

Report on fire safety studies in Maitri station and summer huts at Antarctica

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Introduction

Fire is the principal potential menace in Maitri Station at Antarctica. During the winter, the hazard increases due to increased dry conditions and high winds. The best way to lessen the danger is to practice stringent fire prevention. The condition is further vulnerable because no external assistance from any other agency could be made available to tackle such an emergency. The difficulty of combating fires at extremely low temperature and high winds fore warn that the established fire prevention discipline be observed rigidly. Precautions are required to be taken to eliminate all possible sources of ignition in these areas. Fire preventive measures are the best way than cure by fire fighting.

Maitri station

This permanent station (Appendix "A") presently in use is a compact integral unit encompassing the following modules:

MAIN BLOCK	:	Consisting of living modules, station office, hospital & IMD Lab.
LOFT LEVEL	:	On the top of these living modules used for storage purposes.
BLOCK "A"	:	Presently under renovation and reappropriation as hospital with medical equipment storage area.
BLOCK "B"	:	This accommodates boiler room, kitchen, lounge/dinning hall, bath cubicles & chemical toilets (now storage area).
BLOCK "C"	:	Accommodates 5 Nos. incenerator toilets.

Most of the modules/ rooms are constructed of marine ply sandwiched by PUF as insulating material.

In addition, the in-built risk in genset accommodation placed in three separate containers, garbage incinerator, nitrogen plant and garage-cum-workshop area away from station also becomes a point of concern from fire safety point of view.

Factors contributing to fire threat perception.

- i. Construction Material : Most of the modules/ rooms are made of marine ply with PUF sandwiching; a highly combustibile material.
- ii. Electrical wiring : Laid down from genertors to Maitri station and summer huts for supplying current; Ageing & blizzard conditions may lead to short circuiting.
- iii. Fuel storage : Large quantity of ATF stored inside boiler room & also other fuel dumps(50-60 KL tanks) lying around generator room area in the open.
- iv Flammable liquids / Gases : Isopropy] alcohol, benzene etc stored in loft area of main block, use of LPG cylinders in kitchen without seprate gas room and pipe supplying through common manifold.
- v. Incinerators : Garbage & toilet incinerator can cause fire due to malfunctioning and threatens the adjoining fuel dumps and LPG cylinders in the vicinity.
- vi. Decorative materials : Wall papers/festive decortives of combustibile nature inside living modules and lounge area adds to the fire load.

Possible causes of fire:

Smoking, use of inscence sticks, naked lamp lights etc.
 Worn out electrical cables/wirings.
 Poor housekeeping
 Faulty radiator type heater.
 Open uncontrolled burning of packing material/garbage.

In persuarncce of the workplan submitted to DOD, the following fire safety related tasks were accomplished during my summer duration stay at Antarctica.

Installation of linear thermal detection cable (LTDC) systems:-

This latest technology in the filed of fire detection comprising fire sense cable, fire control panel, interface module and termination box were installed in the boiler room covering all the four fuel feeding lines to the boilers, daily fuel storage tank(500 ltrs.) and weekly fuel storage tank(2500 ltrs) . Fire sensing wire, interfce module and termination box were installed in the boiler room while

the fire control panel and hooter in the lounge/dinning hall keeping in view the presence of members round the clock in this area(appendix "B")

Any rise in temperature/heat generation in the boiler room would activate the fire sense cable which through interface module would transfer audio-visual signals to fire control panel, thus actuating the hooter for the turnout of the members to attend the call. The microprocessor based key board operating the panel/hooter would have to be brought into silence only by pressing four digit secret number known to the authorised persons only after attending the fault in the boiler room.

Recommendations

To maintain the efficacy of the system and to avoid the false alarms the following points must be strictly adhered to:-

- i. To charge maintenance free batteries supplying 24V DC to the interface module once in a week.
- ii. To reset the fire control panel immediately after the disruption of AC supply feeding it.
- iii. Only authorised person to handle and maintain this modern detection cum-alarm system.

