National Health-Care Waste Management Plan
- Final Report -

March 2003
1 US = 980 TSL
## Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<tr>
<td>ALAT</td>
<td>Association of Local Authorities in Tanzania</td>
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<td>APHTA</td>
<td>Association of Private Hospitals in Tanzania</td>
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<tr>
<td>CEDHA</td>
<td>Centre for Educational Development in Health</td>
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<td>CSSC</td>
<td>Christian Social Service Councils</td>
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<td>DED</td>
<td>Deutscher Entwicklungsdienst</td>
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<td>DHMT</td>
<td>District Health Management Teams</td>
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<td>EHSS</td>
<td>Environmental Health and Sanitation Services</td>
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<td>EPI</td>
<td>Expanded Programmes of Immunization</td>
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<td>GNP</td>
<td>Growth National Product</td>
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<td>GOT</td>
<td>Government of Tanzania</td>
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<tr>
<td>HCF</td>
<td>Health-Care Facility</td>
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<td>HCW</td>
<td>Health-Care Waste</td>
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<td>HCWM</td>
<td>Health-Care Waste Management</td>
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<td>HCWMO</td>
<td>Health-Care Waste Management Officer</td>
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<td>HDPE</td>
<td>High Density Polyethylene</td>
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<td>HIV</td>
<td>Human Immune Deficiency Virus</td>
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<td>HO</td>
<td>Health Officer</td>
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<td>HSDP</td>
<td>Health Sector Development Project</td>
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<td>IDA</td>
<td>International Development Association</td>
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<td>MAP</td>
<td>Multi-Country HIV/AIDS Programme</td>
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<td>MAT</td>
<td>Medical Association of Tanzania</td>
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<td>MCH</td>
<td>Maternal and Child Health</td>
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<td>MOC</td>
<td>Medical Officer in Charge</td>
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<td>MOF</td>
<td>Ministry of Finance</td>
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<td>MOH</td>
<td>Ministry of Health</td>
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<td>MSD</td>
<td>Medical Stores Department</td>
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<td>MSF</td>
<td>Médecins Sans Frontières</td>
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<td>MUCHS</td>
<td>Muhimbili University College of Health Science</td>
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<td>NAP</td>
<td>National Action Plan</td>
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<td>NEMC</td>
<td>National Environmental Management Council</td>
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<td>NGO</td>
<td>Non Governmental Organisation</td>
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<td>NMC</td>
<td>Nurses and Midwives Council</td>
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<td>RHO</td>
<td>Regional Health Officer</td>
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<td>TACAIDS</td>
<td>Tanzanian Commission for AIDS</td>
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<td>TARENA</td>
<td>Tanzania Registered Nurse Association</td>
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<td>TUGHE</td>
<td>Tanzania Union of Government and Health Employees</td>
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<td>UNEP</td>
<td>United Nation Environmental Programme</td>
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<td>UNICEF</td>
<td>United Nation Children's Fund</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>PC</td>
<td>Project Co-ordinator</td>
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<td>NSCHCWM</td>
<td>National Steering Committee on Health-Care Waste Management</td>
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<td>NCHHIC</td>
<td>National Committee for Hospital Hygiene and Infection Control</td>
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<td>WGRLL</td>
<td>Working Group on Regulations and Laws</td>
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<td>WGP</td>
<td>Working Group on Health-Care Waste Management Procedures</td>
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<tr>
<td>WGE</td>
<td>Working Group for the Equipment of the Medical Institutions</td>
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<td>WGT</td>
<td>Working Group on Awareness and Training</td>
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SECTION 2. THE NATIONAL ACTION PLAN

PREAMBLE

Define a General Framework for the Implementation of the National Action Plan

1. DEVELOP THE LEGAL AND REGULATORY FRAMEWORK
2. STANDARDISE THE HCWM PRACTICES AND IMPROVE MANAGEMENT AND MONITORING PROCEDURES
3. EQUIP THE MEDICAL INSTITUTIONS
4. LAUNCH TRAINING AND AWARENESS MEASURES
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Executive Summary

Although several isolated attempts have been made to improve the situation in some of the medical institutions, the management of health-care waste in Tanzania remains below minimum international standards, resulting in significant risks to health-care workers. The hygiene conditions linked to the handling and disposal of HCW cannot guarantee a satisfactory control on the transmission of nosocomial infections within the HCFs.

The backstopping and monitoring capacities of the Central, Regional and District Authorities to support the medical institutions remain limited. Furthermore, the legal framework is not sufficiently developed. Direct and indirect costs resulting from this situation are difficult to estimate but are certainly significant.

A standardised health-care waste management system must be developed for the country. The health-care facilities must be provided with appropriate equipment to implement safer procedures. The differentiation of the health-care waste streams within the medical institutions of Tanzania must be progressively upgraded taking into consideration the Tanzanian context.

The GOT must formulate a clear National Policy for the management of health-care waste and more broadly to control infections and improve hygiene in the hospitals. It is of the utmost importance that this policy be completed with National Guidelines to support the Health Authorities in implementing adequate standards for the management of health-care waste.

Developing an integrated strategy for infection control that would include the safe management of health-care waste is strongly recommended to ensure a coherent and sustainable implementation of the system. The mission also recommends to set up Committees for Hospital Hygiene and Infection Control at all relevant levels of the Health Services.

The following priority objectives should be pursued:

1. The consolidation of the legal framework and the reinforcement of the existing rules and regulatory documents. As a minimum:
   - A Decree should be issued, containing the general and specific provisions to determine the authorities of enforcement, the obligations of health-care waste Producers and Operators, the authorised management, treatment and disposal procedures, the range of penalties to be applied;
   - Guidelines for the medical staff to ensure hygiene and control nosocomial infections should be consigned in a comprehensive Code of Hygiene.

2. The standardisation of the current health-care waste management practices with the application of on-going management and monitoring procedures. The minimum recommendations comprise:
   - The establishment of annual health-care waste management plans to progressively lead the medical institutions and the administrative authorities to consider health-care waste management as a routine issue and reinforce progressively their organisational capacities;
   - The designation of a Health-Care Waste Management Officer in large health facilities who should be given the responsibility to operate and monitor the health-care waste management system on a daily basis,
   - Standardised segregation procedures should be set-up in all Tanzanian HCFs by implementing a three bins system that should be systematically associated with a colour coding and labelling procedure,
   - The application of a strict procedure for the most hazardous waste generated in medical institutions such as chemical pre-treatment of the highly infectious waste in a solution of sodium hypochlorite in concentrated form and a centralised disposal of the Cytotoxic and Hazardous Pharmaceutical Waste supervised by the Medical Store Department;
The development of specific treatment/disposal methods according to the type and the location of the health-care facility where the waste is generated. This includes:

- The use of “waste burning pits” in Dispensaries and Health Centres located in rural areas;
- The on-site burning of sharps and the safe burying of the ash in Health-Centres and Dispensaries located in urban areas and the use of pits, specifically designed, for pathological waste as a first step. Off-site disposal may be planned when the collection services are sufficiently developed;
- The incineration of clinical waste in District and Regional Hospitals, as well as some Referral Hospitals located in small municipalities in appropriate low-cost incinerators and the use of placenta pits for some categories of pathological waste that cannot be incinerated in such incinerators;
- In the absence of sanitary landfills, which would be the cheapest option for urban settlements, incineration of health-care waste, without any treatment of the stack emissions, remains the disposal option that is proposed for the Hospitals located in large municipalities. The other alternatives would be either too complicated to implement (autoclaving and shredding, chemical disinfection) or too expensive (treatment using microwaves).

3. The development of on-going awareness and training programmes as well as the review of the curricula of medical and paramedical staff.

The private sector may be associated in the management of health-care waste in large hospitals. However, managing health-care waste is above all a public health issue for which the duty of care and the polluter pays international principles should be applied. The Health Authorities have currently limited capacities to monitor and control the transportation of the waste and their disposal as well as to deal with the private sector. Their capacities should be reinforced through the recruitment of additional Health Officers and specific technical trainings.

A National Action Plan should be implemented over a five-year period to progressively upgrade the current health-care waste management practices and target objectives at all levels of the Health Services for an approximate initial cost of 1.3 billion TSH (1.3 million USD). The annual costs associated with the establishment of new management and disposal procedures ranges between 400 and 500 millions TSH (450'000 USD). The Government of Tanzania should also establish a National Steering Committee on Health-Care Waste Management to ensure the co-ordination and the supervision of the Health-Care Waste Management Plan at country level.
Introduction

In October 2002, The World Bank mandated Emergence to complete initial surveys\(^1\)\(^2\) and to support the Ministry of Health (MOH) to develop an integrated Health-Care Waste Management (HCWM) system for Tanzania. The tasks to be achieved by Emergence include\(^3\): 1) an initial one-week mission carried out in December 2002 followed by a two-week mission that took place in January 2003, 2) the redaction of a National HCWM plan and National Guidelines\(^4\) and 3) the facilitation of a National Workshop held by the MOH, during which the draft documents should be reviewed and validated for further implementation. This overall consultancy ultimately aims at upgrading the HCWM system in the medical institutions of the country.

This report presents the findings of the three-weeks assessment\(^5\) carried out in Tanzania:

In the first section, are successively assessed: 1) the existing legal and regulatory frameworks for HCWM in Tanzania; 2) the current HCWM practices prevailing in the health facilities of the country and the potential risks associated with those practices, and 3) the institutional capacities of the national institutions involved in HCWM. Are also reviewed the different programmes of the Co-operation Agencies already carried out in this field of activity.

The second section provides recommendations that could be applied by the Government of Tanzania (GOT) to improve the HCWM within the health-care facilities;

Finally, the third section of this document contains a possible National HCWM plan that could be implemented by the MOH in the next five years. The costs linked to this plan have been rapidly estimated. It is divided into five objectives with the primary aim at rationalising and securing the HCWM practices in Tanzania. A step-by-step strategy to implement the plan is proposed.

1. General Background

Although the GNP has increased by some 4% per year for the last twenty years, Tanzania remains one of the poorest countries in the world, with an estimated GNP per capita of about 210 USD in 1998\(^6\). Tanzania's with its' 35 million inhabitants and 2.8% annual growth rate is rapidly urbanising despite the fact that more than 70 percent of Tanzanians still live in rural settings.

Since the independence, the GOT has recognized the importance of health and given it a high priority. In the 1970s and 1980s, the Government adopted a Primary Health-Care Approach, and expanded rapidly the number of Health-Care Facilities (HCFs) and staff under an extensive referral pyramid. Universal and free access to public health facilities had been maintained until the early 1990s when financial pressures, expanded demand for services, and declining service quality obliged the government to change towards a cost-sharing policy.

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1 Study Report on Assessment of Health-Care Waste Management in Tanzania, August 2001 Environmental Health Section The United Republic of Tanzania, Ministry of Health and WHO, August 2001 (cf. Annex 10)
3 See the Terms of Reference in Annex 1
4 The redaction of the National Guidelines was not planed in the initial contract, but added following the first mission in Tanzania as a major output expected from the consultancy. The contract between the World Bank and Emergence was reviewed consequently. The National Guidelines have been written separately.
5 The Agenda of the mission is provided in Annex 2, the list of people contacted/met can be found in Annex 3
Social indicators are somewhat better than the average for Sub-Saharan Africa with an infant mortality rate of 86 per 1’000 live births (average is 91) and a child mortality rate of 144 per 1’000 live births (average is 147). The average life expectancy is estimated at 52 years only.

In addition, Tanzania has been severely hit by the AIDS epidemic since the first cases were recorded in the country in 1983. UNAIDS estimates that some 10% of the adult population is infected with HIV/AIDS and that about 1.1 million orphans are due to this epidemic, 700’000 of whom are estimated to be alive today. HIV has become the first cause of mortality in urban centres for adults aged between 15 and 49 and has a direct impact on the occurrence of opportunistic diseases such as tuberculosis, which is having a significant resurgence with an unusual emergence of multi-drug resistance strains.

Since 1985, The GOT has formulated three National Plans to cope with the HIV/AIDS epidemic. In December 2000, The President of Tanzania established the Tanzanian Commission for AIDS (TACAIDS). In February 2001, a request was formulated to get access to IDA funds, under the umbrella of Multi-Country HIV/AIDS Programme (MAP) for Africa Region, to develop a five years multi-sectorial strategy (2002 – 2007) involving the Government, Non-Governmental Organisations, the civil society and community organisations for a total cost of USD 106 millions.

The GOT and the World Bank estimate that some aspects of the project’s implementation could lead to an increase in the environmental and health risks. Inappropriate handling of HIV/AIDS infected materials does not only constitute a risk for HCF staff but also for municipal workers involved in waste handling as well as for families and street children who scavenge on dump sites.

Consequently, the project must include a component focusing on the improvement of the existing HCWM procedures within the medical institutions as well as finding appropriate treatment/disposal technologies through the development of an integrated National HCWM plan, appropriately budgeted with clear institutional arrangements for its execution. The development of the National HCWM plan should also be compatible with the Health Sector Development Project (HSDP), which is currently supported by the World Bank, and includes modules that aim at reinforcing the capacity of the MOH in its central support role and strengthening the District Health Services.

2. Objectives

The mission intends to:

Support the MOH in setting-up a National HCWM Plan to improve the current management and disposal practices,

Find an adequate strategy for the implementation of the plan at country level in the coming years,

Develop National Guidelines (written in a separate document) that should attempt to set-up standardised procedures, which are protective for both the human health and the environment, taking into consideration the financial possibilities of each institution.

3. Methodology

Preparing and implementing a HCWM plan requires developing sequential steps that are presented in figure 1. The satisfactory execution of each of these steps is strongly dependent on the completion of the other ones, none can be omitted but they can be tackled in varying sequences. A special attention in this report has been paid to the analysis of the situation and the formulation of adequate recommendations as well as to the elaboration of the implementation strategy.
To carry out the national sector assessment, the rapid assessment tool jointly developed by the WHO, UNEP and Emergence has been used. The assessment phase, limited to a three-weeks time, consisted in:

- Discussions with officials of the health and environmental sectors, representatives of private industries as well as Public Agencies or Bilateral and Multilateral Agencies, International NGOs working in the Tanzanian health sector,
- Review of the existing documents provided by the MOH and the World Bank office in Dar-Es-Salaam before and during the mission as well as existing policy documents already developed in other countries of the region,
- Visits paid in randomly selected hospitals in- and outside Dar-Es-Salaam with systematic discussions initiated with the medical and administrative staff members.

4. Definitions

No standardized official definitions for Health-Care Waste exist in Tanzania, with clear indication on what waste should be considered as hazardous or un-hazardous. This constitutes a major gap since the establishment of any sectorial policy at country level requires the recording of unambiguous and precise definitions in a legal document.

Definitions vary somewhat from one country to another and at international level, two major leading agencies in this sector, the World Health Organization (WHO) and the United Nation Environmental Programme (UNEP), under the Secretary of the Basel Convention, do not apply the same definitions and characterise HCW differently.

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7 This tool can be requested at the WHO headquarters in Geneva hcwaste@who.int or can be directly downloaded from the website www.health-carewaste.org at the bottom of the on-line documents section

8 For further details, refer to the following documents: Safe Management of Waste from Health-Care Activities Edited by Pruss, Giroult and Rushbrook, WHO 1999, Technical Guidelines on the Environmentally Sound Management of Biomedical and Health-Care Waste, Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, UNEP, 2002
The definitions contained in this report are in accordance with the ones proposed in the National Guidelines for Health-Care Waste Management that the mission drafted for Tanzania. They take into consideration: 1) the necessity to provide a precise characterisation of the hazards associated with the type of HCW produced in Tanzanian medical institutions and, 2) the financial and institutional capacities of these institutions to set-up an overall HCWM scheme as well as to develop an environmentally sound, affordable and safe treatment/disposal system.

In this report:

Health-Care Waste (HCW) includes all the waste, hazardous or not, generated during medical activities. It embraces activities of diagnosis as well as preventive, curative and palliative treatments in the field of human and veterinary medicine. In other words, are considered as health-care waste all the waste produced by a medical institution (public or private), a medical research facility or a laboratory;

Non-risk Health-Care Waste comprises all the waste that has not been infected. They are similar to normal household or municipal waste and can be managed by the municipal waste services. They represent the biggest part of the HCW generated by a medical institution between 75% and 90%. It includes paper, cardboard, non-contaminated plastic or metal, cans or glass, left over food, etc... Can also be included in this category of waste all items (such as gloves, gauze, dressings, swabs) that have been used for medical care but are visually not contaminated with blood or body fluids of the patient, this only being applicable if the patient is not confined in an isolation ward. Sanitary napkins from maternity wards even if contaminated with blood, can be included in this category of waste as they are normally;

Pathological Waste groups all organs (including placentas), tissues as well as blood and body fluids. Following the precautionary principle stipulated by WHO, this category of waste should be considered as infectious whether they may be infected or not. They should be disposed of consequently;

Anatomical waste comprises recognizable body parts. It is primarily for ethical reasons that special requirement must be placed on the management of human body parts. They can be considered as a subcategory of Pathological Waste;

Infectious waste comprises all biomedical and health-care waste known or clinically assessed by a medical practitioner to have the potential of transmitting infectious agents to humans or animals. Waste of this kind is typically generated in the following places: isolation wards of hospitals, dialysis wards or centres caring for patients infected with hepatitis viruses (yellow dialysis), pathology departments, operating theatres and laboratories. Infectiousness is one of the hazard characteristics listed in annex II of the Basel Convention and defined under class H6.2;

Highly infectious waste includes all viable biological and pathological agents artificially cultivated in significant elevated numbers. Cultures and stocks, dishes and devices used to transfer, inoculate and mix cultures of infectious agents belong to this category of waste. They are generated mainly in hospital medical laboratories;

Sharps are all objects and materials that pose a potential risk of injury and infection due to their puncture or cutting properties (e.g. syringes with needles, blades, broken glass). For this reason, sharps are considered as one of the most hazardous category of waste generated during medical activities and must be managed with the utmost care;

Pharmaceutical Waste embraces a multitude of active ingredients and types of preparations. The spectrum ranges from teas through heavy metal containing disinfectants to highly specific medicines. This category of waste comprises expired pharmaceuticals or pharmaceuticals that are unusable for other reasons (e.g. call-back campaign). Not all the pharmaceutical wastes are

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9 The precautionary principle stipulates that the magnitude of a particular risk, when it is uncertain, should be assumed significant and measures to protect health and safety should be designed accordingly.
hazardous. They can thus be classified into two categories: Non-Hazardous Pharmaceutical Waste and Hazardous Pharmaceutical Waste; 

Cytotoxic Pharmaceutical Waste may be considered as a sub-group of Hazardous Pharmaceutical Waste, but this category of waste must be managed and disposed of specifically due to its' high degree of toxicity. The potential health risks for people who handle cytotoxic pharmaceuticals results above all from the mutagenic, carcinogenic and teratogenic properties of these substances, which can be split into six main groups: alkylated substances, antimetabolites, antibiotics, plant alkaloids, hormones and others. Cytotoxic waste are still generated in a limited number of medical institutions in Tanzania; 

Radioactive Waste includes liquids, gas and solids contaminated with radionuclides whose ionizing radiations have genotoxic effects. The ionizing radiations of interest in medicine include X- and γ-rays as well as α- and β- particles. An important difference between these types of radiations is that X-rays are emitted from X-ray tubes only when generating equipment is switched on whereas γ-rays, α- and β- particles emit radiations continuously. The type of radioactive material used in HCFs results in low level radioactive waste and concerns mainly therapeutic and imaging investigation activities where Cobalt $^{60}$Co, Technetium $^{99m}$Tc, iodine $^{131}$I and iridium $^{192}$Ir are most commonly used, 

Special Hazardous Waste includes gaseous, liquid and solid chemicals, waste with a high contents of heavy metals such as batteries, pressurized containers, out of order thermometers, blood-pressure gauges, photographic fixing and developing solutions in X-ray departments, halogenated or non-halogenated solvents... This category of waste is not exclusive to the health-care sector. They can have toxic, corrosive, flammable, reactive, explosive, shock sensitive, cyto- or genotoxic properties, 

Effluents, and more particularly, effluents from isolation wards and medical analysis laboratories should be considered as hazardous liquid waste that should receive specific treatment before being discharged into the sewerage / drainage system, if such a system exists.
PART ONE
Analysis of the situation
This chapter presents the findings of the mission. Are successively analysed 1) the organisation of the Health Services; 2) the legal and regulatory frameworks; 3) the health-care waste production in the medical institutions, 4) the health-care waste management practices; 5) the risks associated with these practices; 5) the institutional and monitoring frameworks, and finally 6) the HCWM projects already carried out in Tanzania. All the findings are synthesised in the last section.

Section 1. Organisation of the Health Services

It is assumed that the reader already has a comprehensive knowledge of the organisation of the Tanzanian Health Sector. However, the information essential to understand the context in which the future National HCWM plan will be established and implemented is synthesised in this section.

Although Tanzania is experiencing one of the highest rates of urbanisation among the Sub-Saharan countries with an urban population growth rate between 8 and 10%, more than 70% of the Tanzanian population still lives in rural communities where the Village Health Posts continue to play an important role providing preventive health through education. Hence, the Health Services and the distribution of the HCFs throughout the country still have a strong rural emphasis.

1. The Public Health Services

Tanzania has created an extensive network of Health-Care Facilities that provides 90% of the population with at least one HCF in a radius of 10 km. NGOs and private institutions play a major role in the sustainability of the Tanzanian Health Sector.

a) District-level. Primary Health Services

At District level, basic clinical and public health services are provided through three layers of HCFs the Dispensaries, the Health Centres and the District Hospitals.

The Dispensary is the smallest curative unit. Usually located at the ward level, it serves 3 to 5 villages and provides health services for 6’000 to 10’000 inhabitants It has an outpatient Department, a Mother and Child Health Unit (MCH) and a maternity room with at least two beds, latrines and rooms for the medical staff. It is administered by a Medical Assistant, a Nurse or a Midwife It provides health education, treatment of diseases, MCH and delivery services, treatment and immunization It can be located in urban or rural areas;

The Health Centre is expected to cater for between 50’000 and 80’000 people, which is approximately the population of one administrative division. The services provided in Health Centres are similar to the ones provided in Dispensaries but short hospitalisations are possible and basic medical analysis can be carried out. A Health Centre groups health-workers trained in different professions such as a Medical Assistant, a rural Medical Aid, a Senior Nurse, a Midwife, a Public Health Nurse, an Assistant Health Officer, an Assistant Laboratory Technician and a Pharmaceutical Assistant. The Health Centre ensures both the supervision and serves as a referral centre for Dispensaries. However, in effect, it often fails to serve as a referral centre and operates like a dispensary but at a higher cost;

The District Hospital is the referent health unit at District level. It normally has between 60 and 150 beds and provides OPD and MCH, a store for drugs and equipment, laboratory and blood banks, X-ray, OT, kitchen, laundry, technical carpenter and tailoring workshop, mortuary and dispensing room. The staff includes graduate and Assistant Medical Officers, Nurses of different qualifications, Pharmacists, Laboratory Technicians, Radiologists and a Health Officer. The GOT attempts to get one District Hospital per District.
b) Regional Level: Secondary Health Services

The Regional Hospital is the secondary referral facility to the districts and serves a population of about 1 million people. There are currently 17 Regional Hospitals in the mainland of Tanzania each one having between 200 and 400 beds. The services are similar to the ones provided in the District Hospitals but in addition, various special medical services are provided such as surgery, gynaecology/obstetrics and paediatrics. The pharmacy and laboratory services are more developed than in a District Hospital.

c) National-Level: Tertiary Health Services

Only four Referral or Consultant Hospitals (the tertiary referral hospitals) and two specialized in psychiatry and tuberculosis exist throughout the country. With more than 400 beds per hospital, they provide highly specialized services. The four Hospitals are considered as Teaching Hospitals.

