adds to its Fire vulnerability. Acid and Base storage also present safety and fire hazard. Value and importance of stored material, Irregular use and seldom approach to these stores make such places very vital in fire prevention and protection planning.

Central Power House (CPH)

Chittaranjan Locomotive Works (CLW) receives power from DVC Maithan & PGCIL in Central Power house (CPH) in the form of 33 kV and then steps it down into 11 kV by a series of 05 Transformers and supply to all the Workshops and other utilities. Two Diesel generators of capacity 2188 kVA have been provided for emergency power backup. To supply fuel to these generators, six HSD tank, each having capacity 20,000 Liters (total 1,20,000 liters) have been placed. CPH has two switchgear rooms, one is termed as DVC panel room/ new panel is kept in standby mode, second one is kept in regular use.



Works Office

The building is double storied with corridors and mainly house offices. The general administrative work in different sections like General section, Medical card section, Quarter section, Water section, Leave section, Welfare section, Personal section, Confidential cell, Drawing section, ELDO office, TM design office, TM office etc is done in this building. The hazards from fire safety point of view are electrical which can further propagate in documents, furniture and can create dense smoke which can cause suffocation and hindrance to escape, one such case was also noticed in past.

Design & Development Building

The building is engaged for offices like 3 phase cell, conference hall accommodation capacity of 40 persons, seminar hall with sitting capacity of 60 persons, document section,

traction motor testing, infinity cell, PLM centre etc. The building is double storied with corridors. The main hazard from fire safety point of view is electrical which may further propagate to the document, furniture etc.

General Manager Building

General Manager's Building is two-storied building and two sections are being termed as 'West' Block and 'East' Block. Atground floor of West block offices like record room, vigilance dept. establishment section, audit room, audit & inspection room, dispatch section, RPF security control room, Cash section, law section & laboratories have been accommodated and offices for few senior officers have been provided. At West block first floor offices for MR section, personal dept. GM works office, refreshment room, welfare section, administrative section, conference room, dispatch section, provident fund room, conference hall etc. Offices for senior officials including General Manager have also been located at this floor.

Ground floor of East block is mainly engaged for finance section, costing section, pension department, RPF security office, Laboratory, lab store including few offices for senior officers. At first floor of East block offices of dispatch section, provident fund room, IT section store, ledger room stores, Bill Section and few offices for officers also have been accommodated.

The main hazards from fire safety point of view in these areas are documents, electrical/ energized equipment, computers, panels, electrical cables, etc.

Electronic Data Processing (EDP) Building

The building houses computer section, data room, UPS room, office of the section in-charge etc. Server is also provided here. The building is centralized air conditioned with centralized air conditioner room at ground floor with Air Handling Unit. The main hazards in this area from fire safety point of view are electrical hazards, which can further propagate to the combustible furniture, documents, AC Ducts, electrical cables, equipment, computers etc. Smoke logging may occur in other rooms and corridor.

Civil Engineering Department

CED building is mainly having offices including drawing store, cubical offices etc. The main hazards in this area from fire safety point of view are electrical hazards and the availability of combustible material like furniture, documents, electrical cables, equipment, computers etc.

Telephone Exchange

The Telephone Exchange is having server room and communication related equipment and intricate network of cable and electrical cable. Presence of Air Conditioner is adding to chances of Fire and its propagation.

Kasturba Gandhi Hospital

Kasturba Gandhi Hospital of CLW is a full-fledged hospital having 197 bed capacity which includes male, female & child ward, Intensive Care Unit. It also houses medicine store room, blood bank, X-ray facility, Operation Theater, Offices, Document Room, Laundry, Kitchen etc. It has a separate building for OPD. It has a modular cold room to store medicines

at controlled temperature. The hospital also has Oxygen Bank and an Oxygen Plant is also coming up. The main hazard from fire safety point of view is presence of combustible material like chemical, medicine, stationery, stores of linen, electrically operated various machines, pressurized oxygen pipe line network, LPG & Air Conditioners.

Water Management & Filter House

To filter the raw water and transport it to the utilities of the plant and township Filter house has been constructed. The filter house has 13 electrical pumps, laboratory and offices. Chlorine is used here for treatment of raw water. At a time one chlorine tonner is kept to use and another kept as reserve. Main fire hazard here is fire in panel, motor, cables, junction box due to electrical malfunction etc. The WMD premises used for offices, storage of lubricant, kerosene, paint, rubber items, plastic items, stationary and old document, spares of combustible & non-combustible nature etc. Main fire hazards are electrical connection & ACs and presence and use of kerosene, paint, lube oil, plastics, rubber etc.

Rest Houses/ Officer's Club

There are 04 Guest Houses and one Officer's Club are available namely Chittaranjan Bhavan, Karnel Singh Bhavan, Kangoi Bhavan, Mihijam Bhawan and Officer's Club. The main fire hazards are electrical, ACs, furniture, electrical equipment and kitchen.

Building Classification Details

As per National Building Code, CLW has mix occupancy of buildings & different area of CLW can be Classified as under:-

- GM Building, Work's Office, Design & Development buildings are classified in Group E (sub- division E-1) Business Building.
- EDP Building is classified in Group E (sub- division E-3) Business Building.
- ELB, ELF, ERS, TM area buildings are classified in Group G (sub- division G-2) Industrial Building.
- KG Hospital is classified in Group C (sub-division C-1) Institutional Building.
- Telephone Exchange is classified in Group E (sub-division E- 4) Business Building.
- Technical Training Centre Building is classified in Group B (sub- division B-1) Educational Building.
- Rest Houses Buildings are classified in Group A {sub- division A-1 and A-4 (Mihijam Bhawan)} Residential Building.
- Officer's Club Building is classified in Group D (sub- division D -4) Assembly Building.
- GSD, CSD, TM Stores buildings are classified in Group H Storage Building.
- CPH building is classified in Group G (sub- division G-3) Industrial Building.

Vulnerability

Based on the available combustible material, processes, handling and storage, the following places are vulnerable for fire and life threats:-

- a) Workshop/ Fabrication & Assembly shades.
- b) Offices and Stores
- c) Diesel, Petrol and Lubricant storage

- d) Air Conditioning system and Air Handling Units
- e) Electrical Sub Station, Cable and accessories
- f) Storage of Paint and Thinner
- g) 25000 kV equipment Testing and Inspection area
- h) LPG, Oxygen and Acetylene storage
- i) Hospital & Water services

Further, due to non-existence of a regular and well equipped Fire Fighting team, mutual-aid with other Industry/ Fire Station and keeping in view of the distance of established and equipped Fire station, Fire risk vulnerability of CLW increases manifold.

Special Hazards & Threat Perception

6. Identification of Special Hazard and Threat Perception

Potential Fire and other Hazards

Substance/ Facility	Hazard	Propagation Potential	Explosion Potential	Likely causes
Electric panel	Fire	Medium	Low	Component failure, Short Circuit.
Electrical Cable	Fire propagation	High	Low	Human factors, Faults
Air Conditioners	Fire	Normal	Low	Component failure, faults
Liquefied Petroleum Gas bank	Fire, Explosion & Suffocation	High	Very High	Leakage, contact with Spark or Hot surface.
Oxygen storage	Fire, Explosion & Suffocation	High	Very High	Leakage, contact with Spark or Hot surface.
Acetylene Storage	Fire, Explosion & Suffocation	High	Very High	Leakage, contact with Spark or Hot surface.
Transformers	Fire	Normal	High	Component failure, faults
HSD & MS	Fire, Explosion & Suffocation	High	Very High	Leakage, contact with Spark or Hot surface.
Chlorine	Explosion & Toxic	High	Low	Leakage, Piping failure.
Paint	Fire	High	Very High	Contact with Spark or Hot surface. (During Spray Painting)

- In most places, the electrical cabling is not done in conduits. Loose electrical connections have been taken in many places.
- Smoking is not allowed inside the premises however no 'Smoking Zone' has been marked in or around the campus.

Electrical Switchgear Panel

For providing necessary power supply to entire facility, shop floors and ancillary processes, electrical switchgear panels have been provided at different areas of CLW. Electric supply is received from DVC and PGCIL. For Fire safety, fire extinguishers and sand buckets have been placed near these panels. Rubber mat has also been provided in front of most of the panels, from electrical safety point of view.

Air Conditioners

Offices, Guest houses, Hospital, few stores, selected Shop floors, Labs and some other facilities are Air conditioned. Air conditioning is being provided by split and window AC of different capacities. Split air conditioning unit Compressor containing units are placed at open space i.e. Roof top/ terrace. Central air conditioning units have also been provided in very few facilities.

