
IMPLEMENTATION OF ALTERNATIVE MEDICAL WASTE TREATMENT TECHNOLOGY IN JAMAICA

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Abstract

In Jamaica, it is estimated that the health sector generates approximately 1,596 tonnes of medical waste annually, of which 83% is produced by public health care facilities. (MOH 2005) At present, there are no environmentally sound medical waste treatment systems at public (or private) healthcare facilities. Most healthcare facilities treat their medical waste with very old (over 20 years) and poorly maintained on-site incinerators or ‘burn boxes’, which are not fit for the treatment of medical waste. (Crown Agent 2003) Further, on numerous occasions when the incinerators are out of service, medical waste is either burnt and/or dumped illegally at municipal controlled disposal sites, in gullies, or on vacant lands. The cost of the negative effects of improper handling and disposal practices is a burden on the public purse. Over the years, there have been several negative media reports and community concerns highlighting the problems, and placing the institutions under tremendous pressure to take corrective measures.

Against this background, the Government of Jamaica is investing in appropriate technology for the treatment of infectious medical waste. Currently, the Ministry of Health is implementing a program aimed at improving the overall management of medical waste in the public health system. It includes:

- Procurement and installation of four regional medical waste collection and treatment facilities with steam sterilization and shredding treatment technology;
- Development of National Medical Waste Management Policy, Regulations, Standards, and Guidelines;
- Standardization of waste management procedures in all healthcare facilities;
- Implementation of waste segregation and minimization strategies; and,
- Training of healthcare staff in proper waste management.

The procurement and installation of the regional medical waste collection and treatment facilities will be implemented in two phases: phase 1 in the largest health region (Region 1) and phase 2 in the other health regions. Phase 1 was successfully implemented in 2008 under the World Bank Funded National HIV/STI Programme.

Background

The Ministry of Health (MOH), together with its Regional Health Authorities (RHAs), Agencies and related organizations make up the public health system and are responsible for health care delivery across the island. There are four RHAs managing the 23 hospitals and 363 health centers in the public health system (Figure 1). The private healthcare system consists of six hospitals and several doctors' offices.

The health sector generates approximately 1,596 tonnes of medical waste annually. (MOH 2005) Approximately, 83% of the total medical waste is generated by public healthcare facilities, while the remaining 17% is produced by private healthcare facilities. Medical waste represents approximately 10% – 25% of the total waste stream from healthcare facilities. (WHO 1999) The remaining 75% – 90% is non-risk or “general” healthcare waste with similar characteristics to domestic waste.

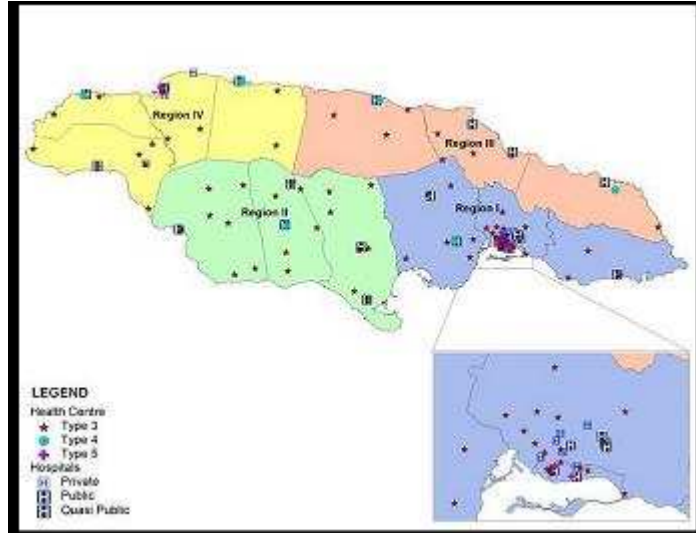


Figure 1: Health Regions and Healthcare Facilities in Jamaica (Source: MOH August 2007)

Medical Waste is generated during the diagnosis, treatment and immunization of humans or animals and is capable of producing infectious diseases. It includes sharps, infectious and pathological wastes containing HIV and other blood-borne pathogens, as well as hazardous chemical, pharmaceutical, genotoxic and radioactive wastes. (MOH 2006)

In Jamaica, waste management practices in the medical community vary widely. Individual healthcare facilities adopt management practices to suit their own financial capabilities as against the recommended local and international standards. The safe management of medical waste is significantly compromised due to limited or no budget, resulting in the following:

- Low priority or poor attitude towards medical waste management at healthcare facilities;
- Limited and inconsistent procurement of appropriate waste disposal supplies (bins, bags, sharps containers) and personal protective equipment; in many instances the required items are provided mainly through donations and gifts from local and international agencies;
- Improper segregation of infectious and non-infectious waste streams at source of generation;
- Limited or no training of healthcare workers in infection control or healthcare waste management;
- Lack of proper treatment and disposal facilities; and poor maintenance of incinerators;
- Stockpiles of pharmaceutical and hazardous waste, particularly chemotherapy agents due to lack of appropriate technology for the treatment of these waste categories;

Figures 2 and 3 presents photographs showing waste management practices and different types of incinerators being used at public healthcare facilities.