2. The Voluntary and Private Health Services

The voluntary organisations are increasingly involved in the rural Health Sector, while the role of the private providers remains limited but has been growing rapidly, particularly in urban areas, since the re-legalization of private practices in 1991.

a) The Voluntary Health Services

Voluntary organisations, NGOs and religious organisations are important auxiliaries of the Public Health Services in Tanzania. They own as many hospitals as the Government and serve especially the rural population. The quality of the services provided by these organizations attracted many patients, even if more expensive. Special agreements have been developed between the GOT and the missionary organisations. For instance, in the Districts where there are no Government hospitals, the Government negotiates with religious organizations to designate voluntary hospitals as District Hospitals and provides staff and essential supplies such as pharmaceuticals. Parastatal Organisations are supposed to offer services free of charge or in accordance with the cost sharing policy of the GOT.

b) The Private Health Services

Since the Private Hospitals Act was amended in 1991, the number of private HCFs in Tanzania has been constantly increasing, mostly in urban areas. Despite its importance, the private sectors hasn’t really been involved in the National Health Policy formulation and there has been little co-operation or co-ordination of planning regarding the delivery of health services between public and private actors.

Inspection mechanisms exist for private practitioners to measure/ensure the quality of services. However a few inspections seem to have taken place since 1991, which could become problematic. The GOT should therefore put in place a number of regulatory mechanisms so as to ensure this important actor develops in a sound manner and integrates well with the public services in a complementary way.

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10 They include Muhimbili National Hospital, which is the largest HCF of the country with 1'400 beds (Eastern Zone), Kilimanjaro Christian Medical Centre (Northern Zone), the Bugando Hospital (Western Zone) and Mbeya Hospital (Southern Zone).

11 The mission however believes that these inspections are not set-up sufficiently developed.
Section 2. Legal and Regulatory Frameworks

The legislative provisions constitute the backbone for improving the management of HCW in any country since it enables to establish legal control and define clearly the duties and responsibilities of each actor involved in the management of HCW. This section rapidly reviews the current legal provisions for HCWM in Tanzania as well as the current rules that are applied within the medical institutions.

1. Review of the Existing Legislation

The different legal documents that have been made available to the mission by the Ministry of Health and other partners have been analysed. Are presented the most important outcomes that should be taken into consideration to implement the National HCWM Plan.

a) Legal Provisions for Environmental Protection and Solid Waste Management

At National level

The environmental management has predominantly been sectoral, a situation which has facilitated the growth of disparate regulatory institutions which has let the environmental legislation to be contained in many Acts and Policies, most of which are sector specific and outmoded. As a response to this fragmented approach to legislation and policy management, an Act of Parliament established the National Environmental Management Council (NEMC) in 1983. However, the NEMC only has an advisory function and lacks regulatory powers, meaning that presently pollution produced by industry or by human settlements is virtually not controlled.

The National Environmental Action Plan addresses Urban Environmental Pollution and solid waste management by setting-up standards and defining permitting requirements as well as promoting environmentally sound waste collection, transportation and disposal systems for urban and protected areas or by establishing emergency sites for solid waste disposal, until permanent ones can be found...

Despite these efforts, the current legislation on solid waste management remains incomplete, and above all impossible to be applied as such for enforcement.

Recently, the Vice President’s Office drafted air emission standards and the MOH prepared Waste Management Guidelines. There are clear attempts to provide comprehensive management guiding principles in these two documents but they remain a compilation of various guidelines and finally fail to be specifically adapted for the Tanzanian context. Furthermore, the provisions contained for the management of hazardous waste, including HCW, are incomplete and not directly applicable for the municipal authorities and the HCFs.

At international level, Tanzania has ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal (1992). It is not party to the Stockholm Convention on the Persistent Organic Pollutants (2002). Despite this, these two conventions have not yet had a major impact on the Tanzanian legislation.

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13 Infectiousness is one of the hazard characteristics listed in annex III to the Basel Convention and defined under class H 6.2

14 Persistent Organic Pollutants (POPs) such as dioxins or furans are produced during incineration of waste. At international level there is a strong debate at present between environmentalists and public health specialists on the permissibility to operate low-cost incinertors and releasing the fumes without prior treatment.
At District and Municipal Level

The Municipal and District Authorities are responsible for the collection and transportation of the solid waste generated in their area of jurisdiction. With the current decentralisation process, this responsibility is constantly increasing. The Local Government (District and Urban Authorities) Act of 1982, details the responsibilities of districts and urban councils, including solid waste management. However, this Act does not contain any particular provision for the management of specific categories of waste such as HCW. Furthermore, enforcement of the existing legislation pertaining to waste management remains ineffective and the refuse collection capacity of the Collection Services in the municipalities is clearly insufficient to cope with the amounts of waste generated in the urban centres. Due to the weaknesses of the public sector, formal and informal waste collection services are flourishing, but without any regulation, co-ordination, monitoring by/with/from the Public Authorities.

b) Legal Provisions Applicable to the Health Sector

The Public Health Act (2001), which is still a draft document, represents a major step forward to regulate and consolidate the promotion, the prevention and the maintenance of public health in Tanzania. This Act broaches the public health services and related topics in a comprehensive and functional manner. The provisions related to solid waste management or occupational health and safety reflect the current situation encountered in the country but no specifications are consigned in this document to enforce hygiene and infection control in the Tanzanian HCFs. Amongst the official documents that the mission analysed, only the Guideline Standards for Health Facilities edited by the MOH in 1996 contains specific provisions related to wastes generated in medical institutions: “a functioning incinerator for waste management is required” for Dispensaries and Health Centres but neither further details are provided regarding the type of incinerator nor for the equipment that is needed for segregation, handling and transport. According to the questionnaire annexed to these Guidelines (Registration / Re-registration of Health Facility), hospitals, in order to get the necessary clearance to be allowed to exercise, have to keep the Health Authorities informed each year about their infrastructures and equipments devoted to the collection and disposal of HCW.

2. Appraisal of the Hospital Regulations

The proper management of HCW depends to a large extent on good administration and organisation but also requires that adequate instructions be consigned in a formal document (e.g. a HCWM plan) and that the medical and paramedical staff be fully aware of their duties and responsibilities.

a) Rules in Hospitals

In all the medical institutions visited, HCWM is organised according to specific schemes but there are no explicit rules consigned in a single document providing adequate instructions regarding the management of the HCW within the establishments. Nobody is formally nominated to supervise the whole HCWM system or co-ordinate the efforts between all actors within the hospitals. This engenders an obvious lack of efficiency and harmonisation in the HCWM procedures.

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15 The Health and Social Welfare Department, the Urban Planning Departments and the Works Departments co-ordinate to ensure the collection services
16 Section 55 G stipulates that the Local Government is responsible for the removal of “refuse and filth from any public or private place”
17 The HCFs must indicate if 1) the “surroundings are clear or dirty”, 2) they have “waste basket / dustbin”, 3) they use “a dumping site or not” and 4) they have an “incinerator that is functioning or not”
b) Duties and Responsibilities of the Medical Staff

Well-defined duties and responsibilities are essential to operate an integrated HCWM system. The responsibility of the different components of the HCWM system is shared between:

The director, who is with the administrative officer directly in charge of the overall implementation of a safe HCWM system inside the hospital;

The medical doctors and nurses in charge of the segregation under the supervision of the head nurses and the matron of the hospital;

The ancillary staff (ward attendants) in charge of the packaging, waste collection and on-site disposal under the direct supervision of the nurses;

The Health Officers who have an important role to monitor the hygiene conditions in the hospitals;

Actually, the *Nurses and Midwives Registration Act, 1997* gathers provisions for education, training, registration, enrolment and practice of nurses and midwives in their expanded role and scope of their practice. This Act regulates the profession. It is completed by the *Professional Code of Ethics for Nurses and midwives in Tanzania, 2002* that governs proper conduct in the profession and in which the responsibilities and the accountabilities of the nurses are defined (section seven). According to these documents, "the nurse is personally legally liable and also can make employer liable for her faults or incompetence". However, the scope of these documents remains very general and they fail to impose a constricting framework directly applicable to enforce the medical staff— in this case, nurses and health officers—to comply with specific standardised procedures.

In their *job descriptions*¹⁸, nurses or nursing-assistants (respectively ward attendants) are responsible for the "cleanliness of patient and his environment" (respectively "absolute cleanliness of ward unit and its surroundings by sweeping, mopping, dusting, polishing and scrubbing floors and walls"). No provisions are contained in the job description related to disinfection of contaminated material or procedures for the safe management of HCW within the wards.

The existing legal framework fails to regulate the professional life in medical institutions and does not provide a strong formal mechanism that enforces hygiene and infection control in hospitals¹⁹

## 3. Conclusion

There is currently a significant gap in the Tanzanian legislation regarding the regulation of HCWM issues as well as for an efficient control of nosocomial infections in HCFs. There are no specific definitions or characterisation of HCW and no legal indications on authorised HCWM practices (segregation, colour coding system, packaging, on-site transportation, contingency plans, etc.). There are not either any specification regarding HCW treatment and disposal technologies that might be considered acceptable in the Tanzanian context.

The legal provisions fail to enforce the private and public medical institutions, the District Health Management Teams (DMHTs) and the Municipal Authorities to reduce the risks associated with the management of HCW through the establishment of HCWM plans at the HCF, Municipal or District levels. This also makes it difficult for medical institutions to set up integrated HCWM plans without having the possibility to refer themselves to a precise legal framework that should anyway provide definitions and characteristics of HCW. In other words, at country, regional or district levels, the *minimum requirements are not established to ensure homogeneous, efficient and safe HCWM practices*. Consequently, neither the managers of HCFs nor the District and Municipal Health Services are urged to develop proper HCWM plans.

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¹⁸ The job descriptions analysed are those of ward attendants and nurses at Muhimbili Hospital

¹⁹ Apparently, an Infection Control Training Unit has been recently created at the MOH. An Infection Control Policy should be established.
Section 3. Characterisation of the HCW Production

The MOH should be fully aware of the current levels of waste production. This information is essential for the development of the future HCWM plan. A comprehensive survey is thus essential for planning an effective HCWM programme. Recently, the MOH and other actors involved in the management of HCW tried to characterise the HCW production in Tanzania. However, providing reliable estimations is a difficult task essentially due to the fact that important data are missing in the National Health Statistics Abstracts such as the bed occupancy rates for each HCF. Another problem is linked to the absence of standardised definitions, which leads to results that can differ significantly from one survey to another.

1. Type of HCW Generated

Among all the categories of HCW produced in the medical institutions, the large hospitals (Referral, Regional and District), in which almost all the ranges of medical activities are practised, produce the following categories of HCW:

- Non-risk HCW or domestic waste made of all wastes that are not contaminated with infectious or pathogen agents (food residues, paper, cardboard and plastic wrapping);
- Pathological waste, infectious waste as well as items that have been used for medical care and also not necessarily contaminated that have been collected together. Some interlocutors call these categories of waste “soft waste” or “clinical waste”. This category of waste includes also highly infectious waste that is discarded without prior treatment;
- Anatomical waste and placenta that are managed separately from the clinical waste;
- Sharps, mainly, but not exclusively, auto-disable or disposal syringes with needles that are collected in general in separate cardboard boxes;
- Pharmaceutical waste that consists in outdated drugs. They are specifically managed by the Medical Stores Department (MSD);
- Specific hazardous HCW (radioactive, cytotoxic) that are produced in a limited number of specialised medical institutions.

The production of HCW in the Health Centres and in the Dispensaries remains limited to non-risk HCW, clinical waste, placentas and sharps, generally in small quantities. This is due to their specific level of services (no major surgery, preventive health-care).

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22. Proposal for the containment, removal and disposal of hazardous medical waste from medical institutions, City of Dar-Es-Salaam. Disposiek Afrika LTD.
23. See definitions provided in the introduction of this document.
24. This terminology will be used in the continuation of this report to define the Pathological waste, infectious waste and other items considered as contaminated and hazardous by the Tanzanian interlocutors.
2. Estimation of the Quantities Generated

a) Estimation Methodology

The production of hazardous HCW was calculated in each medical institution by estimating the number of containers (bags, rubbish bins) used for medical waste collection during a defined period of time. The discussions with the medical and paramedical staff (nurses, nursing-assistants and technical services) enabled to adjust the total volume of waste collected by using a filling rate for each category of container. Finally, a volumetric mass ratio was applied (0.30 kg/l) according to the type of waste thrown into the container in order to estimate the total weight of clinical waste generated. The figure obtained is then divided by the total number of beds and the occupancy rate to estimate the quantity of medical waste generated per occupied bed per day in each hospital category. In Health Centres and Dispensaries, the estimation of the clinical waste production is based on the daily number of patients.

b) Results

At Health-Care Facility Level

Annexe 4 presents the detailed calculations of the quantities of HCW produced in large health-care facilities, as well as an example of how the information was collected in each HCF. Since the level of care and services provided in one type of facility cannot be distinguished from those provided in a facility at a lower level (cf. section 6), no differentiation has been made between Referral, Regional and District Hospitals to estimate the daily production of clinical waste in these establishments. Around 0.41 kg/occupied bed/day of clinical waste are generated in these Tanzanian Health Institutions. In Health-Care Centres and Dispensaries, around 0.03 kg/patient/day of clinical waste are generated.

At National Level

Annexe 5 presents the detailed calculations of the quantities of HCW produced at National Level. The overall production of clinical waste is estimated between 12 and 14 tons per day. About 50% of the HCW is generated in the regions of Dar-Es-Salaam, Kagera, Iringa, Kilimanjaro, Arusha, Pwani and Mwanza. These regions should therefore be considered in priority for the application of the HCWM plan. The other regions and districts produce comparable quantities of HCW.

Production of Sharps

In 2002, MSD supplied all the auto-disable syringes (about 2.8 millions) used in the BCG vaccinations programmes in the country as well as all the disposable syringes for the public health facilities and a substantial part of the private hospitals (about 12.7 millions). Assuming than the average weight of a syringe plus needle is 10 g, this means that approximately 400 to 450 kg of syringes and needles are used and must be disposed of every day in Tanzania. The quantities produced remains thus marginal in comparison with the total amount of HCW to be disposed of (3 to 4%).

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24 For detailed estimations, see Annexe 4. This result is in accordance with the studies carried out in similar countries by the Commission of the European Union in 1994 and the International Health-Care Network in 1995.

25 This result is similar to the one obtained by J. Christen in 1996 Dar-Es-Salaam Urban Health Project Health-Care Waste Management in District Health Facilities Situational Analysis and System Development, SKAT.

26 Dispostek Africa LTD estimated the total production at 11 tons a day (cf Proposal for the containment, removal and disposal of hazardous medical waste from medical institutions, City of Dar-Es-Salaam Dispostek Africa LTD).

27 This means for instance that an incinerator of an average capacity of 200 kg per hour would be able to treat all the needles and syringes used in Tanzania each day in 2 to 3 hours.
Section 4. Characterisation of the HCWM Practices

The HCW that are generated within a HCF should always follow an appropriate and well-identified stream from their point of generation until their final disposal. This stream is composed of several steps that include generation, segregation collection and on-site transportation, on-site storage, off-site transportation (if needed) and finally on or off-site treatment and disposal (see figure 2). All these steps require a rigorous organisation that should be translated into HCWM plans at health-care facility level.

In addition, management of HCW should always be considered as an integral part of hospital hygiene and infection control. Infectious HCW contributes to nosocomial infections, putting the health of medical staff and patients at risk. Proper HCWM practices should therefore be strictly followed as part of a comprehensive and systematic approach to hospital hygiene and infection control. A set of protective measures should also be developed in relation with the handling and the treatment/disposal of HCW.

Implementing adequate procedures to minimise the overall risks associated with HCWM should remain one of the priority objectives of the MOH. Waste management and treatment options should first protect the health-care workers and the patients and minimise indirect impacts from environmental exposures to HCW. A special emphasis has therefore been put by the mission on the level of risk associated with the management of HCW in the Tanzanian HCFs. Due to the current lack of clear protocols for the management of HCW, a wide variety of inadequate practices are found in the medical institutions. The practices which should be urgently improved are underlined below.

For practical reasons, in the following section, the Referral, Regional and District Hospitals where HCWM practices do not differ significantly are regrouped into Large Health-Care Facilities while Dispensaries and Health Centres are gathered as Small Health-Care Facilities.
1. Segregation, Packaging and Labelling

Segregation is one of the most important steps to successfully manage HCW. Given the fact that only about 10-25% of the HCW is hazardous, treatment and disposal costs could be greatly reduced if a proper segregation were performed. Segregating hazardous from non-hazardous waste reduces also significantly the risks of infecting workers handling HCW. Actually, the part of the HCW that is hazardous and requires special treatment could be reduced to some 2-5% if the hazardous part were immediately separated from the other waste.

The segregation consists in separating the different waste streams based on the hazardous properties of the waste, the type of treatment and disposal methods that are applied. A recommended way of identifying HCW categories is by sorting the waste into colour-coded, well packed and labelled containers. Segregation must always be applied at source.

a) In the Large Health-Care Facilities

In the Large Health-Care Facilities visited, segregation is practised at the source (i.e. in the wards themselves), which is a positive aspect. However, in the absence of clear definitions and protocols, segregation is not carried out according to international standards and the medical staff is not fully aware of what type of waste should be considered as infectious or hazardous. Another problem identified is that due to inadequate management practices or simply because of the absence of adequate treatment/disposal facilities, segregation is not systematically maintained all along the waste stream.

The wastes produced within hospitals are generally segregated as follows:

Non-risk HCW, similar to domestic waste, is collected into plastic or metallic rubbish bins of different sizes (50, 80 litres) and colours. These bins are not lined with PE bags;

Clinical waste or “soft waste” as named by some interlocutors is collected together into a variety of containers like plastic bins that may be covered with a lid or not. These containers, located at strategic points inside the wards, are not lined with adequate leakage proof bags. They can be mixed at the storage points and disposed of with the domestic waste. Anatomical waste and placentas are generally collected and disposed of separately;

Sharps are collected in plastic bottles or cardboard boxes recycled after being used (photos 1 and 2). These bottles and boxes are not hermetically sealed. Specific UNICEF / WHO safety boxes, generally used for Expanded Programmes of Immunization (EPI) can also be used when the HCFs have extra stocks. Once full the cardboard boxes are either disposed of or emptied to be reused. Sharps have been found with clinical wastes indicating failure in the segregation practices. Following the new indications provided by the MOH in relation with the EPI campaigns, syringes are discarded immediately after being used but the mission can not exclude that some two-hands recapping practices still exist in some HCFs;

Highly infectious waste generated in Medical Laboratories is not segregated separately and pre-treated before being disposed of with the clinical waste (photo 3). Nevertheless, a solution of Lysol 10% is added into the waste generated at the Cholera Treatment Centres before disposal but no guarantee can be given regarding the efficiency of the disinfection process. The waste joins the general domestic waste stream afterwards. a practice that should be strictly prohibited.

b) In the Small Health-Care Facilities

In Health Centres and Dispensaries two different practices have been observed:

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28 This is for instance the case in Amman Hospital in Irbid District
With the exception of placentas, segregation is not practiced (as seen in several rural dispensaries visited) and all the waste generated, including sharps, are collected and disposed of together;

The waste is segregated and handled in the same way as in large HCFs. The management of sharps however can vary significantly depending on the guidelines locally available. In some facilities the needle is separated from the syringe, which is then disposed of separately.

2. Collection, On-Site Transportation and Storage

In order to avoid an accumulation of the waste, it must be collected on a regular basis and transported to a central storage area within the HCF before being treated or removed. The collection must follow specific routes through the HCF to reduce the passage of loaded carts through wards and other clean areas. The carts should be 1) easy to load and unload, 2) have no sharp edges that could damage waste bags or containers and 3) easy to clean.

Great care should be taken when handling HCW. The most important risks are linked with the injuries that sharps can produce. When handling HCW, sanitary staff and cleaners should always wear protective clothing including, as a minimum, overalls or industrial aprons, boots and heavy duty gloves.

In the large health-care facilities HCW is temporarily stored before being treated / disposed of on-site or transported off-site. Non-risk HCW should always be stored in a separate location from the infectious / hazardous HCW in order to avoid cross-contamination.

a) Collection and On-Site Transportation

The organisation of collection and on-site transportation depends on the type of HCF and the human resources available. Two collections per day are normally scheduled (one in the morning and one in the afternoon). In some Hospitals, sanitary labourers do not come directly from the on-site disposal facility/location to collect the HCW in the wards/ departments by themselves, which is a positive aspect to minimize potential spread of infections. In these cases, it is usually the nursing-assistants who transport and drop off the waste directly to the storage or disposal points.

The following failures have also been noticed in almost all the facilities surveyed:

- Collection of waste is not done on a regular basis nor along well defined routes within the HCFs,
- There are often no specifically designed teams to carry out this task
- General medical waste or syringes and needles sometimes drop from the overfilled bins / sharp boxes and can be found scattered on the ground inside the hospital compound;
- The trailers used to collect the bins are not well equipped to prevent spillages in the wards in case of an accident (see photo 4);
- In some of the hospitals visited, sanitary labourers or nursing-assistants are not properly protected during waste handling. Personal protective equipment such as heavy duty-gloves, aprons or overall and boots is not always available.

b) Storage in the Large Health-Care Facilities

In large health-care facilities, the clinical waste can be stored in specific locations or directly inside the burning chamber of the “incinerators” while non-risk HCW can be stored in separate dumps.

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29 For instance, Médecins Sans Frontières, working in remote areas, recommends to recycle empty drugs containers to use them as sharp recipients by practicing a slot through which the needle is inserted and removed from the syringe.

30 Storage facilities are not useful in small HCFs where the amounts of HCW generated remain limited.
When there is no on-site disposal facility and when no special collection services are organised, clinical waste and domestic waste are stored in the same location, although segregation has been previously ensured. The "incinerators" are also regularly used as storage points before the waste is burned.

