PRE-FEASIBILITY PROJECT REPORT

OF

CENTRALISED BIO-MEDICAL WASTE TREATMENT FACILITY IN KERALA

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CHAPTER - I

1.0 INTRODUCTION

M/s. MALABAR ENVIRO VISION PVT. LTD., is interested in setting up Common Bio-Medical Waste Treatment and Disposal Facility (CBMWTDF) in the Kerala State under the CSS scheme of the Ministry of Environment & Forests.

The proposed CBMWTDF will collect and treat waste from entire district of Malappuram, Kozhikode, Wayanad, Kasargod & Kannur.

Concept of common waste treatment facility has been applied in the field of wastewater treatment for a number of years. Efficacy of Common Effluent Treatment Plants (CETP) is yet to be established beyond doubt in effective mitigation of pollution particularly in the case of wastewater from diversified industrial units. But, in case of Biomedical waste management a Common Bio Medical Waste Treatment Facility (CBMWTF) is perhaps the only feasible solution for environment protection and effective legal compliance.

Biomedical Waste (Management & Handling) Rules 1998, stipulates that occupier of every organization generating biomedical waste (as defined in the Rules) must manage his biomedical waste as prescribed in the Rules so as not to cause any harm to the environment. It may not be possible for small nursing homes, dispensaries, clinical laboratories and other small organizations or individual medical professionals to carry out treatment and disposal of biomedical waste generated as per the methods prescribed in the Rules on their own. Neither it is economical for even bigger hospitals to have their own treatment facilities. A CBMWTF is an ideal and perhaps only solution to all such problems.

BIO-MEDICAL WASTE MANAGEMENT RULES

As per the Gazette Notification dated 20th July, 1998 it is the duty of every occupier (a person having control over an institution or premises) of an institution generating bio-medical waste including a hospital, nursing home, clinic, dispensary, veterinary institution, animal house, pathological laboratory, blood bank to take all steps to ensure that such waste is handled without any adverse effect to human health and the environment.

Under these rules…

- Bio-medical waste shall not be mixed with other wastes.
- Bio-medical waste shall be segregated into container / bags at the point of generation as per their respective categories.
- Bio-medical waste shall not be stored for more than 48 hrs.
- Every occupier is required to set up requisite bio-medical waste treatment facilities like incinerator, autoclave, microwave system for the treatment of waste or ensure requisite treatment of waste at a common waste treatment facility.
- Every occupier shall make an application to the prescribed authority for grant of Authorization.
- Every occupier shall maintain records related to generation, collection, reception, storage, transportation, treatment and disposal of bio-medical waste.

CHAPTER - 2

2.0 CATEGORIES OF BIO-MEDICAL WASTE AND ITS MODE OF TREATMENT

NO.	CATEGORY	WASTE CATEGORY	METHOD OF DISPOSAL
1	No. 1	**Human anatomical waste** (human tissues, organs, body parts)	Incineration
2	No. 2	**Animal waste** (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals animal houses)	Incineration
3	No. 3	**Microbiology & biotechnology waste** (wastes from laboratory cultures, stocks or specimens of micro-organism live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals toxins, dishes and levices used for transfer of cultures)	Autoclaving/ shredding
4	No. 4	**Waste sharps** (needles, syringes, scalpels, blades, glass, etc. That may cause puncture and cuts. This included both used and unused sharps)	Autoclaving/ shredding
5	No. 5	**Discarded medical and Cytotoxic drugs** (wastes comprising or outdated, contaminated and discarded medicines)	Incineration
6	No. 6	**Soiled waste** (items contaminated with blood, and body, fluids including cotton, dressings, soiled plaster casts, lines beddings, other material contaminated with blood)	Incineration
7	No. 7	**Solid waste** (wastes generated from disposable items other than the waste sharps such as tubings, catheters, in travenous sets etc.)	Autoclaving/ shredding
8	No. 9	**Incineration ash** (ash from incineration of bio-medical waste)	Disposal in secured landfill

2.2 NEED FOR BIOMEDICAL WASTE TREATMENT IN KERALA

Exposure to infectious BMW can result in disease or injury. It may contain infectious agents, toxic or hazardous chemicals or pharmaceuticals, radioactive wastes and waste sharps. The infectious wastes may contain any of the great variety of pathogenic microorganisms. Pathogens in infectious wastes may enter the human body through a number of routes like a puncture or cut in the skin, mucous membranes, by inhalation or ingestion. Sharps may not only cause cuts and punctures but also infect the wounds if they are contaminated with pathogens. Because of this dual risk – of injury and disease transmission – sharps are considered as a very hazardous waste class. **For e.g: WHO estimates that, in 2000, injections with contaminated syringes caused 21 million hepatitis B virus (HBV) infections, two million hepatitis C virus infections and 260 000 HIV infections worldwide.** Other potential infectious risks may include the spread of drug-resistant micro-organisms from health-care establishments into the environment.