LPG, Oxygen and Acetylene Storage

LPG is being used in shop floors, kitchen of hospital, guest houses and club. For shop floors LPG is made available through pipeline and manifolds. Three separate LPG godowns are located at CLW. Fire water hydrant, Fire extinguishers and sand bucket have been provided as Fire protective measures. These banks are being operated by contract laborers. Similarly Oxygen is also being used at shop floors and provided from storage tank through piping network. Acetylene is also being used for fabrication process.

Chlorine

Chlorine is being used in water treatment process. Heavy leakage of Chlorine may prove to be disastrous. Failure in timely detection of Chlorine leakage and lack of provision for its arrest, make this portion vulnerable from human life safety point of view.

Common Causes of Fire

Potential ignition sources (sources of heat or otherwise) which could initiate fire in the premises are: -

- Excessive Heating of Electrical Appliances
- Massive electrical discharge from High voltage line
- Electric Short circuits
- Poor house keeping
- LPG, Chlorine & Acetylene Leakage
- Smoking
- Oxygen leakage
- Dry wild growth and dry vegetation
- Spark from ferrous materials
- Welding/ cutting
- Grinding
- Hot surface
- Lightning

Fire Zone

As per National Building code, the building of Cittaranjan Locomotive Works comes in Fire Zone classification as under

- Residential (Group A), educational (Group B), assembly (Group D), business (Subdivision E-1) Buildings are classified in Fire Zone -1

- Business (Subdivisions E-2 to E-5) and industrial buildings (Subdivisions G-1 and G-2), except high hazard industrial buildings (Subdivision G-3) comes under Fire Zone -2 classification.
- Group H, Storage Buildings are classified in Fire Zone - 3.

Existing Fire Protection Arrangements

7. Existing Fire Protection Arrangements and Manpower

Fire Protection Arrangements

Fire Extinguishers

Portable fire extinguishers are an important part of the overall fire protection arrangements for any facility. Portable fire extinguishers are not expected to deal with large fire since those are essentially first aid firefighting equipment.

Portable fire extinguishers are intended to as first line of defense to cope up with fires of limited size. Provision of unsuitable types, incorrect operation or improper maintenance of the extinguishers have at times, led to failure in tackling the fire effectively at the early stages, thus involving greater loss of life and property. When portable extinguishers are used promptly and effectively by trained personnel, they can prevent a small fire from becoming a major emergency. The essential requirement is suitable type of portable fire extinguishers and their location for quick application. Periodical inspection, testing of the extinguishers and training of personnel are equally important. The selection and installation of extinguishers is independent of whether the building is equipped with automatic sprinklers, hydrant and hose or other fixed fire protection equipment. The selection of fire extinguishers for a given situation shall be determined by the applicable requirements of the following factors:

- (1) Type of fire most likely to occur
- (2) Size of fire most likely to occur
- (3) Probability of Rate of Spread of Fire/ Fire Propagation
- (4) Hazards associated with the area
- (5) Energized electrical equipment in the vicinity of the fire
- (6) Ambient temperature conditions


Further, the number and size of fire extinguishers required for any particular premises is determined by the appropriate authority taking into consideration the severity of incipient fire anticipated, rapidity with which a fire may spread, intensity of heat that may be developed, accessibility to fire, type of extinguisher, the smoke contributed by the burning material, special features of building construction and nature of occupancy (single or mixed) and electrical fitting, equipment etc. installed therein.

Consultancy team physically checked different types of fire extinguishers deployed in various locations in the Chittaranjan Locomotive Works and reviewed adequacy and further requirement keeping in view the above factors. Following Fire extinguishers have been placed at strategic locations: -

- | | | | |
|-------------------|----------------------------------|---|-----|
| • DCP (BC Type) | 2 Kg/ 5 kg | - | 700 |
| • CO ₂ | 2kg/3kg/4.5 Kg/6.5kg/22.5kg/50kg | - | 259 |
| • Foam Type | 9 liter | - | 03 |

Existing Fire Fighting Equipments

Fire Extinguisher



Sl. No	Locations	DCP Type	CO ₂ Type	Foam Type	Total
1.	Locoshop premises of CLW	395	85	-	480
2.	All the Stores Godowns including GSD	178	67	-	245
3.	Works office building	14	08	-	22
4.	GM office building and its annexes	21	28	-	49
5.	D&D office	20	06	-	26
6.	K.G. Hospital	17	37	-	54
7.	Technical Training Centre	04	03	-	07
8.	Central Power House	14	18	03	35
9.	Rest Houses	11	01	-	12
10.	Officers Club	01	01	-	02
11.	SSE/WD's office	14	02	-	16
12.	Filter Plant	11	03	-	14
Total		700	259	03	962

Fire Detectors:

As it is very essential to get the information of any fire incident in its incipient stage otherwise loss of life and property may increase to manifold. Fire detectors (Smoke Detector) installed at TM assembly 3 phase coil insulation AC room with MCP, EDP Centre, AC Godown C-Ward/TM and old panel room/ switchgear room of CPH.



Manual Call Points

Areas protected with Fire detector are provided with Manual Call point to raise an alarm manually in case any person notices fire at any part of the protected area.



Hydrants

Hydrants are pressurized water sources to provide continuous water to tackle fire. 24 hydrant outlets have been provided throughout the CLW (Loco shop premises-18, GSD-01,

Works Office building-01, D & D Building-01, K G Hospital- 02 & CPH-01) and only 01 hose box with two hoses and a short branch has been provided only at Central Power House.



Fire Fighting Water Supply Arrangement:

Consultancy team noticed that in CLW no dedicated firefighting pump house has been provided. Raw water fed in hydrants through pipe by means of gravity from an overhead tank of 1,00,000 gallon capacity at a height of approximately 25 meters. Total 13 static Fire water tanks of various capacities have been provided at strategic locations to make suction lift the water by fire tender in case of requirement.

Communication system

The fire station is provided with a P&T number 0341-2527254, Intercom-telephone numbers 40888 & 40480, for communicating information regarding fire and other emergencies.

Nearby Fire Station

1. State Fire service Asansol (WB) -Approx. 32 Km. away from CLW
2. State Fire service Jamtara (JH) – Approx. 17 km away from CLW.

Approach Roads

Approach roads leading to Loco shops are wide enough to provide direct entry for firefighting and emergency vehicle.

Manpower

Skill & knowledge profile of Firefighting Staff

Sub Inspector P K Dutta of Railway Protection Force RPF, has been assigned to look after fire prevention and protection of the CLW organization along with 06 other RPF Constables. Those personnel have been deployed with just rudimentary firefighting training to cater the need of Firefighting, equipment or system inspection and its maintenance.

RPF Security personnel are providing security to entire premises and they are also supposed to have skill and knowledge of operation of Fire extinguisher and other firefighting system.



Observations & Recommendations Based on Gap Analysis

8. Observations and Recommendations of Fire Protection Arrangements.

Observations:

- As per records available with RPF, most of employees of CLW have been facilitated with operational training of Fire extinguishers by RPF personnel. During interaction with the employees, it was experienced that most of them are not having hands on experience for operating Fire extinguishers. Few employees verbally showed confidence to have operative knowledge of Fire Extinguishers but couldn't perform at expected level.



- Similarly, only very few security personnel were confident to use fire extinguisher, few of them also found to be not sure to choose suitable extinguisher in case of fire of different materials.
- In some places Fire extinguishers have not been checked for more than expected time period.



- Extinguisher operation is responsibility/ expected from personnel of Fire fighting and Security team.
- Type and number of extinguishers placed in most of the facilities are found to be inappropriate and inadequate.
- Most of the extinguishers deployed throughout the works and office premises are very old and not confirming to present norms.



- At few places some Extinguishers are not kept at conspicuous and appropriate places.
- At few places extinguishers are placed or kept in such a way that it will be very difficult to approach those in case of emergency.



Fire Extinguisher

- Most of the extinguishers provided in CLW are very old (some of those are 20 years old) and not conforming to present norms. In few confined places Dry Chemical Powder extinguishers have been provided, but when DCP is used in confined areas, it may reduce visibility for a few minutes, which may temporarily jeopardize escape, rescue or other emergency action.
- Fire Hydrants are of old pattern and connected with gravity tank. No dedicated Fire water pump house is there for the hydrant network. No hose boxes with firefighting hoses and branch pipes have been installed near the hydrant points.
- Hydrant keys are also not provided near the hydrant points therefore those can only be operated by fire fighting personnel only after their arrival at the spot. Hence it may not be useful for the employees to attack the fire in its incipient stage.