Fire risk analysis of maitri station and summer huts

A detailed fire safety survey was conducted covering main block (both ground floor and loft area), boiler room, kitchen, lounge/dinning, Genset accommodations (Aditya, Bhaskar and Jan Gan Man), Nitrogen plant, Jwala garbage incinerator and workshop area. This survey was extended to summer huts also covering Nandadevi, Tirumala, NPL Hetrodyne lab, Doddabetta, Annapurna, Vindhya, Siwalik, Nilgiri, Aravalli, Mount Abu, Mishmi, Khasi, Satpura, Girnar, Kamet and the three helipads (main, penguin 1 & 2). Both the toilet modules in operation were also taken into consideration.

Maitri station

Main Block

All thirty one modules accommodating 26 members in living rooms, IMD lab, Hospital and Station office were inspected for the type of construction, addition fire load in the rooms, type of electrical wires and number of switch/extension boards being used for the purpose of drawing the current for running computers and other instruments/equipments installed in the rooms. The operational readiness of fire protection devices/systems such as smoke detectors, fire blankets and the fire extinguishers installed in the corridor outside the rooms were also inspected.

Observations

- (i) Out of 37 smoke detectors installed in rooms and corridor of main block, 32 detectors were found in non-functional condition, some for want of refurbishing 9V Ni-Cd batteries and other broken. To make all the detectors in working condition, new/charged batteries were fitted into them. The fire detectors not found in working order inspite of replacement of batteries were replaced by new smoke detectors (Single station type).
- (ii) In few rooms the fire blankets were found in torn condition thus rendering them of no use in case of any eventuality.
- (iii) The usage of electrical switch/extension boards and drawing the current without plugs was alarming. In addition, the amount of fire load in terms of personal baggages/packing material etc. was like adding fuel to the fire.
- (iv) All the fire extinguishes (5 Kg. DCP and 9.2 Kg. CO, type) kept in the corridor outside each room were opened and checked for their operational worthiness. It was seen that only few of them would have worked, had there been any fire. This was because some of 5kg DCP type extinguishers had CO, gas cartridges in punctured condition while others were just kept inside the inner container without fitted into the cap of the extinguisher. Among the three 9.2 kg CO, extinguishers, one had broken discharge horn while other had no gas inside it.

Each one of these extinguishers was checked/serviced to make them in operational readiness. In addition, 16 soda acid extinguishers (1988 make) lying in the store, besides 4 new water CO, cartridge type (1996 make) were charged and installed in the corridor replacing few of earlier kept DCP extinguishers, keeping in view the suitability and type of fire risk envisaged.

Some sign markings were also displayed for various Fire Points, Fire Exits and Fire fighting House Reels installed in Maitri station with a view to enable the occupants and guests an easy identification/wayout in the event of any unforeseen eventuality.

Recommendations

- (i) The battery of the smoke detector shall be checked fortnightly and replaced if so warranted.
- (ii) Every fire extinguisher shall be checked quarterly if other wise not used/discharged.
- (iii) The discharged extinguishers shall be stored at a central place earmarked and recharged immediately to make them operationally fit.
- (iv) All the existing fire blankets of old origin shall be replaced by the new ones "burnshield" type, being used worldwide.
- (v) Any fire detector found broken or in non-working condition shall be

immediately replaced.

- (vi) All used/discharged CO₂ gas and DCP stored pressure (Cease Fire) type fire extinguishers shall be back loaded, since these cannot be locally charged.
- (vii) Each living module shall be provided with an escape breathing unit to counteract any fire emergency situation.
- (viii) The main block shall be provided with fire check doors to restrict the movement of smoke travel from the place of origin to unaffected areas.

Loft Level

The complete loft area corresponding to each room on the ground floor was studied from fire safety angle and the following observations made :

Observations

- (i) This area was seen having lot of fire risk potential in terms of stores consisting of various combustible/flammable materials stacked such as wooden boxes, packing material, benzene, isopropyl alcohol, spirit, polar clothings, electrical cables/components/equipments and other combustible materials.
- (ii) Out of all smoke detectors installed in this area, only three were found in single piece but in non-working condition for want of batteries, others were found completely smashed/broken.

The batteries (9V Ni-Cd) of smoke detectors otherwise found in working order were replaced to make them in operational readiness. Out of all other broken detectors, only four were replaced with the new single station type smoke detectors. The remaining could not be replaced for want of availability of new ones in the station store.

- (iii) The fire point near radio room had seven halon (BCF) type extgrs, both 25 kg. Trolley mounted and 2.5 kg, portable type. These were removed and backloaded.