According to report by CPCB, Kerala has the highest number (about 27%) of health care institutions in India. The total bed strength of hospitals in Kerala is 1, 13,530 of which 43,273 are in the Government sector, 2,740 in the cooperative sector and 67,517 in the private sector. The Board has so far identified nearly 4000 biomedical waste generators in the State. However, there is only Common Biomedical Treatment Facility (M/S IMAGE Incinerator Unit, Kanjicode, Palakkad, Kerala) is available for hospital Waste Management.

In absence of a waste treatment facility, the biomedical waste lands up in Municipal landfill and open grounds. Hence, there is an urgent need to set up treatment facility in state to curb the menace and danger posed by irregular dumping of biomedical waste.

2.3 BIOMEDICAL WASTE GENERATION IN KERALA

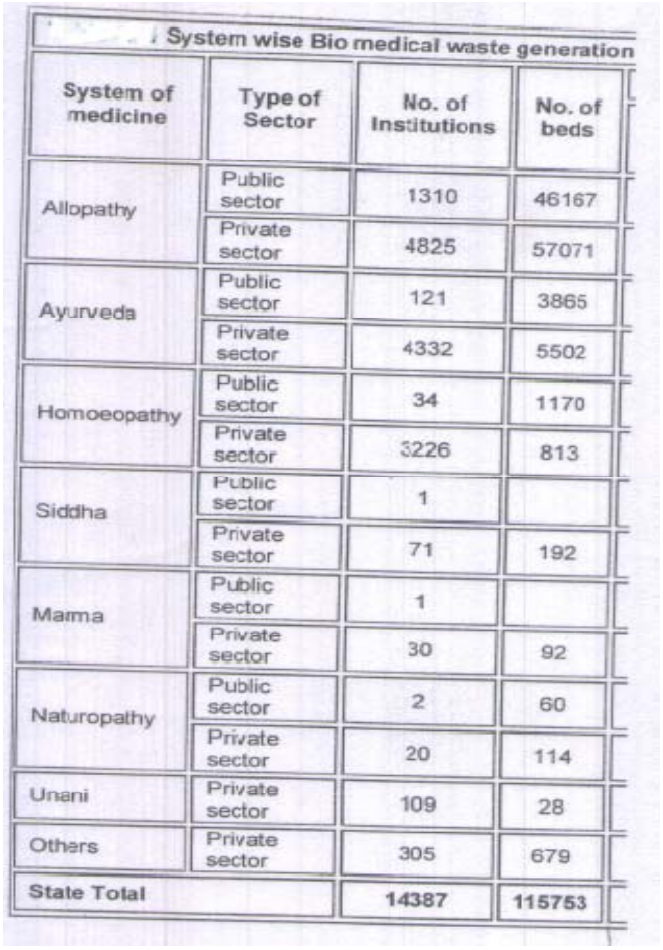
2.3.1 HEALTH CARE CENTRES IN NORTHERN KERALA

The Northern Kerala covers district of Malappuram, Kozhikode, Wayanad, Kasargod & Kannur.

TABLE 2.1: THE NUMBER OF HEALTH CARE INSTITUTION IN NORTH KERALA

NO	DISTRICT	NUMBER OF HOSPITALS	NUMBER OF BEDS
1.	Malappuram	15	2161
2.	Kozhikode	37	4395
3.	Wayanad	7	811
4.	Kasargod	9	689
5.	Kannur	12	2115
		80	**10171**

Source: GoK, Economic Review, 1998, State Planning Board, Thiruvananthpuram.



System wise Bio medical waste generation

System of medicine	Type of Sector	No. of Institutions	No. of beds
Allopathy	Public sector	1310	46167
	Private sector	4825	57071
Ayurveda	Public sector	121	3865
	Private sector	4332	5502
Homoeopathy	Public sector	34	1170
	Private sector	3226	813
Siddha	Public sector	1	
	Private sector	71	192
Marma	Public sector	1	
	Private sector	30	92
Naturopathy	Public sector	2	60
	Private sector	20	114
Unani	Private sector	109	28
Others	Private sector	305	679
State Total		14387	115753

2.3.2 QUANTUM OF BIOMEDICAL WASTE & CAPACITY CALCULATION

According to a WHO report, around 85% of the hospital wastes are actually non-hazardous, 10% are infectious and 5% are non-infectious but hazardous. However, health-care waste is often not separated into hazardous or non-hazardous wastes in low-income countries making the real quantity of hazardous waste much higher where proper waste segregation is minimal and collection is made in mixed form.

There are no national level studies on the quantity of hospital waste generated per bed per day, but studies have been carried out at local or regional levels in various hospitals. Whatever data are available from these studies, it can be safely presumed that in most hospitals, roughly 1-2 kg/bed/day of waste is generated. One study claims that the estimated quantity of the waste generated in the hospitals varies from 2-5 kg/bed/day. According to Indian Society of Hospital Waste Management, The quantum of waste that is generated in India is estimated to be 1-2 kg per bed per day in a hospital and 600 gm per day per bed in a general practioner's clinic. It is estimated that only 5 – 10% of this comprises of hazardous/infectious waste (5 – 10kgs/day)

TABLE 2.2: CAPACITY CALCULATION

The data below are average values obtained from 10 large hospitals in Bombay, Calcutta, Delhi, and Nagpur during the period 1993–1996.