- Safety Data Sheet (SDS) of stored hazardous Chemicals in different stores has not been displayed for ready reference.
- The practice of special permission for performing hot job does not exist.
- Eye shower at paint shop was not working.
- Eye shower not provided in PLT charging station, Acid Godown.
- Smoke detection system in Air Conditioned Godown/ TM, EDP centre & Coil shop were not functional. There is no system of periodical joint fire safety inspection of FDA System.
- At Central Power House, for the fire protection of transformers of rating more than 10 MVA, active fire protection system, like Medium Velocity Water Spray System, has not been provided.
- Fire Tender Driver is outsourced, which is not at all a reliable mode of operation, as only 01 person has been hired for driving fire tender. The so engaged person doesn't possess technical knowledge of how to fire vehicle pump operation and safety measures to be adopted during a fire call.
- The consultancy team conducted two mock fire drills on two separate days and place, to check the efficiency and efficacy of present fire fighting response mechanism. In one such drill, the driver arrived at Fire station from his residence, only after 28 minutes of placement of call. As the call was placed during regular factory hours i.e. around 4 PM, it indicates that inappropriate odd hour human resource management may cause severe loss to the organization. On that mock fire drill, the Fire crew responded at the spot after 35 minutes only.
- In another Fire Mock Drill the response time was little better but a fire crew of three personnel responded, though enthusiastic but found to be not as effective as it was supposed to be. During the same operation Consultancy Board found only 2 Kg/Cm² pressure in fire hydrant network, which as per norms and technically cannot be trusted as effective pressurized source of water for firefighting.
- A Fire Fighting Team of RPF comprising only 07 personnel without any proper fire fighting training, is providing fire protection to the entire CLW and its other facilities with 01 Fire Tender of 14000 Liters Water Tank Capacity and a Fire Goods Vehicle (Jeep) which is used for imparting training and transportation.
- In CLW no one has been designated as Fire Officer to supervise, upkeep and maintain appropriate fire safety and service standards.
- In all the three shifts, no dedicated manpower is detailed for manning of the Fire Control Room. In case of simultaneous fire calls no other driver and man-power is readily available to respond, even the fire call will not be received at Fire Control Room. Literally no team or Fire Tender will be available to respond at all, till arrival of reserve/ off-duty strength.
- It will be pertinent to mention that even though 400 RPF personnel are performing Security Duty in CLW and all of them are having theoretical knowledge of operation of Fire extinguisher but most of them are not having hands on experience and confidence to initiate fire fighting or respond properly in such emergency. Improper training and non-availability of fire tenders and trained fire fighters, it may therefore anytime lead to disastrous scenario as the State Fire Services may arrive for help only after 40 minutes to

1 hour as CLW is situated at 32 km distance from Asansol (West Bengal) and 17 km From Jamtara (Jharkhand).

- The intercom and land line numbers mentioned in various safety posters or flex banners for communicating emergency services are mostly no more in existence and mobile nos. mentioned there, are of individuals (Constable/ Security persons) who were sometimes found to be off duty and as such diverting calls for onward communication. During Mock drills the call placement itself took more than 3-5 minutes on two different occasions.
- The Fire Station is having only one but very old Breathing Apparatus and no firefighter is trained in using BA set and conducting search and rescue operations. For refilling BA sets no compressor is also available.
- No dedicated Man-Power was found earmarked for fire prevention checking purpose. Contrary to norms, there is no specific mandate of periodical checking on monthly, quarterly, half yearly or annual basis.
- The fire station is not equipped with Fire Protective Suit, Fire Proximity Suit, Fire Entry Suit, Chlorine Handling Kit or PVC Suit and as such is not at all capable of critical fire emergency management.
- Availability of alternate extinguishing media (other than water) was found to be inadequate. Only 640 liters of AFFF Foam compound was available whereas availability of DCP was less than 200 Kgs.
- No pressurized outlet was observed at Fire Station or any nearby location, for refilling of fire tender. As such the 14000 Liters Fire Tender takes more than 15 minutes for refilling through suction lift from the available open reservoirs, which means if in case water exhausts during fire fighting it will take a minimum of 25 minutes to return back to action and till such time the fire scenario may worsen and blow out of proportion, resulting in colossal loss.
- Another fire tender having 2800 liters water tank capacity was found to be old, defunct and awaiting condemnation.
- No walkie talkies were found with the fire fighting team during the Mock Drills. Communication may become difficult with mobile at times and as such a dedicated Fire Alarm Call Attendant should have been coordinating with the fire fighting team to assess, if additional back up of man-power or any other assistance is required, but the same was not available.
- It was observed that at some places electrical power source is being used without adopting proper electrical safety norms such as not using plug tops, multi-taping, not ensuring appropriate concealed wiring which increases fire risk and hazards.
- All pressurized gas cylinders like Acetylene/ Argon should be kept upright/ vertical and secured with the application of compact flexible chain lock system and must not be allowed to suffer from accidental fall. Failing which, cap assembly may get ruptured (in absence of protection cap) in case of accidental fall and the same may become projectile and cause collateral structural damage and explosion which in turn may cause mass casualty incidents.
- In few places pressurized gas cylinders have been stacked near electrical points, which poses serious hazard in case of any electrical spark.

- Sand buckets and DCP Extinguishers have been provided for fire protection of CNC Machines, which is not advisable keeping the cost and sensitive nature of the machine in view. Use of sand or DCP can affect the coolant and electronic system of CNC.
- Live Hot Fire Mock Drills are not being organized on regular basis in CLW. As an extended follow up, training of Extinguisher Operation are only being imparted without hands on exposure (only methodology is being shared) for participants and termed as “Mock Drill”. No proper sensitization of active participation during simulated Fire/ Emergency/ Rescue scenario is being carried out and as such community awareness on fire safety parameters are being compromised.
- Assembly Points for most of the shops and offices, within and outside Factory Premise (including Hospital/ Guest Houses/ Clubs) were not found displayed prominently.
- Dates of last calibration and next due calibration are not marked/ pasted on pressure gauges.
- No LPG gas detector and Alarm System was found provided in LPG Godowns and LPG pipeline in shops except in one of the Godowns situated at Paint Shop.
- In few stores Petrol (MS) and other flammable liquid like kerosene, Diesel, Thinner etc was found kept inside, which may prove to be dangerous.
- At few charging stations, Acid and batteries are closely placed near the charging point.
- In many places the shop floors were found in slippery condition.
- Cable Layout of LTHT Switch Gears and Sub Stations cum Transformers and few electrical installations were found to be inappropriate.



- Improper stacking up to the height of the store ceilings was observed.



- In few shops and stores, personal vehicle specially two wheelers are being parked in close vicinity of machines and stores.
- Heap of spare scrap cables are piled very near to the wall of ERS.
- It was informed to consultancy team that Disaster Management Plan is not vetted by competent authority i.e. District Magistrate/ Collector and it is not properly circulated and therefore employees are unaware of their role and responsibility during different emergencies. Fire Alarm signal/ siren is an integral part of DM Plan but most of the employees are unaware of the same.
- Signal testing schedule was found to be unavailable.
- It is observed that no history sheet of fire extinguishers is available and fire extinguisher checking card/ sticker is not available due to which the history of the extinguishers deployment/ checking details are not available.
- Periodical Hydraulic pressure testing of extinguisher is not being carried out to ensure its trustworthiness.
- Identification numbers of fire extinguishers not provided.
- Fire extinguishers checking register not maintained in fire station.
- Old scrap/damage batteries are stored in PLT charging station haphazardly.
- Rubber mats are not provided in few HT/LT switchgear/ electrical panel.
- Cables in many placed specially in Panel room not properly provided with cable tray/cover.



- High voltage caution plate should be placed in appropriate location.
- In paint shop PPE's such as rubber hand gloves, canisters condition is found in compromised position.



- Use of agarbatti/ incense sticks/ Diya shall be prohibited in paint shop/store areas/shop floors etc.



- It is observed that no wind socks have been provided at appropriate places of CLW.
- No fire order, clearly indicating duties and responsibilities of various department, employees and personnel has been published and distributed.

House keeping

At most of the places the standard of housekeeping at CLW is having sufficient scope for improvement.

- Traction motor area and stores in TM areas are very congested due to haphazard placement of machines, accessories, spares and other material.



- Dry grass, plastic drums, packing & waste materials etc. are dumped in few places.