Recommendations

- (i) The batteries of the detectors shall be fortnightly checked and replaced with the charged / new ones.
- (ii) The remaining broken detectors shall be replaced with the *new* ones, whenever, available and made operational.
- (iii) The fire point near radio room shall be properly maintained.
- (iv) No combustible / flammable material shall be stored in the loft area. The presently stored materials shall be immediately shifted to the containers to be designated and kept outside the station.

- (v) To gain the visibility and ease of movements during any fire accident, every segment in the loft shall have separate bulb in working condition and also the provision of an emergency light to be looked into.
- (vi) No smoking shall be allowed in this area.
- (vii) The habit of good housekeeping shall be inculcated in each member.

Block "B"

(a) Boiler Room

This area has high degree of fire risk because of the presence of fuel (ATF) storage tanks inside if for the purpose of running the boilers. This room was protected by automatic fire detection-cum-alarm system (linear thermal detection cable system).

Observations

- (i) Each boiler and the fuel tank was seen protected by modular fire extgrs. (halon type) and also small hand held extgrs., (2.5 kg halon type). These portable extgrs. were one to one replaced by 2 Kg. DCP extinguishers and kept at strategic points inside the room for fire fighting purposes.
- (ii) The critical areas in the boiler room were identified and protected by fire sense wire.
- (iii) All smoke detectors installed inside the boiler room were found to be in non-working condition which were made operational by replacing the batteries of these detectors.

Recommendations

- (i) The existing modular Halon type extgrs, are required to be backloaded and replaced by DCP type modular extgrs in near future.
- (ii) All the smoke detectors shall be replaced by charged Ni-Cd batteries from time to time in order to keep them in operational readiness state.
- (iii) The power supply (24DC) feeding to LTDC-Interface Module shall be charged at regular interval (once a week) or this may be changed to battery eliminator capable of supplying the required voltage uninterruptedly.
- (iv) A motor/pump with higher rate of discharge and pressure shall be installed in the boiler room and the capacity of water tank to be enhanced in order to have an optimum water jet throw for fire fighting.

(b) Kitchen Area

In the present trend of storage 4-5 LPG cylinders in the kitchen for the purpose of cooking and use of other electrical appliances like microwave oven etc., it becomes imperative to make this area fire safe. The presence of smoke

detector, DCP extgr and halon modular extinguisher were inspected and put to the state of functioning.

Recommendations

- (i) A battery of LPG cylinders kept outside connected with a common manifold may be worked out for the future, with no extra cylinder inside the kitchen.
- (ii) Halon type modular extgr. Shall be replaced by DCP modular extinguisher.
- (iii) Presently installed smoke detector shall be replaced by a heat detector.

(c) *Lounge / Dining Hall*

This area was inspected for the purpose of studying the presence of fire load in terms of combustible materials. The probable causes of fire were seen as negligence on the part of the smokers or the electrical short circuit by way of poor quality and underrated electrical wires or use of naked wires to draw the current or extra current drawn from the existing switch boards. One halon type extgr earlier installed was replaced by 2kg. DCP extgr thus making the total number of fire extgrs, as two in order to render the fire protection coverage to this area.

(d) *Incinerator Toilets /Drying room*

The use of fuel (ATF) for burning the toilets was also seen and the potential of fire risk analysed. The presence of halon and soda acid extinguishers outside the toilets was not felt necessary. In place of these two type of extinguishers only 5kg. DCP extinguisher was kept near inner door to meet the eventuality.

The position of Fire Point outside the toilet area near the urinals was relocated outside the drying room. Few extinguishers not found in working order and also some halon type were removed and backloaded. Only water, DCP and CO₂ hand held extinguishers (2 nos. each) were kept at this fire point.

The drying room protected by an empty halon modular extinguisher was replaced by a fresh charged one for the time being, till the alternative to halon is made available.

Recommendations

- (i) No discharged fire extinguisher be mixed up with the extinguishers kept at the fire point.
- (ii) Halon type modular extinguishers shall be replaced by DCP type modular extinguisher in the event of its availability in the next expedition.
- (iii) During toilet firing, the member on galley duty shall be constantly present till such time it is over.
- (iv) No flammable/combustible material shall be dumped inside the chemical

toilets which had been reappropriated as store rooms. Also, no garbage/store dumps be laid outside this area.

