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Bio Medical Waste Disposal System for Pune

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Abstract: ***The rapid development of urban and industrial areas in country like India at the economic growth is observed, but these developments at another corner try to degrade the surrounding environment which ultimately affects the human health. The health issues associated with the natural and manmade sources produces its bi-products as a biomedical waste. In India, The Ministry of Environment and Forest (MOEF) has notified Bio-medical waste management rules in 1998, according to rules they provide a guidelines for disposal of bio medical waste. They differentiate the waste into several categories and their disposal provisions. According to the guidelines they provide the rules for their collection methods from which the segregation of the waste has been done. Also gives the instruction for transportation and program for their storage and final disposal of the treated waste. The date we are trying to improve ourselves and trying to setup an effective management system but due to less exposure and awareness of the problem associated with biomedical waste proves it, Insufficient and Failure. This system only limited to the urban area. It does not include the suburban, villages and remote areas. Because of this waste is getting mixed with municipal solid waste and spreading infection to the surrounding. So the paper aims to study a system which can potentially handle and dispose the all biomedical waste generated due to the all type of sources.***

Keywords: Bio medical waste, Incineration, pyrolysis, autoclaving, shredder

1. Introduction

Bio-medical waste' means any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research pertaining thereto or in the production or testing thereof. The physico-chemical and biological nature of these components, their toxicity and potential hazard are different, necessitating different methods / options for their treatment / disposal. In Schedule I of the Bio-medical Waste (Management and Handling) Rules, 1998 (Annexure II) Hospital waste refers to all waste generated, discarded and not intended for further use in the hospital. It is broadly categorized into the following categories:

1. Human anatomical waste
2. Animal waste
3. Microbiology and biotechnological waste
4. Waste sharps
5. Discarded medicine and cytotoxic waste
6. Solid waste(contaminated)
7. Solid waste(non contaminated)
8. Liquid waste
9. Incinerated ash
10. Chemical waste

Improper handling of this waste affects not only medical personnel, doctors who came in contact with medical waste, but also Nurses, Para-medical staff, Ward Boy, Workers, Waste pickers and citizens at large. Solids waste generated from medical institutions need to be handled very carefully as these wastes may contain infectious material. Different types of solids are generated in hospitals and nursing homes which need different types of handling and disposal. In the country like India only 1 to 1.5% is Bio medical waste of the total amount of solid waste generated in a city, of which 10-15% is considered infectious. The paper aims to create awareness amongst the souls. The key step in reducing the hazards from Bio medical waste is to segregate the waste at source.

In Maharashtra total no of health care establishments are 45,785 (approximately) from that 14.439 are bedded and 31346 are bedded. So the total no. of beds in Maharashtra is 1, 94,623. In Pune 7,184 no of health care establishments ,which 19.28% of total HCE from that bedded establishments are 2763 and non bedded are 4421. Total waste generated in Maharashtra is around 43,380 Kg/Day. In Pune region waste generated is 8495 Kg/Day out of which 4158 Kg/Day is generated by the Bedded HCEs and 4337 Kg/Day is generated by the non bedded HCEs.Total waste incinerated is 79 % of total generated waste. It is very huge quantity because of improper segregation and in Pune region total incinerated waste is 60. 32 %. it means the 5097 Kg/Day Bio medical waste is get incinerated in Pune region itself and 34,270.2 Kg/Day Bio medical waste is get incinerated in Maharashtra state.

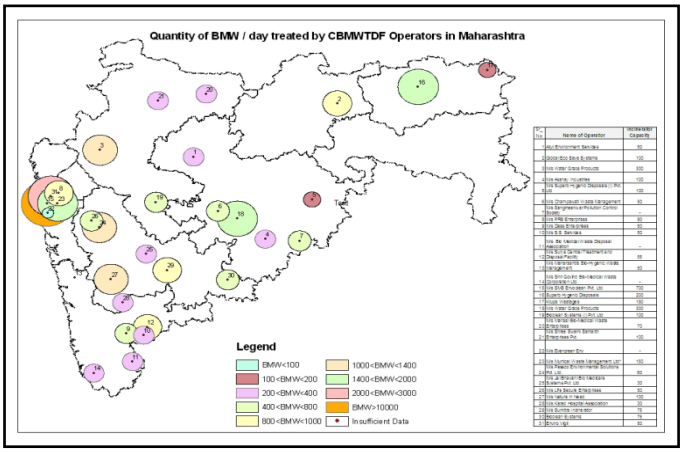

Figure 1: Map showing coverage of BMW disposal

2. Problems Statement

After forming a guideline by ministry of environment and forest a Bio medical waste disposal programme starts in a country effectively but it creates some consequence such as air pollution, lack of awareness, not seriousness on the issue and poor management structure. Also it is found that this management system is limited only to the urban area. It does

not include the village area, remote areas and household Biomedical waste because according to guidelines of disposal is very costly and proves uneconomical to the most of areas so there should be required such kind of system which dispose the waste at all level.