- Similarly, most of the offices and store at ELB, ELF and TM area found to be clumsy and less spacious. Furniture, material and other combustibles are stored and stowed in such a manner that in case of Fire emergency it might be very difficult for occupier to approach to the place of safety. At the same time in case of Fire, it will be very difficult for the Fire fighters or other responder to douse the fire in a short time which will allow the fire to propagate and expand.
- In many places the shop floors were found slippery which may lead to accidents resulting in collateral damage including fire.
- Even though waste materials were found segregated separately, still the schedule of disposal is not regular and the same creates unnecessary fire hazard.
- It was observed that in few of the shops proper Central Pathway/ Track/ Alley/ Free Passage for to and fro movement of emergency management vehicles/ ambulances etc were not maintained.
- Improper stacking up to the height of the store ceilings was observed as in absence of a standard safety margin even a small fire incident may propagate beyond control.
- Cable Layout of LTHT Switch Gears and Sub Stations cum Transformers were found to be inappropriate and placed in haphazard manner.
- Stacking and stowage at few stores, especially Air Conditioned stores are found to very congested and hazardous from Fire safety point of view. Flammable materials along with other material has been stored together
- Multi-agency coordinated mock drill for better preparedness has not ever been conducted.
- Mutual-aid does not exist with nearby industries.

Recommendations:

- Regular and proper first aid Fire fighting training with hands on experience of Extinguisher operation shall be arranged for the employees and contract workers.



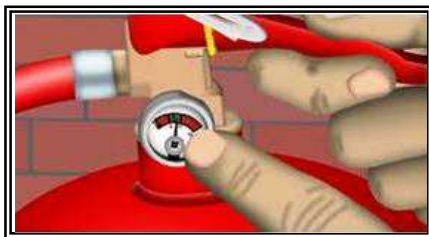
- Similarly, RPF security personnel shall be given such training including hydrant operation with hose.



- Extinguisher operation is expected from personnel at shops or affected area. Such participation is very much expected from the employees toward ensuring fire safety of their esteemed organization. Efforts shall be made to make it clear to all the occupants that extinguisher operation not only the responsibility of security personnel.



- Type and number of extinguishers is given at the end of recommendation section.
- Extinguisher conforming to new norms (mainly IS: 15683: 2018) shall be deployed for better fire safety.
- Extinguishers shall be placed and kept at conspicuous and appropriate places.
- In all places, materials/ furniture shall be stored in such a way that during fire emergency, approach to extinguisher is not obstructed.
- All Fire extinguishers shall be checked minimum on quarterly basis.



- A new pressurized Fire water hydrant network shall be constructed to meet the Fire water need of CLW. To feed Hydrant network a dedicated fire water pump house shall be installed at appropriate place/ places with two electrical pump of 1280 rpm of min. capacity 410 M3/hrs, one diesel pump of min. capacity 410 M3/hrs and two Jockey pump of min. capacity 40 M3/hrs along with 4, 00,000 liters static water tank of underground or above ground. The so constructed pump house shall be provided with properly round the clock manned control room.



- Sufficient pressure gauges shall be provided on entire length of Hydrant water line.



- Fire hydrant outlets shall be provided near various facilities. Those hydrant outlets shall be equally spaced and generally kept 30 meters apart.
- Hose boxes with firefighting hoses and branch pipes shall be provided near hydrant points with all other accessories to operate it.



- Employees shall be trained to have basic operative knowledge of Fire hydrant.



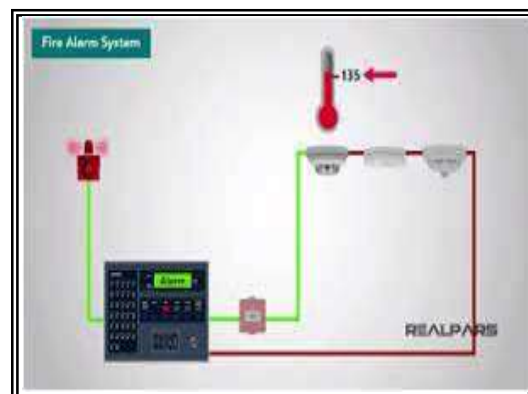
- Safety Data Sheet (SDS) of stored hazardous Chemicals in different stores must be displayed for ready reference.



- Prior permission for performing hot job at any place within CLW premises shall be taken from Safety Officer or any other designated person. Such written permission shall contain all safety norms to be followed, in from of a checklist.
- Costly and delicate machines like CNC, shall be protected with Clean Agent type or specified type (if any) of extinguisher.
- Eye shower shall be provided at all places where hazardous chemicals are being used or stored. The proper functioning of Eye Wash and Body Shower shall be ensured on quarterly basis.



- Smoke detection system in Air Conditioned godown/ TM, EDP centre & Coil shop shall be got checked and made functional (if found cost effective). In case of repair of these system is found to be non- cost effective, a fresh Smoke detection system can be given priority. Joint fire safety inspection schedule of Fire Detection and Alarm, FDA System shall be brought in practice.



- The General Manager's Building and Design and Development, D&D building are, as per norms required to be protected with Fire Detection and Alarm, FDA system.
- Annual Maintenance Contract for keeping the system healthy will prove to be useful and effective.



- At Central Power House, for the fire protection of transformers of rating more than 10 MVA, active fire protection system, like Medium Velocity Water Spray System shall be provided and the same shall be inspected on regular basis and tested for its healthiness on regular basis.



- All transformer installations should comply with the provisions of IS1646: and as a protection against excessive damage due to occurrence of faults, transformers fitted with conservators should be protected with Buchholz Relay. All other transformers should be equipped with oil temperature alarms or excess current relay protection. The level and dielectric strength of the transformer oil should be checked at periodic intervals and in the event of presence of a large quantity of sludge, the oil shall be renewed.
- Few buildings and facilities of CLW have not been provided protection against "Lightning". Lightning can cause 'consequential effect' on not only material, goods and property but also on other aspects as the disruption of essential services of all kinds, particularly in hospitals and sophisticated and costly machines of various shops. Life risk can also not ruled out during Lightning, therefore suitable Lightning arrestor shall be provided as a safety measure.
- All electrical power sources shall be used by adopting proper electrical safety norms such as use of plug tops, no multi-taping, ensuring appropriate concealed wiring of proper rating, which will in turn limit and restrict fire risk and hazards.

- As such the responsibility of fire fighting and manning cum operating the Fire Station in an effective manner, it must be handed over to a properly trained team (from any standard Fire Service Training Institute, preferably Central or State Govt. Organizations authorized for the purpose) of fire fighters comprising a minimum strength of 28. At least a strength of 08 fire fighters (Officer and Firemen) including 01 Driver cum Pump Operator shall be engaged in each shift of 08 hours (6 AM to 2 PM, 2 PM to 10 PM and 10 PM to 6 AM), under the supervision of Shift In-Charge in each Shift (of the stature of Station Officer). In order to supervise the entire functioning of the firefighting and fire preventive activities of CLW, 01 Fire Officer of the stature of Divisional Officer shall be deployed. Fire Officer shall supervise, up keep and maintain appropriate fire safety and service standards. Further to assist him, 01 Sub Officer and 01 Lead Fireman and 01 Driver cum Pump Operator shall be spared for Office work, Store Management, Record Keeping, Management Correspondence and Vehicle Maintenance cum Training purpose.



- The above Man Power may be recruited from the Open Market as well, against fulfillment of the eligibility criteria which must essentially include basic Fire Fighting Training from any GOI recognized training institute as specified above and Heavy Commercial Driving License in case of Shift I/C's i.e., Station Officer Course qualified candidates and DCPOs. The Fire Officer must possess a minimum experience of 10-15 years in the field of fire fighting and should have qualified the Divisional Fire Officer Course or equivalent Course. The Sub Officer and Clerk should also have Basic Fire Fighting Training.



- The approximate market rate of engagement (all inclusive Cost to Company) may be assumed as a total of approximately Rs. 95 Lakhs per annum i.e., 7.9 Lakh per month @ Rs 1 Lakh (01 Fire Officer), Rs. 60 Thousand (03 Shift I/C's), Rs. 50 Thousand (01 Sub-Officer) and Rs. 20 Thousand per head for 22 Skilled Fireman/Driver cum Pump Operator and 01 Clerk.

- Live Hot Fire Mock Drills shall be organized on regular basis in CLW to keep Fire fighting system effective and all associated persons sensitized.
- It will be better if two such mock drills are organized in a month, keeping the practicality and level of awareness in view, number of Mock drills can be reduced to at least one in a month. New problems and area of emergency shall be fruitful to improve Fire preparedness of CLW. Proper sensitization for active participation during simulated Fire/ Emergency/ Rescue scenario shall be carried out and as such community awareness on fire safety parameters shall be improved.



- A Water Mist jeep with 500 liters of water and 100 liters Foam capacity is recommended to strengthen Fire Fighting preparedness.
- All RPF personnel deployed for security duty at CLW shall also be provided with theoretical and practical knowledge to operate Fire extinguisher. They shall also possess the skill to use Fire fighting hose. Refresher training for them is required at regular intervals to keep their skill updated.