Genset accommodations

All the three genset accommodations namely Aditya, Bhaskara and Jan Gan Man were inspected from fire safety point of view.

(A) Aditya :

This area accommodating four generators each 62.5 KVA were inspected to study the adequacy of existing fire protection arrangements.

Observations

- (i) A large chunk of trolley mounted fire extinguishers (50 lit. mechanical foam and 50 kg. DCP type) and other hand held extinguishers (9 lit mechanical foam, 3.3 kg/9.2 kg. CO₂ and 2.5 kg/25 kg halon type) were lying outside the genset accommodation surrounded by snow/ice all around. All these extinguishers when tested were found to be non-functional.
- (ii) In the inner area accommodating generator 1,2 and generator 3,4 the presence of halon extinguishers (1.25 kg/2.5 kg) was seen. Also three of these generators were found to be protected by 5kg halon type modular extinguishers in which one of them was empty indicating zero reading on the pressure gauge.

All the four halon extinguishers (portable) were one to one replaced by 2kg DCP extinguishers while the discharged halon modular extinguishers by the charged ones for want of DCP modular extinguishers in the station stores. In addition one each type 50 kg DCP and 50 lit. mechanical foam trolley mounted were recharged and tested and kept close to the generators inside the accommodation.

Recommendations

- (i) No extinguisher shall be kept outside the generator rooms which may lead to freezing of the contents especially in 50 litres mechanical foam extinguishers.
- (ii) The present halon modular extinguishers installed shall be replaced by DCP modular fire extinguishers.
- (iii) All the six generators to be protected by LTDC, which could not be done for want of additional termination box and also the difficulty faced in proper laying of the cables/wires from genset accommodation to the lounge area because of the blizzard conditions in which case all the wiring would have been blown/carried away, This laying out to be judiciously done in underground conduits.

(b) Bhaskara

Two gensets each 62.5 KVA were inspected in the working condition which supply the power to the boiler room.

Observations

- (i) Three extinguishers (2 nos. - 9.2 kg CO, and 1 no. - 2.5 kg halon type) were seen lying outside this accommodation. Out of which halon type extinguisher was backloaded and the other two were shifted inside the room.
- (ii) There had been no localised fire protection coverage to both these generators. Keeping in view the threat perception from the fuel, one 50 lit. mechanical foam (trolley mounted) extinguisher and three 2 DCP portable extinguishers were installed near these generators.

(c) *Jan Gan Man*

This 75 KVA generator capable of supplying 110 V was not seen in working condition. In near future as and when this generator is made functional, the same level of fire protection coverage to be provided as done for the Bhaskara accommodation.

Liquid nitrogen plant

This newly functional plant was also inspected from the fire safety point of view. No fire threat perceptions, except from the use of electricity could be seen. One 2.5 kg Halon type extinguishers installed for the purpose of fire fighting was replaced by 2 kg. DCP extinguisher.

Outdoor fuel dumps

Lot of bigger size fuel tankers were seen all around the places behind Maitri station.

Observation

In order to give fire protection coverage to the fuel tankers ranging from 50 KL to 60 KL capacity about 20 fire extinguishers of CO₂, DCP and halon type were found submerged into snow/ice around these tankers, thus rendering them as false sense of security, because none of them was found in working order.

Recommendations

No fire extinguishers shall be kept outside/near to the fuel depot. For giving fire protection coverage to the fuel (ATF) tankers an alternate/additional fire point to be earmarked in the area for keeping these extinguishers.

Garbage incinerator (Jwala)

Two incinerators installed for the purpose of burning the garbage inside were inspected from the fire safety point of view. During the inspection it was seen that the fuel barrel and fuel supply tank kept inside may pose a problem in the event of

any malfunctioning of any of the burners (3 Nos.) or the fire may originate from the exhaust pipe which is sealed with the silica gel and glass-wool used as thermal insulation.

From the human safety point of view the observations on the types of gases emitting from the burning of the garbage were taken and it was noted that the concentration of the oxygen during the process falls as low as 16.4% after 20 to 30 minutes of burning. Also, the emission of H₂S and CO was also noticed using multiple gas analyser on three different occasions.