Figure 2: Photographs showing current waste management practices public healthcare facilities (Source: Crown Agent 2003)



Figure 3: Photographs showing different types of incinerators being used at public healthcare facilities (Source: Crown Agent 2003)

Medical Waste Management Program

In seeking to improve, standardize and provide a modern and environmentally friendly treatment solution for the management of medical waste in the public health system, in 2003 the MOH, under the World Bank funded National HIV/AIDS Prevention and Control Project, embarked on a comprehensive assessment of current waste management practices and treatment capabilities at all major public healthcare facilities. The study concluded that *inter alia* current waste management practices are poor due mainly to economic constraints on healthcare facility funding, and that most healthcare facilities treat their medical waste with very old (over 20 years) and poorly maintained on-site incinerators or 'burn boxes'. Of the 29 incinerators assessed, 26 were found to be unfit for the treatment of medical waste and is a serious concern for public health and the environment. (Crown Agent 2003) It was recommended that incinerators be phase-out and alternative technology be implemented for the treatment of infectious medical waste on a regional basis. A new programme strategy that includes waste minimization, waste segregation and regional waste collection and treatment facilities as the underling elements was therefore developed. This framework entails:

- Drafting National Medical Waste Management Policy, Standards and Guidelines;
- Standardizing waste management procedures in all healthcare facilities;
- Training of healthcare staff in proper waste management;
- Implementing four regional medical waste collection systems and treatment facilities with specialized medical waste collection vehicles and alternative technology.

To date, a Draft Medical Waste Management Policy for Jamaica has been developed to support and provide the framework for the implementation of proper medical waste management practices and treatment solutions. Additionally, the Health Facility Infection Control Policies and Procedures Manual have been revised to include comprehensive guidelines, standards and procedures for the proper management of waste from healthcare facilities. It includes a colour-coded system to guide the segregation of the different waste streams generated at healthcare facilities. It also formed the basis for the development of a training programme on proper waste management. Over 1,500 different categories of healthcare workers, at all levels, have received training. Requisite waste disposal supplies and equipment to support segregation and standardization of waste management procedures have also been provided.

A technical evaluation of medical waste generation, treatment capacity requirement, and alternative treatment technologies was conducted to determine the requisite budget for implementation of the four regional collection and treatment facilities. The steam sterilization and shredding technology was determined to be the most cost effective and appropriate technology for Jamaica. The regional treatment facilities will be implemented on a phased basis, with the first to be established in the largest health region (Region 1). The other three health regions are to follow thereafter.

Region 1 collection and treatment facility was implemented in December 2008. Its procurement was conducted in accordance with the Government of Jamaica's Procurement Guidelines and the 1999 revised World Bank 'Guidelines: Procurement under IBRD Loans and IDA Credits'. SEEN Environnement (Martinique) was selected to provide the turnkey contract for the supply and installation of the treatment facility with the T2000 ECODAS steam sterilization and shredding technology from France.

Pilot operations of Region 1 collection and treatment facility commenced in January 2009 and became Jamaica's first environmentally sound state-of-the-art medical waste treatment facility. It was established to serve the public healthcare facilities within the southeast east health region, with a treatment capacity of up to 874 tonnes per year (based on an operation of 96 hours per week).

With several public healthcare facilities in the other health regions experiencing significant treatment challenges with frequent breakdown and extended downtime of their aged (>20 years), unsuitable and poorly maintained on-site incinerators or 'burn boxes', Region 1 treatment facility quickly became the only environmentally sound alternative treatment option available to the public and private sector. It was envisioned that phase 2 implementation of the regional medical waste treatment facility and collection system would have been in Region 4 (2nd largest health region). However given the urgent need to provide additional treatment capacity immediately, an interim short to medium term solution that would benefit all the health regions is being recommended. This includes the upgrading of Region 1 treatment facility with additional treatment capacity and installing supporting storage and collection systems in each of 4 the health regions.