- The intercom and land line numbers, communication system shall be improved and proper functioning numbers (not pertaining to any specific person) shall be given wide publicity.
- At least 06 Breathing Apparatus set shall be provided to fire fighting team and regular training and practice shall be arranged. Arrangement for refilling of those BA Cylinder is also essential. In case of non availability of such facility in local area, it would be convenient to procure a BA compressor for the purpose.



- Regular Fire preventive checks are required to be carried out by proposed team of firefighters and record of the same to be kept as a statutory requirement.



- A minimum of 02 Fire Protective Suit (Fire retardant overall), 02 Fire Proximity Suit, 01 Fire Entry Suit, Chlorine Handling Kit and 02 PVC Suit shall be made available as capacity building measures for critical fire emergency management.



- Availability of alternate extinguishing media (other than water) shall be ensured. Minimum 2000 liters of AFFF Foam compound and 2000 kg DCP (Mono Ammonium Phosphate based) shall be kept in ready stock.



- At least one pressurized hydrant outlet shall be provided at Fire Station or any nearby location, for refilling of fire tender in shortest possible time.
- Minimum 04 walkie-talky sets shall be made available with firefighting team to improve reliable communication while tackling with emergencies.
- All pressurized gas cylinders like Acetylene/ Argon should be kept upright/ vertical and secured with the application of compact flexible chain lock system and must not be allowed to suffer from accidental fall. In no case pressurized gas cylinders shall be stacked near electrical points. Such system shall be followed in case of empty cylinders also.



- Assembly Points must be clearly earmarked using Flex Boards/ Painted Boards etc., in distinctly visible fonts using local and official languages.



- Pressure gauges shall be periodically calibrated and dates of last calibration and next due calibration shall be marked/ pasted on it.



- In LPG Godowns and LPG pipeline in shops, LPG gas detector and Alarm System shall be provided to control the risk of fire emergency. In Paint Shop such type of detector has been provided.



- The practice of storing Petrol (MS) and other flammable liquid like Kerosene, Diesel, Thinner in various stores shall be stopped immediately. Such material in small quantity can be permitted to be stored in separate enclosures to avoid any fire incident.
- Acid shall be kept in a safe way so no one shall get affected from Acid or Acid fumes while working in those areas.
- The places in various shops, where lubricating oil or other chemicals are being used, the shop floors shall be provided with epoxy coating which will be easy to clean if leakage or splash of oil/chemicals takes place.



- Cables in Switch Gears, Shop floors and Sub Stations cum Transformers shall be properly laid out in tidy manner in trenches or cable trays.
- Stacking of material in stores shall be done in neat and tidy manner. Stacking up to Ceiling or False ceiling, any electrical fitting like fan, light or any other energized equipment shall be stopped/ removed immediately.
- Parking of personal vehicle, specially two wheelers in shops and stores in close vicinity of machines or process area shall be stopped and discouraged.
- Heap of spare scrap cables, piled adjacent to the wall of ERS and other location of CLW shall be removed and kept at a safer place to avoid any fire incident.
- The Disaster Management Plan should be vetted from District Magistrate and should be circulated to all the employees.
- Fire Siren/ signal shall be at least tested once in a month to ensure its effectiveness and to make employees aware of the same.
- History sheet of fire extinguishers and checking records shall be maintained and fire extinguisher checking card/ sticker shall be made available.
- In order to ensure trustworthiness of extinguishers periodical hydraulic pressure testing shall be carried out as per norm.
- Identification numbers of fire extinguishers is to be provided.

- Old scrap/ damage batteries shall be removed from PLT charging station and placed in a safer location.
- Rubber mats shall be made available in all HT/LT switchgear/ electrical panel.
- High voltage caution plate should be placed in appropriate location.
- Dry grass, plastic drums, packing & waste materials etc. shall not be allowed to be dumped at any work/ store location of CLW. These should be properly disposed off.
- Compromised PPE's such as rubber hand gloves, canisters shall not be taken in to use in paint or any other shop.
- Use of incense sticks and lamp (candle etc.) shall be restricted in all shops/ store areas/ work area.
- Wind socks shall be provided at appropriate places of CLW.
- Fire order, clearly indicating duties and responsibilities of various department, employees and personnel is required to be published and distributed among employees.
- Two motor cycles with water mist system shall be provide for ensuring quick response.
- Evacuation drill shall be conducted at least on six-monthly basis in buildings, stores and the areas where accumulation of number of people is on the higher side (dense occupancy).
- If extinguishers are placed outside, proper shade shall be made to protect it from extreme weather.
- As CLW is an industry of national importance and keeping in view of its vulnerability, at least one in a year such joint mock drill involving nearby industries, local District administration, State authorities and NDRF shall be conducted.
- There shall be Mutual-aid with nearby industries to help each other at the time of emergency.
- A Fire control room shall be established at fire station with round the clock manning in three shifts with intercom telephone, CUG telephone facility.
- Smoking shall be strictly prohibited in entire CLW premises to prevent Fire incident.
- Proper earthing of electrical installation shall be tested on regular intervals.

Stores and storage arrangement

Few recommendations are given below for better and fire safe storage of goods at stores:-

Aisles and Passageways

- Aisles and passageways should be maintained at reasonable intervals to provide convenient access to all portions of storage.
- These passageways or aisles should be so spaced that the total content of individual stacks does not exceed 700 m³. In case of baled fibers or other combustible goods, however, aisles shall be placed as intervals not exceeding 15.0 m.
- The passageways or aisles should be of sufficient width for the removal or transfer of material and in general, shall have a minimum width of 2.0 m.
- Where mechanical handling appliances are used a minimum width of 2.5 m should be provided
- As far as practicable, passageways and aisles should be located opposite doors or window openings in the exterior walls and no goods should be deposited within 2.0 m

of any such opening so as not to cause difficulties in the way of effective operation of water jets from hoses connected to hydrant points or from fire engines.

- Wall aisles, that is, the aisles alongside walls should be of sufficient width to permit passage of an employee. In case of storage of water absorbent materials, the width of wall aisles should not be less than 1.0 m.

Stack Heights

- Stack should not be piled so high as to make them unstable under fire fighting conditions and in general they should not be more than 4.50 m in height where no automatic sprinklers are installed.
- In any case, the maximum height of stacks should not exceed 12 m.
- In no case, however, the clearance of the top of the highest storage level from undersides of the lowest beams, girder or other ceiling projections should be less than 1.0 m.
- A colour band should be painted on the walls of the godown indicating the maximum height to which materials are to be stacked
- Stacks shall have a clear distance from any electrical appliance.

House keeping

At most of the places the standard of housekeeping at CLW is having sufficient scope for improvement.

- Machines, accessories, spares and other material in Traction motor area and stores in TM areas shall be kept in neat and tidy manner. Their arrangement shall be such that any response vehicle shall reach at place of incident in the situation of emergency.
- Most of the offices and store at ELB, ELF and TM area found to be clumsy and less spacious. Furniture, material and other combustibles shall be stored and stowed in such a manner that in case of Fire emergency it occupier can approach to the place of safety, at the same time in case of Fire, Fire fighters or other responder can reach without any obstruction to douse the fire in a short time.
- Regular housekeeping competition in all the shops on quarterly basis and amongst all the shops on annual basis may be introduced to encourage adaptation of best practices including proper storage and stacking of combustible consumables.
- Schedule of disposal at regular interval may be designed and proper record of the same may be maintained to ensure strict compliance of the pre planned routine execution.
- Better housekeeping measures and supervision shall be ensured and all the access and evacuation points to be kept clear of any sort of obstruction so as to allow movement of major fire fighting appliances/ fire fighters.
- Stacking and storage at few stores, especially Air Conditioned stores shall immediately be improved. Flammable materials shall not be stored along with other material.
- It should be taken care and kept in mind that materials are not stored beyond the capacity of the stores. If required excessive items (just keeping the requirement of items for a specified time) shall be shifted to safer, spacious location.

Evacuation Drill

Though SOP for emergency evacuation is formulated and is reported to being practiced, however, Fire evacuation drill process guidelines are enclosed as Annexure – V may be incorporated

Fire extinguishers:

General guidelines for extinguisher deployment is being given below:-

- New extinguishers are proposed to be procured and placed according to latest, relevant BIS codes including IS: 15683. If it is not possible to replace old extinguishers at once, a phase wise program shall be followed for the same.
- For buildings used as offices, minimum of two extinguishers per compartment should be available. The extinguishers should be so located as to be available within 10 m radius.
- For buildings used as workshops/ workplaces, minimum of four extinguishers per compartment should be available. The extinguishers should be so located as to be available within 15 m radius.
- Extinguishers shall be properly placed/ secured on wall so as not to hinder routine operation and its easy withdrawal in case of need.
- Extinguishers to be housed in readily accessible and unlocked receptacles, clearly visible and unobtrusive.
- Labels of fire extinguisher shall indicate its usability and operational guidelines.