3. Methodology

For the disposal of Bio-medical waste we should have an integrated plan for whole state of Maharashtra. For designing such system we have to take a pilot area for study the effectiveness and cost benefit analysis also we require an EIA report for the system. Mainly in state of Maharashtra, disposal plants are for the people so the state government provides a good response.

3.1 Description of pilot area

1. Selected Area- Pune district
2. Tahsils-13
3. Villages-1912
4. Area to serve-15642 KM^2
5. Population to be get served-9426959
6. Density – 600/KM^2
7. **Location-** 18^0 31' N 73^0 55' E
8. Importance of area- Historical and education background
Approaching for design of the system firstly divide the system into the levels so it will distribute work and aprochment to system according design and operating cost can be get control

3.2 Disposal in three levels

3.2.1 Primary level

1) In this level, plant location in the urban area so it is located in the city area.
2) Problem of air pollution will be the concern, so we replace the incinerators with the plasma pyrolysis system which are capable to destroy the dioxin and furan, which are the carcinogenic compound emitted during improper combustion.
3) For improvement the capacity we replace the auto clave with Hydroclave, by using Hydroclave we can increase the speed and efficiency.
4) In this level main focus should be on proper segregation and avoid mixing of kitchen waste resulting in the decrease in the incinerated waste.
5) Adaptation of GPS tracker in the vehicle also used for proper collection
6) Transport vehicle will be as per motor vehicle act.

3.2.2 Secondary Level

1) Prime aim is collection of waste from the suburban and village area and the disposal of the waste
2) As the plant is located in the non residential area so there is not required the advance system because it will be result in expensive.
3) Plant will consist of incinerator and autoclave.
4) Collection and Transportation purpose we are implemented the collection points. Local HCEs will collect their waste to the centers. Transport vehicle will collect the waste to the plant.

3.2.3 Tertiary Level

1) Prime aim is disposal of the waste
2) Area is remote so the old burning using the Brick masonry incinerator and old container can be used to dispose the waste

3.3 Estimation of waste generated

An effective design of the process of managing any waste needs fairly accurate knowledge of the quantity waste generated.

- Estimation of waste in case of BMW is generally based on medical treatment given to the number of patients and when the medical facility has indoor patients it can also be based on the no of beds provided and % occupancy of facility.
- The rate and type of BMW generated in various departments, sections and units will depend upon their nature of activity; OPD, WARDS, OT, ICU/ACCU, Laboratory, radiology etc.
- In general estimation first can be based on the rate based experience of others which is in the range of 150 grams to 350 grams per bed per occupied day.
- Assessment of the quantity of BMW in terms of the groups of categories of BMW for incineration and disinfecting by Autoclave/Microwave treatment can be done when a systematically designed BMW management system including monitoring throwing waste audit is introduced in a sustainable manner.
- Waste collected according to survey done by us

Table 1: Waste Generation Quantities

S No	*Source*	*Waste in Kg/Day*
1.	Clinics	1 Kg/Day
2.	Hospitals	350 TO 750 Grams/Day
3.	Labs	Depends but considering for calculation 1 kg/day
4.	Other	Provide by particular Institute/day

Table 2: Categories of waste and its treatment

S	*Category*	*Treatment &*
1	Human	Incineration
2	Animal	Incineration
3	Microbiology	Autoclaving
4	Waste Sharps	Autoclave and

3.4 Zoning of the pilot area

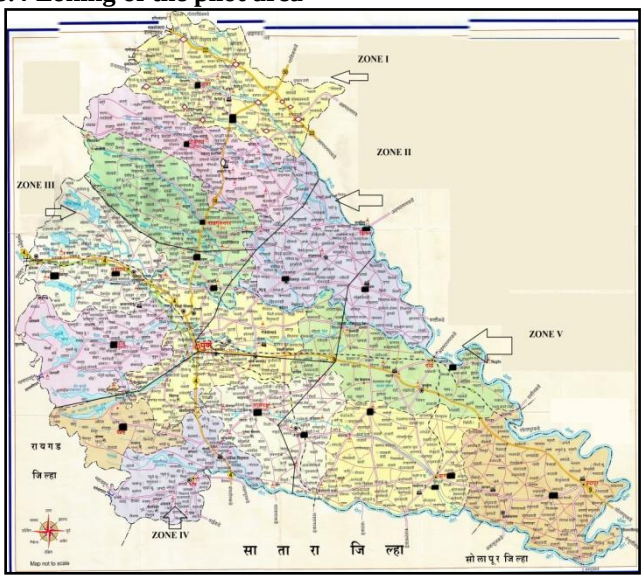

Figure 2: Map showing the distribution of area

In above figure that we divide the area in the 5 zone in this five zones are zone I and zone II plants are in the primary level and remaining zone comes under the secondary level. Zones are divides according to density and the consist of MDR and SH and NH so the transportation will be easy.