Recommendations

- (i) No person shall be allowed to stay inside the structure/building during the period of burning which otherwise may become a common practice especially during the winter conditions outside.
- (ii) The fuel supply tank and the barrel (containing 200 lit. ATF) shall be isolated/Compartmented from the burners using gypsum board sheets.
- (iii) The burners shall not be subjected to a stage of over temperatures/heat generation inside the accommodations, which may lead to complications because in one of the occasions the temperature escalation was seen to the level of 1950 deg C to 2000 deg. C.

Workshop accommodation

The only fire threat perception in this area would be in the fuel either due to electrical short circuit or due to negligence on the part of the occupants.

One fire point with seven DCP extinguishers was designated. Also the spare parts store containers were given fire fighting coverage by keeping one 5 kg DCP extinguisher in each.

Recommendations

- (i) The only fire point designated and displayed shall be properly maintained.
- (ii) Utmost care shall be taken to avoid any occurrence of fire by observing good house-keeping, adhering to the norms of no-smoking and proper usage of electricity.

Summer huts

All summer huts were thoroughly surveyed and fire risk areas identified. The three main huts namely Nanda Devi, Tirumal and NPL Laser Heterodyne Lab, having no fire detection mechanism were fitted with single station types smoke detectors. The functioning of 2kg. DCP extinguishers installed in each huts was also ascertained. The usage of electrical switch/extension boards with many tapping points was quite discouraging from fire safety angle. The construction material of each hut was also noticed for the purpose of coating

with fire retardant paint. In addition to the aforesaid huts all other huts were also inspected and the probable cause of fire identified. The three helipads in this area and the incinerator toilets were also given equal weightage during this study.

Recommendations

- (i) Only the bare minimum number of electrical tapping points and extension boards shall be used. The wiring from the switch board to the instruments shall be properly laid for any fault leading to short circuiting..
- (ii) No coil heaters shall be used. The heat convectors\blowers if used shall be given due care for any excessive amount of heat generation or any fault.
- (iii) The smoke detectors Fitted in the huts shall be timely checked for their proper functioning and the batteries replaced\recharged to keep them in operational readiness.
- (iii) Three helipads shall be given protection by keeping 50 lit mechanical foam extinguishers and DCP extinguishers only. No fire extinguisher be kept around them during the period of their non operation i.e., when there are no helicopters to land or refuel.
- (v) The incinerator toilet modules shall be constantly attended to during the firing period. In the rest of time i.e., when the toilets are not in use no fire extinguishers be kept around.

Monitoring of gases

The presence of toxic\flammable gases were measured in genset accommodations, garbage incinerators and vehicle exhaust. On observation it was seen that toxic gases like CO, H₂S were present to the level as high as 16.4% in the garbage incinerator accommodation, thus signifying the threat to the presence of human beings in this area.

Maintenance of fire fighting equipments

All the extinguishers lying in and around Maitri station and summer hut areas were inspected for their operational readiness. Surprisingly, it was seen that no trolley mounted extinguisher i.e., 50Kg DCP (16 nos.) and 50 lit mechanical foam type (2nos) were found to be in charged condition. Also only 2 nos. soda acid (water type) extinguishers were seen and that too in non-working condition.

To upkeep the fire protection arrangements especially in genset and boiler room accommodations, 50 kg. DCP and 50 lit. mechanical foam extinguishers (2 nos. each) were charged and kept at strategic locations. In addition, soda acid extinguishers (16 nos.) lying in the stores since 1988 were also charged and made operational to meet any unforeseen eventualities.

ties. All these extinguishers were provided with the labels mentioning the date of charging/checking and the next due date in order to make the members aware of their periodic role in maintaining these extinguishers was taught to the selected group of members to enable them to be self-reliant at the time of necessity.

CO₂ Conductivity test apparatus

This apparatus/experiment was installed in Aravalli hut to evaluate the conductivity level of CO₂ gas when used on an electrically charged target/switch gear etc. The various parameters measured included the humidity, distance between target and CO₂ cylinder, CO₂ gas discharge time, voltage supply to the target and the current values for CO₂ cylinder etc. This experiment had been conceived with a view to measure the intensity of electrical shock received by the operator using CO₂ extinguishers when fighting a fire in an electrically charged target. Arrangements were made to continue this experiment in the winter period also, to study the shock effect at lower temperature humidities during the winter.