Access is rarely restricted and the waste is not protected from the effects of the weather (sun, rain...) and scavenging by animals (dogs, birds, flies, etc.) Only at Muhimbili hospital have lockable storage rooms with a concrete floor for some of them, a roof and a wire netting stopping animals (including birds but not flies!) from entering been seen. No adequate support facility like washing and disinfecting material has been observed close to the storage areas (photo 5).

This situation associated with inadequate behaviours (no regular hand-washing practices, free access to wards...) results in insufficient standards of hygiene. Although a maximum storage time should not exceed 24 hours, the storage may last up to 4-5 days before the waste is disposed of, which leads to leakages of body fluids from the storage facilities and strong putrefaction odours.

3. Treatment and Disposal

Hazardous / infectious HCW can be treated on-site (i.e. in the HCF itself) or off-site (i.e. in an other HCF or in a dedicated treatment plant). On-site treatment is often the only one possible in rural HCFs but on-site treatment can also be carried out for HCW generated in large HCFs. On-site treatment systems are particularly appropriate in areas where hospitals are situated far from each other and the road system is poor. The advantages of providing each health-care establishment with an on-site treatment facility includes convenience and minimization of risks to public health and the environment by confinement of hazardous / infectious HCW to the health-care premises. However, extra technical staff may be required to operate and maintain the systems and it may be difficult for the relevant authorities to monitor the performance of many small facilities. This may result in poor compliance with operating standards, depending on the type of systems, and increased environmental pollution.

The HCW generated in a HCF can also be treated off-site, when centralized facilities exist, in urban areas for instance. Greater cost-effectiveness may be achieved for larger units, through economies of scale, unless the running costs for waste collection and transportation remain too expensive.

Although off-site treatment increases dependency of the HCF on an external actor and requires a fine-tuned transportation system, it provides the following advantages.

- Hospitals will not have to devote time and personnel to manage their own installations;
- Efficient operation can be more easily ensured in one centralized facility than in several plants where skilled workers may not be readily available,
- Future modifications or expansions (relating to flue-gas cleaning systems of incinerators, for example) are likely to be less expensive,
- Where privatization of facilities is seen as a desirable option, this can be achieved more easily on a regional basis than for numerous small units,
- Air pollution may be more easily kept to a minimum at a centralized plant, if specific flue-gas cleaning procedures and incineration temperatures are respected.

Incineration is the only disposal technology known in the Tanzanian medical institutions. The GOT must be aware that alternative technologies exist to treat hazardous / infectious HCW and reach a level of hazard / infectiousness that is considered as acceptable, enabling the disposal of such categories of waste with the general solid waste. Detailed information on the advantages and disadvantages of each treatment / disposal technology are provided in Annexe 7.
a) In Large Health-Care Facilities

Different ways of disposing of HCW have been observed by the mission, but none of them are fully satisfactory. The current disposal of HCW in the absence of adequate financial means and specific budget lines is problematic and will certainly remain so in the coming years. In addition, the lack of specific and affordable transportation services in municipalities and towns as well as the low monitoring capacities of the Municipal Authorities reduces drastically the waste treatment and disposal options, which could be envisaged.

Due to the lack of protocols, there are disparities between the institutions visited in the way HCW is disposed of. The following practices have been observed:

In some hospitals, clinical wastes and sharps are burnt in masonry single-chamber “incinerators” built by local private manufacturers (photo 6). The burning is carried out on a periodic basis (from daily to weekly depending on the resources of the HCF). The combustion is initiated by adding fuel, usually kerosene or charcoal. The air inflow is based on natural ventilation. Most of these “incinerators” are in bad shape and temperatures of only 300°C to 400°C are reached in these “incinerators”. In many HCFs, more than one incinerator has been built, but they are usually all in a dismal state (photo 7). The conclusion is that these rudimentary single-chamber “incinerators” are not able to sustain combustion of waste in a reliable manner and do not demonstrate any significant advantage/improvement compared to open burning.

General medical and domestic wastes, although they have been segregated at source can also be collected by the municipal services and disposed of together in dumpsites. In this kind of situation, sharps are burnt separately or dropped into pits without any specific precautions. However, it has been observed that they may also be collected by mistake together with the municipal waste. In this kind of situation, the segregation benefice failed to be maintained all along the waste stream.

Anatomical wastes generated in Operation Theatres are disposed of separately. When a “satisfactory” incinerator exists in the medical institution (such as Muhimbili Hospital), body parts are incinerated. Otherwise, anatomical wastes are buried inside the hospital compound. Placentas and major human tissues are either burnt in a single-chamber incinerator or dropped inside a “placenta-pit” with concrete lining (photo 9).

Finally, General medical waste but also sharps (photo 8) can be dumped, without any segregation, into an open pit. The pit can be lined or not and sometimes delimited by a fence (photo 10). The waste is then periodically burnt or covered with earth when it is full; a new pit is then built next to it.

Effluents 33 of medical institutions are treated in general through separate septic tanks.

WHO (at central level, photo 11) and DFID (in Mbeya Region, photo 12) have supported the installation of low-cost, high-temperature incinerators that have been specifically developed and designed for the treatment of HCW in low-income countries by the De Montfort University 34. Mark II and III models of the De Montfort incinerator have been already installed in various Tanzanian HCFs and they are “recommended for district hospitals, health centres, dispensaries and regional and

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33 It has not been possible to address this point in a comprehensive way during the mission. Only some highlights are provided in the report showing that the current situation may be considered as unsatisfactory. The review of the current system for discharge of effluents from hospitals should be addressed in a second phase after having first successfully implemented a solid waste management system.

34 The Mark III is designed for hospitals up to 1'000 beds, and burns at about 4 times the rate of the Mark I & II (50 kg/h approx). The Mark IV incinerator is thermodynamically the same as the Mark III, but modified to carry the weight of a much higher chimney for use where a high chimney is a legal requirement or where the proximity of other buildings makes a high chimney necessary to disperse smoke and fumes.
consultancy hospitals respectively. If properly operated, a De Montfort incinerator has the following advantages:

- It reaches temperatures above 900°C;
- The operating costs of the De Montfort incinerator remain extremely low (less than 5 USD/ton) as well as the capital cost (about 1'000 USD for a Mark II and 2'000 USD for a Mark III);
- Operation and maintenance are simple (coconut shells can be used for instance to initiate the combustion instead of kerosene);

Products of Incomplete Combustion (PCI) are obviously generated during the whole process. Nevertheless in areas that are not densely populated, incineration enables to reduce the immediate hazards linked to medical waste and sharps. With respect to the financial resources available in the hospitals, this type of incinerator, if upgraded (for instance Mark V incinerators can be used), can constitute an acceptable intermediate solution to dispose of clinical wastes and sharps. The remaining ashes must be buried. In densely populated areas, incineration shouldn’t be seen as a long term satisfactory solution but the reality of the current situation prevailing in Tanzania must be taken in consideration when alternative solutions are proposed.

In any case, Operation and Maintenance of these incinerators must be well planned to ensure their sustainability and they should be replaced or repaired every 3 to 5 years when they are continuously operated. In that respect, the MOH should propose adequate financial, management and institutional mechanisms.

b) In Small Health Facilities

There is no significant difference in the way that clinical waste and sharps are disposed of. In the absence of adequate infrastructures and equipment, they are dropped into a pit, without segregation, and burnt periodically. Placentas are dropped directly in latrines or pits after delivery. DED and MSF have developed two different programmes to improve the situation in the Health Centres and in the Dispensaries located in remote rural areas.

Following pilot projects that have been conducted in Tanzania by international and bilateral agencies (cf. section 6), the MOH has developed and is implementing a plan to install 63 Mark II De Montfort incinerators in District Hospitals, Health Centres and Dispensaries. Low-cost De Montfort incinerators should actually become a standard disposal facility for the Dispensaries and the Rural Health Centres. The mission believes that it will be probably hard to implement such a policy for at least two reasons:

- Sustainable maintenance and adequate operation of such facilities cannot be guaranteed in rural HCFs due to their limited institutional capacities (cf. section 5);
- The implementation of such a solution remains relatively expensive.

c) Specific cases

The Municipality of Dar-Es-Salaam

Disposal of HCW in the municipalities of Dar-Es-Salaam or Mwanza remains problematic for the following reasons:

35 Source Waste Management Guidelines, draft document Ministry of Health, September 2002
36 Results of a campaign of measures carried out at De Montfort University Personal communication of Professor D. J. Picken
37 See section 6
38 Considering the price of a Mark II De Montfort (1'000 USD), the number of Dispensaries (4'380), and the number of Health Centres (402) the total cost would approximately be 5'000'000 USD.
The number of HCFs scattered in this municipality is important and the amount of HCW produced in such a densely populated area is significant. The utilisation of De Montfort incinerators, although some are already in use, cannot be seen as a sustainable long-term solution. On the other hand the use of on-site pyrolytic incinerators would be too expensive and would not significantly reduce the air pollution from that of a De Montfort.

Although the introduction of alternative technologies such as autoclaving or hydroclaving could be seen as valuable on-site treatment technologies, the success of their implementation is uncertain as long as pilot projects won't have been carried out and evaluated.

The implementation of a centralised solution (off-site treatment), although interesting poses another set of problems relating amongst others to the verification of the transport of HCW. Currently the Municipal Council does not have the capacity to perform such controls. In addition, the public hospitals would have difficulties to pay for such a service and the public sector is, for the time being, not sufficiently developed to ensure that both transportation and treatment will be performed in the most cost effective, environmentally friendly way.

There is no proper sanitary landfill where the general medical HCW could be safely buried.

For the time being, there is only one private company, Dispositek Africa Ltd that would be able to propose a centralised incineration of the HCW. The City Council of Dar-Es-Salaam signed a Memorandum of Understanding with Dispositek Africa in 1997, reviewed in 2001. A double chamber pyrolytic incinerator has been installed in a compound provided by the Ilala District Authorities thanks to a loan of the American foundation PATH. According to the information provided to the mission by the MOH, Dispositek plans to provide a comprehensive service for the HCFs of DES including:

- The delivery of preconditioned cardboard boxes lined with PE red bags and HDPE sharp boxes to the medical institutions of Dar-Es-Salaam;
- The collection of the clinical waste with three enclosed trucks to prevent any spillage in the hospital premises or on the road during transportation;
- The disposal of the clinical waste that includes: 1) a sterilisation pre-treatment before; 2) a "separation of polymeric material from organic" with a magnetic removal of "steel components" so that it may "undergo a solid state shear pulverization (SSP) processing; 3) a pyrolytic incineration of the remaining waste, and finally, 4) land-filling of the residues.

39 According to the MOH, this situation is also representative of the situation prevailing in the municipality Mwanza
40 For instance at Muhimbili Hospital
41 The mission strongly recommends not introducing any other alternative technologies in Tanzania such as microwave or chemical disinfections. The operation costs of such technologies remain extremely high while the maintenance requires very skilled personnel
42 The Tanzania Health Authorities should be aware that negotiations can be biased when there are monopolistic situations
43 Commercial company registered in Tanzania, but whose main office is located in South Africa
44 Classic pyrolytic incinerator with two chambers designed to reached respectively 800°C and 1200°C
45 For the time being, the site is located in the future industrial zone of DES at Buyini Village (25 km). It is not supplied with electricity or water, which will be problematic when the incineration will start
46 The mission visited the site where the HCW should be incinerated, met Dispositek Country Representative and contacted PATH. However both interlocutors were reluctant to provide detailed information related to the financial sustainability of the overall HCWM system that Dispositek attempts to implement in Dar-Es-Salaam.
47 See “Proposal for the containment, removal and disposal of hazardous medical waste from medical institutions, City of Dar-Es-Salaam Dispositek Africa LTD.
48 Apparently a microwave system is planned. Surveys carried out on autoclave and microwave systems show that, in practice, a disinfection of the clinical waste can only be guaranteed with these processes
49 Double-chamber incinerator (the first chamber should reach 800°C, the second 1200°C)
To date, only the incinerator is under construction (photo 13). The nominal costs of the overall process were initially estimated in the proposal at 2'500 USD/tonnes (1'500 USD/tonnes if the depreciation costs would not be taken into consideration). Compared to prices found in other countries\textsuperscript{51}, the cost of the technology proposed would have remained expensive and not really affordable for Tanzanian HCFs. However, after having negotiated major points such as the donation of the land, Dispositek has reviewed the nominal costs down to 420 USD/tonnes\textsuperscript{52}. If the Private Hospital might cope with these costs, they would remain problematic and high for the Public Sector, which will have difficulties to afford them.

**The Disposal of Pharmaceutical Waste**

Drugs are state property. Therefore HCFs are not allowed to destroy expired drugs by themselves. These drugs are returned to the District or Regional Health Authorities that must get a clearance from the Government Auditors of the Ministry of Finance (MOF). Once the MOF certified that the drugs are effectively expired, District and Regional Authorities contact the pharmaceutical board to get the necessary recommendation for disposal (incineration or burning).

MSD, which supplies nearly all the HCFs of the country through the Regional and the District MSD stores, disposes of its pharmaceutical waste at central level. Drugs are sent back to the Central MSD at Dar-Es-Salaam that must request the authorisation from the MOF to dispose off the drugs. This procedure prevents MSD from disposing the expired drugs regularly and stocks of pharmaceutical waste can increase significantly until they are destroyed. MSD incinerates the pharmaceutical waste in a pyrolytic incinerator\textsuperscript{53} (photo 14).

MSD has also developed in the past a co-operation with the Twiga Cement Factory to incinerate the pharmaceutical waste in the rotary kiln used to produce clinker. Actually the temperatures reached in this kiln as well as the current incineration capacity of the cement factory\textsuperscript{54} would be sufficient to treat all the HCW generated in Dar-Es-Salaam. This option, as recommended by the WHO\textsuperscript{55}, would represent the best solution on both a technical and financial\textsuperscript{56} point of view if the GOT could find an agreement with Twiga Cement Factory.

**Sharps**

The MOH, in agreement with UNICEF, has developed a new policy for disposable syringes and needles that is in accordance with WHO and UNICEF international recommendations: syringes and needles must be discarded of immediately following use. Needles shouldn’t be recapped or removed from the syringe and the whole combination must be inserted into the safety box directly after use. UNICEF provides safety boxes specially designed for safe collections and open-air burning. The boxes provided are used only for EPI programmes.

\textsuperscript{50} This treatment processing should aim at avoiding release of PCI in the atmosphere. If implemented as such, this treatment plant would be one of the most modern that the mission would have ever seen since it would combine two technologies that are generally, mainly due to their high cost, used separately.

\textsuperscript{51} As an example, the *Health-Care Waste Management Guidance Note of the World Bank (May 2000)* gives indication of nominal costs that includes treatment (microwave or incineration with a flue gas control or autoclave) transport and disposal. They range (in USD/ton) from 280 to 420 in USA, 410 to 750 in Mexico, 630 to 1'670 (for a comprehensive treatment of the stack emissions) in Argentina, 200 to 500 in UK, 186 to 1'530 (for a mobile treatment unit) in Brazil, 500 to 1'500 in Germany, 150 to 500 in France, 150 in Egypt.

\textsuperscript{52} Personal Communication from Allan Reynolds during the workshop held on March the 13\textsuperscript{th} and 14\textsuperscript{th}, 2003

\textsuperscript{53} This incinerator has been installed by Balton CP Ltd, reaches 1'200 °C for a capacity of 200 kg/hour.

\textsuperscript{54} Three rotary kilns of 3,80 m diameter and 58 m long are capable to produce 3 x 220'000 tonnes of clinker a year. The temperature reaches 1'400 to 1'600°C in the rotary kiln

\textsuperscript{55} See Safe management of wastes from health-care activities, Pruss, Giroult, Rushbrook, WHO, 1999

\textsuperscript{56} Needles can only be vaporized in rotary kilns. In all the other categories of incinerators (low-cost or pyrolytic), they remain in the ashes that must be safely buried. Approximately 100 USD/ton are charged by Twiga Cement Factory.
There are no provisions for the handling and disposal of syringes and needles used for curative care. In order to follow the new policy of the MOH, the medical and paramedical staff has to develop alternative solutions and reuse recycled plastic bottles or cardboard boxes. In some health facilities, other practices exist, sometimes in parallel of the new MOH policy for EPI campaigns creating confusion among the medical and paramedical staff (cf. section 6).

4. Risks Associated with the Current Practices

There is no standardized segregation procedure applied in the Tanzanian medical institutions – in this regard, the Guidelines provided by the MOH are not adapted – the labelling system is deficient and there is no systematic colour coding system. The ancillary staff that is uncertain about the definition of medical wastes uses therefore identical and unmarked bins. Potential mistakes in segregation can easily occur and the risk of a person accidentally coming into contact with hazardous waste is important. In addition the incorporation of highly infectious waste to clinical waste without prior treatment should be prohibited. The WHO precautionary principle should be more rigorously respected.

The nurses or the nursing-assistants fail to apply the aseptic measures when they handle and transport the bins within the wards or outside. The waste containers are not lined with adequate bags or even not regularly disinfected. The lids are manipulated with no specific precaution; fundamental hygienic measures are not applied. This obviously results in an increase of the risk of transmitting nosocomial infections.

The risk of spillage of medical waste and sharps during the transportation due to the use of inappropriate containers and the loss of syringes and needles from overfilled cardboard boxes (that are sometimes re-collected by the sanitary labourers without specific precautions), the failure in restricting access to the storage points, the lack of protection from scavenging animals or the disposal of HCW in dump sites without prior treatment increases the risks that HCW may be dispersed in the HCF compound and enter in contact with the general public.

The inappropriate off-site transportation (at least for DES), the disposal of clinical waste with the domestic waste in dumpsites and the absence of control procedures increase the risk for scavengers to be contaminated. The use of incineration, whatever temperatures may be reached, release air pollutants (PCI, heavy metals, etc...) that constitute an environmental health threat.

Section 5. Appraisal of the Planning Capacities of the Health Services

Most of the interlocutors met by the mission tend to develop a purely technical approach of the HCWM issue: numerous aspects that should be taken into consideration for the implementation of a sustainable HCWM programme – such as the capacity of the Administrative Authorities, the Health Services as well as the mobilisation of the civil society, etc – are rarely mentioned.

1. Monitoring Capacities of the Health Authorities

The capacities of the Health Authorities remain limited. There is no sufficient local or national expertise available in Tanzania for the management of HCW. Scientific knowledge on HCWM remains limited at central level and the Health Authorities have difficulties to provide adequate backstopping for the medical institutions under their jurisdiction.

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57 The Annexe 6 provides more information on alternative solutions for the disposal of sharps
58 Waste Management Guidelines, draft document Ministry of Health September 2002
a) At Central Level

Despite the decentralisation management process that Tanzania has been experiencing since the mid 1980s, the MOH continues to play a major role in the day-to-day management of the Public Health Services but progressively shifts its role from a direct provider to a facilitator in order to centre most efficiently its tasks towards: 1) the policy formulation through appropriate legislation and regulations; 2) the development of guidelines and standards to facilitate the implementation of the National Health Policy; 3) the monitoring and evaluation of the Health Services to improve their quality; 4) the training, the deployment and transfers of all cadres of health workers.

The recent capacity building effort increased the number of staff trained in specialized areas and strengthened some sections of the MOH. However, the MOH's capacity remains limited and overstretched, due to the shortage of staff with relevant skills and experience as well as the workloads from fragmented tasks. In addition, the past project approach and the implementation of vertical programmes (HIV/AIDS control, TB/Leprosy, EPI, etc.) have led to complex, fragmented planning and implementation arrangements with many parallel systems co-existing to serve multiple projects and programs as well as a serious lack of co-ordination. This has failed to strengthen the institutional capacity of the Tanzanian Health Administration. The MOH currently intends to move away from such fragmentation, and coordinate all activities in the sector under one common program and harmonize planning and implementation arrangements, using the Government systems as much as possible.

b) At Local Level

Authorities and budgets of the Public Health Services are more and more decentralised to the district level. However, Local Authorities have so far not been able to exercise sufficiently their authority in the management of these services due to lack of critical decision making power and inadequate resources available. Despite the decentralisation process, the present staffing level of the DHMTs and their capacities are severely limited, as the ones of the Regional Health Authorities that are in charge of the interpretation of the national policies and the supervision of their implementation by the DHMTs. It is however expected that each of the 113 districts develop a Health Plan using guidelines provided by the MOH. These District Health Plans could be used to initiate monitoring and control procedures of the production of HCW in the medical institutions.

2. Institutional Capacities of the Health Services

The financial and institutional capacities remain extremely limited in the Tanzanian HCFs and the situation will not improve rapidly. The hospital administrations face drastic budget reductions while the medical needs are increasing continuously. In this context, the safe management of the HCW is not – and cannot be – seen as a priority by the executive and managerial teams.

a) Management and Administration

Several sections of the referral system are not functioning as intended, largely because of consistent under-funding, weak management support systems and poor communications (roads and

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59 This is particularly the case for the Environmental Health and Sanitation Services (EHSS), which will be in charge of co-ordinating the National HCWM Plan.

60 See for instance the dispersed and non-coordinated approaches of the different co-operation agencies that have developed projects on HCWM throughout the country (section 6).

Telecommunications. Consequently, it is difficult to distinguish the level of care and services provided in one type of facility from those provided in a facility at a lower level. For instance, most of the Regional (respectively Consultant) Hospitals perform like District (respectively Regional) Hospitals but at a higher cost. They frequently lack essential medical equipment, drugs and supplies and suffer from deteriorating infrastructures and provide a substantial amount of primary health-care services, which could be dealt with by lower-level facilities. This often leads to overcrowding, as well as inefficient use of resources.

Hospital reforms are intended to change the current status by enabling the Regional and Consultant Hospitals to have devolved and decentralized management authority, broadened financing options, and strengthened management in resource utilization (financial, human, and infrastructure). Hospital Management Committees have been created to set up strategic and business planning. Commercial-style financial management and independent external auditing should be progressively introduced so that hospitals may know the real cost of their services to allow management decisions based on cost-effectiveness.

b) Financial Resources and Planning

Tanzania allocates a relatively high proportion of its budget to the Health Sector compared to the neighboring countries. However, shortages of funds and weak management have meant that many public HCFs lack essential drugs and supplies and has also led to deteriorating infrastructures.

The GOT budget for health is largely used to cover staff salaries (about 60% of the recurrent budget), leaving very little to cover day-to-day operation costs. If drugs and medical supplies are excluded, since managed directly by MSD, resources made available to Districts and HCFs are very limited. In addition, its release from the Treasury is unreliable and inadequate, and its use is highly restricted by itemized budget lines. Recently the Government with IDA has developed a cost-sharing program that aims at increasing the incomes of the HCFs and progressively changes the current unsustainable system. At HCF level, the move to cost-sharing practices in the Health System does not generate for the moment the resources, which would be necessary to allocate financial means specifically for HCWM.