- For CLW following extinguishers are proposed :

S.N	Location	Type & Quantity of extinguishers			
		Clean Agent (ABC Type) 4 Kg	CO ₂ 4.5 Kg	DCP (ABC TYPE)	
				6 Kg	6 Kg MFCF**
01	GM Building and Annexes	10	30	10	50
02	Work Office	10	40	30	10
03	Design & Development	10	10	-	20
04	Loco shop premises	20	200	350	30
05	Stores Godowns including GSD	-	50	150	
06	Technical Training Centre	05	10	05	
07	Central Power House	-	20	30	
08	SSE/W/WD's office		04	16	
09	Filter Plant		04	12	
10	Kasturba Gandhi Hospital	05	40	25	05
11	Rest Houses		08	32	
12	Officers Club	04		02	04
		64	416	662	119

Special Recommendation								
S.N	Location	Type & Quantity of extinguishers						
		Trolley Mounted Water Mist cum CAFS 50	Modular type DCP 5 Kg	Modular type Clean Agent 5 Kg	Clean Agent (ABC Type) 4 Kg	DCP 25 Kg	Foam 9 Ltr	Foam 45 Ltrs
01	CPH Diesel Tank & Gen. Area					05		05
02	CNC Machines				15			
03	Valuable Stores		24					
04	Cabin of Over Head Cranes				20			
05	Loco Shops (Extra Protection)	10					25	
06	Medicine/ Vaccine stores at K G Hospital			06				
07	Servers, EDP & Telephone Exchange			06	06			
	Total	10	24	12	41	05	25	05

Note: The Extinguishers, which are already held with CLW, complying to BIS 15683 and proposed type and capacity, can be taken into use if found suitable after relevant performance test.

* 10% extinguishers are to be kept as reserve to replace the used one immediately.

** Keeping the dignity, sophisticated nature and significance of few important offices like GM Building and other important locations, Maintenance Free and Corrosion Free, MFCF extinguishers, which are having a shelf life of 20 years are being proposed. These extinguishers have an added benefit as these can be operated over live electrical equipment due to non – conductive extinguishing media Though the initial cost of those extinguishers is on higher side but in long run, due to virtually no requirement of maintenance, these can prove to be cost effective.

8.5 Financial Implication

Approximate financial implication for the recommendations made is as under:-

S.N	Particular	Qty	Approximate Rates per Unit in Rs.	Rupees
01	Clean agent 4 Kg	105	20,000/-	21, 00, 000
02	CO ₂ 4.5 Kg	416	5,000/-	20, 80, 000
03	Dry Chem. Powder (ABC) Type 6 Kg	662	3,000/-	19, 86, 000
04	Dry Chem. Powder (ABC) Type 25 Kg	05	16000/-	80, 000
05	Dry Chem. Powder (ABC) Type 6 Kg Maintenance Free Corrosion Free	119	48,000/-	57, 12, 000
06	Trolley Mounted Water Mist cum CAFS 50 Liter	10	5,00,000/-	50, 00, 000
07	Modular type DCP 5 Kg	24	5000/-	1, 20, 000
08	Modular type Clean Agent 5 Kg	12	20,000/-	2, 40, 000
09	Foam 9 Ltr	25	3,000/-	75, 000
10	Foam 45 Ltr	05	10,000/-	50, 000
11	Motor Cycle with Water Mist	02	4,00,000/	8,00,000
12	Jeep with Water mist	01	15,00,000/-	15, 00, 000
13	Fire Detection and Alarm system	02	50,000/-	1, 00, 000
14	Hydrant network with Pump House	01	12,00,00,000/-	12,00,00,000
15	Man Power (Annual Recurring Expense)			95,00,000
	Total			14, 93, 43, 000

Annexures

Inspection & Maintenance Procedure of Fire Extinguishers

A well planned and approved maintenance schedule is essential to ensure that an extinguisher:

(A) Will operate properly between the time intervals stipulated in the maintenance program for periodical inspection/maintenance:

(B) Will not constitute a potential hazard to persons in its vicinity or to those who operate or recharge the extinguishers.

1.1 General safety precautions for Maintenance:

While opening any extinguishers

- a) Ensure that there is no residual pressure in hose and / or Nozzle assembly.
- b) Unscrew the cap or valve assembly slowly for two to three turns only, to allow residual pressure to escape via the vent holes and do not unscrew it further until all pressure is released.
- c) Do not depend on pressure indicating devices like gauges (in the case of stored pressure type extinguishers) to verify whether the container is under pressure or not, as they could malfunction.
- d) If pressure is not being released after unscrewing the cap or valve assembly two or three turns, then do not unscrew it further without taking appropriate safety measures; sudden release of pressure may eject parts, cap assembly, or the contents of the extinguishers. The use of suitable clamping arrangements and appropriate personal protective is advisable.
- e) At all times when attempting to remove parts from extinguishers at the time of inspection/maintenance, persons, should ensure that they are clear of any parts may be ejected.
- f) Other safety Guidelines:
 - Dry powder extinguishers should be opened only in the driest available conditions and for the minimum time, necessary for examination to minimize the effect of atmosphere moisture on the powder. Moisture causes caking of the powder.
 - It is even more important that mixing or cross-examination of different types of powder be avoided as it may cause chemical reaction resulting in a dangerous pressure buildup in the container. This reaction may become apparent only after a few weeks.
 - All sealing components should be cleaned and properly lubricated to prevent leakage after recharge.
 - Check pressure indicating devices to ascertain that it gives proper readings.
 - Never connect to a stored pressure extinguisher to be charged direct to the high-pressure source. Connecting directly to the high-pressure source could cause damage or even rupture of the container and may result in injury.
 - Only those gas cartridges which will suit the particular type and capacity of the extinguisher should be used.
 - Certain recharging materials deteriorate with age, exposure to excessive temperature and moisture. Storage of recharge materials for long periods should be avoided.
 - Normal workshop compressors deliver air with high moisture content. Moisture traps halogenated agents, clogging of pressure gauges and internal corrosion.

- On all higher capacity dry powder and carbon dioxide extinguisher equipped with a shunt off nozzle, the hose (without the nozzle) should be removed and tested annually.

1.2.1 Fire extinguishers Dry Powder Type gas cartridges

All dry powder extinguishers should be inspected and maintained in accordance with the following. The dry powder extinguishers should be opened in a dry room and for a minimum possible time to avoid effect to atmospheric moisture on powder.

- a) Dry powder extinguisher, where discharge control is fitted on the nozzle, should be operated before opening the extinguisher to ensure that there is no pressure in the extinguisher.
- b) Weigh the extinguisher to check the correct mass of powder filled in it which should be marked on the body of extinguisher and record book when it was first put into service.
- c) Open the extinguisher and remove gas cartridge and see that sealing disc is intact. Weigh and compare its mass with full mass of cartridge marked on it. In case loss of mass is more than 10 percent, it should be replaced by new cartridge.
- d) Check the operating mechanism, discharge control for free movement and closing. Examine nozzle, hose, vent holes, piercing mechanism of cap cartridge holder, grease and wipe clean.
- e) Remove the inner shell (if any) and clean port holes.
- f) Empty the dry powder in a dry container and examine for caking, lumps and foreign matter, in which case replace it with new dry powder charge.
- g) Examine the extinguisher body internally for any damage or corrosion and replace corroded or damaged extinguisher.
- h) Clean the extinguisher using dry air.
- i) Return the original charge to the extinguisher and fit the cartridge and other fittings.
- j) In case of higher capacity dry powder fire extinguisher as per IS 10683, remove the carbon-dioxide cylinder and check the weight marked on the cylinder to ensure that the size confirms to that stipulated in the specification. On weighing, if the loss of mass is more than 10 percent it should be sent for recharging. Also, examine the wheel carriage and discharge hose assembly with control nozzle for free flow and test it with dry air.
- k) The safety valves and pressure gauges fitted on higher capacity extinguishers should be calibrated once in 3 years and recorded in the register.

1.2.2 Fire Extinguisher Carbon Dioxide Type

- a) Examine extinguisher body externally. Damage or corroded extinguisher should be replaced.
- b) Check the discharge horn and ensure there is no damage to it.
- c) Weigh the extinguisher to check its contents of the extinguishing media and compare it with mass recorded on the cylinder. In case of loss of more than 10 percent, the extinguisher should be sent for recharging.