Fire retardant paint

This experiment was setup in shivalik hut to measure various fire spreadability related parameters in exterior Antarctic conditions. Four test samples were coated with FR paint and subjected to LPG stove flame to observe the various parameters which include the intensity of flame, the exterior wind speed, the ambient temperature and the time of flame exposure to the test samples, and to the flame for a period of 45 minutes to 60 minutes.

Apart from this experiment, the interior and floor of Maitri station is required to be painted with FR paint as a part of winter team task. For this purpose the following critical areas were identified.

- (i) Main Block : All living modules/lab, areas after taking out wall paper.
- (ii) Boiler Room : All the wooden/metallic components and wirings/cables leading to main station

In the second phase, the other areas like kitchen, lounge and newly built up (reappropriated) Block "A" Garbage incinerator and the exterior of the station. In addition, three summer huts Nanda Devi, Tirumala and NPL Laser Heterodyne Laboratory shall also be given thought of painting with FR paint (two coats each).

Fire drills

Two fire drills were conducted during the period from 8th January to 27 February 1997 to observe the fire fighting preparedness of the members. After each drill, the debriefings on the important points was given.

Relating to this, various sign markings indicating the fire points (3 nos) were labelled at the appropriate places. Also to avoid the confusion among the members all discharged extinguishers were pasted with the label of 'Empty' marking on to them to enable the fire fighting teams not to carry these extinguishers to the site of fire.

Recommendations

- (i) To maintain the record of the occurrences of various activities during fire drill a new register named as Occurrence Book shall be opened to record the various activities performed during the fire drill and other occasions.
- (ii) Each time the presence of the members at the site of the fire to be recorded and the names of the absentees to be mentioned in the occurrence book & reported to the Leader of the Expedition.

Visit to Russian station (Novo Lazarevskya)

A visit to Russian station was made to study the types of fire safety arrangements available there. On observance, it was seen that this station spreading over into four to five buildings also had adequate fire protection arrangements in terms of fire extinguishers (both portable and trolley mounted), BA sets etc. The various fire extinguishers which were seen installed in various accommodations/buildings, included CO₂ gas type (portable and trolley mounted), mechanical foam (trolley mounted) and DCP (portable).

1. Retrieval of halon type fire extinguishers

About 130 fire extinguishers were retrieved from the places in and around Maitri station and summer huts. Majority of them were of halon type and only a few CO₂ gas type and DCP (Cease fire type) in the discharged state having no local charging facility. Halon extinguishers were suitably substituted by DCP and CO₂ type extinguishers.

2. Provision of extinguishers to field camps

Two field camps namely JU\BSI and GSI Mountain camp set up as far as 200 kms. From Maitri station were provided with DCP type fire extinguishers to tackle any fire emergency situation.

Recommendation

At least one DCP type fire extinguisher shall be issued to each field camp as a part of their normal field kit.

Additional recommendations

The walkie talkie sets each to the attendant in the boiler room and the generator rooms shall be given to have two way communication in case of any emergency.

The station fire officer/Alternate fire officer shall be provided with walkie

talkie sets to enable them to have the contact with the radio room for any requirements during the fire drills\actual fire emergency

The summer huts namely, Tirumala, NPL HETERO DYNE LAB and Anna purna shall be installed with intercom lines and the one available in Nanda Devi hut shall be made functional all the time.

The workshop area shall be fitted with fire detection/communication devices.

Separate water tanks each 5000 lit. capacities shall be provided for the three hose reels installed in the station.

No open fire/burning of the garbage bags/wooden boxes etc. shall be allowed.