3.5 Procedure of disposal in ZONE I

Calculation of generated waste
Total no of villages in Zone I = 595
Average clinic per village =1.86
Total clinics in Zone I-1.86*595 =1120
Hospital and Primary health care center- 2*50+28*5+10*30=
No of labs =13 considered for design purpose
Research institute = 2
Avg no. Of beds per hospital = 5

Table 3: Calculation of generated Waste

Total waste generated			
HCE's	No	Wastage	Total
Clinics	1120	10 Kg	11200 KG
Hospital	540	4500 Gram/Bed	2700 KG
Lab	13	10	130
Research	2	100	200
Total Waste			14230 KG
Design Waste			30000 KG
Incineration (90 % Of Total Waste)			27000KG

3.6 Collection and Transportation

Collection of Waste
Total biomedical waste from the hospital, research centre's etc is segregated properly according to the type of waste. They are segregated in different coloured bags as in red, yellow, blue and green .This process of segregation is done for easy separation of waste from the hospitals and research centres.

Now, comes the actual collection process. Collection of wastes means collection from the hospitals to the particular plant where it needs to be treated accordingly as per the process. This is a stepwise procedure. First step consists of selecting the desired/exact location from where the waste will be collected. The collection of waste is done by transportation of cars/trucks. Wastes from the bags are sealed properly and the weighing is done on the weighing machine. Then, the bags are given suitable barcodes so that the identification becomes easy. Then, finally wastes transported in the trucks upto the location of the plant. These trucks which carry the wastes needs proper cleaning and maintenance. Cleaning of the trucks is done by plain water.

(i) Respective coloured bags be kept in similar coloured container i.e. coloured bags shall not be directly kept in vehicle
(ii) Sharps collected in puncture resistant containers.
(iii) Temporary storage at healthcare unit designated.

Plant layout

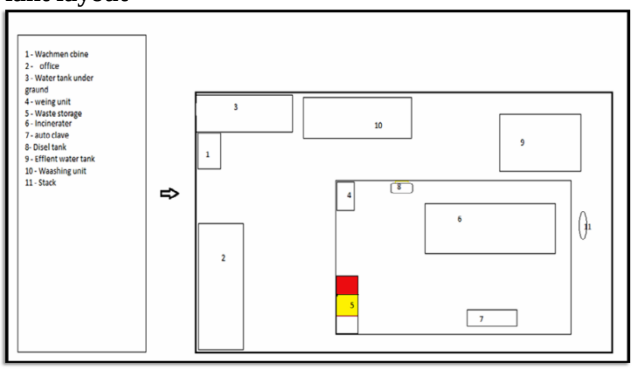

Figure 3: Plant Layout

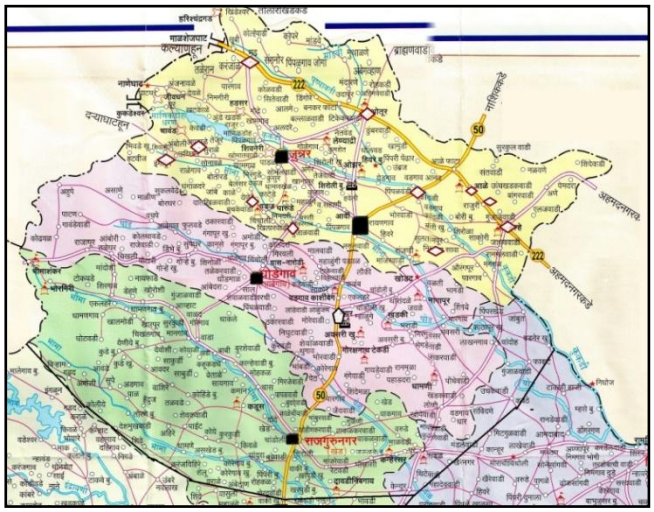

Figure 3: Map showing the zone I and its collection points

It is impossible to collect the waste from the each village. For these we have to require some collection points. We have to distribute the collection point according to density and its locality. Government provides the primary health care centres are in that order so these places are consider for collection centers. People from that area will collect the waste within 48 hours to the center on their own. Transport

vehicle of the plant will collect that waste from center to the plant.