Regional Medical Waste Collection and Treatment System

Region 1 medical waste collection and treatment system replaced approximately 10 malfunctioning incinerators/'burn boxes' that operated at public healthcare facilities within the region. The facility is situated in close proximity to the largest hospital in the region – the Kingston Public and Victoria Jubilee Hospital, which is a general and maternity hospital with a capacity of 668 beds. The facility treats infectious, sharp, and pathological wastes. Over the period January 2009 to April 2010, it has treated approximately 302,163 tonnes of medical waste from a total of 41 healthcare facilities.

The regional medical waste collection and treatment system consist of four components, namely:

1. Segregation and interim storage of medical waste at healthcare facilities;
2. Collection and transportation of medical waste from healthcare facilities to the regional treatment facility;
3. Processing or treatment of medical waste at the regional treatment facility; and,
4. Disposal of the sterile unrecognisable waste residue from the regional treatment facility to the designated municipal disposal site.

Figure 4 provides an overview of the regional medical waste collection and treatment system.

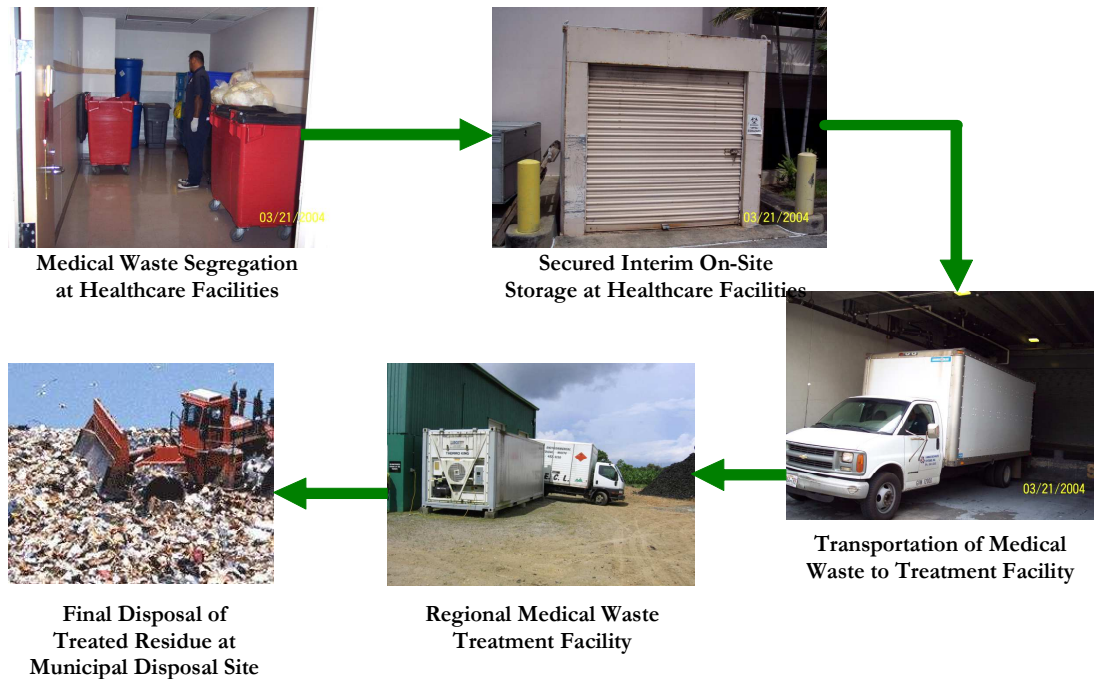
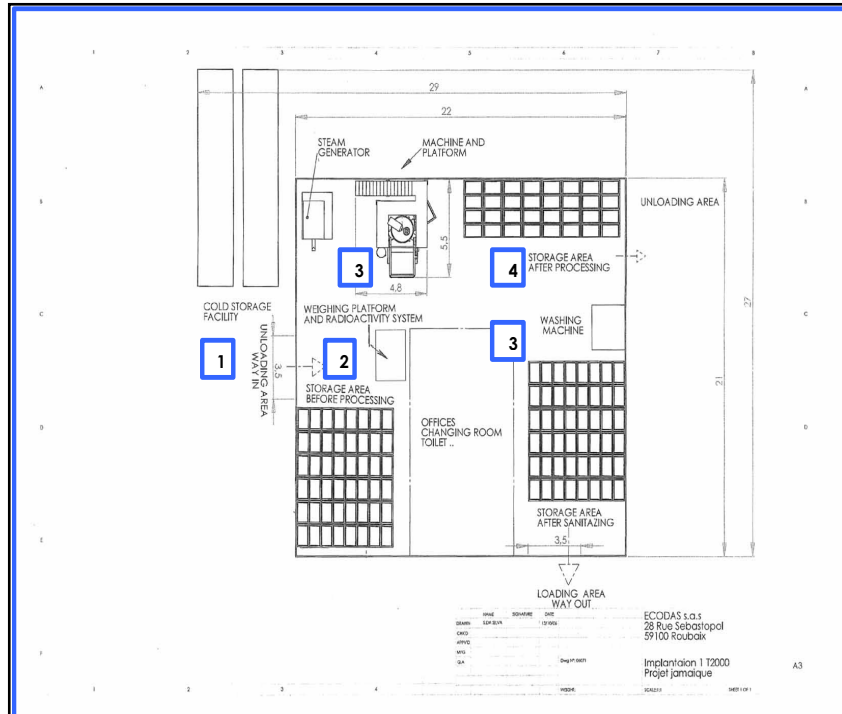