Material	Percentage (wet-weight basis)
Paper	15
Plastics	10
Rags	15
Metals (sharps, etc.)	1
Infectious waste	1.5
Glass	4.0
General waste (food waste, sweepings from hospital premises)	53.5

[a]Source: National Environmental Engineering Research Institute (personal communication, 1997).

NO	ITEM	VALUE	APPROXIMATION
1.	Number of Beds	10000	-
2.	% of Biomedical Waste	**10%**	-
3.	Occupancy	**70%**	-
4.	Total Biomedical Waste per bed in Kg	1540	**1600**
5.	% of Incinerable Waste	**70%**	-
6.	Total Incinerable Waste in Kg per day	1078	**1100**

NO	ITEM	VALUE	APPROXIMATION
7.	Total Sterilization Waste in Kg per day	462	**500**
8.	Incinerator capacity in Kg/hr @ 12 hours working	91.66666667	100
9.	Autoclave capacity Kg/hr @ 12 hours working	41.66666667	100
10.	Ash kg/day @ 15%	161.7	180

CHAPTER - 3

3.0 DETAILS OF TREATMENT FACILITY WITH INFRASTRUCTURE

The CBMWTF shall have enough space within it to install required treatment equipment, incoming and out going waste storage area, vehicle-parking and washing area, effluent treatment plant (ETP), staff room, Security Cabin, Sharp Pits, Chimney foundation, Boundary wall etc. The required area for CBMWTF would depend upon the projected amount of bio-medical waste to be handled by it. A CBMWTF shall have the following infrastructure:

Land Requirement

3.1 TREATMENT EQUIPMENT ROOM:

A separate housing may be provided for treatment equipment at the CBMWTF such as incinerator room, autoclave room, microwave room etc, as applicable. Each room shall have well-designed roof and walls. Such room shall be well ventilated and easy to wash. The floor and interior finishing of the room shall be such that chances of sticking/ harbouring of microorganisms are minimized. This can be attained by providing smooth & fine floor and wall surfaces (to a height of 2 meter from floor) preferably of tiles. The number of joints in such surfaces shall be minimal.

The equipment room shall also have a separate cabin, to supervise the operation of the equipment and to record the waste handling and equipment operational data. Attached to each equipment room, there shall be two waste storage rooms, one for storage of untreated wastes and another for treated wastes. The storage room shall have provisions similar to that of equipment room being well-ventilated with easy to wash floors & walls, smooth and fine surfaces etc.

3.2 MAIN WASTE STORAGE ROOM

This shall be provided near the entry point of the CBMWTF to unload and store all bio-medical wastes that have been transported to the facility by vehicle. The size of the room shall be adequate to store all wastes transported to the CBMWTF. The front portion of the room shall be utilized for unloading the wastes from the vehicle and back or side portion shall be utilized for shifting the wastes to the respective treatment equipment. In the front of the room where vehicle is parked for unloading, the floor shall be made impermeable so that any liquid spilled during unloading does not percolate into the ground. The liquid generated during handling of wastes and washing, shall be diverted to the inlet of ETP. In the main storage room, wastes shall be stacked with clear distinction as per the color coding of the containers. From here, the coloured containers may be sent to the respective treatment equipment. The main storage room too shall have provisions similar to that of equipment room such as roofing, well ventilated, easy to wash floors & walls, smooth and fine surfaces etc.

3.3 TREATED WASTE STORAGE ROOM:

This is the room where wastes treated in different treatment units shall be stored. The wastes shall be stored in separate group as per the disposal options. Other provisions in the room shall be similar to the main storage room.

3.4 ADMINISTRATIVE ROOM:

This room shall be utilized for general administration, record keeping, and billing etc.

3.5 SITE SECURITY:

High walls, fencing and guarded gates shall be provided at the facility to prevent unauthorized access to the site by humans and livestock.

3.6 PARKING:

Provision shall be made within the confines of the site for parking of required number of vehicles, loading and unloading of the vehicles meant for transporting waste to and from the facility, etc.

3.7 SIGN BOARD:

An identification board of durable material and finish shall be displayed at the entrance to the facility. This shall clearly display the name of the facility, the name, address and telephone number of the operator and the prescribed authority, the hours of operation and the telephone numbers of the personnel to be contacted in the event of an emergency.

3.8 GREEN BELT:

The open area within the CBMWTF shall be developed into greenbelt.

3.9 WASHING ROOM:

A washing room shall be provided for eye washing/hand washing/bathing etc. Besides above, following important provisions should be made in a CBMWTF:

- A telephone shall be provided and maintained at the facility.
- A first aid box shall be provided and maintained at the CBMWTF. Proper lighting shall be provided at the facility.
- Proper care shall be taken to keep the facility and surroundings free from odours.
- Proper fire fighting facilities and emergency alarm shall be installed. Measures shall be implemented to control pests and insects at the site. Measures shall be implemented to control the escape of litter from the site.
- Necessary provision shall be made to prevent and control noise generated, if any, due to the activities at the site. Necessary protective gear for the waste handlers shall be provided.