Therefore, the HCWM plan will have to balance optimal but costly and unaffordable solutions with realistic but not always fully satisfactory technical options for the disposal of HCW. In order to cope with this constraint, a clear difference between short term and long term solutions will have to be provided in the plan.

c) Monitoring and Control

In practice, there is a lack of monitoring of the management of HCW due to: 1) scarce knowledge on HCWM in the country; 2) limited financial resources; 3) incomplete legal and regulatory provisions and 4) the understaffed Health Authorities. The finite resources of the Government strongly limit its...
possibilities to set-up a monitoring system to control HCW streams inside and outside the public and private HCFs of the country. In addition, the general low salaries of health-care staff are not motivating and explain to a large extent the turnover observed by MSF in the Health Centres and Dispensaries. The monitoring of new HCWM practices and the control of new procedures in the medical institutions will thus be problematic.

d) Training and Awareness of Staff

Following the expansion of the HCF network in the 1970s, several training schools were established where a large number of health workers were instructed “However, performance of these health workers and quality of services offered are considered as generally poor. Weak management of health personnel has led to inadequate deployment of workforce, creating serious imbalances and mal-distribution of skilled staff with heavy bias toward urban areas and large referral hospitals. The levels of education of many health workers are low (e.g., the largest cadres such as Nurse B, Rural Medical Assistants, MCH Aides and Medical Attendants recruited at the standard seven level), and the inadequate curricula and the limited opportunities for skills development hinder development or upgrading of necessary skills for career development”.

| What is your appraisal of the current situation regarding the HCWM within your institution? |
|---------------------------------|---|---|---|---|---|
| MUHIMBILI HOSPITAL               | Very bad | Bad | Fair | Good | Very Good |
| * direction                     | x       |     |     | x    |           |
| * hospital head nurse           |         | x   |     |     |           |
| * attendant                     |         |     |     |     |           |
| * mission                       |         |     |     |     |           |
| MBEYA REFERRAL HOSPITAL         |         |     |     |     |           |
| * direction                     |         |     |     |     |           |
| * chief nursing                 |         |     |     |     |           |
| * mission                       | x       |     |     | x    |           |
| IRINGA REGIONAL HOSPITAL        |         |     |     |     |           |
| * direction                     |         |     |     |     |           |
| * matron                        |         | x   |     |     |           |
| * health officer                |         |     |     |     |           |
| * mission                       |         |     |     |     |           |
| MTWARA REGIONAL HOSPITAL        |         |     |     |     |           |
| * regional health officer       |         |     |     |     |           |
| * direction                     |         | x   |     |     |           |
| * medical staff                 |         |     |     |     |           |
| * mission                       |         |     |     |     |           |

Table 1: Opinions on the HCWM system in selected HCFs

Awareness

The level of awareness is a key element to change and improvement. To compare the needs identified by the mission with those expressed by the administrative and medical staff of the hospitals, a number of tasks to be performed by the HOs is such that it is obviously impossible to ensure that a proper monitoring is applied in all these fields of activities.

of qualitative questions were systematically asked during the field visits. This information is essential in helping to select the most appropriate strategy for the implementation of the new policy.

Table 1 illustrates both the differences in appreciation of a situation, which can prevail within a HCF depending on the actor’s function/knowledge and how the situation is assessed by the mission. Actually, the discussions with the staff directly involved in the management of HCW (nurses, nursing assistants, attendants) reveal that most of them are quite aware that the current practices are unsafe and the minimum standards are not reached. It should be thus relatively easy to raise awareness in the “nurse community” and to get the support of the national nurse associations to implement the HCWM plan. However, at executive level (nurses trainers, managers or some medical doctors), the situation is slightly different and the awareness less obvious.

Training

Several in-service trainings have been organised by different stakeholders, including WHO and DFID in Mbeya. Obviously, more regular in-service training should be developed but it will be necessary to review or complete the academic curricula of nurses and medical doctors with specific lectures dedicated to hospital hygiene and infection control as well as safe management of HCW. In addition, motivation will be a major issue to implement adequate HCWM practices in the HCFs of the country. A participative approach could be developed for in-service training (see part two, recommandations).

Section 6. External Support Capacities

1. Review of the HCWM Projects Carried out in Tanzania

Among the international co-operation agencies involved in the Tanzanian Health Sector, WHO, UNICEF, SDC, DFID, DED and MSF have developed HCWM projects in relation with their specific programmes unfortunately without coordination. Each agency has therefore proposed several solutions for the management and the disposal of HCW, not all of them having the same standards, which are sometimes hardly compatible with each other. In addition, the management practices fail to be improved in a sustainable way since these projects have not been integrated in a global and national strategy. For instance:

- DFID, through its Tanzania Family health Project 1994-2001, installed several De Montfort incinerators in the region of Mbeya and produced a little brochure providing indications for the management of HCW that does not fully comply with the international recommendations of the WHO.

- Based on DFID experience, WHO has recently financed the installation of 12 De Montfort incinerators in large hospitals and the training of the nurses for the management of the HCW based on the recommendations developed in Geneva headquarters;

- DED (German cooperation) is currently working in Mtwara Region. For Health Centres and Dispensaries located in rural areas, DED has built “waste burning pits” (photo 15) and recommends throwing all the waste produced in the HCFs without segregation and burning them. In the same region, MSF has developed its own specific guidelines for HCWM. The organisation recommends the segregation of the waste into three categories, the use of sharp pits (photo 16) as presented in annex 6 and, “waste burning pits” but with a different design (photo 17). UNICEF recommends the use of safety boxes (in which the entire combination syringe plus needle are dropped) and then burning these containers. The medical and paramedical staff may be confused with so many varying approaches.

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68 Analysis of the needs identified by the mission vs the demand expressed by the interlocutors
2. Mobilisation of the Civil Society

National NGOs and religious institutions play a major role in the provision of health-care services in Tanzania by managing half of the HCFs in the country. Their mobilisation capacity and the possibility to train medical and paramedical staff through their institutions are important. They should be part of the national workshop that the MOH intends to organise.

Some Tanzanian NGOs dealing with environmental protection have already stigmatised Twiga Cement Factory when the pharmaceutical waste was incinerated in the rotary kilns, arguing that atmospheric pollutants were emitted. Such actions that do not take into consideration the necessary holistic approach that must be developed when dealing with the HCWW issue are regrettable. Twiga is now reluctant to repeat the experience unless it could rely on a strong commitment of the GOT.

Another set of private actors are currently setting up plans and are clearly interested in taking part in the HCWM issue. However, the mechanisms to control transportation of solid waste in the municipalities as well as the negotiation capacities of the Local and National Authorities must be strengthened before hand.

The GOT could certainly stimulate the involvement of small and private enterprises in the construction and in the long-term maintenance of the De Montfort incinerators that are currently built in District and Regional Hospitals by proposing adequate subvention mechanisms.

Section 7. Synthesis of the Findings

In the absence of disposal or treatment facilities within the hospitals, clinical and domestic wastes are disposed of together. All the efforts currently carried out in the wards/departments to segregate the wastes are consequently ruined. When clinical wastes are disposed of separately, most often they are burnt in single-chamber incinerators or dumped into open-air pits. In general, treatment and disposal of clinical and highly infectious waste remains an urgent problem to be addressed. There is also an urgent need to develop an integrated and homogenous HCWM system for the country as well as to provide the hospitals with adequate equipment and to implement proper managerial procedures (colour coding system, collection procedures, etc...).

Although the medical and paramedical staff has a relatively good perception of the degree of hazard associated with HCW, the current practices in the hospitals visited by the mission result in significant risks to public health. The hygiene conditions linked to HCW handling and disposal cannot guarantee a satisfactory control on the transmission of nosocomial infections throughout the HCFs. Although direct and indirect costs of this situation are difficult to establish, they remain certainly significantly high.

The backstopping and monitoring capacities of the Central, Regional and District Authorities to support the medical institutions remain limited. Furthermore, the legal framework is not sufficiently developed. Additional decrees, code of hygiene and internal rules for hospitals will have to be established and put at the disposition of the local authorities as well as the hospital administrations so as to clarify roles, duties and responsibilities of all the actors involved. Finally, the implementation of an efficient monitoring framework and the involvement of the executives remain key issues to improve the situation within the hospitals.

The administrations of the medical facilities have difficulties to estimate the costs related to the management of HCW. The structure of their accounting system does not enable them to differentiate the expenses associated with the management of the HCW from the ones linked to other activities.

To avoid this kind of problem, these NGOs should not be left aside and should be invited at the national workshop to be fully part of the decisional process.
Consequently it is extremely difficult for the medical institutions to estimate the financial costs for the development of an integrated HCWM plan.

Some suggestions to improve the management of HCW within the medical institutions of Tanzania are proposed and their economical implications roughly analysed in the following part of this report. A strategy to upgrade the current HCWM practices is also developed taking into consideration that the improvement of the prevailing situation requires a long-term involvement from the MOH to monitor and implement adequate managerial procedures. A potential "National Action Plan" with measures that could be carried out by the MOH within the next five years to implement the recommendations is contained in the third part of this report.
The differentiation of the HCW streams within the medical institutions of Tanzania must be progressively improved taking into consideration the current situation prevailing in the country. The clear identification of the priority areas of improvement and the enunciation of adequate recommendations constitute the basis for the definition of the National HCWM Plan. The mission recommends targeting in priority the following objectives:

Consolidating the legal and regulatory frameworks;
Standardising HCWM practices,
Strengthening the institutional capacities for HCWM;
Encouraging the involvement of the Civil Society.

Section 1. Consolidating the Legal and Regulatory Frameworks

The legal and regulatory frameworks must be complete to provide the necessary basis for an efficient HCWM plan at national level. Legal procedures should aim at obliging the medical and non-medical staff in being responsible at their own level and securing the HCW disposal process.70

Section 1. Consolidating the Legal and Regulatory Frameworks

1. National Legislation and Regulations

A number of legal documents should be reviewed or edited by the MOH to reinforce the duties and responsibilities of key staff / institutions. Any policy should outline the rationale for HCWM in Tanzania, the short-term and long-term objectives to improve HCWM and the key steps essential to achieve these objectives.

a) The Legislation

The current legislation must be consolidated by completing the Public Health Act, 2002 and by editing a specific decree related to the management and the disposal of HCW. The decree should contain general and specific provisions to determine the authorities of enforcement, the obligations of HCW Producers and Operators, the authorised management, Treatment and Disposal procedures as well as the range of penalties to be applied. Some details are provided in table 2.

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70 In this respect, the international "polluter pays" principle that implies that all producers of waste are legally and financially responsible for the safe and environmentally sound disposal of the waste they produce, should be applied. However, the set-up and the application of this principle for Tanzania exceeds the scope of this report.
An annexe specifying the different elements contained in the decree for the management of HCW should be added to the *Local Government Act, 1982.* Actually the GOT would have an advantage in elaborating an addendum that includes provisions for the safe management of hazardous waste in general.

**b) The Regulations**

In addition to the legislation, the mission recommends that the MOH urgently prepare for publication a paper presenting the *National Policy* on HCWM. It should be completed with practical, informative and incentive *National Guidelines* – jointly drafted with this report – to precis the national regulations for Tanzania. In absolute, the *Professional Code of Ethics for Nurses and Midwives in Tanzania, 2002* should precise that “all nurses and midwives are personally responsible for the waste they may generate during their professional activities”.

It could be worthwhile that the GOT elaborate a specific *Policy on injections safety* – the current poster available at the MOH cannot be considered as National Guidelines. The MOH should also consider the development of an integrated *Policy on Hospital Hygiene and Infection Control* as a priority.

### 2. Code of Hygiene and Rules in Medical Institutions

**a) Code of Hygiene**

The Management of HCW must be considered as an integral part of hygiene and infection control in HCFs. The legal framework must therefore be reinforced with the application of strict internal rules that should be regularly monitored. Guidelines for the medical staff to ensure hygiene and control of nosocomial infections should be consigned in a comprehensive *Code of Hygiene* providing:

- Ongoing monitoring and managerial activities to be carried out in hospitals to reinforce hygiene and infection control;
- Rules setting duties and responsibilities of the medical and para-medical staff regarding the hygiene and infection control measures that should be applied in hospitals and during their medical practices,
- Recommended practices to maintain a high level of hygiene, particularly with regards to HCWM.

**b) Assignment of Responsibilities**

Personal responsibility is a key issue to ensure that the medical and paramedical staff actively participate in the general HCWM effort. The Medical Officers in Charge should formally appoint each category of staff, in writing, informing them of their duties and responsibilities concerning the management of HCW. A Health-Care Waste Management Officer (HCWMO) in major health-care facilities should be designated and left with the responsibility for the day-to-day operation and monitoring of the HCWM system (cf. section 4). Nurses and attendant job descriptions should be reviewed so as to reinforce the duties and responsibilities of this category of staff in the daily management of HCW.
General Provisions of the Decree

The rationale and the purpose of the Decree should be explained in the General Provisions of the Decree as well as basic but important definitions allowing to specify the appliance area of the Decree.

The main object is to regulate the generation, handling, segregation, collection, transportation, treatment and final disposal of all the HCW generated by health activities of preventive, curative and palliative treatments; activities of research as well as industrial production in relation with biomedical products;

The objectives are that every producer and operator of HCW comply with the management, treatment and disposal procedures stipulated in the Decree and abide by the registration and tracking provisions contained in the Decree;

As a minimum a glossary with the following information should be provided in the Decree: definitions and a classification of HCW, generation, handling, segregation, collection, transportation, treatment and final disposal, HCW producers and operators.

Authorities of Enforcement

The Decree should: 1) specify which institution is responsible for the enforcement and the coordination of the policy on HCWM, 2) explain what should be the different competencies of the Central, Regional and District / Municipal Authorities regarding HCWM, 3) describe the enforcement power of each of these authorities.

Provisions Related to HCW Producers and Operators

Should be listed in the Decree.

The type of institution that should be considered as a producer in the framework of the Decree, the type of institutions / societies that should be considered as operators; The obligations that each HCW producer and operator should comply with to be allowed to operate, registration procedures to enforcement authorities, list of environmental mitigation measures taken,

The compulsory measures that should be taken by the HCW producers and HCW operators to reduce health risks for the staff and reduce the environmental impact of HCWM,

The training courses on the risks and the safety measures that should be taken during the handling, transportation and treatment of HCW, medical check-up to be carried out in case of an accident, compulsory immunisation vaccines that staff being in contact with HCW should receive, equipment that the staff dealing with HCW should have, the security instructions and guidance manual that should be available for the staff in any establishment generating HCW.

Provisions Related to Management, Treatment and Disposal Procedures

The mission recommends to include the following provisions:

List all the management procedures that the producers should comply with: segregation, handling, on-site transportation, storage, off-site transportation, on/off-site treatment and final disposal,

Describe the standard treatment and disposal norms that should be respected by HCW producers and operators to get an operating certificate issued by the Ministries to allow them to run their activities,

Give the duration of validity of the certificate and provide specific provisions in case of an accident; Describe and inventory compulsory labelling and tracking measures and provide standardised labelling and registration forms in the annex of the Decree.

Penalties

The major mismanagements that would lead the enforcement authority to withdraw the certificate and to apply penalties should be inventoried.

Table 2: Fundamental provisions to be included in the Decree

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71 Are considered as a producer of health-care waste all the physical or legal bodies, public or private, whose daily activities generate HCW in the sense of the definition given by the Decree.


Section 2. Standardising HCWM Practices

The recommendations that are presented hereafter should be implemented in all the medical institutions of the country. The financial constraints that the medical institutions face are taken into consideration to propose pragmatic and affordable HCWM plans and disposal technologies. A step-by-step strategy has to be implemented to progressively improve the HCWM practices.

1. Minimising the Quantity of HCW Generated in Medical Institutions

The MOH should encourage the reduction of hazardous HCW generated in HCFs by coordinating, in co-operation with MSD, the establishment and the implementation of an adequate minimisation policy aiming at:

- Improving the purchasing practices to reduce the source of potentially hazardous HCW;
- Rationalising the stock management (use of the oldest batch of a product first, regular checking of expiry date);
- Enforcing a rigorous and careful segregation of the HCW, at source (see below).

1. Minimize the production of HCW
   - Improve purchasing practices
   - Rationalise stock management

2. Ensure adequate segregation, packaging and labelling
   - Set-up a three-bins system and a colour coding system
     - Non-Risk HCW
     - Clinical Waste
     - Sharps
   - Consider special categories of waste:
     - Highly Infectious Waste
     - Cytotoxic and Hazardous Pharmaceutical Waste
     - Placentas and other pathological waste

Figure 4: The first steps for rationalising HCWM

2. Segregation, Packaging and Labelling

The recommendations provided in this chapter are mainly valid for major health-care facilities (i.e. District, Regional, Referral Hospitals) and in Health-Centres located in urban areas.

a) Segregation

The segregation of HCW is of the utmost importance for three different reasons: 1) proper segregation is the basis for safe manipulation and appropriate disposal of medical waste; 2) the treatment and disposal procedures can be optimized for each category of waste; 3) it is the best way to reduce the costs linked to the treatment and the disposal of HCW.

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For instance, the replacement of mercury based thermometers with simple gallium (indium + stann) based thermometers would advantageously replace the mercury ones, avoiding that a heavy, toxic and volatile metal be disposed of when thermometers are broken or out of order.
The mission recommends to set-up standardised segregation procedures in all the HCFs of Tanzania by implementing a three bin system that should be systematically associated with a colour coding and labelling procedure. The following categories of HCW should be considered:

- Non-Risk HCW or domestic waste;
- Clinical Waste (hazardous HCW) that includes all the pathological and infectious wastes as described in the introduction of this report as well as some particular waste generated in isolation wards,
- Sharps that include all items that can cause cuts or puncture wounds. They should always be collected in rigid safety boxes. In particular, all disposable syringes and needles should be discarded immediately after being used without recapping the needle or removing it from the syringe: the whole combination should be inserted into the safety box.

In addition to this three bins system, in the different services where they are generated:

- Anatomical Waste, generated in Operation Theatres and Placentas should be collected separately to be specifically disposed of,
- Highly Infectious Wastes generated in Medical Laboratories have to be pre-treated before being disposed of with clinical waste (cf. Draft National Guidelines and annexe 8),
- Pharmaceutical Waste generated in Pharmacies should be separated into two categories. Non-Hazardous Pharmaceutical Waste could be disposed of with Non-Risk HCW while Hazardous Pharmaceutical Waste and Cytotoxic Waste should be specifically packed to be sent back to MSD (cf. chapter 4). The MOH, in co-ordination with MSD should thus establish a comprehensive list with adequate instructions of Hazardous Pharmaceutical Waste and Cytotoxic Waste and ensure a proper distribution within the country.

b) Packaging

Packaging is a problem in Tanzania. The mission proposes to take into consideration the reality of the country by implementing different solutions for packaging:

- In all the HCFs outside cities, where on-site treatment is planned, 60 litre plastic bins can continue to be used if they are regularly disinfected. To enable the monitoring process, the use of other sizes should never be allowed by the MOH!
- In the major HCFs located in cities, when off-site treatment is planned, bins for medical waste should be replaced with bag-holders using 80 litre yellow PE bags (200-300μm gauge). Black plastic bins could continue to be used for non-risk HCW;
- In all HCFs, cardboard safety boxes, similar to the one used for EPI programmes should be used for sharps.

c) Colour Coding

A standardised colour coding system aims at ensuring an immediate and non-equivocal identification of the hazards associated with the type of HCW that is handled or treated. In that respect, the colour coding system should remain simple and be applied uniformly throughout the country. The internationally recognised colours that should be applied in the medical institutions of Tanzania should be:

- Black for all bins, bags containers filled with non-risk HCW;
- Yellow for all bags, sharp boxes and containers filled with hazardous HCW.

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73 It is actually essential to implement homogenous procedures throughout the country to reduce the risks of mistakes by the medical staff

74 Or at least to use recycled cardboard boxes in minor HCFs adequately conditioned, as shown in the poster edited for the EPI by the MOH.
d) Labelling

In the major HCFs located in cities, when off-site treatment is planned, the mission would recommend to set-up an adequate tracking system of clinical waste and sharps. The labelling should be written in Swahili and English and mention: 1) the type of waste in the container with the formulation « Domestic waste » or « Danger ! Hazardous biomedical waste »; 2) the name of the hospital; 3) the date of collection.

<table>
<thead>
<tr>
<th>Clinical Waste</th>
<th>Sharps</th>
<th>Non-risk waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves, gowns, masks, gauze, dressings, swabs, spatulas that are visually contaminated with blood or body fluids</td>
<td>Needles, Needle and Syringe assemblies, Lancets, scalpels, blades, Scissors, Broken glass, ampoules, Intravenous catheter, Glass slides, cover slips</td>
<td>Gloves, gowns, masks, gauze, dressings, swabs, spatulas that are contaminated neither with blood nor body fluids, Sanitary napkins, Incontinence pads (except in isolation wards), Packages, boxes, Wrappings, Newspapers, Magazines Disposable plates, cups, Food utensils, left over food and packaging, canisters, Tissues, paper towels, intravenous bottles, packs.</td>
</tr>
<tr>
<td>Urine, blood bags, sump tubes, Suction canisters, disposable bowls and containers used for medical purposes, Haemodialysis tubing, Intravenous (IV) lines, bags Foley catheters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-treated highly infectious waste from medical laboratories, isolation wards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are considered as potentially infectious waste but are managed separately for technical reasons: Human tissue placenta, body parts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 : Practical segregation examples

3. Collection, On-Site Transportation and Storage

The recommendations provided in this chapter are mainly valid for major HCFs, i.e. District, Regional and Referral Hospitals. For their formulation, the mission assumed that a medium-term objective that the MOH should target is the safe off-site transportation and disposal of the clinical waste generated by the major institutions located in the cities (i.e. Mwanza and Dar Es Salaam).

a) Collection and On-site Transportation

The mission would recommend:

- Store temporarily filled up yellow bins or waste bags and black bins in separate locations so as to avoid mistakes, away from patient areas, preferably close to the nurses room,
- In the major HCFs located in cities, two-wheeled 240 litre bins (with a lid) should be used, for temporary storage of clinical wastes and sharps inside the HCFs and off-site transportation. Once again, to enable the monitoring process, the use of other sizes should never be allowed by the MOH!
- Precise the schedule for the collection of waste and containers from each Medical Department in order to ensure the regular removal of waste from each location and to avoid misunderstandings between medical and non medical staff;
- Remove the waste from the different units within the HCF at least once a day,
- Set-up separate schedules and separate collection times for black bins and yellow bags/bins;
- Ensure that the cleaners and waste collectors wear protective clothes when they handle waste, at least, heavy duty gloves, industrial boots and an overall.
b) Central Storage

The mission would recommend to improve the central storage point(s) in hospitals for the two types of waste. They should be geographically separate within the hospital ground in order to: 1) avoid contamination of Non-Risk HCW waste from Clinical Waste; 2) facilitate the collection of both wastes that will go to different treatment/disposal facilities. The wastes should be stored in a way that they are protected from the effects of the weather and from the scavenging of animals and insects. All waste should be disposed of within a maximum of 48 hours.

c) Off-Site Transportation

For large municipalities, the mission recommends to target at medium-term the treatment of clinical waste in central disposal facilities (cf. chapter 4). It is thus necessary to consider off-site transportation. A question remains open: how effectively can off-site transportation for HCFs located in cities be monitored in Tanzania? Whilst the mission has currently no satisfactory solution, the following recommendation can be made.