Futuristic action plan

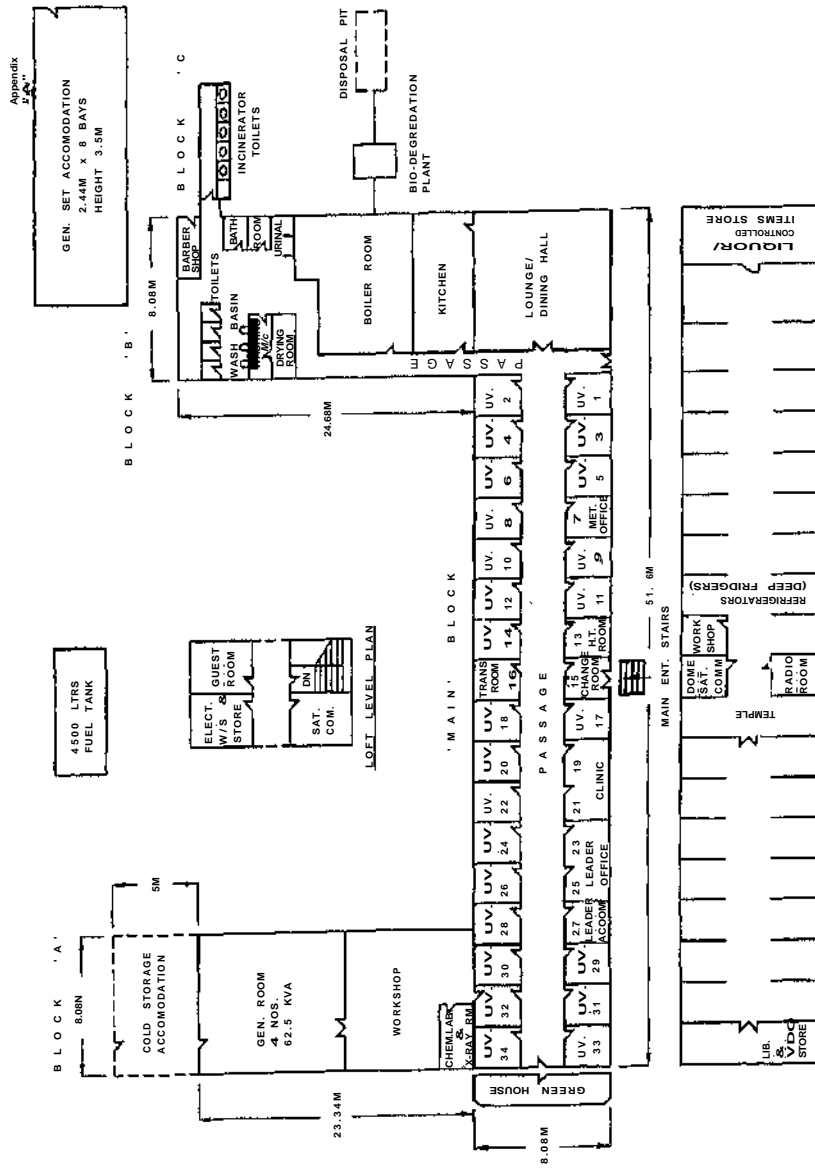
- i. Genset accommodations (Aditya & Bhaskra) covering all six generators to be protected by Linear Thermal Detection Cable system with proper encasing of the cables/wires required to be brought to the lounge area in order to protect it from the blizzard conditions.
- ii. To work out the feasibility of installing automatic fire detection, alarm and extinguishing system using water/CO₂/DCP/Halon alternatives extinguishing agents at vulnerable places. ²
- iii. At present there is no segregation of zones in the main block. There is a necessity to install smoke/fire check doors with at least 1hr. rating separating main block from Block 'A' & 'B' to prevent spread of smoke & flame from one zone to the other.
- iv. Boilers & generators protected by Halon type modular fire extinguishers to be replaced by DCP type modular extinguishers.
- v. Each living module to be provided with ELSA type breathing help & fire blanket JEL type to enable the occupant to rush to the place of safety in case of any eventuality.
- vi. To segregate the fuel tank/drum stored in Garbage incinerator room from the burners by creating a Separating wall of one hour rating using fire retardant material like gypsum board.
- vii. To augment the capacity of pump installed for hose reels and also to have separate water storage tanks each 5000 ltrs. for all three hose reels installed in Maitri Station.

Conclusion

In the end, it is needless to emphasize the importance of fire safety in such a dry, windiest and isolated continent, where "Fire prevention is everybody's business." With the existing constraints of non-availability of external assistance in the event of any fire emergency, it becomes of paramount importance to keep the available fire detection and fire fighting equipment's in operational readiness all the time without losing the respect for them at all.