3.10 RECORDS OF WASTE MOVEMENTS:

Daily records shall be maintained for the waste accepted and treated waste removed from the site. This record shall include the following details:

- Waste accepted: - waste collection date, name of the healthcare unit, waste category as per the rules, quantity of waste, vehicle number and receiving date (at site).
- Treated waste removed: - date, treated waste type, quantity, vehicle number and location of disposal.

CHAPTER - 4

4.0 COLLECTION & TRANSPORTATION OF BIOMEDICAL WASTE

The collection and transportation of bio-medical waste shall be carried out in a manner so as to avoid any possible hazard to human health and environment. Collection and transportation are the two operations where the chances of segregated bio-medical waste coming in contact with the public, rag pickers, animals/birds, etc are high. Therefore, all care shall be taken to ensure that the segregated bio-medical waste, handed over by the healthcare units, reach CBMWTF without any damage, spillage or unauthorized access by public, animals etc.

A responsible person from the CBMWTF operator shall always accompany the vehicle to supervise the collection and transportation of bio-medical waste. An organogram of CBMWTF is attached herewith.

4.1 COLLECTION OF BIO-MEDICAL WASTE

Generator of the bio-medical waste is responsible for providing segregated waste to the CBMWTF operator. The wastes shall be segregated as per the provisions of the Bio-Medical Waste (Management & Handling) Rules, 1988 & amendment in 2003. The CBMWTF operator shall not accept the non-segregated waste and such incident shall be reported to the prescribed authority.

Temporary storage at healthcare unit shall be designated the coloured bags handed over by the healthcare units shall be collected in similar coloured containers with cover. Each bag shall be labeled as per the Schedule III & IV of the Bio-Medical Waste (Management & Handling) Rules, so that at any time, the healthcare units can be traced back that are not segregating the bio-medical wastes as per the rules. The coloured containers should be strong enough to withstand any possible damage that may occur during loading, transportation or unloading of such containers. These containers shall also be labeled as per the schedule iii of the rules. Sharps shall be collected in puncture resistant container.

The person responsible for collection of bio-medical wastes shall also carry a register with him to maintain the records such as name of the healthcare unit, the type and quantity of waste received, signature of the authorised person from the healthcare unit side, day and time of collection etc.

4.2 TRANSPORTATION OF THE COLLECTED BIO-MEDICAL WASTE TO THE CBMWTF:

The bio-medical waste collected in coloured containers shall be transported to the CBMWTF in a fully covered vehicle. Such vehicle shall be dedicated for transportation of bio-medical waste only. Depending upon the volume of the wastes to be transported, the vehicle may be a three-wheeler, light motor vehicle or heavy duty vehicle.

In either case, the vehicle must posses the following:

(I) Separate cabins shall be provided for driver/staff and the bio-medical waste containers.

(II) The base of the waste cabin shall be leak proof to avoid pilferage of liquid during transportation.

(III) The waste cabin may be designed for storing waste containers in tiers.

(IV) The waste cabin shall be so designed that it is easy to wash and disinfect.

(V) The inner surface of the waste cabin shall be made of smooth surface to minimize water retention.

(VI) The waste cabin shall have provisions for sufficient openings in the rear and/or sides so that waste containers can be easily loaded and unloaded.

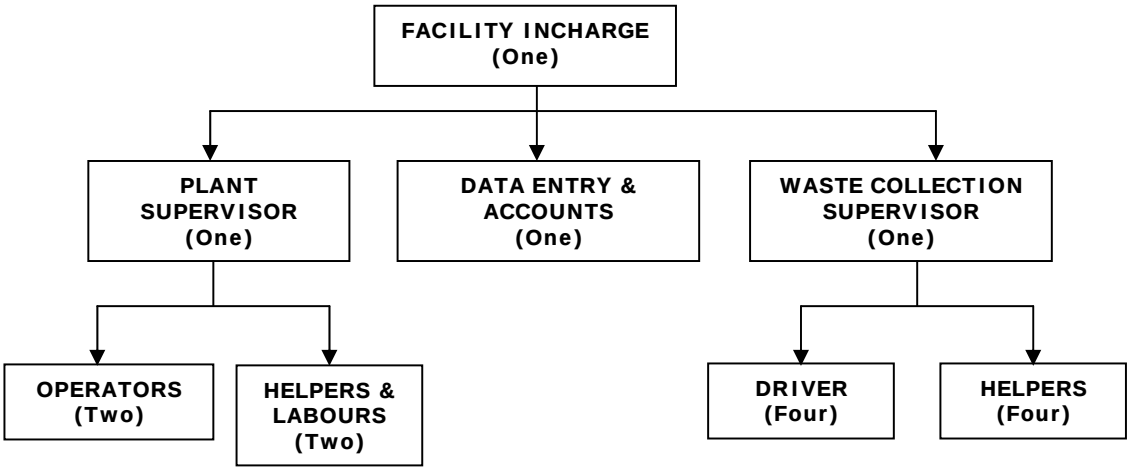
(VII) The vehicle shall be labeled with the bio-medical waste symbol (as per the schedule iii of the rules) and should display the name, address and telephone number of the CBMWTF.