Delivery forms specifying the number of 240 litres wheeled bins conveyed for each trip should be prepared by the MOH to ensure an adequate monitoring of off-site transportation. The hospital, the conveyor, and the waste regulator should have the duty to fill-in and sign the form, plus keep a copy when loading (respectively unloading) the clinical waste. Local Health Authorities should always receive a copy on a weekly or monthly basis. The vehicles used for the transport of yellow bags should not be used for any other purpose. They should be free of sharp edges, easy to load and unload by hand, easy to clean/disinfect, and fully enclosed to prevent any spillage in the hospital premises or on the road during transportation. They should carry a consignment note from the point of collection to the central treatment facility. They should be cleaned and disinfected after use.

While Local and National Authorities are developing an efficient control system for clinical waste transportation, MSD, even if it is not in its mandate, could assist the GOT to transport the clinical waste in the large municipalities – of course, dedicated trucks, specially purchased for that purpose should be used. Actually this intermediate solution would present the following advantages:

- MSD is currently the only actor in Tanzania capable to schedule daily and reliable shuttles,
- MSD logistics is well developed and the MOH could take advantage of MSD’s experience to develop technical specifications for the collection and transportation of clinical waste in some municipalities;

This solution would certainly be the least expensive and the fastest to be implemented.

4. Treatment and Disposal

Environmental-friendly, safe and affordable options may not be available for every situation in Tanzania. The health risks from environmental exposure should always be weighed against the risk of accidental infection due to an inadequate disposal system.

To date, incineration has been the treatment technology chosen in Tanzania, even in urban areas. Other technologies internationally recognised and accepted for treating hazardous HCW exist (cf. annexe 7). Currently, at international level, two major concepts for the treatment/disposal of HCW are applied.

In most European countries (England, France, Germany, Switzerland...), where public health and environmental standards are quite strict, land expensive, etc., expensive modern incinerators are frequently used to dispose of the waste.
In other countries (USA, Canada, Mexico, Argentina), where land is easily found for dumpsites or where modern incineration cannot be afforded, alternative solutions are often proposed such as autoclaving or controlled land-filling. These solutions remain anyway quite expensive.

With the recent Stockholm Convention on Persistent Organic Pollutants (POPs), ratified by most of the international community, pressure for the use of alternative technologies to incineration when strict air emission control cannot be ensured is increasing. However, in urban areas of low-income countries, because of the lack of funding on the one hand and the increase of the urban population on the other, finding affordable, environmentally sound and sustainable technologies that remain sufficiently simple to be durably operated is often impossible. For these countries, burying HCW in sanitary landfills, using adequate techniques remains the most affordable acceptable option also not fully satisfactory.

**a) Disposal of General Clinical Waste Generated in Health-Centres and Dispensaries**

Unfortunately, such a solution cannot be envisaged currently for most cities of Tanzania since municipal waste collection services are not in a position to carry out the work in appropriate conditions and there are no sanitary landfills operated in the country. Aware of the reality of the country, the mission proposes to adopt a pragmatic step-by-step approach.

**In Rural Area**

Clinical waste, sharp safety boxes and domestic waste should be burnt daily together in “burning pits” as already recommended and implemented by DED. The MOH should adopt the design proposed by MSF. Placentas and other pathological waste that may not burn well should be buried (the use of pit latrines is possible).

**In Urban Area**

In Health-Centres and Dispensaries located in urban areas the first improvement would consist in ensuring the on-site burning of sharps and the safe burying of the ash; the safe burying of placentas in pits, specifically designed, as already done in several medical institutions. The other category of waste may be disposed of together with the municipal waste. In a second step, these HCFs may be included in a general HCW collection scheme, when the collection services are sufficiently developed.

**b) Disposal of General Clinical Waste Generated in Major Health-Care Facilities**

**In Small Municipalities**

District and Regional Hospitals, should be progressively equipped with Mark III or Mark V De Montfort incinerators to deal with sharps and clinical waste, depending on the location of the hospitals inside the municipality. In District Hospitals located in rural area, Mark II De Montfort should be sufficient. The mission believes that this option is the most realistic one at short-term and represents a significant improvement comparatively to the present situation for the following reasons:

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75 The expression General Clinical Waste has been used only for this title and the previous one. It comprises clinical waste, sharps, placentas and pathological or anatomical waste that are difficult to burn.

76 Some of the four Referral Hospitals, for instance Mbeya Referral Hospital, should be included in this list.

77 The Mark III is designed for hospitals up to 1'000 beds, and burns at about 4 times the rate of the Marks I & II (50 kg/h approx.). The Mark V incinerator is thermodynamically the same as the Mark III, but modified to carry the weight of a much higher chimney for use where a high chimney is a legal requirement or where the proximity of other buildings makes a high chimney necessary to disperse smoke and fumes.
This double chamber incinerator, designed at the De Montfort University (England) has been tested and reaches temperatures above 900 °C if it is properly operated.\(^78\)

The operating costs of the De Montfort incinerator remain extremely low (less than 5 USD/tonne) as well as the capital cost (about 1'000, 2'000 and 2'500 USD for respectively a Mark II, a Mark III and a Mark V).

Operation and maintenance is relatively simple (coconut shells can be used for instance to improve the combustion), but the MOH must be aware that without a proper national maintenance strategy and a proper training of the operating staff, this incinerator will breakdown as any other system,

The medical institutions cannot afford alternative solutions and/or are difficult to apply;

A lot of these incinerators have already been built and they are already included in the general strategy developed by the MOH.

Placentas and anatomical wastes cannot be treated in this kind of incinerator since they would drastically reduce the efficiency of the combustion. Therefore, the mission would recommend also to equip the Hospitals with a specific pits for the safe burying of this category of waste.

In Large Municipalities

For Large Municipalities (the City of Dar-Es-Salaam and Mwanza are included) a decentralised solution, using low-cost De Montfort incinerators cannot be considered as an acceptable medium-term solution. In the Tanzanian context two alternatives are possible, both of them requires to set-up a reliable and safe transportation system of the clinical waste, which may be critical in Tanzania:

The safe burying of HCW in a specific site dedicated to this purpose with a restricted access.

This solution requires that the Municipal Authorities select a specific site for this purpose, having adequate hydro-geological characteristics;

The use of a central incinerator without any stack emission control.\(^79\) The MOH must be aware that any incinerator that is not equipped with air-pollution control devices will generate, when operated, products of incomplete combustion such as dioxins or furans, whatever the temperatures may be reached.

The mission would recommend to select the first option. However, this option cannot be implemented in Tanzania since there is no sanitary landfill in Tanzania. The second option must be considered. The MOH and the NEMC should jointly determine the adequate technical specifications for equipment required for this option. These specifications should be used by the City Councils or the Hospital Mutual Benefit Groups for the preparation of international tender documents.\(^80\)

c) Disposal of Highly Infectious and Hazardous Pharmaceutical Waste

Highly Infectious Waste

Highly infectious waste from the Medical Analysis Laboratories such as sputum cups, media and culture plates, etc should be autoclaved before being disposed of with clinical waste. However, such a solution can hardly be applied in Tanzania. The mission recommends thus to ensure a chemical pre-treatment in a solution of sodium hypochlorite in concentrated form. Ideally, waste from Isolation

\(^{78}\) Results of a campaign of measures carried out at De Montfort University, Professor D J Picken, personal communication

\(^{79}\) Air pollution control devices are very costly and complex to operate/maintain

\(^{80}\) For Dar-Es-Salaam, at present and technically, the use of the rotary kiln of Twiga Cement Factory would be the best solution to dispose of the clinical waste of Dar-Es-Salaam. In any case, the mission would recommend the Authorities to pay a great attention to the terms of the contracts that they may have with private companies.
Wards should also be pre-treated before being disposed of, and, in Permanent Cholera Treatment centres, waste from isolation wards should be locally incinerated.

**Cytotoxic and Hazardous Pharmaceutical Waste**

While Non-Risk Pharmaceutical Waste can be disposed of locally, the safe on-site disposal of Cytotoxic and Hazardous Pharmaceutical Waste cannot be ensured. Each facility is regularly supplied with drugs through the District Health Services and MSD. MSD trucks return empty from regional MSD stores to the Central MSD in Dar-Es-Salaam. Sending back little quantities of expired hazardous drugs (waste) if well and distinctly packed, should be possible to organise without major difficulties. MSD could then incinerate on a regular basis these wastes or treat them with specific and cheap chemical procedures (for cytotoxic waste). The mission recommends that the MOH consider this option and previously:

- Set-up a list of Cytotoxic and Hazardous Pharmaceutical Waste and specify for Tanzania the adequate protocols for the destruction of these wastes,
- Liaise with the MOF to organise quarterly audits from the MOF and facilitate the destruction by MSD of Cytotoxic and Hazardous Pharmaceutical Waste – that are considered as public properties and thus cannot be disposed of without the clearance of the MOF.

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**Figure 5: Disposal technology Options**

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**Section 3. Strengthening the Institutional Capacities for HCWM**

In order to be able to manage efficiently the HCW produced during their activities, medical institutions must develop their own strategy. The elaboration of HCWM Plans at HCF level is a major issue. To facilitate their implementation, this requires that the MOH set-up:

- An adequate management information system to estimate the quantities of HCW generated in medical institutions,
Strategies for the implementation of the HCWM plans;
Monitoring systems to control the HCW streams within and outside the medical institutions.

<table>
<thead>
<tr>
<th>Central</th>
<th>Regional District</th>
<th>Health-Care Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide Guidelines for the establishment of HCWM Plans</td>
<td>Compile annual HCWM Plans</td>
<td>Set-up annual HCWM Plans</td>
</tr>
<tr>
<td>Standardize job descriptions adding provisions for HCWM</td>
<td>Complete the District Health Plan</td>
<td>Nominate a HCWMO</td>
</tr>
<tr>
<td>Complete the Health Management Information System</td>
<td>Set-up a Committee for Hospital Hygiene and Infection Control</td>
<td>Complete Job descriptions</td>
</tr>
<tr>
<td>Set-up a Committee for Hospital Hygiene and Infection Control</td>
<td>Set-up a Committee for Hospital Hygiene and Infection Control</td>
<td>Complete the Health Management Information System</td>
</tr>
<tr>
<td>Complete the National Health Accountancy System</td>
<td></td>
<td>Set-up adequate financial resources</td>
</tr>
<tr>
<td>Reinforce the Capacities of the Health Services</td>
<td></td>
<td>Implement In-Service training and review curricula</td>
</tr>
</tbody>
</table>

Figure 6: Recommendations to increase Institutional Capacities

1. Improving Management by Establishing HCWM Plans at all Levels

The establishment of periodic HCWM plans on an annual basis should progressively lead the medical institutions and the administrative authorities to consider HCWM as a routine issue to cope with and reinforce progressively their organisational capacities. A national HCWM system should be co-ordinated at central level to ensure that HCWM plans are annually set-up in all the major HCFs of the country.

a) Implementing a routine for HCWM in the Medical Institutions...

The mission would recommend to consolidate the on-going management and administration by undertaking the following steps:

The MOH should oblige the major hospitals to formally nominate a Health-Care Waste Management Officer (HCWMO) who should co-ordinate and supervise the whole HCWM system. He/she should have sufficient authority to ensure that all hospital staff comply with the HCWM plans;

In each medical institution, roles, responsibilities and duties of the medical and non-medical staff regarding HCWM should be well defined in standardised and personal job descriptions;

Stock positions for the supply of equipment (bags, sharp boxes, containers) should be up-dated on a regular basis to avoid any shortages, while disposal facilities should be regularly operated and maintained.

b) ...And at all Levels of the Health Services

District Health Services should gather and synthesise all the HCWM plans of the hospitals under their jurisdiction and set-up their own annual HCWM plans that should contain at least 1) an inventory on existing treatment and disposal facilities in each HCF; 2) a compilation of the needs for each HCF and recommendations; 3) an estimation of the budget to be allocated for the management of HCWM in the coming year; 4) a provisional agenda for the monitoring of the disposal facilities in HCFs. Such plans could be included in the Annual District Council Health Plan.

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81 More details on the duties and responsibilities of the HCWM Officer are provided in the National Guidelines.
2. **Improving the Monitoring Framework**

The introduction of a protocol for the monitoring and the auditing of the HCWM plans, implemented at all levels, should lead the Regional and District Health Authorities to regularly follow-up the HCWM practices in their institution.

**a) Completing the Health Management Information System**

The mission recommends to complete the District Health Plans and the National Health Management Information System. These documents should contain provisions to allow the Administrative Authorities to have a better knowledge of the status of the HCWM practices in the medical institutions and modify the National HCWM Policy and Strategy if required.

**b) Setting-up Committees for Hospital Hygiene and Infection Control**

If HCW is inadequately managed, it can contribute to the risk of nosocomial infections, putting the health of hospital staff and patients at risk. The MOH should develop an integrated strategy to control infection in hospitals and include the safe management of HCW as a part of it. The mission strongly recommends to set up Committees for Hospital Hygiene and Infection Control at all levels of the Health Services:

- A National Committee could develop a country policy;
- Regional and District Committees could have the task to monitor their implementation in the HCFs of their jurisdiction;
- Hospital Committees could be in charge of their direct implementation. Should participate in these committees: the HCWMO and infection control nurses that should receive specific job descriptions.

**c) Enforcing Safe Practices**

The Regional and District Health Authorities should verify that segregation procedures are respected as well as safety measures applied. At central and regional levels, the application of this protocol could be enforced by regular inspections (in application of the specific directives mentioned above). The use of dissuasive penalties (mentioned in the Law/Decree), at least for the institutions that dispose of clinical waste with municipal waste (ineffective segregation) could force them to respect standardised HCWM procedures.

3. **Improving the Accountancy and Financial Resources**

Without specific financial resources, it is impossible to get sustainable improvements in the management of HCW. Since HCWM is an integral part of health-care it needs to be budgeted for and each HCF should be aware of the costs that are linked with the safe management and disposal of the waste it generates.

An adequate accountancy system, with a specific budget line dedicated to the management of the HCW within the medical institutions should be set-up. This measure, which could at least be taken for

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82 For instance the knowledge of the occupancy rate in hospitals and the daily recording of the volumes of waste produced would enable to estimate more accurately the production of HCW and establish easily crosschecking procedures in order to evaluate the equipment needs of each HCF for the management of HCW.

83 At hospital level, an alternative to the formation of these committees would be to precise the tasks of the Hospital Management Committees so that they may have the task to develop strong policies on Hospital Hygiene and Infection Control.
a temporary period,' would force the actors involved at all levels of the Health Facilities to take into consideration and estimate the expenses linked to the management of HCW.

The implementation of a cost recovery mechanism will be difficult with regards to the current priorities in the Health Sector. However, a minimum amount generated by the incomes of the cost-sharing programme should be dedicated to the safe management of HCW, considering the high indirect costs associated with any mismanagement of HCW.

4. Launching Capacity Building and Training Measures

A National Awareness Programme will have to be prepared early on in the process and launched rapidly once appropriate means (budgetary and human resources) are made available. The following target groups should receive training: regulators and decision makers, regional and municipal authorities (when necessary), HCF managers, health-care workers and waste collectors. To date, periodic training of nurses and attendants regarding HCWM are organised but there are neither regular sessions nor well-established criteria for the selection of the staff that should participate in these training courses. Despite these efforts, the level of knowledge on HCW remains relatively low in Tanzania.

a) Reinforcing the Capacities of the Health Services

At Regional and District Levels the capacities of the Health Authorities remain limited. Reinforcement of the capacities of the MOH are necessary to backstop the decentralised Health Services in their planning, monitoring and negotiation 44 abilities through:

- The establishment of a National Steering Committee on Health-Care Waste Management that will be in charge of implementing the National HCWM Plan,
- The strengthening of the human resources at the Environmental Health and Sanitation Services through the recruitment of additional Health Officers with specific technical knowledge;
- The training of the Officers in charge of initial and in-service training of the health workers as well as the supervision of the Hospitals (cf. "train trainers of trainers" hereafter).

The mission recommends that the MOH improve the co-ordination between the Health Planning Services, the Environmental Health and Sanitation Services, the Training Services and the Services in charge of the supervision of the Hospitals.

b) Training Requirements

The following priorities have been identified:

- Specific in-service training programmes on HCWM should be organized for hospital staff including administration services, nurses, medical doctors and technical services;
- Academic programmes in all the Faculties of Medicine and the Nursing Schools should be reviewed to ensure that adequate training on HCWM is provided;
- Initial briefing should be systematically organised for each of the new nurses recruited in a hospital;
- Comprehensive training packages in Swahili should be prepared under the responsibility of a National Health Institution.

44 The private sector should be encouraged to get involved in the HCWM sector. However, the emergence of private operators must be accompanied imperatively with the reinforcement of the Public Health Services in their control and negotiation capacities.
Potential Strategy for the Implementation of the Training Programmes

The mission believes that the PHAST approach that has been developed by the WHO and the World Bank in the water and sanitation sector could be adapted to organise in-service training and raise awareness to the medical and non-medical staff regarding hospital hygiene and control of nosocomial infections. The following steps could then be implemented by the MOH:

Step 1: Develop PHAST Tools focusing on hospital hygiene and control of nosocomial infection;
Step 2: Conduct advocacy sessions to hospital and Council Health Management teams using the specially developed PHAST Tools. These teams are responsible for the day-to-day management of hospitals and other HCFs in the peripheral areas;
Step 3: Train Trainers of Trainers in the use of these Tools. In turn, these trainers will train facility staff in the participatory methods on hospital hygiene and control of nosocomial infections. The HCF staff will thereafter, develop action plans and monitoring protocols for the management of health care waste generated in their respective facilities.

The review of the curricula of nurses and medical doctors could be performed by the appropriate services of the MOH. Compulsory modules specifically dedicated to HCWM could be set-up. They should pinpoint: 1) the health risks associated with HCWM; 2) the adequate management systems that should be applied in all the HCFs of the country, and 3) duties and responsibilities of health-care workers.

Section 4. Encouraging the Involvement of the Civil Society

The involvement of the Civil Society in the implementation of the HCWM Plan and in the day-to-day management of the HCW would certainly quicken the overall process. The Civil Society could certainly play an important role in the implementation and in the monitoring of new HCWM Practices.

1. In the Implementation of the National HCWM Plan

In addition to the Local Authorities and MSD, Trade Unions, Professional Organisations and the representatives of the Voluntary and para-official Health Services, which are managing half of the HCFs and have the capacities to mobilise the medical and paramedical staff, should be part of the overall decision process by being invited to the National Workshop. International Agencies such as the WHO, UNEP, UNICEF, MSF or DED or the Bilateral Agency having a co-ordination role for all the ones involved in the health sector should be invited or at least be informed of any change in the HCWM policy prevailing in Tanzania.

2. In the Daily Operations

The GOT would have a great advantage in encouraging some local masonry enterprises in the construction of De Montfort incinerator by preparing technical specifications for these incinerators and standard contracts including a clause for the maintenance of the incinerators and the training of the operators. The local manufacturing of standardized cardboard safety boxes for sharps should also be encouraged. The GOT should study the possibility to set-up a public-private joint venture.

The option of involving the Private Sector in the day-to-day management, by granting concessions for the collection or the treatment of HCW can be recommended under the following conditions:

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They include the Association of Local Authorities in Tanzania (ALAT), the Association of Private Hospitals in Tanzania (APHTA), the Tanzania Registered Nurse Association (TARENA), the Medical Association of Tanzania (MAT) and the Tanzania Union of Government and Health Employees (TUGHE), the Christian Social Services Council (CSSC).
The capacities of the Central and Local Health Authorities to control the quality and audit the practices of the Private Sector are ensured;

The Health Authorities is in a position to prepare adequate technical specifications and bidding documents for international and transparent requests for Proposals.

Section 5. Conclusion

Improving durably the HCWM practices in Tanzania through the implementation of all the recommendations formulated in the second part of this report remains a difficult exercise. In the absence of an integrated solid waste management system for the country, tackling specifically with the management of HCW has led the mission to formulate recommendations that would not have been made if such a system had existed.

The mission recommends that the GOT strongly encourage Local Authorities – at least the Councils of the Large Municipalities – to develop integrated solid waste management systems and build sanitary landfills.

The numerous aspects that must be taken into consideration to improve the HCWM in the Tanzanian medical institutions must be articulated into a coherent National HCWM Plan, with the development of a precise Strategy for its implementation. This is the object of the third part.
PART THREE
National Action Plan
The GOT must develop a step-by-step strategy to improve the management of HCW in the HCFs of the country and reduce significantly the occupational risks associated with the current practices. The strategy should show clearly the medium and the long-term objectives to be achieved and reflect the integrated effort that is necessary to set-up safe and environmentally sound HCWM practices. Whenever possible, it should underline the institutional and individual responsibilities as well as define the monitoring and administrative procedures.

**Section 1. National Strategy for the Implementation of Plan**

It is of the utmost importance that the GOT implement new HCWM procedures in close co-operation with all the stakeholders of the country and induce them to develop their own HCWM plan. *New standards should be applied first in the four Referral Hospitals.* A three-steps approach is proposed:

1. **First Step: Organise a National Workshop**
   
   The national workshop should focus on amending and validating the *National HCWM Plan* as well as the *National Guidelines*. The implementation of the HCWM plan will require a regular commitment and monitoring. Thus *participative decisions* should be taken during the workshop to ensure a good co-operation between all the stakeholders for the future implementation of the plan. The following institutions should participate to the workshop:
   
   National and local institutions: MOH, Vice President Office, NEMC, MOF, MSD, CEDHA, Nurses and Midwives Council (NMC); Muhimbili University College of Health Science (MUCHS), representatives of the District / Regional Health Management Teams;
   
   Civil Societies: CSSC, ALAT, APHTA, TARENA, MAT, TUGHE, environmental NGOs, representatives of the private sector,
   
   International Agencies: WHO, UNEP, MSF, DED, Representatives of the Bilateral Agencies;

   The mission strongly recommends to set up a National Steering Committee for HCWM and designate the members of the Committee during the workshop. In addition, specific work groups should also be established.

2. **Second Step: Set-up the Institutional Framework to Implement the Plan**

   The National Steering Committee for HCWM should supervise the overall implementation of the HCWM plan. Some key institutions should be involved in this Committee in order to obtain a broad consensus. The tasks of the National Steering Committee should be the following:

   Nominate a project co-ordinator and compose the task groups;
   
   Establish the criteria for the evaluation of the HCWM plan during its implementation;
   
   Designate the administrative authorities in charge of the implementation of the HCWM plan at Regional and District levels.