Figure 4: Overview of the Regional Medical Waste Collection and Treatment System (Source: MOH 2005)

Region 1 medical waste collection and treatment system comprises:

- Pre-engineered treatment plant building of approximately 462m² (Figure 5);
- Steam sterilization and shredding treatment system rated at 200 kg/hour with associated accessories and equipment including;
 - Electric Broiler – to provide a source of steam for the treatment equipment;
 - Radioactive detection device – fitted with an alarm system to prevent any radioactive waste being processed in the facility;
 - Cooling system – to reduce water consumption by 50%;
 - Spare parts – minimum stock of mandatory spare parts, including an additional shredder;
- Mechanical washing system to sanitize storage bins before returning to healthcare facilities;
- Weighting platform/machine of 500kg capacity fitted with (non-slip) stainless steel access ramp, indicator and transmitter connectable to a computer and label printer; to be used for weighing of waste upon arrival at the facility;
- Refrigerating containers to be used for the temporary storage of pathological waste in the event of equipment down time;
- Back-up power generator;
- Back-up water storage tanks;

- Roll-on/roll-off container for transfer of sterile treated waste to the landfill;
- Truck-washing platform integrated with an oil/water separator wastewater treatment system;
- Specialized collection vehicles with a payload capacity of 5,000 kg; and,
- Waste storage bins sized at 770 litres.



**SCHEMATIC DIAGRAM
OF ACTIVITY / PROCESS FLOW**

- 1 – Unloading of the waste bins (from the trucks or the refrigerated containers)
- 2 – Weighing and radioactivity testing of the bins to be treated: depending on the tracking system set up by the employer, either after or before storage (right after unloading or right before treatment)
- 3 – Treatment cycle / Sanitization of emptied bins and storage of sanitized bins in the dedicated area
- 4 – Unloading of the treatment equipment after processing and storage in the dedicated area prior to collection for final disposal

Figure 5: Layout of Region 1 Medical Waste Treatment Facility
(Source: SEEN Environment 2006)

The Technology

The patented T-2000 ECODAS steam sterilization and shredding technology from France is a hybrid design of existing static autoclave technology. It is a vertical autoclave that is fully automated with an internal shredding system at the start of the treatment cycle (Figure 6). The pre-shredding of infectious and pathological waste exposes greater surface area and allows easy and effective waste treatment with direct pressurized heated steam of 138°C, 3.8 bars for 10 minutes to achieve complete sterilization of infectious materials, all in one enclosed system. (ECODAS 2007) This allows complete decontamination of the inside, including the shredder, during each cycle.

The T-2000 ECODAS equipment achieves a volume reduction of 80% and ensures microbial inactivation of up to 8 log₁₀. (HCWH 2004) This is above the maximum efficiency level (Level IV) defined by the State and Territorial Association on Alternative Treatment Technology (STAATT), USA: “Inactivation of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacteria, and *B. stearothermophilus* spores at a 6 log₁₀ reduction or greater”. (EPRI 1998) The final treated waste is unrecognisable, harmless, and is safe to dispose as ordinary municipal waste. (ECODAS 2007)

The ECODAS technology is fitted with an automated system for the loading of the waste to be treated, and it is able to accommodate 770 litres plastic wheeled bins. This loading system, combined with a high treatment capacity, ensures absolute minimal handling for the maximum security of the operators.

Conclusion

Similar to other Caribbean countries, the proper management of medical waste in Jamaica is inadequate and has posed serious public health and environment problems. The Ministry of Health is currently implementing a programme to foster proper waste management practices and provide a cost effective environmentally friendly treatment solution. Phase 1 of this programme was implemented under the National HIV/AIDS Prevention and Control Project. Region 1 treatment facility comprises the steam sterilization and shredding treatment technology. It is currently the only environmentally sound alternative treatment option available to the public and private sector for the treatment of medical waste.



Figure 6: Photograph showing a T2000 ECODAS Steam Sterilization and Shredding Treatment Equipment (Source: SEEN Environnement 2006)

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