Depending upon the area to be covered under the CBMWTF, the route of transportation shall be worked out. The transportation routes of the vehicle shall be designed for optimum travel distance and to cover maximum number of healthcare units. As far as possible, the transportation shall be carried out during non-peak traffic hours. If the area to be covered is very large, a satellite station may be established to store the bio-medical waste collected from the adjoining areas. The wastes so stored at satellite station may then be transported to the CBMWTF in a big vehicle. It shall be ensured that the total time taken from generation of bio-medical waste to its treatment, which also includes collection and transportation and treatment time, shall not exceed 48 hours.

DETAILS OF TRANSPORTATION VEHICLE

TATA ACE / MAHINDRA BOLERO WITH CLOSED BODY: 4 Nos.

DETAILS OF MANPOWER : ORGANOGRAM



CHAPTER - 5

5.0 TREATMENT METHODS OF BIOMEDICAL WASTE

Treatment technology adopted is incineration and sterilization (autoclaving) followed by shredding. Our technology includes:

- 2 no. of Incinerator having capacity 200 & 300 Kg/hr along with Automatic waste loading system.
- Venturi Scrubbing System (APCD)
- Chimney (30 M)
- 2 no. of Autoclave having capacity of 400 Kg/hr each
- Shredder having capacity of 700 Kg/hr
- Air Compressor
- Effluent Treatment Plant (ETP).
- Electrification
- Plumbing
- D.G. Set (45 KVA) (With Acoustic Enclosure)

Equipment selected for the treatment of biomedical waste are selected so as to comply with all the provisions of the Rules, simultaneously achieving high standards of efficiency of the treatment and durability to match the best in India.

5.1 INCINERATOR:

The waste, which requires incineration, is stored in yellow non-chlorinated HDPE bags in storage area. A known quantity of this waste is charged into the Primary Chamber through the charging door. The primary chamber is lined with refractory and insulation bricks of IS 8 & IS-2042 standards. The air required for volatilization is supplied through an air duct and introduced through equally placed nozzles. Airflow is controlled with the help of air dampers provided. The primary chamber is fitted with a fuel oil burner, which has necessary instrumentations to function automatically. A forced draft fan is used to provide for combustion/volatilization air. This fan also supplies air required for the dilution of the flue gases before venturi scrubber. The combustion air is controlled to have minimum turbulence, restricting ash fly off. The fly ash collected in Primary Chamber is removed from the deashing door. Inside primary chamber a min. of 800 Deg C +/- 50 Deg C temperatures is maintained.

The volatiles/gases emitted from the primary chamber pass through the neck of the secondary chamber, which is also lined with refractory and insulation bricks. The gases are subjected to the right temperature/heat in secondary chamber, which is generated using an automatic fuel oil burner system. The secondary chamber is designed to ensure the flue gas residence time of more than one second.

The waste destroyed in the Pyrolytic has the following composition:

- Volatile Matter.
- Fixed Carbon.
- Moisture.
- Ash or Non Combustibles.

The volatile matter has a low flash point and hence gets liberated in the primary combustion chamber. This is later burnt in the secondary chamber. Volatiles give rise to smell and smoke. These hence have to be burnt, at a high temperature & in the presence of excess air in the secondary chamber. Volatiles are basically long chain hydrocarbons. Fixed carbons are the non-volatile portion of the waste and are completely incinerated in primary chamber only. The moisture present in the waste is evaporated in the primary chamber. This then passes through the secondary chamber and leaves the system as super heated water vapour.

Sterilized ash and non-combustible material remains in the primary chamber. To prevent them from flying out along with the gases, non-turbulent conditions are maintained in the primary chamber.

Depending upon the type of waste destroyed in the incinerator the sterile ash content ranges between 5-10 %. At the end of the burning operation we get a similar quantity of sterile ash remaining as left over, providing that the destruction of the waste is complete.

The flue gases then passes through the downstream Air Pollution Control System, comprising of venturi scrubber, droplet separator followed by ID fan & Stack.

Venturi scrubber is a high-energy device where (sub micronic) particulate matters as well as acidic pollutants are scrubbed. Here, the acidic gases are removed by absorption with caustic solution and the particulates by the inertial impaction energy. A high-pressure drop (40-50 cm WC) across the venturi scrubber, imparts sufficient high energy, which helps in atomizing the scrubbing liquid and thus trapping the particulates. In venturi, gases saturate due to evaporation of water vapour and thus cool. 5% caustic solution is used as scrubbing liquid to neutralize the SO2 etc. present in flue gases.

The flue gases then enter tangentially into the droplet separator, which is of cyclonic type. By the action of centrifugal force, the larger droplets present in flue gases settle down. This helps in protecting the impeller of the ID Fan.

The ID Fan maintains the balance draft and draws out the clean gases into the atmosphere through a 30m high stack.

At the end of the incineration process the sterile ash that is left over is packed in a black-colored HDPE bags. These bags are then transported to the sanitary landfill site where they are disposed off.