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86 Drafted separately
87 And most particularly the following services: Policy and Planning, Preventive Health Services, Curatives Health Services, Health Human Resources Development
88 The institutional scheme proposed by the mission to implement the National HCWM Plan is shown in the figure 7
Select institutions and Regions to test the HCWM plan already established;
Set-up intermediary and final evaluations of the implementation of the HCWM plan.

A project co-ordinator should be assigned a full time post during the overall duration of the implementation of the plan (i.e. five years minimum). He/she should have excellent organising, managing and communication skills and should receive external support if necessary. He/she should co-ordinate the work of specific work groups that will be established by the Steering Committee.

Four multidisciplinary work groups should be set-up to deal with the numerous aspects linked to the implementation of the HCWM plan and achieve, in their respective field of competences, the five objectives contained in the National HCWM plan, that is:

Objective 1: develop the legal and regulatory frameworks for HCWM;
Objective 2: standardise HCWM practices, improve management and monitoring procedures;
Objective 3: equip the medical institutions;
Objective 4: launch training and awareness measures;
Objective 5: reduce hospital waste and pollution.

The mission recommends to clearly identify at all levels – for the implementation of the specific actions – supervision and co-ordination bodies with well defined duties:

At National level, a task force is responsible for the overall implementation of the HCWM plan. It includes the National Steering Committee in charge of the supervision of the HCWM plan, the project co-ordinator and the leaders of the work groups;
At Regional and District levels, the Regional and the Council Health Management Teams are responsible to supervise HCWM practices within the Regions / Districts. The Regional and District Health Officers are in charge of the implementation of the plan;
At hospital level, each Medical Officers in Charge is administratively responsible for the HCWM within his/her institution. He/she watches over the application of the rules and nominates the HCWMO and an Infection Control Committee.

3. Third Step: Launch the National Action Plan

The implementation of the five objectives contained in the National HCWM Plan requires the development of specific actions. They are included in the National Action Plan (NAP) presented hereafter. The Plan should be periodically monitored and reviewed. As mentioned previously, a typical timeframe for a NAP is around five years. The NAP is structured as follows:

For each objective, a table summarises the actions that must be taken to achieve this objective. The actions are classified by order of priority.

For each action, the institution responsible for its implementation and its co-ordination are designated. Indicators of achievement that should help in the regular monitoring of the Plan are indicated. The initial and the annual costs in relation with this action are presented.
Figure 7: Institutional Framework for the Implementation of the HCWM Plan
**Section 2. The National Action Plan**

This section presents the National Action Plan in five tables. The first table summarises the recommendations already formulated in the first section while the five other tables present in details, the actions to be launched to implement the objectives.

**Preamble: Define a General Framework for the Implementation of the National Action Plan**

<table>
<thead>
<tr>
<th>Actions</th>
<th>Co-ordination</th>
<th>Supervision</th>
<th>Indicators of achievement</th>
<th>Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Organisation of a national workshop to modify and validate the proposed NAP and set-up specific work groups</td>
<td>MOH</td>
<td>Chief Med Off Of Health</td>
<td>Minutes of the Workshop</td>
<td>5'000</td>
</tr>
<tr>
<td>02 Establish a National Steering Committee on Health-Care Waste Management</td>
<td>MOH</td>
<td>Chief Med Off Of Health</td>
<td>A list of the members is established, the objectives are stipulated and regular meetings are scheduled</td>
<td>20'000</td>
</tr>
<tr>
<td>03 Designation of a project co-ordinator (PC) for the implementation of the NAP</td>
<td>NSCHCWM</td>
<td>Chief Med Off Of Health</td>
<td>Job description with clear definition of tasks</td>
<td>120'000</td>
</tr>
<tr>
<td>04 Establishment of the criteria for the evaluation of the NAP during its implementation</td>
<td>PC</td>
<td>NSCHCWM</td>
<td>Indicators of evaluation available</td>
<td></td>
</tr>
<tr>
<td>05 Designation of the administrative authorities in charge of the implementation of the NAP at Regional and District levels, selection of the Regions to test the NAP</td>
<td>MOH</td>
<td>Chief MOH</td>
<td>Directive of the MOH</td>
<td></td>
</tr>
<tr>
<td>06 Set-up of 1) intermediary and 2) final evaluations of the implementation of the NAP</td>
<td>PC</td>
<td>NSCHCWM</td>
<td>Progress and final reports</td>
<td>10'000</td>
</tr>
</tbody>
</table>

**Recommendation**

The involvement of bilateral or multilateral Agencies should be sought to obtain a financial support for the implementation of the NAP.
## 1. Develop the Legal and Regulatory Framework

<table>
<thead>
<tr>
<th>Actions</th>
<th>Co-ordination</th>
<th>Supervision</th>
<th>Indicators of achievement</th>
<th>Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-term</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Prepare National Guidelines for HCWM</td>
<td>WGLR &amp; PC</td>
<td>NSCHCPH</td>
<td>Guidelines are available at all health service levels</td>
</tr>
<tr>
<td>1.2</td>
<td>Prepare National Policies for 1) Hospital Hygiene and Infection Control 2) Safe Management of the Health-Care Waste</td>
<td>MUCHS</td>
<td>PC</td>
<td>Two documents are available</td>
</tr>
<tr>
<td>1.3</td>
<td>Complete the Public Health Act and edit a specific Decree</td>
<td>NSCHCPH</td>
<td>MOH</td>
<td>Decree published in the Tanzanian Gazette</td>
</tr>
<tr>
<td>1.4</td>
<td>Establish a Code of Hygiene for Hospitals</td>
<td>NCHMIC</td>
<td>MOH</td>
<td>Code of Hygiene available</td>
</tr>
<tr>
<td><strong>Long-term</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Elaborate a Specific Policy for Infection Safety</td>
<td>?</td>
<td>MOH</td>
<td>Document available at the MOH</td>
</tr>
<tr>
<td>1.6</td>
<td>Elaborate an Addendum to the Local Government Act</td>
<td>MOH</td>
<td>GOT</td>
<td>Addendum available</td>
</tr>
<tr>
<td>1.7</td>
<td>Complete the Professional Code of Ethics for Nurses and Midwives in Tanzania</td>
<td>NMC</td>
<td>MOH</td>
<td>Code of Ethics available and taught in the nursing schools</td>
</tr>
</tbody>
</table>

**Recommendations**

To implement these actions, the MOH should set up a Working Group on Legislation and Regulations (WGLR) that should participate with Lawyers, Environmental and Public Health Specialist from the MOH and MOE.

Ideally, the "National Guidelines", the list of acceptable technologies and a catalogue of equipments should be annexed to the Decree. The regulatory documents should clearly define roles, responsibilities, duties and penalties for the mismanagement of HCW (cf part 2 of this report).

Ongoing controls carried out in the field by the MOH and the PHS should be reinforced to ensure an adequate implementation of the HCWM plans. They should be accompanied with activities of advice and follow-up.

The criteria for enforcement and moting measures to ensure that the medical staff complies with the management procedures defined in the law/decree and described in the "National Guidelines" should be set up together with the Trade Unions.
### 2. Standardise the HCWM Practices and Improve Management and Monitoring Procedures

<table>
<thead>
<tr>
<th>Actions</th>
<th>Co-ordination</th>
<th>Supervision</th>
<th>Indicators of achievement</th>
<th>Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Set-up Committees for Hospital Hygiene and Infection Control at all levels of the Health Services</td>
<td>MOH</td>
<td>Chief MOH</td>
<td>Member list is established, regular meetings scheduled</td>
<td>0</td>
</tr>
<tr>
<td>2.2 Define acceptable procedures of HCWM and requirements for HCW disposal technologies</td>
<td>WGP &amp; PC</td>
<td>NSCHCHM</td>
<td>Amended Nat. Guidelines &amp; list of accepted technologies</td>
<td>1'500</td>
</tr>
<tr>
<td>2.3 Designate 1) HCWMO in Referral, Regional and District Hospitals, 2) Officers in charge in Health centres and Dispensaries</td>
<td>WGP &amp; PC</td>
<td>NSCHCHM</td>
<td>Job descriptions</td>
<td>0</td>
</tr>
<tr>
<td>2.4 Define a plan to reduce hospital waste and pollution</td>
<td>WGP &amp; PC</td>
<td>NSCHCHM</td>
<td>The plan is set-up</td>
<td>2000</td>
</tr>
<tr>
<td>2.5 Complete medical and paramedical job descriptions</td>
<td>WGP &amp; PC</td>
<td>NSCHCHM</td>
<td>Job descriptions</td>
<td>500</td>
</tr>
<tr>
<td>2.6 Establish of the HCWM plans in the medical institutions</td>
<td>MOC</td>
<td>DHMT</td>
<td>District Council HCWM Plans</td>
<td>7'500</td>
</tr>
<tr>
<td>2.7 Prepare official forms for the establishment of Regional, District and Hospital HCWM plans</td>
<td>WGP &amp; PC</td>
<td>NSCHCHM</td>
<td>Form available in medical institutions</td>
<td>15'000</td>
</tr>
<tr>
<td>2.8 Establish Regional and District HCWM plans</td>
<td>DHMT</td>
<td>DMOH</td>
<td>District Council HCWM Plans</td>
<td>0</td>
</tr>
<tr>
<td>2.9 Prepare a Plan to reduce HCW and pollution</td>
<td>RMHT</td>
<td>RMOH</td>
<td>The plan is available</td>
<td>2000</td>
</tr>
<tr>
<td>2.10 Elaborate a cost recovery system</td>
<td>WGP</td>
<td>MOH &amp; MOF</td>
<td>HCWM included in the accountancy books</td>
<td>4'500</td>
</tr>
</tbody>
</table>

### Recommendations

The action 2.2 should include:
1) the inventory by MSD of Hazardous Pharmaceutical Waste & Cytotoxics and the set-up of standardised procedures for their safe disposal.

The action 2.4 should include:
1) the inventory by MSD of the materials susceptible to generate pollution when treated,
2) a feasibility study for the implementation of a national waste recycling programme,
3) the set-up of a waste minimisation programme.

The forms for the HCWM plans should provide the necessary indications to estimate the quantities of HCW generated in their institutions / Districts, report incidents, inventory the available equipment and materials and assess the on-going needs for HCWM. The Regional and District HCWM plans should be gathered and analysed at central level to periodically adjust the "National Guidelines" and the "National Policy".
3. Equip the Medical Institutions

| Actions |
|-----------------|-----------------|-----------------|-----------------|
| 3.1 | Elaborate of a National Catalogue of Equipment for segregation, packaging, collection and disposal of the HCW in the Medical Institutions materials | Co-ordination | Supervision |
|       | | WGE & PC | NSCHCM |
| 3.2 | Write Technical Specifications and Bids for the installation of centralised treatment plants in Mwanza and Dar-Es-Salaam | City Councils, WGE & PC | NSCHCM |
|       | | City Councils | NSCHCM |
| 3.3 | Impulse the creation of Mutual Benefit Groups in Mwanza and Dar-Es-Salaam | City Councils | NSCHCM |
|       | | City Councils | NSCHCM |
| 3.4 | Negotiate with the Private Sector for the construction of De Montfort incinerators in the Large HCFs outside Mwanza and Dar-Es-Salaam | Referral Authority | MSO |
|       | | Referral Authority | MOH |
| 3.5 | Launch international bids for Dar-Es-Salaam and Mwanza Municipalities Evaluate the possibility to use sanitary landfills | | |
| 3.6 | Equip all large HCFs with segregation, packaging, collection material (including protective clothes), transportation (if necessary) and disposal equipments | City Councils | NSCHCM |
|       | | City Councils | WGE & PC |
| 3.7 | Equip all small HCFs | Referral Authority | SCHCM |
|       | | Referral Authority | WGE & PC |

**Cost (USD)**
- Initial: 4'500
- Annual: 0

**Recommendations**

An Action Plan for the equipment of the HCFs should be set-up. The mission recommends to start in one or two regions first and always with large HCFs.

The Catalogue of Equipment should specify the technical characteristics of all the material (including protective clothes) that is accepted for segregating, handling, packaging, collecting and transporting HCW inside and outside Medical Institutions. Ideally, the equipment should be listed.

The private sector should be encouraged to participate and comply with the technical requirements issued by the MOH for HCWM handling and disposal. Subventions could be foreseen for the private Tanzanian enterprises ready to commit themselves in producing disposal material/equipment at a reasonable price (e.g. WHO/UNICEF cardboard boxes or De Montfort incinerators).
4. **Launch Training and Awareness Measures**

<table>
<thead>
<tr>
<th>Actions</th>
<th>Co-ordination</th>
<th>Supervision</th>
<th>Indicators of achievement</th>
<th>Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Set-up an awareness campaign for the medical and paramedical staff</td>
<td>WGT &amp; PC</td>
<td>NSHCWM</td>
<td>Posters are displayed in Hospitals</td>
<td>Initial: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New curricula available</td>
<td>Annual: 0</td>
</tr>
<tr>
<td>4.2 Review the Academic programmes in Faculties of Medicine and Nursing Schools</td>
<td>WGT &amp; PC</td>
<td>MOH</td>
<td>Training packages available and sessions organised</td>
<td>Initial: 1'000</td>
</tr>
<tr>
<td>4.3 Provide Technical Training for the Health Officers of the MOH, NESC, Health Officers of National Institutions (CEDHA, MUCHS), Regional and District Authorities (Train &quot;trainers of trainers&quot;)</td>
<td>WGT &amp; PC</td>
<td>NSHCWM</td>
<td>Registration of the groups</td>
<td>Initial: 1'000</td>
</tr>
<tr>
<td>4.4 Set-up a Group of Trainers and elaborate a specific and detailed training package in Swahili for them (train the trainers)</td>
<td>WGT &amp; PC</td>
<td>NSHCWM</td>
<td>Reports of the different groups of trainers</td>
<td>Initial: 15'000</td>
</tr>
<tr>
<td>4.5 Set-up in-service training programmes in Regional Centres for medical, paramedical and technical staff</td>
<td>WGT &amp; PC</td>
<td>NSHCWM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6 Recruit new staff members at the MOH</td>
<td>MOH</td>
<td>GOT</td>
<td>Job descriptions and new positions at the MOH</td>
<td>Initial: -</td>
</tr>
<tr>
<td>4.7 Organise systematic initial briefing in medical institutions</td>
<td>WGT &amp; PC</td>
<td>NSHCWM</td>
<td>Briefing procedures available</td>
<td>Initial: -</td>
</tr>
</tbody>
</table>

**Recommendations**

Academic curricula should be reviewed as soon as possible.

The mission recommends that the groups of trainers organise the on-going sessions directly in the hospitals. Several steps implemented every sixth week for instance. The sessions should be organised in a participative way and could be based on some elements already developed by the WHO and the WB through the PHAST programmes.
5. Develop a Plan to Reduce Hospital Waste and Pollution

<table>
<thead>
<tr>
<th>Short Term</th>
<th>Actions</th>
<th>Co-ordination</th>
<th>Supervision</th>
<th>Indicators of achievement</th>
<th>Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Inventory the materials susceptible to generate pollution when incinerated</td>
<td>WGE &amp; PC</td>
<td>NSCHWM</td>
<td>List available</td>
<td>10'000</td>
</tr>
<tr>
<td>5.2</td>
<td>Contact suppliers to assess the feasibility to replace hazardous materials with less hazardous ones</td>
<td>WGE &amp; PC</td>
<td>NSCHWM</td>
<td>List of materials to be replaced available</td>
<td>5'000</td>
</tr>
<tr>
<td>5.3</td>
<td>Inventory inadequate practices associated with incineration</td>
<td>WGE &amp; PC</td>
<td>NSCHWM</td>
<td>Synthesis report</td>
<td>25'000</td>
</tr>
<tr>
<td>5.4</td>
<td>Assess the feasibility to implement a national waste recycling programme</td>
<td>WGE &amp; PC</td>
<td>NSCHWM</td>
<td>Synthesis report</td>
<td>10'000</td>
</tr>
<tr>
<td>5.5</td>
<td>Set-up a waste minimisation programme</td>
<td>WGE &amp; PC</td>
<td>NSCHWM</td>
<td>Action Plan</td>
<td>40'000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish waste minimisation and waste management objectives for each facility, propose and adopt modifications in current practices and policies aimed at achieving objectives,</td>
</tr>
<tr>
<td>Monitor and review progress, provide ongoing support and assistance to ensure objectives are being met, revise approaches as needed,</td>
</tr>
<tr>
<td>Establish a countrywide or regional training program, with access to the facility, to train and certify experts who can then implement similar best practices at other health facilities in the country and/or region</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special attention should be paid to the risks linked to the introduction of unsafe practices (for instance linked to the recycling programme) or to introduce at least more hazardous or costly material as the ones in use. For instance, the replacement of mercury-base thermometers by simple gallium (indium +stain) based thermometers would represent a huge improvement to reduce the release of hazardous pollutants in the atmosphere</td>
</tr>
</tbody>
</table>
6. Timeframe

The mission proposes to develop a five-year action plan. The MOH should establish an adequate timeframe according to its institutional and financial possibilities. A regular monitoring of the implementation of the HCWM plan should be set-up—every quarter—and the strategy reviewed accordingly if necessary. The Project Coordinator will play a major role in this matter.

Section 3. Cost Estimations

Disposal of HCW remains costly. The direct management costs should however always be weighted against the indirect costs associated with mismanagement practices. The overall initial and annual costs for the implementation of the plan and the standardization of the HCWM practices are presented in the table 4 and based on the calculation provided in the annexe 9. The initial costs cover the implementation period of five years of the plan.

It has been assumed that:

- The National Action Plan is implemented over a period of five years,
- Dar-Es-Salaam City Council will be able to negotiate an adequate price for the collection and the treatment of the HCW and will use the incinerator currently in construction,
- Not all the Dispensaries and the Health-Centres of the country will be immediately equipped during the implementation of the HCWM Plan,
- Only the initial costs associated with the equipment of the Governmental Hospitals have been taken into consideration, assuming that the other health-facilities will be equipped by themselves.

The total implementation costs of the plan ranges between 1'300'000 USD and 1'400'000 USD while the annual costs associated with the new HCWM procedures would range between 450'000 and 500'000 USD, but could be crossed subsidised and significantly reduced through the development of Mutual Benefit Groups among Private and Public HCFs in Dar-Es-Salaam and Mwanza.
| 21 | Set-up Commission for Hospital Hygiene and Infection Control at all level of the Health Services | 0 | 0 | 1,920,000 | 2,350 | 1 | person per 3 months |
| 22 | Define acceptable procedures of HCDM and requirements for HCDM personnel/technicians | 0 | 0 | 7,000 | 1 | person per 3 months |
| 23 | Designate 1 HCDM in Regional, District and District Hospitals, 2 HCDM in District and 3 HCDM in Regional Hospitals | 0 | 0 | 7,000 | 1 | person per 3 months |
| 24 | Define a plan to reduce hospital work and pollution | 1,750,000 | 2,350 | 1 | person per 3 months |
| 25 | Organize medical and paramedical staff training | 400,000 | 500 | 1 | person per 3 months |
| 26 | Select CNM and HCDM for the regional and district hospitals | 2,350,000 | 2,350 | 1 | person per 3 months |
| 27 | Prepare official forms for the establishment of Regional and District offices | 1,000,000 | 1,000 | 1 | person per 3 months and above of the forms |
| 28 | Establish of Regional and District HCDM office | 0 | 0 | 1,750,000 | 1 | person per 3 months and above of the forms |
| 29 | Prepare a plan to reduce HCM and pollution | 1,750,000 | 2,350 | 1 | person per 3 months |
| 30 | Establish a follow-up system | 4,750,000 | 5,000 | 1 | person per 3 months |

**TOTAL** | 2,370,000 | 2,680,000 | 1 | person per 3 months and above of the forms
### Table 4. Estimation of the capital and annual cost of the National HCWM Plan

<table>
<thead>
<tr>
<th>Description</th>
<th>Capital Cost (TSH)</th>
<th>Annual Cost (TSH)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Demonstrate the results of the collection and disposal of the HCW in the medical institutions.</td>
<td>441'000</td>
<td>4'000</td>
<td>6 / 2 persons for 3 months</td>
</tr>
<tr>
<td>3.2 Final Technical Specifications and Design for the installation of incinerator (incinerator in the Ministry of Health)</td>
<td>443'000</td>
<td>4'000</td>
<td>6 / 2 persons for 3 months</td>
</tr>
<tr>
<td>3.3 Develop the incinerator for the incineration of waste in the Ministry of Health</td>
<td>176'970</td>
<td>1'900</td>
<td>6 / 2 persons for 3 months</td>
</tr>
<tr>
<td>3.4 Collaborate and coordinate with the Ministry of Health to ensure the safe disposal of waste in the Ministry of Health</td>
<td>190'950</td>
<td>2'000</td>
<td>6 / 2 persons for 3 months</td>
</tr>
<tr>
<td>3.5 Launch a new project for the Ministry of Health to ensure the safe disposal of waste in the Ministry of Health</td>
<td>52'238'000</td>
<td>664'000</td>
<td>392'714'000 / 399'000 see detailed calculations</td>
</tr>
<tr>
<td>3.6 Equip HCWMs with a garbage collection system including waste collection, transportation (6 incinerators) and disposal, maintenance and comprehensive training (6 incinerators)</td>
<td>147'730'000</td>
<td>1'670'000</td>
<td>64'108'000 / 63'9000</td>
</tr>
<tr>
<td>3.7 Review the Academic Programme in Faculties of Medicine and Nursing Schools</td>
<td>450'000</td>
<td>5'000</td>
<td>6 / 1 person for 2 months</td>
</tr>
<tr>
<td>4.1 Prepare a Technical Training for the Health Officers of the Ministry of Health with the Ministry of Health (CoP, MOHC)</td>
<td>450'000</td>
<td>50'000</td>
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<tr>
<td>4.2 Plan a Technical Training Programme for the Regional and District Auditors (CoP, MOHC)</td>
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<td>5'000</td>
<td>6 / 1 person for 2 months</td>
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<td>4.3 Set up a Group of Trainers and elaborate a specific and detailed Training Package in Swahili for them (see the training)</td>
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<td>6 / 1 person for 2 months</td>
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<tr>
<td>4.4 Set up a Professional Training Programme in Regional Centres for medical paramedical technical staff</td>
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<td>4.5 Select 5 new staff members to the HCWM</td>
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<tr>
<td>4.6 Organize systematic in situ training in medical institutions</td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>1'670'000</strong></td>
<td><strong>392'714'000 / 399'000 see detailed calculations</strong></td>
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**GRAND TOTAL**

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<td>4'208'000</td>
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Notes: The table presents the estimated capital and annual costs for the National HCWM Plan. The costs are calculated based on various activities, including the installation of incinerators, training of personnel, and equipment acquisition. The table includes details of the activities, costs, and remarks for each category.
Conclusion

With a few exceptions, the current HCWM practices observed in Tanzania are not safe and have harmful environmental effects due to a lack of knowledge of management procedures and the disposal technologies available as well as the low financial resources of the Health Sector. Although they are difficult to estimate, the direct and indirect costs associated with this situation are certainly high.