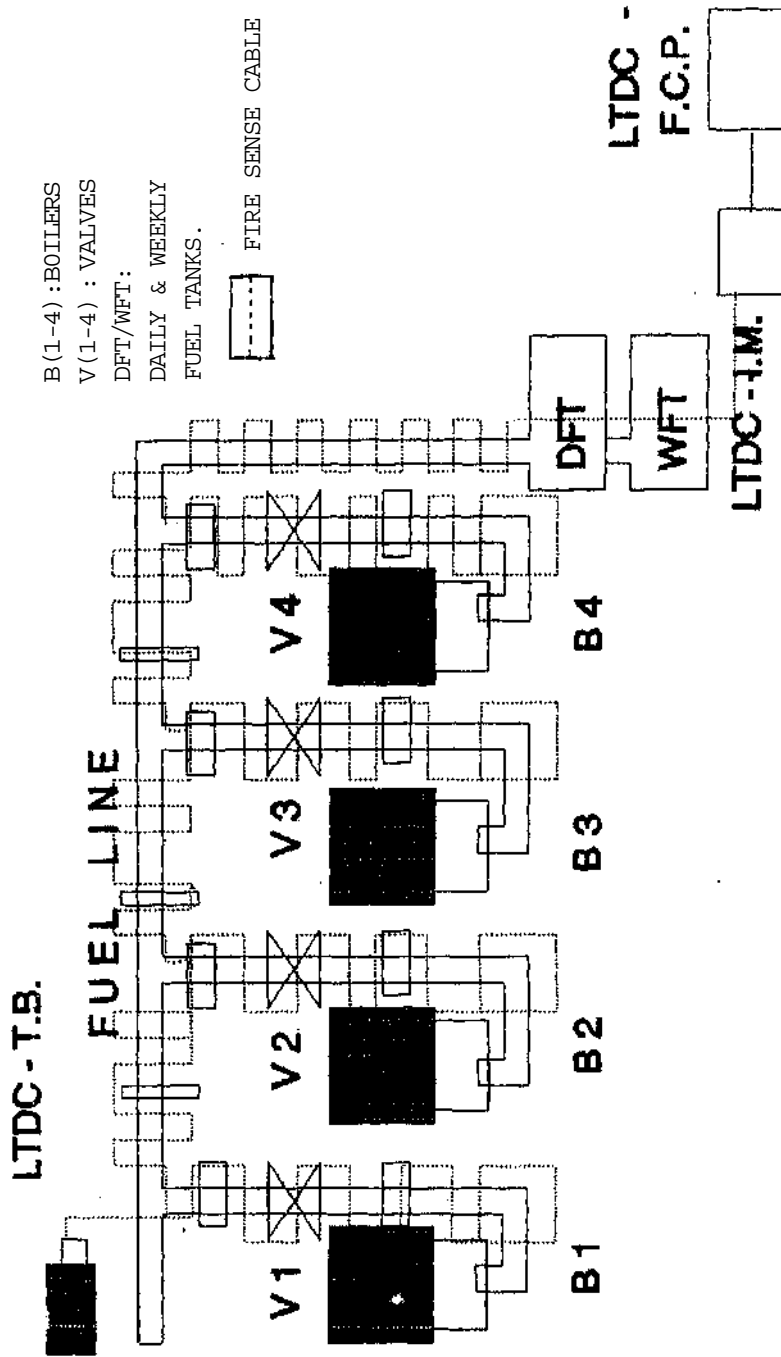
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Layout plan of Maitri Station

Appendix 2



Layout of linear thermal detection cable system

ions and air-earth current density made at a coastal station, Maitri (70° 45' S, 11° 44' 03" E, 130 m above sea level) at Antarctica during January to February 2005, are reported. Although, small and large positive ion concentrations do not show any systematic diurnal variations, variations in them are almost similar to each other. On the other hand, variations in intermediate positive ion concentrations are independent of variations in the small/large positive ions and exhibit a diurnal variation which is similar to that in atmospheric temperature on fair weather days with a maximum during Antarctica research stations, as mentioned above, are either permanent or seasonal. Permanent stations are those that run all year round. Some of the most common permanent stations are led by countries such as Argentina, Australia, Belgium, Chile, France, Germany, and Italy among others. Argentina has a total of six active research stations operating all the year round. Some of its permanent research stations include Esperanza base in the Hope Bay, Marambio base, Orcadas, and Belgrano II. The station houses around 20 personnel during winter, and as many as 60 personnel during summer, and is the only station that uses wind generators for 70% of its electrical power needs. Belgium is known for the Prince Elizabeth Antarctica research station.