INCINERATOR

Nos.	:	2
Capacity	:	200 and 300 Kg./ Hr.
Fuel	:	LDO / HSD (Duel Fired)
Type of Burner Operation	**:**	**Automatic.**
Operating Hours	:	Continuous.
Residence Time of gases in Secondary Chamber	:	2 Sec.
Stack Height	:	30 m.
Temperature	:	Primary Chamber – 850 ^{0}C
	:	Secondary Chamber – 1050 $\pm$ 50 ^{0}C
Scrubbing media	:	SS Scrubber with 5% caustic solution
Interlock	:	Primary and Secondary Burner on/ off.
	:	Limit Switch on Charging Door.
	:	Venturi outlet temperature.
	:	ID Fan Failure.
Make	:	EEEPL

5.2 AUTOCLAVING

The waste, which requires Autoclaving, is stored in red non-chlorinated HDPE bags in storage area. With the autoclave in loading position, a known quantity of these waste-bags is loaded manually in the chamber. The system design ensures that the bags do not stick to the autoclave chamber even at high temperatures. The sterilizer chamber, jacket, Door, Outer Cover, Piping, Stand, Carriage & Trolley are made of SS material.

The doors are then shut and the sterilization cycle is initiated. The first phase of the process is a steam-vacuum pulsing to ensure total air removal and effective penetration of steam. Steam is subsequently injected to raise the temperature of the load to 121.5ºC. This load is maintained at this temperature for 45 minutes. This is an over-kill approach, which results in total destruction of Bacillus Stearothermophilus. After the sterilization phase the steam is vented out and the steam is passed through a condenser where it is condensed to water.

The high vacuum and pressurization phases of the process typically achieve a 30-40 % volume reduction in the treated waste. The treated waste is then manually discharged into the handling system for feeding into the shredder.

The system is also equipped with a printer for printing the key process parameters time, temperature, pressure and vacuum for every sterilization process using a dot-matrix printer. At the end of every batch the printout is removed and stored in a file maintained at the facility to establish process effectiveness.

Safety Features

The autoclave is designed with special doors to prevent opening in pressurized condition. Secondly the process is controlled by a PLC, where the parameters are programmed and cannot be changed by the operator. The system has been designed such that the load cannot be discharged unless the required vacuum, pressure, temperature and time have been achieved. Thirdly high temperature/pressure alarms and automatic pressure relief devices are incorporated for maximum operator safety.

The system also incorporates special treatment devices for processing the condensate, which is produced when the steam condenses upon contact with the chamber and the contaminated waste. The system also decontaminates the air drawn out of the chamber during the prevacuum stage.

AUTOCLAVE

Nos.	:	2
Type	:	High Pressure High Vacuum.
Capacity	:	400 kg/hr each
Material of Construction	:	Stainless Steel
Condensate Treatment	:	Secondary Sterilization
Door Operation	:	Automatic
Control System	:	Micro Processor Controlled Process Management
	:	Automatic Door lock, Temperature/ Pressure alarms and relief devices

5.3 SHREDDING

After the waste is autoclaved it is feeded to the shredder. Shredder is equipped with hopper of adequate size to accept the material to be shredded. The hopper is also provided with a lid, which can be locked during operation. The hopper is well designed to take care of volume and weight of the material. The hopper directs the materials to the cutting chamber.

Both, main and side shafts are pivoted on bearings on cutting chamber endplates. The speed of the main shaft is less than 40 rpm and that of the side shaft is less than 35 rpm.

The knives/cutters are fitted on shaft, which rotate in opposite direction to achieve necessary shredding action. Knives are constructed from non-corrosive, high alloy heat-treated steel for extra long life. Below the shredder there is a trolley for collecting shredded material.

Once the hopper lid and enclosure door is closed, shredder operates as a closed system. This also avoids any dust generation etc.

The shredded waste is then packed in a black-colored HDPE bags. These bags are then transported to the sanitary landfill site where they are disposed off.

SHREDDER

Nos.	:	1
Capacity	:	700 Kg./Hr.
Blades	:	Combined Hook / Shear Blades.
Safety Features	:	Auto Reverse System
	:	Interlocks to avoid aerosolizing.
	:	Low Noise, Non Ballistic.
	:	Auto Shut Off.

5.4 AUTO SYSTEM

A complete automatic system (with PLC SCADA) right from the feeding of waste to the treatment is planned which will give flexibility and ease in operation.

5.5 UTILITY SPECIFICATIONS:

The unit shall be designed to use the utilities of the following specifications :

- Fuel : LDO/Furnace Oil (FO)
- Compressed air : @ 6.0 Kg/Sq. cm.
- Process water : 250 Litres/hour @ 30 º C
- Caustic solution : 50 Litres/hour 10 % NaOH
- Bleed (Quantity) : 1400 Litres/hour
- Electricity
  - Drives : 440v, 3 phase, 50 Hz
  - Instrumentation : 230v, 1 phase, 50 Hz
- Electric Power (Connected) : 50 KW

CHAPTER - 6

6.0 DISPOSAL OF TREATED BIOMEDICAL WASTE

The treated bio-medical waste shall be disposed as per the following table-6.1.