The development of appropriate financial means for the regular implementation of the National Health-Care Waste Management Plan will remain a key issue for its application with regards to the relatively high costs associated with such plans. The Government of Tanzania may therefore develop a specific strategy aiming at improving the health-care waste management practices in the large medical institutions of the country first or implementing measures for specific categories of health-care waste, such as sharps.

However, the experiences carried out by several actors in the Tanzanian Health Sector have little chances to remain sustainable as long as a holistic approach is not developed. Actually, the sustainable implementation of safe procedures to manage health-care waste requires a lasting commitment starting at the government level and prolonged all the way down to the hospital staff. The implementation of the five objectives targeted by the National Health-Care Waste Management Plan should contribute to durably improve the situation if they are progressively implemented.

The legislative and regulatory provisions will need to be completed so as to define both which practices and technical solutions are admissible or not as well as who is competent/responsible for what.

The standardisation of the health-care waste management practices, though the establishment of clear protocols as well as managerial and monitoring measures will be a key issue so as to secure the whole health-care waste stream. The procedures will have to be in accordance with the prescriptions contained in the national legislation and in the internal hospital rules.

The equipment of the health-care facilities will provide to the administration and medical staff the necessary tools to apply the standardised procedures in their establishments and medical services;

In-service training programme and adequate curricula will have to be set up followed by the ongoing training of all people involved so as to ensure that hospital staff know the importance and the best practices linked to the management of health-care waste.
Annexes
Annexe 1: Terms of Reference

HEALTH CARE WASTE MANAGEMENT PLAN
GENERIC TERMS OF REFERENCE
for
Multi-sectoral HIV/AIDS programs for the African Region
(Sénégal, central African Republic, Benin, Madagascar, Cape Verde, Lagos-Abidjan Corridor, Tanzania)

The introduction and project justification is taken from the CAR HIV/AIDS project and changes from project to project.

1. Background and Introduction

The proposed project is part of the World Bank's Multi Sectoral HIV/AIDS program for the Africa Region (MAP). In accordance with the main goal of the MAP, the development objectives of the project in the Central African Republic (CAR) will be (a) to contribute to reducing HIV/AIDS prevalence; (b) to reduce the impact of HIV/AIDS on persons infected with or affected by HIV/AIDS.

The objectives will be attained through a multi-sectoral approach, facilitating effective activities undertaken in various sectors by public and private organizations, and by communities in the fight against HIV/AIDS. Project-supported activities will complement government, donor, and private sector initiatives. The activities will vary by community and sector but be consistent with the draft national strategy against HIV/AIDS, and proposed by the actors themselves. Nevertheless, the overall focus of these activities is likely to be massive behavioral changes, access to voluntary testing, counseling and treatment, and support to people infected or affected by HIV/AIDS.

2. Project Justification

A social assessment and a series of consultative workshops held in early 2001 emphasized the lack of support to many public and private initiatives against HIV/AIDS, and requested that the proposed project focus on supporting and scaling-up of large numbers of such initiatives, in a massive, cost-efficient and coherent way, in order to facilitate a rapid nation-wide expansion of responses against HIV/AIDS. The project will support responses in agreement with (Comité National de Lutte contre le SIDA) CNLS strategic priorities, which are in line with the Government's overall policy to fight HIV/AIDS. Project supported activities will complement the activities of existing programs financed by various donors and NGOs which are already engaged in the fight against HIV/AIDS in CAR. The project will channel resources through large public and private organizations already providing basic health and other HIV/AIDS-related services at the national level. In addition, the project will develop Comités Préfectoraux de Lutte Contre le SIDA (CPLS) at the prefecture level to directly channel resources to local organizations and communities.

3. Detailed Project Description

a. Objectives

The proposed project will reach its objectives through activities financed under three components. These are: (a) strengthening of the public-sector responses, (b) strengthening of civil society responses, and (c) coordination, financial management, monitoring and evaluation. The project will invest in cost-effective activities with potential to reach large segments of the population. To strengthen local capacities and ensure continuous and timely flow of information on HIV/AIDS and its prevention, all project components will include substantial emphasis on training and behavioral change communications activities.
The handling, collection, disposal and management of HIV/AIDS infected materials is the most significant environmental issue in this program. In light of its importance to contributing to the spread of the disease, the project will prepare a Medical Waste Management Plan, which will be appropriately costed with clear institutional arrangements for its execution. In many of our client countries, the inappropriate handling of HIV/AIDS infected materials constitute a risk not only for the staff in hospitals and in municipalities who are involved in waste handling, but also for families and street children who scavenge on dump sites. Some aspects of project implementation for example the establishment of testing clinics, the purchasing of equipment by communities for home care of the sick etc... could constitute an increase in the environmental and health risk with regard to the handling of HIV/AIDS infected waste.

b. Development Objective

The objective of the study is to identify the level of Health Care Waste Management that will be relevant to help implement and enforce proper health and environmentally sound, technically feasible, economically viable, and socially acceptable systems for management of health care waste in CAR.

The examination of the of the current practices with regard to the handling of hospital waste will verify both the management of waste within the hospitals, clinics and other health centers as well as the management by municipal authorities once the waste has left the source. It will also look into the level of knowledge among staff (hospital orderlies, nurses, patients, municipal workers etc...) about the practices to be adopted, and into the availability of equipment such as incinerators to deal with this type of waste.

4. Scope of the Study

Task I: analysis of the current situation related to HCWM

✓ Assess the Policy, Legal and Administrative Framework as well as the Regulatory Framework on health care waste management and treatment /destruction facility in the country including air emission standards which are currently required by law and which would likely be required in the next say ten years

✓ Identify permit requirements, including environmental building, and other permits and procedures that health care waste treatment/destruction facilities would need to address

✓ Outline any public participation or public hearing requirements and procedures. For each requirement, list the lead agency to be contacted.

✓ Assess the typical time demands for proposed facilities to obtain permits and address environmental impact requirements and public participation requirements

✓ Identify all healthcare facilities in the country and include basic information for each facility, such as number of beds, bed occupancy rate, specialists, divided into categories. University Hospitals (if any), Regional Hospitals, general hospitals, Municipal Hospitals, and other health care establishments.

✓ Assess the health care waste generation at (i) one major hospital (ii) one major regional hospital (iii) one general hospital, and (iv) one private clinic. The details should include the minimum weigh of total generated at each health care facility per week. Composition of the waste should be determined through segregation at the waste end point, extrapolate the results to cover the entire country

✓ Assess the level of scavenging, if any, or recycling taking place inside health care facilities; along transportation routes, and at final disposal sites. Determine social issues in relation to scavenging taking place.

✓ Review and analyze existing health care waste storage, collection and disposal systems with due regard for level of separation, the frequency of collection; and environmental and health impacts for existing treatment

Task II: determination of technology and facilities for the treatment of HCWM

✓ Assess alternative technologies and facility sizes for treatment and destruction. The assessment shall compare the alternatives on the basis of capital cost, operating cost, ease of operation, local availability of spare parts, local availability of operational skills, demonstrated reliability, durability and environmental impact.
The technologies to be considered include, safe land-filling, incineration, sterilization (autoclave and microwave) and chemical disinfection.

On the basis of this assessment recommend a process flow for economic and environmentally sound treatment and final disposal of health care waste leading to selection of appropriate technology. The Government and/or facility should make the final decision on choice.

Special provisions for the determination of disposal sites

If site for disposal exists, collect all existing plans of suitable sites to be considered for the locations of the treatment facility(ies) and review general transport and traffic systems relative to appropriate sites. Consider (a) accessibility to the site, (b) distance from health care facilities to the site, (c) distance to sensitive areas, (d) future development plans of the area, (e) possibility to acquire the area (f) cultural and historical sites, (g) public opinion, (h) noise and dust impact to nearby areas. Public consultation/hearing must be held as part of the final assessment for siting of the treatment facility.

Analyze the site: analyze the above information to determine whether there is sufficient appropriate material on site for daily and final cover, whether the site soil, hydrological and geo-hydrological conditions would ensure adequate protection of any ground and surface water used for drinking and/or irrigation. If the sites prove to be unsuitable, inform the client stating the reasons.

Financing

The National/Local Governments, potentially in conjunction with other municipal solid waste treatment and disposal activities, may finance a regional facility. An alternative approach is for the private sector to provide the health-care waste treatment and disposal activities or waste transport for the entire region.

Assess private sector participation as service provider.
Assess public-private partnerships and cost recovery at the regional, municipal level, based on the polluter pays principle, where each health care facility pays according to the volume of waste generated.

Task III: awareness and training

Review existing training and public awareness programs on health care waste management at hospitals and other health care establishments and prepare a training needs assessment.

Working in conjunction with the relevant government institutions and Municipal councils, prepare a costed training program and a well targeted Awareness Building Campaign Program including the general public, and more specifically health-care workers, municipal workers, dump site managers, incinerator operators (if that is the choice of technology), nurses, scavengers/pickers families and street children. The design of the material required for the awareness building programs should be discussed with the relevant authorities and the general public to ensure that their concerns that are deemed appropriate are incorporated in the design of the program, siting layouts, mitigation measures and community communication programs.

The Training and Awareness Building Program as well as the Management Program shall be appropriately costed and the Plan shall be presented in a National Workshop.

Task IV: final report

Output and Reporting

Present and discuss a full draft report with the project authorities and the proponent, and focus on the significant environmental and human health issues in a format similar to the following:

Executive Summary
Policy, Legal and Administrative Framework
Project Description
Baseline Data
Assessment of Healthcare waste
Healthcare waste Training Needs Assessment
Final report

Revise the draft report in accordance with the comments of the World Bank, the Government and other interested parties and submit the Final Report incorporating all changes and modifications required to the Project Task Team.

5. Study supervision and time schedule

The work of the consultant would be supervised by the relevant government institution(s) responsible for the project. The Agency will coordinate with all other governmental agencies, ministries and other donors working in the sector. The Consultant:

- shall begin work no later than one month after the date of the effectiveness of the contract. It is anticipated that the Consultant would complete the outputs of the work over a maximum duration of 6 weeks with four weeks in the field for data collection and two weeks for report writing and finalization of the document after the review has been carried out;
- should propose a clear schedule with critical milestones, and makes all possible efforts to complete the work at the appointed time;
- should have the technical competence in scientific, health, environmental and engineering fields in particular sanitary engineering. He/She may also have competence in the private sector participation field and skills in training and institutional strengthening;
- is expected to provide 6-8 well bound reports with pictures and maps where necessary to the Government and the Bank.
Annexe 2: Agenda of the mission and contact list

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Place</th>
<th>Purpose / topics discussed</th>
<th>Institutions</th>
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Note: Health and Wastewater Management (HWW)
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**Health-Care Waste Management - Tanzania**

- A double chamber incinerator being installed for the treatment of the health-care wastes at DLS in a year prior by FAO (Funke). DLS is equipped to manage the site for 3-year waste to build up an incinerator waste with a PE tank.
- FAO funded funds to be implemented for the construction of the HWT plan in DLS.
<table>
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Notes:
- Visits were conducted to various hospitals and health facilities in Tanzania.
- The burns ward was actually located at 3 km from the main hospital.
- Involvement very representative of the local district health centers and hospitals in Tanzania according to our observations.
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<td>24 Dec.</td>
<td>Dar es Salaam</td>
<td>Visit of the minster and discussion with the Director</td>
<td>Mr. Kalane</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>24 Dec.</td>
<td>Dar es Salaam</td>
<td>Last round of meetings, draft of last information</td>
<td>Mr. Kalane</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>24 Dec.</td>
<td>Dar es Salaam</td>
<td>Last meeting</td>
<td>Mr. Kalane</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>29 Dec.</td>
<td>Dar es Salaam</td>
<td>Last round of meetings</td>
<td>Mr. Kalane</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>30 Dec.</td>
<td>Dar es Salaam</td>
<td>Last round of meetings</td>
<td>Mr. Kalane</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>31 Dec.</td>
<td>Dar es Salaam</td>
<td>Departure to Dar es Salaam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annexe 4: Data collection and analysis

1. Example of Hospital Assessment

Min contact: Dr Ngwalle, Executive Director
Date of the survey: 18-19 Dec. 2002

General information

Muhimbili Medical Centre was built in 1956. It includes the Muhimbili Health Faculty and the Muhimbili National Hospital, which is the biggest Hospital in Tanzania and the main of the four referral Hospitals in the Country. A short walk through the hospital reveals a poor shape of the infrastructures (leakages of boilers, water tanks or plumbing material, parts of ceiling falling down etc…). Muhimbili National Hospital brings to mind Gericault’s painting “Le Radeau de la Méduse”.

- Number of wards: 40
- Number of beds: 1’200
- Average occupancy rate: 90%
- Total staff: 2’800 workers

HCW generation

Type of wastes generated

All the categories of health-care waste (HCW) are generated in this hospital corresponding to the numerous medical activities that are carried out in it. More details are provided hereafter.

Quantities of HCWM produced

The quantity of health-care waste produced at Muhimbili hospital has been roughly estimated through the discussions with the ancillary staff. The estimation of the daily quantity of HCW produced per occupied bed per day is actually important to estimate to:

1) plan more adequately the resources necessary for the management of the HCW;
2) size the disposal equipment.

<table>
<thead>
<tr>
<th>Waste category</th>
<th>Daily production</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic waste</td>
<td>2800</td>
<td>3000 kg are daily collected by the municipal services of Dae-Es-Salaam, including General Domestic waste that can roughly estimated to represent less than 10% of the total weight.</td>
</tr>
<tr>
<td>General medical waste</td>
<td>200</td>
<td>considering that the capacity of the DeMontfort incinerator (Mark II) does not exceed 30 Kg/hour in the current conditions and that the incinerators is run 5 hours a day.</td>
</tr>
<tr>
<td>Sharp production</td>
<td>150</td>
<td>considering that approximately 6 m3 are disposed weekly and that the waste has a ratio mass / volume of 0,6 kg/litre.</td>
</tr>
<tr>
<td>Organic waste</td>
<td>214</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>564</td>
<td></td>
</tr>
<tr>
<td>Special and hazardous waste production</td>
<td>0,42 kg/occupied bed/day</td>
<td></td>
</tr>
<tr>
<td>Ratio (total hazardous HCW / total waste)</td>
<td>17%</td>
<td></td>
</tr>
</tbody>
</table>

The figures hereupon are similar to figures found in other African countries for a similar health facility. However, the production of hazardous and special HCW might have been overestimated since the hospital treats also the “organic waste” generated at the Medical Health Faculty.
Segregation, packaging & labelling

After having received a training organised by the WHO, the nurses attempt to segregate at source the HCW generated in the different wards, which is a positive aspect of the HCWM practices in Muhumbili Hospital that should be maintained and reinforced. A three bins system has been set-up in the different medical units:

- The “organic waste” are collected in separate plastic bins of different size (mainly 60 litres) and colours. They consist in anatomical and pathological waste as well as placentas. They are collected in plastic bags or buckets and disposed of separately. They are incinerated in an old air-excess incinerator. When the “organic waste” is too “bleeding”, it is placed in a plastic bag (PE, black, no more than 0.35 µm of thickness). In general the bins are covered with a lid. Typically, they are located in the ward/department, next to the nurse room.

- Sharps are collected in separate containers, more often in recycled plastic bottles. The containers are not hermetically sealed and have no specific labelling that enable the medical staff or the general public to easily recognize them. Once full the containers are either disposed of or else emptied into the incinerator to be reused. Sharps have been found with general medical wastes indicating failure in the segregation practices.

- The other categories of waste that consists in a mixture of domestic waste (papers, plastic bottles, left-over food, etc...) and general medical waste (gloves, bandages, swab) are collected into a variety of containers of different quality. The absence of adequate definitions does not enable to perform a correct segregation between these two categories of waste.

Unfortunately, the absence of a systematic colour coding and labelling system is one of the numerous factors that lead to mistakes in the segregation. Segregation remains quite ineffective and sharps are founds in every category of waste due to the absence of a clear and systematic protocol that fails to be rigorously applied. The segregation and handling practices remain coarsely managed. The lack of equipment such as adequate bins or sharps containers worsens the situation. In final, the risks of 1) a person accidentally coming into contact with hazardous waste, 2) mistakes occurring during segregation are important.

Waste collection system and on-site transportation

The staff members of the Technical Services collect the HCW daily in the wards. The dustbins are transported through the corridors without any particular precautions before being emptied pell-mell directly on the floor of the storage sheds. During on-site transportation, there is a significant risk of spillage of the waste since the trailers does not have adequate edges to prevent the bins from falling down.

Collection and on-site transportation are generally organised by the technical services. There are no specific schedule and collection routes within the hospital. However, sanitary labourers do not enter directly the wards/departments to collect the dustbins by themselves, but the nurses seems to leave the dustbins once they are full outside the department for collection. It is a positive aspect to limit the risks of nosocomial infections.

Sanitary labourers carry heavy gloves and industrial boots.
Storage

Different storage facilities and practices exist in the hospital:

- Sharps are directly stored next to the incinerator before being incinerated;
- Four lockable storage facilities of 6 m² without pavement are used to store the general medical waste. They are dispersed in the hospital compound and not locked. A roof and a wire net prevent animals (but not the flies) from entering but the doors remain permanently open (see annexe 5 photo 3). The waste are daily removed;
- "Organic wastes" are stored in a similar facility to the one hereupon but the facility has a concrete slab and is maintained locked. The facility is not kept clean and the wastes are not protected from the effects of the weather. The storage lasts too long (up to one week). An impressive number of flies (a noisy black cloud) fly in and around the facility. The decomposing waste generates odours and leaks on the pavement that the mission refuses to describe or illustrate.

No adequate support facility like washing and disinfecting material has been observed near the storage areas. This situation associated with inadequate practices (no regular handwashing, decomposition of the "organic waste", flies...) results in absolute insufficient standards of hygiene. In addition the localisation of the storage facilities in the hospital compound remains inappropriate and too dispersed.

Waste treatment and disposal

Solid waste disposal

General medical and domestic wastes are collected by the municipal services and disposed of together with the solid wastes of the municipality in the dump-site (located at Ilala district?).

Sharps are incinerated in a masonry double chamber DeMontfort incinerator. The incineration is carried out on a periodic basis (daily, except on Sunday). Apparently, the incinerators used have some difficulties to reach a temperature of 900°C. Products of Incomplete Combustion (PCI) and Persistent Organic Pollutants (POPs) are generated during the whole process. Nevertheless, incineration is performed in an area that is not densely populated and enables to reduce immediate hazards linked to the sharps. With respect to the financial resources available in the hospital, this type of incinerator can constitute an acceptable intermediate solution to dispose of the sharps. The ashes, full of needles, produced during the process are buried nearby.

"Organic wastes" generated in Operation Theatres or in wards are disposed of separately. Twice a week, they are incinerated in an old incinerator, air excess type.

Sanitation & Wastewater

N/A.

Management and administration

Planning capacities

The management of the HCW is not rigorously planned (no agenda scheduled for collection, the "organic waste" incinerator works when "we have fuel", etc...). The lack of planning is due to: 1) inadequate management procedures, 2) lack of equipment, 3) deficient resource and 4) a lack of know-how.
What is your appraisal of the current situation regarding the HCWM within your institution?

<table>
<thead>
<tr>
<th></th>
<th>Very bad</th>
<th>Bad</th>
<th>Satisfactory</th>
<th>Good</th>
<th>Very Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital head nurse</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ward head nurse</td>
<td>x</td>
<td></td>
<td></td>
<td>x(1)</td>
<td></td>
</tr>
<tr>
<td>Overseers</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mission</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specific issues

Safety provisions in the Laboratories & Infectious Disease Units

The mission was not able to analyse how highly infectious waste are managed in the Laboratories and if they receive at least a chemical pre-treatment before being discarded with the general medical waste.

Hospital Hygiene & Infection Control

Poor hygiene and infection control procedures in the different wards have been observed.

Handling of syringes and needles – sharp management

see Annexe 5

2. Results of the surveys

<table>
<thead>
<tr>
<th>HCF</th>
<th>Category</th>
<th>No. of beds</th>
<th>Occupancy rate</th>
<th>Occupied beds</th>
<th>Occupied beds per day</th>
<th>General Medical waste &amp; sharps</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amana Hospital</td>
<td>District</td>
<td>150</td>
<td>200%</td>
<td>300</td>
<td>537</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td>Mbeje Consultant Hospital</td>
<td>Referal</td>
<td>477</td>
<td>95%</td>
<td>453</td>
<td>600</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Innga Regional Hospital</td>
<td>Regional</td>
<td>365</td>
<td>85%</td>
<td>310</td>
<td>450</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Mafinga District Hospital</td>
<td>District</td>
<td>130</td>
<td>120%</td>
<td>150</td>
<td>150</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Mwara Regional Hospital</td>
<td>Regional</td>
<td>272</td>
<td>170%</td>
<td>544</td>
<td>960</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Mulbah National Hospital</td>
<td>Referal</td>
<td>477</td>
<td>95%</td>
<td>453</td>
<td>600</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Dodoma Hospital</td>
<td>Regional</td>
<td>395</td>
<td>71%</td>
<td>280</td>
<td>30</td>
<td>0.11</td>
<td>Surveys carried out during the consultancy</td>
</tr>
<tr>
<td>Korogwe Hospital</td>
<td>District</td>
<td>142</td>
<td>50%</td>
<td>71</td>
<td>50</td>
<td>0.70</td>
<td>Surveys carried out previously and completed during the consultancy</td>
</tr>
<tr>
<td>Bagamoyo Hospital</td>
<td>District</td>
<td>86</td>
<td>44%</td>
<td>39</td>
<td>13</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>Mwananyamala Hospital</td>
<td>District</td>
<td>113</td>
<td>110%</td>
<td>127</td>
<td>156</td>
<td>1.24</td>
<td></td>
</tr>
</tbody>
</table>

Average: 237 beds; 101% occupancy; 241 General Medical waste & sharps; 0.41
Annexe 5: 

a/ National Inventory of the Health Facilities

<table>
<thead>
<tr>
<th>REGION</th>
<th>HOSPITALS</th>
<th>CLINICS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addis Ababa</td>
<td>120</td>
<td>50</td>
<td>170</td>
</tr>
<tr>
<td>Amhara</td>
<td>100</td>
<td>40</td>
<td>140</td>
</tr>
<tr>
<td>Benishangul-Gumuz</td>
<td>50</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Bonga</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Dire Dawa</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Gamo-Gofa</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Gambella</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Horre</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Jimma</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Kaffa</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Konso</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Melka</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia</td>
<td>100</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>Oromia - Addis Ababa</td>
<td>120</td>
<td>50</td>
<td>170</td>
</tr>
<tr>
<td>Oromia - Amhara</td>
<td>100</td>
<td>40</td>
<td>140</td>
</tr>
<tr>
<td>Oromia - Benishangul-Gumuz</td>
<td>50</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Oromia - Bonga</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Oromia - Dire Dawa</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia - Gamo-Gofa</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Oromia - Gambella</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia - Hareen-Gofa</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Oromia - Jimma</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Oromia - Kaffa</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia - Konso</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Oromia - Melka</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia - Oromia</td>
<td>100</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>Oromia - Oromia - Addis Ababa</td>
<td>120</td>
<td>50</td>
<td>170</td>
</tr>
<tr>
<td>Oromia - Oromia - Amhara</td>
<td>100</td>
<td>40</td>
<td>140</td>
</tr>
<tr>
<td>Oromia - Oromia - Benishangul-Gumuz</td>
<td>50</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Oromia - Oromia - Bonga</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Oromia - Oromia - Gamo-Gofa</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Oromia - Oromia - Gambella</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia - Oromia - Hareen-Gofa</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Oromia - Oromia - Jimma</td>
<td>15</td>
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<td>20</td>
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<tr>
<td>Oromia - Oromia - Kaffa</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia - Oromia - Konso</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Oromia - Oromia - Melka</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addis Ababa</td>
<td>120</td>
<td>50</td>
<td>170</td>
</tr>
<tr>
<td>Amhara</td>
<td>100</td>
<td>40</td>
<td>140</td>
</tr>
<tr>
<td>Benishangul-Gumuz</td>
<td>50</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Bonga</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Dire Dawa</td>
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<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Gamo-Gofa</td>
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</tr>
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<td>Gambella</td>
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<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Hareen-Gofa</td>
<td>20</td>
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</tr>
<tr>
<td>Jimma</td>
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<tr>
<td>Kaffa</td>
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<td>15</td>
</tr>
<tr>
<td>Konso</td>
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<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Melka</td>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Oromia</td>
<td>100</td>
<td>50</td>
<td>150</td>
</tr>
</tbody>
</table>

Note: The table above lists the number of hospitals and clinics in various regions of Ethiopia. The data is presented in a tabular format for ease of reading and analysis.
b/ National HCW Production Ventilated per Regions

The ratio of 0.41 kg/occupied bed/day has been used to estimate the National HCW production, using the National Inventory of HCFs provided in the Health Abstracts, 2001. The National production vary between 12 and 14 tonnes per day.