3.7 Technical Specification of Transport

1. The generator segregate at source and they will separately collect the waste in yellow and red bags as explained earlier. It is mandatory to use the non-chlorinate bag for waste incineration. It is advisable to use biodegradable plastic bag for waste for the waste to go to Autoclave for treatment.
2. The bags will be tied and labeled as per instructions given in the notification of the Bio-Medical Waste rules, 1998 and mentioned earlier. It is preferable to use bar code label for identifying the generator of waste, type of waste and date of collection.
3. Vehicle can be equipped with Bar code reader and equipment for generating receipt of waste collected.
4. Vehicle shall be closed with two compartments, one for transporting waste for incineration and another for transporting waste for autoclave type of treatment.
5. Each compartment should be provided with relevant colour coded bins labeled as per the mandate to receive the respective bags.
6. The vehicle will be painted with appropriate colour and symbols as specified in the notification.
7. The vehicle shall confirm to the motor vehicle act 1988 with all amendment there after including pollution prevention directives which should be preferably Bharat III.
8. The driver and crew members on the vehicles need to be trained to handle Briefed with specific instruction to handle the waste spill over which may occur accidently.

3.8 Proposed Zones and their Routes-

The project area is divided into five zones. The details of Zone I out of five is taken for the presentation purpose.

Zone-I

1. Manchar-Nimgoan-Gunjawadi-Rajuri-Ale-Vadagoan-Otur-Madhe-Junar-Apatale-Ingaloon-Yenere-Nimadari—Pimpalgoan-Mahalunge-Padwala-Manchar
2. Manchar-Ghodeghar-Supeghar-Borghar-Taleghardehane-Wada-Manchar
3. Manchar-Nirgoodsar-Bhegadewadi-Kavate-Kandur-Wakgoan-Phet-Manchar
4. Manchar-Rajgurunagar-Chandoli-Pait-Amboli-Kude-Manchar

3.9 Plant Procedure Guidelines:

1. Name of the Proponent: PUSHKAR BHAMARE
2. Proposed location of the CBWTF: Manchar (khed)
3. No. of HCFs in the locality: 1169
4. No. beds: 540
5. Total Bio-medical Waste Generation in kg/day: 30000
(i) Incinerable in kg/day : 18300
(ii) Autoclavable in kg/day: 9300
(iii) Glass waste in kg/day: 300
(iv) Waste sharps in kg/day: 210

3.10 Procedure of the Disposal

It will be as per the guidelines of the CPCB. Collected waste is barcodes with respective centers weighing of the waste is to be taken at the time of collection for applying charges. Waste is stored at the storage station as per shown in figure no.3 .then it will go for disposal

1. Incinaration

According to the EPA, 90% of medical waste is incinerated. Incineration is the controlled burning of the medical waste in a dedicated medical waste incinerator. Among industry folks, these units are often referred to as hospital/medical/infection waste incinerators (HMIWIs).The waste generally passes through the incinerator on a belt, and because most medical waste can be incinerated, the waste is not sorted or separated prior to treatment. Incineration has the benefit of reducing the volume of the waste, sterilizing the waste, and eliminating the need for pre-processing the waste before treatment. The resulting incinerated waste can be disposed of in traditional methods, such as brought to a secured landfill. The flames in the primary chamber can ignite fossil fuels in a secondary chamber and power facility boilers. For the controlling air pollution problem venturi scrubber is fitted to the incinerator and waste from venturiscrubber goes to the effluent treatment chamber.

2. Autoclave

Autoclaves are closed chambers that apply both heat and pressure, and sometimes steam, over a period of time to sterilize medical equipment. Autoclaves have been used for nearly a century to sterilize medical instruments for re-use. Autoclaves are used to destroy all microorganisms that may be present in medical waste before disposal in a traditional landfill. The autoclave lowers the pressure within the chamber, which shortens the amount of time required to generate steam. Steam sterilization provides generators a way to treat waste in a cost-efficient manner. The destruction of the microorganisms is highly effective, but the problem comes when transportation is required. Many landfills and general incineration facilities are reluctant to accept the waste, fearing the waste is infectious

3. Shredder

The plastic material which autoclaved need to be dispose. Recycle is also the option for disposal. Before it is get to be dispose to decrease the volume so shredding is done. In this process plastic material passes through shredding machine. Crushing or grind that plastic material. Plastic material converts into granular form. So it use for recycle process.

Table 4: Approximate Estimates for Setting up BMW Plant

Sr. No.	Description	Cost in INR
1.	Plant Installation Cost	28,00,000
2.	Office including furniture	1,00,000
3.	Underground Water Tank	2,50,000
4.	Generator	2,00,000
5.	Vehicle (5 nos.)	50,00,000
6.	G.P.S. Tracker	1,00,000
7.	Weighing Machine (8 nos.)	70,000
8.	Bar coding system	20,000
9.	Recording system including software	1,25,000
10.	Incinerator (50 ton)	65,00,000
11.	Autoclave	15,00,000
12.	Shredder	40,000

13.	Effluent Treatment Plant	1,00,000
Total Cost in Rs.		1,68,05,000

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