TABLE 6.1: CAPACITY CALCULATION

NO.	WASTE CATEGORY	DISPOSAL METHOD
1.	Wastes after disinfection and shredding	Municipal landfill
2.	Disinfected & Shredded sharps	Sharp Pits
3.	Incineration ash (36.2/ BMW Cat. No. 9) @	Municipal landfill
4.	Treated waste water	Used for gardening
5.	ETP Sludge	Municipal landfill

CHAPTER - 7

7.0 DETAILS OF POLLUTION CONTROL FACILITIES

7.1 WASTE WATER TREATMENT SYSTEM

7.1.1 ETP DESCRIPTION

Main source of waste water in our facility is bleed from ventury scrubber of incinerator, condensate from autoclave, floor & vehicle washing. Bleed from scrubber is free of organics and is stabilized water and meets all the norms prescribed by Pollution Control Board. The condensate from autoclave is passed through secondary sterilizer before discharge and hence not polluting. Floor washing / vehicles washing are invariably carried out with hypochlorite solution which is a known disinfectant.

Due to above reason ETP is not at all necessary in our facility. But to safeguard against worst-case scenario and as a precautionary measure not to take any chance, ETP has been provided in our facility.

The waste water from the unit is collected in to a collection tank and then it is subjected to dosing for disinfections and coagulation. The bleached effluent is passed through dual media filter and the filtered water is used for Gardening. The back wash from the dual media filter is collected into a sludge drying bed and the leachate of this sludge drying bed is collected back to collection tank. Detailed drawing of ETP is enclosed herewith.

Additionally, the whole facility will have garland drain which will collect any spillage, run off of rain water. The garland drain will be connected to the collection chamber of ETP.

7.1.2 CHARACTERISTICS OF UNTREATED WASTE WATER:

Our untreated waste water confirms the norms prescribed by CPCB for final out let.

TABLE 7.1: CHARACTERISTIC OF EFFLUENT

CHARACTERISTICS OF UNTREATED WASTE WATER			TREATED WASTEWATER
NO.	**PARAMETERS**	**QUALITY**	**QUALITY**
1.	pH	6.5 – 8.5	6.5 – 8.5
2.	BOD	80 mg/L	< 30 mg/L
3.	COD	150 mg/L	< 100 mg/L
4.	SUSPENDED SOLIDS	200 mg/L	< 100 mg/L
5.	OIL & GREASE	10 mg/L	< 10 mg/L

- All the parameters are in mg / lit except ph.
- Shows high content of suspended solids in the effluent because, we are scrubbing incinerator flue gas, which contains ash particles.

TABLE 7.2: PROPOSED CIVIL UNITS OF ETP

SR. NO.	NAME OF UNIT	MOC
1.	Equalization Tank (Acid/Alkali Proof Lining)	RCC M20 with A/R Tile Lining
2.	Mixing Channel	RCC M20
3.	Chemical Dosing Tank Lime Alum Polyelectrolyte	HDPE/RCC
4.	Primary Settling Tank	RCC M20
5.	Intermediate Sump	RCC M20
6.	Filter Foundation	RCC M20
7.	Treated Water Tank	RCC M20
8.	MCC Panel	RCC M20
9.	Sludge Drying Beds	Brick Masonary

TABLE 7.3: PROPOSED MECHANICAL UNITS OF ETP

SR. NO.	ITEM	MOC	MAKE
1.	Horizontal centrifugal non clog Equalization Transfer Pump	CI	JOHNSON.
2.	Paddle Type Agitator For Chemical Dosing Tank	MSEP	EEEPL
3.	Filter Feed Feed Pumps	CI	JOHNSON
4.	Pressure Sand Filter	PP	EEEPL
5.	Activated Carbon Filter	MSEP	EEEPL
6.	Hypochlorite Dosing System	CI	EEEPL
7.	Piping Works	-	-
	• Interconnecting Piping	HDPE/UPVC	ASTRAL-UPVC PARIXIT-HDPE
	• Valves	PP/CI/HDPE/UPVC	ASTRAL-PARTH

7.2 DETAILS OF AIR POLLUTION CONTROL SYSTEM:

A chimney of sufficient height (30 Mts) and a Wet Venturi Scrubber will be provided with the incinerator.

Type of Fuel: LDO/ HSD

Fuel Consumption: LDO/HSD – 85 - 90 LIT/HR

TABLE 7.4: DETAILS OF EMISSION FROM STACKS

NO.	OPERATING PARAMETER	UNIT	INCINERATOR
1.	Stack height	meter	30
2.	Stack diameter at top	meter	0.40
3.	Flue gas exit velocity	m/s	4.0
4.	Emission	-	PM ≤ 150 MG/NM^3
5.	Flue gas temp.	^0K	353
6.	Control Measures	-	Ventury Scrubber with Droplet separator

A ventury scrubber with a scrubbing media of 10 % NAOH solution is provided with the incinerator to mitigate the air pollution.