List of Vendors

Sl. No.	ADDRESS
HYDRANT VALVES, BRANCH PIPES & NOZZLES	
01.	M/s Shah BhogilalJethalal& Bros, Gheekanta Road, Near Madhuram Cinema, Ahmedabad – 380 001.Gujrat. Ph: 079 – 2562 4817 Email: info@aaagindia.in Web: www.aaagindia.in
02.	M/s Cosmo Fire Safety Industries, D – 23,1-2, Sec 21-22, CBD Belapur, Navi Mumbai, Maharastra. Ph: 93240 43100 Email: cosmosfirenavimumbai@gmail.com Web: www.cybergroup.in
03.	M/s HD Fir Protect Private Limited, C – 3/6, Nandavan Industrial Estate, LBS Marg, Thane, Mumbai – 400 604, Maharastra. Ph: 022 – 2582 6958, 2582 6793 Fax: 022 – 2851 2524, 6796 9069 Email: info@hdfire.com Web: www.hdfire.com
SPRINKLER AND DRENCHER SYSTEM	
01.	M/s Lloyd Insulations (India) Ltd., Punj Star Premis, Kalkaji Industrial Area, New Delhi – 110 019. Ph: 011 – 3088 2874 / 75 Email: kk.mitr@lloydinsulation.com Web: www.lloydinsulation.com
02.	M/s New Engineering Corporation, 126, Shanti Industrial Estate, Sarojini Naidu Road, Mulund West, Mumbai – 400 080, Maharastra. Ph: 022 – 2560 0131/2561 8734, Email: fireage@vsnl.com Web: www.necfireage.com
03.	M/s Sterling and Wilson Limited, 9 th Floor, Universal Majestic, P L LokhandeMarg, Chembur (W), Mumbai, Maharastra. Ph: 022 – 2548 5452, Fax: 022 – 2548 5331 Email: manojnair@sterlingwilson.com Web: www.sterlingwilson.com

Sl. No.	ADDRESS
AUTOMATIC FIRE FIGHTING SYSTEMS	
01.	M/s Nitin Fire Protection Industries Limited. 501, Delta, Technology Street, Hiranandani Gardens, Powai, Mumbai – 400 076, Maharashtra. Ph: 022 – 4045 7000, Fax: 022 – 2570 1110 Email: nitinfire@vsnl.com Web: www.eurotechcylinders.com
02.	M/s Tyco Fire & Security India Pvt. Ltd., No.141/142,1 st Floor, G Wing, KailashVaibhav Complex Vikhroli West, Mumbai – 400 069
03.	M/s SupremexEquipments, D-2A, Ghatkopar Industrial Estate, LBS Marg, Ghatkopar (W), Mumbai – 400 086, Maharashtra. Ph: 022 – 2500 7406/7493, Fax: 022 – 2500 7295 Email: info@supremexfireextinguisher.com Web: www.supremexfireextinguisher.com

Sl. No.	ADDRESS
AUTOMATIC SMOKE, FIRE DETECTION AND ALARM SYSTEM	
01.	M/s Honeywell Automation India Ltd., 56 & 57, Hadapsar Industrial Estate, Hadapsar, Pune 400 013.
02.	M/s Cinque Solutions Pvt. Ltd., 304, AnkitaJanki Devi School Road, Andheri (W), Mumbai – 400 053, Maharashtra. Ph: 022 – 6529 1068, Fax: 022 – 2393 3380 Email: mumbai@cinquesolutions.com Web: www.cinquesolutions.com
03.	M/s MSA India Ltd., Central Logistics Hub, Panvel Industries Co-operativ Estate Ltd., Panvel, Navi Mumbai, Maharashtra. Ph: 022 – 6529 5486 / 6529 5487 Email: indiasales@msanet.com Web: www.msa-india.com

FIRE EXTINGUISHERS	
01.	M/s Safemax Fire Services, Shop No. 5 & 7, Shree Ganesh Apptt. Sr. No. 79/1, Mokate Nagar, Near Kothrud Depot, Paud Rd., Pune – 38, Maharashtra. Ph: 020 – 2528 1573, Telefax: 020 – 2528 3925 Email: safemaxfire@gmail.com
02.	M/s Bharati Fire Engineers, 206 – B, Flying Colours, LBS Cross Road, PDU Marg, Above Croma, Mulund (W), Mumbai – 400 080, Maharashtra. Ph: 022 – 2568 1269, Fax: 022 – 2568 4298 Email: info@bharatifire.com Web: www.bharatifire.com
03.	M/s Safex Fire Services Ltd., 202 A, Dhanraj Industrial Area, Sunmill Road, Lower Parel West, P B No. 6314, Industrial Estate, Mumbai – 400 013, Maharashtra. Email: sandip812@yahoo.co.in Web: www.safexfire.com
04.	M/s Aska Equipments Pvt Ltd., R- 482, New Rajendra Nagar, Sir Gangaram Hospital Square Shankar Road, New Delhi – 110060. Ph: 011 – 49458800, Fax: =91 - 11– 49458844 Toll free number- 18001238611 Email: sales@askagroup.com Web: www.askagroup.com

Sl. No.	ADDRESS
FIRE FIGHTING CHEMICALS (FOAM / DCP)	
01.	M/s KV Fire Chemicals (I) Pvt. Ltd., Kamala Nivas, 2 nd Floor, Plot No. 32, Lane D, Vashi, Navi Mumbai – 400 703, Maharashtra. Ph: 022 – 2782 0827, Fax: 022 – 2782 4712 Email: info@kvfire.com Web: www.kvfire.com
02.	M/s Integrated Fire Protection Private Limited, 60 A, PanditMadan Mohan MalabyaSarani, Chakraberia Rd. North Kolkata – 700 020 (WB). Ph: 033 – 2454 1061 / 2475 5634 Email: info@integratedfire.net Web: www.integratedfire.com

Sl. No.	ADDRESS
FIRE HOSES	
01.	M/s Newage Fire Protection Industries Pvt. Ltd., 4, Champak Lal Industrial Estate, Sion (E), Mumbai – 400 022, Maharashtra. Ph: 022 – 2407 7421, Fax: 022 – 2407 1320 Email: info@newagefireprotection.com Web: www.newagefireprotection.com
02.	M/s Chhatariya Rubber & Chemical Industries, 23 – A, Suryadaya Mills Compound, 96, Tardeo Road, Mumbai – 400 034, Maharashtra. Ph: 022 – 2351 3705, 2352 1313, 2351 0849 Fax: 022 – 2351 0400 Email: info@chhatariyafiretech.com Web: www.chhatariyafiretech.com
03.	M/s Nirmal Rubber Industries, 45, Udyonagar, Jintan Road, Surendranagar – 363 002, Gujrat. Ph: 02352 – 224178, Fax: 02352 - 232889 Email: nirmal_ad1@sancharnet.in Web: www.nirmalrubber.com

Sl. No.	ADDRESS
FIRE RETARDANT GARMENTS	
01.	M/s Swastik Fire Company, 232, New Sonal Link Estate, Link Road, Malad (W), Mumbai – 400 064. Ph: 022 – 2880 3688, 2808 7195 Email: hemratna108@gmail.com
02.	M/s System 5S Private Limited 105, NyniappaNaicken Street, Chennai – 600 003, Tamil Nadu. Ph: 044 – 2535 9493, Fax: 044 – 2534 3502 Email: systement@vsnl.net Web: www.system5s.com
FIRE SECURITY SIGNAGE AND POSTERS	
01.	M/s AV Industrial Associates, A – 901, Nilkanth, Paranjape Estate, Near Makhmali Talao, Thane – 400 601, Maharashtra. Ph: 022 – 2539 5364 / 2541 3888 Email: aviassociates9@gmail.com

02.	M/s Ankita Fire Tech Pvt. Ltd., 25/4, First Floor, Mandir Lane, YusuSfSarai, New Delhi – 110 016. Ph: 011 – 3204 9167 Email: info@anikafiretech.com Web: www.anikafiretech.com
03.	M/s Citadel Fire Aid Technologies Pvt. Ltd., 253 A, 1 st Floor, Panchsheel Park, Malaviya Nagar, New Delhi – 110 017. Ph: 011 – 6566 1462, 4175 1462 Email: info@citadelindia.com Web: www.citadelindia.com

Sl. No.	ADDRESS
INTELLIGENT BUILDING SYSTEM	
01.	M/s Tyco Fire Suppression & Building Products, R – 70, TTC Industrial Area, MIDC, Rabale, Navi Mumbai – 400 701, Maharashtra. Ph: 022 – 2760 5765, 2760 5767, Fax: 022 – 2769 4638 Web: www.tyco-fire.com
02.	M/s Tech Fire Engineers, F – 38, Ashoka Mall, Opposite Sun North, Sand Bund Garden, Pune – 411 001, Maharashtra. Ph: 020 – 3233 5189, Fax: 020 – 3233 5208 Web: www.techfire.co.in
03.	M/s Siemens Building Technologies Pvt. Ltd., No. 49, Eldams Road, Chennai – 600 018, Tamil Nadu. Ph: 044 – 2431 4313, Fax: 044 – 2431 4323 Email: security@sbtdats.com Web: www.sbtdats.com

General Fire Preventive Measures

Fire can be extinguished by early detection and prompt action with suitable extinguishers but it can be prevented by adopting simple preventive measures. The following measures/do's and don'ts are suggested for prevention of Fire.