Specifications:-

Diameter **:** 400 MM

Material of Construction **:** MS

Lining **:** 3 MM rubber lining

SMF Details **:** Provided at a height of 12 m with ladder and plat form.

7.3 ASH MANAGEMENT

Any solid residue (inorganic left after combustion process) from the incinerator and APC system and liquid residue should be considered to be a hazardous waste and handled as such. Liquid streams will be neutralized and returned for reuse in plant. While solid residue that is Incineration Ash @ 15% of the Biomedical waste Incinerated will be disposed to landfill site.

CHAPTER - 8

8.0 EMERGENCY PREPAREDNESS PLAN

Organization is responsible for safety and accident prevention. Accident prevention is a first step in emergency.
The emergencies are normally.

- Fire
- Natural Calamities
- Plant shut down

PLANNING

- Management is committed for plant as well as employees safety and time to time conduct programs and the importance of emergency planning.
- When emergency situation arises the watchman / plant personnel / administration staff will ring the Hooter situated in security cabin. During such situation if arises, everybody will assemble near assembly point on listening to hooter. The supervisor administration will inform the concerned authority for necessary actions.
- A copy of plan should be kept where employees can refer to it at convenient times. In fact, to go a step further employer could provide the employees with a copy of the plan, particularly all new employees.

FLOOD EMERGENCY

- In case of flood warning we will shut down the plant and we will transfer all treated as well as untreated waste to a room at height.
- In case of flood warning we will empty our ETP sludge / Ash from seal pit as well as Ash settling tank into our sludge drying beds. We will empty our ETP treatment tank by pumping after providing treatment to the effluent into the drain.
- Levels of our ETP will be such that there will not be run over of rain water into Ash settling tank as well as seal pit.

FIRE EMERGENCY

- In case of fire emergency we will shut down the power supply from mains.
- All the personnel from the plant will be evacuated.
- Fire fighting staff will be informed immediately.

PLANT SHUT DOWN

- Excess waste accumulated due to plant shut down will be stored in a designated storage area with sufficient storage capacity.
- Contingency plan for treatment of stored waste will be listed out and followed.
- If situation requires, excess waste will be deep buried.

RESPONSIBILITIES

NO.	DESCRIPTION	RESONSIBILITY	LEGAL AUTHORITY
01.	Fire	Plant Incharge	Fire Brigade
02.	Short Circuit	Plant Incharge	Power Station
03.	Flood	Plant Incharge	SPCB/Municipal Council
04.	Accident (Vehicles)	Plant Incharge / Collection personnel	SPCB/Municipal Council
05.	Safe assemble point	Plant Incharge	Open Area Lawn near office building
06.	First Aid	Plant Incharge	-

CHAPTER - 9

9.0 CORPORATE SOCIAL RESPONSIBILITIES

The proposed project is a pollution abatement project. The implementation of this project will control the hazard posed by improper management of medical waste. Further to this, the company shall continue to be mindful of its social and moral responsibilities to, employees, shareholders, society and the local community.

Funds shall be earmarked for CSR activities, this fund shall be utilized over a period of 5 years which is a 1% of the total project cost. Following activity given in table 9.1 shall be under taken a part of CSR.

TABLE 9.1: PROPOSED CSR ACTIVITIES

NO.	PARTICULARS	CSR ACTIVITIES
1.	Education Development	Education Material Distribution, scholarship, Training to Teachers, Promote to 10^{th} and 12^{th} std. students, etc
2.	Health Care	Immunization Camp, General & specialization Camp, training & awareness. Facilities for drinking water like, R.O. Plant
3.	Other	Environmental awareness programme foundations, Relief Societies, etc.

CHAPTER - 10

10.0 PROPOSED TIME SCHEDULE

No.	EQUIPMENT	COMPLETION SCHEDULE FROM EFFECTIVE DATE
1.	Design, engineering, construct, fabrication, supply & Install	8.5 months
2.	Erection & pre-commissioning	2.5 months
3.	Commissioning & performance trial	1.0 month
	TOTAL	12 month*

* Time required for the completion of first phase with incineration capacity of 200 kg/hr.

CHAPTER - 11

11.0 PROPOSED COST ESTIMATE

NO	ITEM	COST ESTIMATE(INR)
1.0	**BUILDING & INFRASTRUCTURE**	
	Administrative Building & Laboratory	15,040,000
	Approach Road and Pathways	1,760,000
	Treatment & Storage Shed	12,410,000
	ETP(Civil)	2,740,000
	Green Belt Development	210,000
	Value	**32,160,000**
2.0	**MACHINERY & EQUIPMENT**	
	Incinerator	**13,770,000**
	APCS system	
	Autoclave System	**7,370,000**
	Boiler/Steam Generator	
	Mechanical System	8,540,000
	Interconnecting Piping	3,630,000
	Electrical System	5,720,000
	Instrumentation Works	1,530,000
	Value	**40,560,000**
3.0	**BMW COLLECTION VEHICLE**	**6,700,000**
4.0	**DG SET**	**920,000**
	TOTAL	**80,340,000**