Do's

- ✓ Good housekeeping must be ensured
- ✓ Switch off the electrical mains before fighting the fire
- ✓ Use staircase only for evacuation
- ✓ Make sure to close the exit door while getting out of fire zones
- ✓ Switches and fuses should conform to correct rating of circuit
- ✓ Welding/Cutting jobs should be carried out under strict supervision
- ✓ Keep means of escape clear of obstructions
- ✓ Impart firefighting training to occupants
- ✓ Conduct fire/evacuation drills regularly
- ✓ Always use ash-tray (non-combustible) while smoking
- ✓ All receptacles/waste bins should be emptied regularly
- ✓ Faulty electrical and mechanical appliances/equipment should be repaired/replaced immediately
- ✓ Keep smoke/fire check doors closed
- ✓ Emergency organization must be setup
- ✓ Keep yourself up to date.

Don'ts

- Do not use lifts in times of fire
- Do not dispose off lighted cigarette buds carelessly
- Do not paint fire detector/sprinkler heads etc
- Do not plug too many electrical appliances in one socket
- Do not make unauthorized electrical connections and overload the electrical points
- Do not store inflammable materials inside the building
- Do not use unauthorized LPG kits in cars
- Do not obstruct fire exit staircases with old/unused furniture
- Do not return to collect valuables incase of outbreak of fire/ fire emergencies

Do's:-

- ✓ Keep the doors and windows shut to prevent entry of smoke
- ✓ Evacuate without panic from the nearest exit
- ✓ If fire is in upper floor, go to lower floor/open ground
- ✓ Crawl on the floor if smoke obscures visibility
- ✓ Request Fire service help by dialing 101 or by messenger or by intimating nearest police station.

Don'ts

- Do not use lifts (in fire situation)
- Don't be panic
- Don't argue at scene of fire
- Do not hide in toilet /store rooms
- Don't try to operate fire extinguishers, if you don't know
- Don't stay unnecessarily

Action In Case of a Fire

DON'Ts IN CASE OF FIRE

- Don't run in panic.
- Don't make undue risk.
- Don't tamper with electrical installation, Air conditioning system etc during Fire Fighting leave them for authorized handling.
- Don't argue or discuss on the scene of fire.
- Don't linger with the equipment if you don't know its operation, keep away or ask someone nearby.
- Don't crowd at the scene of fire
- Don't resort to breaking, cutting unless required.
- Don't use all types of extinguisher on one fire.
- Don't use water or water type extinguisher on electrical fire.

DOs IN CASE OF FIRE

- Raise alarm or shout "FIRE" at the peak of your tone, if you notice a fire within your vicinity.
- Approach the scene within the quickest possible time.
- Try to attract other's attention as far as possible on your way to the scene of fire.
- If you are first to reach, make sure that no life is trapped.
- Try to put off the fire with the nearest appropriate type of extinguisher.
- As other rush to the scene, tell them what the type of fire is and which extinguisher to use.
- Do arrange to put off the supply in case of electrical fires, do not take any chance.
- Dial telephone number of Fire Station and other key personnel and give exact location and the item which has caught fire.
- Open all doors and windows after the fire is completely extinguished to avoid inhalation of any fumes.
- Keep yourself posted with information from time to time.

"The best way to start any program or effort is to start today. Do not delay or wait for a tragic fire incident. Each step you take puts you one step closer to a fire safe community and two step farther from a tragedy. Bring your community together to solve the problem and not to mourn the tragedy".

Fire Drill– at Places of Work

1. Preamble

For securing that persons employed to work in the premises receive instruction or training on what to do in case of fire, and that records are kept of instruction or training given for that purpose “.

2. Plan of Action

All persons employed in factory buildings for which a fire certificate is required should be instructed and trained to ensure that they are familiar with and understand the fire precautions and the action to be taken in the event of fire. This should include person on shift duties or other regular duties outside normal working hours. The aim should be to ensure that all staff receive instruction and training, appropriate to their responsibilities in the event of an emergency. It should be based on written instructions.

In each factory there should be a precise and carefully considered plan, the details of the same will vary according to the circumstances, but it should normally cover the points listed below:

- ✓ Raising the alarm.
- ✓ Calling the Fire Brigade.
- ✓ Stopping certain process or machines, isolation of power supplies.
- ✓ Evacuation of Buildings.
- ✓ Assembly- These will depend on the situation of the premises and the number of Persons employed.
- ✓ Roll Call
- ✓ Attacking the fire.

a. Raising the Alarm

The alarm should normally be sounded as an informative and precautionary measure immediately an outbreak is discovered. While it is preferable that the person discovering the fire should give the alarm, authority to sound it may be entrusted to certain persons where this seems necessary. Where this is done, it must be ensured that there is no delay in its operation in an emergency.

In larger premises it will be necessary to form a central point for transmission of information on fire alarms. The position of this point will depend on circumstances. It may be the works telephone switch room of the general office.

b. Calling the Fire Brigade

The duty of informing the Fire Brigade immediately the alarm is sounded must be specifically allotted to a particular person or persons. Facilities must be made available at all times when persons are on the premises.

c. Stopping of Machinery Etc.

These tasks should be carried out by those persons who have been designated to carry out duties when a fire breaks out, which will ensure the safety of all concerned.

d. Evacuation of the premises

It is of the utmost importance that everyone is able to escape from danger. In most premises personnel who do not have specific duties to carry out should start to leave the building as soon as the alarm sounds unless instructions have been given to the contrary.

Personnel should leave in an orderly manner by the most direct route. Departure must not be delayed by personnel collecting belongings from any other part of the building.

e. Assembly Points

In certain circumstances extreme difficulty will be experienced in finding a suitable point and in these cases, arrangements should be sought with neighboring factories.

Roll Call

Due to the numbers involved and lack of suitable assembly points being available, for the larger factory premises the following is suggested:-

i. A responsible member of the staff in each section or department (with a deputy to cover absences) should answer for the safe and complete evacuation of that department or section.

ii. On evacuation signals being sounded, these officials should search their department or section, checking with the officials of any upper floors and report their findings to persons in charge of the factory at that time.

Fire Fighting

Where possible, those members of the staff designated for firefighting purpose should attack the fire with suitable appliances which have been provided. In larger premises where teams are formed for the purpose of fire fighting, it will be necessary to assemble these teams at a central point, from which they can be directed to the outbreak of fire.

The point should be stressed that fire fighting should only be carried out secondary to personal safety.

3. Instruction and Training

In all premises, one person should be responsible for organizing fire instruction and training and in larger premises a person or persons should be named to co-ordinate the actions of persons in the event of fire, and should generally provide for the following:-

The action to be taken on discovering a fire.

The action to be taken on hearing the alarm.

Raising the alarm, including the location of alarm call points, internal fire alarm telephones and alarm indicator panels.

The correct method of calling the fire brigade.

The location and use of firefighting equipment.

Knowing the escape routes including the important part played by the fire doors.
Stopping machines and processes and isolating power supplies, where appropriate.

In addition to the above, certain categories of staff should be instructed and trained in any matters peculiar to their particular responsibilities at the time of a fire. Examples are:-

- Engineering and maintenance staff.
- Chemists.
- Security staff. (Including night security patrols).
- Telephone Operators.

4. Frequency of Drills

At least once a year a practice fire drill should be carried out simulating conditions in which one or more of the escape routes from the building is obstructed by smoke. During these drills the fire alarm should be operated by a member of the staff who is told of the supposed outbreak and thereafter the fire routine should be reached as fully as circumstances allow.

Instruction should be given frequently by a competent person, at such intervals as will ensure that all persons are instructed preferably at least twice a year and in all cases at least once, in each period of twelve months.

5. Recording Fire Drill Details

Such details as are necessary to show the training and instruction given should be recorded. The following are examples of matters which may need to be included in such a record:-

- i. Date of the instruction or exercise;
- ii. Duration;
- iii. Name of the person giving the instruction;
- iv. Names of the persons receiving the instruction; and
- v. The nature of the instruction, training of drill.

6. Fire Instruction Notices

At conspicuous positions in all parts of the building printed notices should be exhibited stating, in concise terms, the essentials of the action to be taken upon discovering a fire and on hearing the fire alarm.