The seven regions of Kagera, Iringa, Kilimanjaro, Arusha, Pwani and Mwanza produce 50% of the total HCW of the country. They should considered as priority regions.

<table>
<thead>
<tr>
<th>REGION</th>
<th>Hospitals (kg/bed/day)</th>
<th>Health Centres (kg/bed/day)</th>
<th>Total (kg/bed/day)</th>
<th>% total production</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUKWA</td>
<td>164.4</td>
<td>60.4</td>
<td>224.8</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>MORONGORO</td>
<td>326.36</td>
<td>45.6</td>
<td>371.96</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>KIGOMA</td>
<td>315.7</td>
<td>70.8</td>
<td>386.5</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td>MARA</td>
<td>375.6</td>
<td>70.2</td>
<td>445.8</td>
<td>3%</td>
<td>10%</td>
</tr>
<tr>
<td>LINDI</td>
<td>419</td>
<td>42</td>
<td>461</td>
<td>3%</td>
<td>13%</td>
</tr>
<tr>
<td>SINGIDA</td>
<td>476.4</td>
<td>45.2</td>
<td>521.6</td>
<td>4%</td>
<td>17%</td>
</tr>
<tr>
<td>MTWARA</td>
<td>453.1</td>
<td>72.8</td>
<td>525.9</td>
<td>4%</td>
<td>21%</td>
</tr>
<tr>
<td>SHINYANGA</td>
<td>446.9</td>
<td>86.2</td>
<td>533.1</td>
<td>4%</td>
<td>25%</td>
</tr>
<tr>
<td>TABORA</td>
<td>512.5</td>
<td>74.6</td>
<td>587.1</td>
<td>4%</td>
<td>29%</td>
</tr>
<tr>
<td>TANGA</td>
<td>617.5</td>
<td>114.0</td>
<td>731.5</td>
<td>5%</td>
<td>34%</td>
</tr>
<tr>
<td>RUVUMA</td>
<td>672.8</td>
<td>76.0</td>
<td>748.8</td>
<td>5%</td>
<td>40%</td>
</tr>
<tr>
<td>MBeya</td>
<td>555.8</td>
<td>87.0</td>
<td>752.8</td>
<td>5%</td>
<td>45%</td>
</tr>
<tr>
<td>DODOMA</td>
<td>536.2</td>
<td>66.6</td>
<td>763.0</td>
<td>5%</td>
<td>50%</td>
</tr>
<tr>
<td>DAR ES SALAAM</td>
<td>698.2</td>
<td>123.6</td>
<td>821.8</td>
<td>6%</td>
<td>56%</td>
</tr>
<tr>
<td>KAGERA</td>
<td>710.1</td>
<td>126.0</td>
<td>836.1</td>
<td>6%</td>
<td>62%</td>
</tr>
<tr>
<td>IRINGA</td>
<td>737.6</td>
<td>158.6</td>
<td>896.2</td>
<td>6%</td>
<td>69%</td>
</tr>
<tr>
<td>KILIMANJARO</td>
<td>823.3</td>
<td>92.0</td>
<td>915.3</td>
<td>7%</td>
<td>75%</td>
</tr>
<tr>
<td>ARUSHA</td>
<td>934.4</td>
<td>72.6</td>
<td>1007.0</td>
<td>7%</td>
<td>82%</td>
</tr>
<tr>
<td>PWANI REGION</td>
<td>1118.9</td>
<td>38.4</td>
<td>1157.3</td>
<td>8%</td>
<td>91%</td>
</tr>
<tr>
<td>MWANZA</td>
<td>1045.5</td>
<td>272.6</td>
<td>1318.1</td>
<td>9%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**TOTAL** 12210.2 1795.4 14005.6
Annexe 6: Fundamentals on the Management of Sharps

Sharps represent one of the most problematic and hazardous types of waste generated within HCFs. Syringes and needles are of particular concern because they constitute an important part of the sharps and are very often contaminated with blood. The occupational risks are linked to:

- The great quantities that are manipulated daily by health-workers and generated throughout the world for both curative and preventive activities,
- The cuts and punctures they may cause followed by a potential infection of the wounds. The main diseases of concern are those which may be transmitted by subcutaneous introduction of the pathogens such as viral blood infections,
- The scavenging and re-use practices that occur in some countries, exposing the populations (and most particularly children) to risks of cross contamination.

All biomedical and health-care waste with sharps or pointed parts have a high potential to injure and inoculate potentially dangerous pathogens. They must therefore be categorized as infectious waste and have to be manipulated, discarded, transported and disposed of with maximum precautions by health workers.

Due to the lack of reporting at HCF level, needle-stick injuries occurring worldwide are globally underestimated. However a recent study carried out by the WHO shows that, depending on the country, a nurse can get a needle-stick injury more that twice a year. Therefore, handling and disposing of safely needles and syringes, and more generally sharps, must be seen as an absolute priority by the Health Services of any country. The safe management of sharps requires to:

- Define a strict policy at national level with clear handling and disposal protocols to be respected in all HCFs,
- Provide each HCF with adequate equipment for sharps discarding and disposal;
- Ensure that all HCF staff are aware of the protocols and properly trained (in-service trainings and review of the initial curricula are often necessary);
- Establish a system to report accidents that occur and monitor the application of the policy.

It is internationally recognized that the safe management procedures of sharps should comprise the following practices:

- A health-worker performing an injection or the staff member transporting health-care waste should always wear appropriate gloves (a study carried out at the Geneva University Hospital - Switzerland - showed actually that more than 50% of the blood remaining in an infected needle is stopped by the gloves when a needle-stick injury occurs);
- All disposable syringes and needles should be discarded immediately following use. The needle should never be recapped or removed from the syringe since most of the accidents occur when the nurses attempt to recap the needles;
- Under no circumstances are syringes or needles (or the full containers) to be disposed of with normal garbage or dumped randomly without prior treatment;
- Sharps should be placed in specific cardboard, plastic, high-density polyethylene or metallic containers resistant to punctures and leak-proof, designed so that items can be dropped in using one hand, and no item can be removed. The container should be: 1) labelled with the international biohazard symbol; 2) be of a yellow colour (the international colour coding system for infectious waste strongly recommended by the UN Agencies), and 3) marked "Danger! contaminated sharps, do not open";
The containers should never be overfilled but systematically disposed of once they are three-quarters full. They should not be emptied for re-use, except when specifically designed for this option (see "the MSF practice" described hereafter).

There are two ways to dispose of needles and syringes in a safe way. The first solution consists in discarding the needle and/or syringe in a puncture and leak-proof recipient which, once filled will then be treated/disposed of with other infectious waste or emptied in a sharp pit. The second option consists in destroying the needle on the spot using a specific device.

**Option 1a**

The basic idea is to discard the whole combination "syringe plus needle" into a safety box immediately after use. The box is then treated with other infectious waste. This option is recommended by the WHO and UNICEF and applied in all industrialised countries. This practice enables to reduce the risk of needle-stick injuries for the medical staff but generates important volumes of sharp waste that must be incinerated since alternative technologies such as autoclaving and shredding or microwave processing are difficult to apply in low income countries.

In order to oxidise completely the needle, it is necessary to incinerate it at a temperature greater than 1'400°C. Modern pyrolytic incinerators or rotary kilns, which are expensive to install and operate, must therefore be used. Alternatively, air-excess incinerators or improved double-chamber autocombustion incinerators such as the De Montfort incinerator can be used. These kinds of incinerators are able to burn the syringes and disinfect the needles at temperatures of 900°C. However the ash that is produced during the process still contains the needles. It must be carefully buried. Alternative incineration can hardly be applied in populated urban areas due to the potential emission of persistent organic pollutants (POPs) this technique may generate.

Open-air burning of cardboard safety boxes is also seen as an alternative in rural areas when there is no other possibility. It is typically the case during mass immunisation campaigns. The WHO and UNICEF recommend this practice in the rural areas of low-income countries.

![](image1)

**Option 1b**

In this case one inserts the needle into a slot of a container specially designed to separate it from the syringe using one hand only. The syringe is then discarded with the other categories of health-care waste while the needles remain in the container, which can be made of polyethylene (closed tube or empty drug-boxes, cans, etc.). Once full, the container is safely emptied into a sharp pit, using a system that prevents the user from being in contact with the needles it contains ("the MSF practice").
The container can also be directly dropped into the sharp pit. The pit, once full, is encapsulated and a new one must be built. This option requires greater care from the health-workers who must separate the needle from the syringe, using one hand only.

<table>
<thead>
<tr>
<th>MSF PE sharp box</th>
<th>PATH removable can (&quot;Popper&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="MSF PE sharp box" /></td>
<td><img src="image2" alt="PATH removable can" /></td>
</tr>
</tbody>
</table>

**A sharp pit**

**Option 2**

In this case, the needle is destroyed at the point of use with a needle destroyer. The user inserts the needle into a hole or slot in the device, which positions the needle between two electrodes in the device's interior. By contacting both electrodes simultaneously, the needle causes an electric current to run through it which heats the needle to temperatures reaching 1500°C to 3000°C. The result is a partial or total oxidation of the needle.

![A needle destroyer](image3)

Encapsulation consists in adding an immobilising material in the pit and sealing it. The immobilising material can be mortar, clay, or bitumen.

---

1 Encapsulation consists in adding an immobilising material in the pit and sealing it. The immobilising material can be mortar, clay, or bitumen.
The table below provides a comparison of the advantages and the drawbacks of the different options.

<table>
<thead>
<tr>
<th>Options</th>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
</table>
| 1       | It is possible to dispose of AD syringes  
The handling of the needle and syringe is reduced at a maximum enabling to diminish the risks of needle-stick injury  
The volume reduction, once incinerated, is drastic (more than 90%) | POPs may be produced depending on the incineration system used  
If the incineration is not performed at sufficiently high temperatures, the needles remain and ash must be safely buried  
Incinerators require regular maintenance to be kept in optimal working conditions  
Except for open-air burning the capital and operational costs remain relatively high |
| 2       | Once it has been constructed the pit is simple to use and does not require any maintenance  
There are no operational costs. The capital costs remain limited  
There is no emission of air pollutants  
The volume reduction is similar to the one obtained with incineration | The needle has to be separated from the syringe which may increase the risks of needle-stick injury for the health-workers  
It is not possible to dismantle AD syringes, which are used more and more frequently in low-income countries  
A new pit has to be periodically built depending on its filling rate  
The pit may be filled with other material than sharps and become rapidly full, increasing the construction costs  
Requires space within the HCF compound to dig the successive sharp pits |
| 3       | Provides a satisfactory solution to get rid of the needle at the point of use  
Avoids the transport of sharps  
Does not require an on-going supply of sharp boxes or containers  
May be an alternative technology in urban areas for some specialised HCFs where a lot of sharps are manipulated (Mother and child centres, blood banks, sexual transmitted disease clinics) | Requires electricity to run  
 Require a good maintenance of the device that can "clog" easily if the small amounts of ashes produced are not regularly removed  
Expensive solution that will be difficultly to include in a HCWM policy in a low-income countries |
## Annexe 7: HCW Disposal Technologies

The choice of a technology for HCW treatment and disposal should always be driven with the objective of minimizing negative impacts on health and the environment. Several technologies exist to treat or dispose of HCW. They include: 1) Incineration in rotary kilns or double chamber incinerators; 2) Burning in single chamber incinerators; 3) Wet thermal treatment (autoclaving); 4) Chemical disinfection, 5) Microwave irradiation, 6) Sanitary landfill, including inertization and encapsulation.

Not all these technologies can be used for the treatment or the disposal of all categories of HCW. The suitable treatment and disposal technologies according to the different categories of HCW are presented in the table below.

<table>
<thead>
<tr>
<th>Waste category</th>
<th>Rotary kiln</th>
<th>Two chambers pyrolytic incineration</th>
<th>Single chamber incineration</th>
<th>Wet thermal treatment (autoclave)</th>
<th>Chemical disinfection</th>
<th>Microwave irradiation</th>
<th>Sanitary landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>non-risk HCW</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Human anatomical waste</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Waste sharps</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES for small quantities with encapsulation</td>
</tr>
<tr>
<td>Hazardous Pharmaceutical waste</td>
<td>YES</td>
<td>Small amount only</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Cytotoxic pharmaceutical waste</td>
<td>YES</td>
<td>NO for modern ones</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Infectious waste</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Highly infectious waste</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES only after pre-treatment</td>
</tr>
<tr>
<td>Other hazardous waste</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES if specially designed</td>
</tr>
<tr>
<td>Radioactive health-care waste</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES specially designed</td>
</tr>
</tbody>
</table>
Incineration is not the same as burning. **Incineration** is one of the only technologies that can treat all types of health-care waste properly and has the advantage of reducing significantly the volume and weight of the waste treated. Incinerators nevertheless require skilled operators, extensive flue gas emission control systems and, frequently, imported spare parts. Incineration generates ash residues and air emissions can contain pollutants such as dioxins and heavy metals.

**Burning** in small-capacity single chamber "incinerators" is a technique often used in HCFs in low income countries. These installations may nevertheless constitute a serious air pollution hazard to the surrounding area due to the relatively low operation temperatures and the lack of emission control systems. If biomedical and health-care waste are treated with single chamber "incinerators", waste fractions such as cytotoxic drugs, chemicals, halogenated materials or waste with a high content of heavy metals (batteries, broken mercury thermometers, etc.) **should not be treated** with this type of system (see table above).

<table>
<thead>
<tr>
<th>Incineration</th>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
</table>
| Pyrolytic or double chamber incinerators (incineration at 800-900°C) | • Elimination of health risks due to the complete destruction of the waste  
• The waste is non-recognizable  
• Fully destroys micro-organisms and sharps  
• Reduces significantly volume and weight of the waste  
• Destroys all types of organic waste (liquids, pharmaceuticals, and other solids)  
• Important quantities of waste can be treated (except for batch incinerators)  
| • High investment costs  
• Requires skilled staff to operate  
• Continuous monitoring required  
• High maintenance, especially for rotary kilns  
| 
| Rotary kiln (incineration at 1200°C and higher) | • Good disinfection efficiency  
• Reduces significantly volume and weight of the waste  
• No need for highly trained operators  
| • Significant emission of atmospheric pollutants  
• Need for periodic removal of slag and soot  
| 
| Single chamber "incinerators" (incineration at low temperatures 300-400°C) | • Good disinfection efficiency  
• Reduces significantly volume and weight of the waste  
| • Significant emission of atmospheric pollutants  
• Need for periodic removal of slag and soot  

**Autoclaving** is the exposure of waste to saturated steam under pressure in an enclosed container. Preparation of material for autoclaving requires segregation to remove unsuitable material and shredding to reduce the size of the individual pieces for greater treatment efficiency. Small autoclaves are common for sterilization of medical equipment but a waste management autoclave can be a relatively complex and expensive systems requiring careful design, appropriate segregation of materials, and a high level of operation and maintenance support. The output from an autoclave is non-hazardous material that can normally be land-filled with municipal waste. There is also a wastewater stream that needs to be disposed of with appropriate care and control. Furthermore, large autoclaves may require a boiler with stack emissions that will be subject to control.
### Steam Disinfection

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Relatively simple to operate (a known technology at health-care facilities)</td>
<td>• Relatively expensive to install and operate</td>
</tr>
<tr>
<td>• Environmentally sound technology</td>
<td>• Requires boiler with stack emissions controls</td>
</tr>
<tr>
<td></td>
<td>• Relatively high maintenance costs</td>
</tr>
<tr>
<td></td>
<td>• Cannot be used to treat some special wastes</td>
</tr>
<tr>
<td></td>
<td>• Generates contaminated wastewater that needs special treatment</td>
</tr>
</tbody>
</table>

### Microwave irradiation

Microwave irradiation is based on the use of a high energy electromagnetic field that heats up rapidly the liquids contained in the waste causing the destruction of the infectious components. The HCW passes through a preparative process which may include segregation to remove undesirable material before it is shredded and then eventually humidified prior to being treated in the irradiation chamber. At the end, the waste goes through a compactor before being disposed of.

Similar to the autoclaving technique, the output from a microwave facility is considered non-hazardous and can be land-filled together with municipal waste. Since the technology does not involve the application of steam, there is a minimal generation of wastewater which can be recycled to the system. Since electricity is the main source of energy for operating this technology, gas emissions are also minimal compared to incineration or even autoclaving, which can require the combustion of fuel for the generation of steam.

### Chemical disinfection

Chemical disinfection, used routinely in HCFs to kill microorganisms on medical equipment has been extended to the treatment of HCW. Chemicals (mostly strong oxidants like chlorine compounds, ammonium salts, aldehydes, and phenolic compounds) are added to the waste to kill or inactivate pathogens. This treatment is most suitable for treating liquid wastes such as blood, urine, stools or hospital sewage. Thermal sterilization should nevertheless be given preference over chemical disinfection for reasons of efficiency and environmental considerations.
**Chemical treatment**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>When applied, the shredding process reduces the volume of the waste</td>
<td>Can't be used to treat some special wastes such as pharmaceuticals, and cytotoxic waste</td>
</tr>
<tr>
<td></td>
<td>Highly skilled operators required, Chemicals used are themselves also hazardous and require special precautions/equipment when used. Final disposal must be same as for untreated special HCW, Generates hazardous waste water that needs treatment</td>
</tr>
</tbody>
</table>

**Land disposal** of untreated HCW is not recommended and should only be used as a last resort option. When this solution has to be used, it is important the HCW be disposed of in a sanitary landfill and rapidly covered: one technique consists in excavating a trench in mature municipal waste at the base of the working face and immediately covering it with a two-metre thick layer of fresh municipal waste.

Alternatively, a specially constructed burial pit can be used. Ideally it should be lined with a material of low permeability such as clay to prevent pollution of shallow groundwater and have a fence around it to prevent scavengers accessing the waste. HCW should be covered immediately with a layer of soil after each load. For added health protection and odor suppression, it is suggested that lime be spread over each waste load. Once the pit is filled, it should be sealed off.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe land filling, Trench method (HCW is buried in a trench excavated in other waste)</td>
<td>Simple and inexpensive to operate, No specific construction costs required, Operates within readily available landfill system, Waste pickers are unable to access the health-care waste</td>
<td>Special health-care waste is not treated and remains hazardous, High demand for coordination between collector and landfill operator, Reduces awareness amongst health-care workers of the need to segregate waste categories, Potentially long/costly transportation to landfill</td>
</tr>
<tr>
<td>Safe land filling, Separate disposal cells (HCW is deposited in specifically designed cells)</td>
<td>Simple and relatively inexpensive to manage if operated in connection with existing landfill for other waste</td>
<td>Special health-care waste is not treated and remains hazardous, Requires a safe landfill with fencing, Requires control of scavenging and animals, Needs conscientious operation according to manual</td>
</tr>
<tr>
<td>Encapsulation, (Filling containers with waste adding an immobilising material and sealing the container)</td>
<td>Simple, low-cost and safe, May be used for sharps, Efficient way of reducing the risk of scavengers gaining access to the waste</td>
<td>Not recommended for non-sharp waste, Must be considered as an temporary solution</td>
</tr>
<tr>
<td>Inertization, (Mixing waste with cement before disposal in order to minimise the risk of leakage of toxic substances contained in the waste)</td>
<td>Simple, low-cost and safe, May be used for pharmaceutical waste</td>
<td>Not applicable to infectious HCW</td>
</tr>
</tbody>
</table>
Annexe 8: HCWM Procedures in Medical Laboratories

The management of HCW in medical laboratories remains a sensitive issue since highly infectious waste are often generated there. International standard procedures of highly infectious waste management should therefore be respected. They are summarized in the table below. Consequently, each laboratory should be equipped with the adequate material and rigorous protocols set-up to ensure a pre-treatment of the highly infectious waste before it joins the other medical waste for final treatment/disposal.

Highly infectious waste from medical laboratories, such as media or culture plates, should be collected in leak proof yellow bags or containers suitable for autoclaving and properly sealed. Ideally, each laboratory should have an autoclave room dedicated for the specific pre-treatment of this category of waste only. No office waste or other miscellaneous waste should be placed in this room, which shouldn’t be either used for waste storage. Once disinfected, medical laboratory waste should be collected and treated with the infectious HCW.

If a distinct autoclave is not available at the medical laboratory to ensure a thermal treatment, highly infectious waste should be disinfected in a solution of sodium hypochlorite in concentrated form and left overnight. It should then be discarded in a specific yellow bag, properly sealed before joining the hazardous HCW.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
</table>
| Segregation         | Highly infectious waste should be:
|                     | - kept in the medical area until it is pre-treated,                   |
|                     | - segregated from other general and medical waste,                    |
|                     | - placed immediately into leak-proof bags or containers               |
| Pre-treatment       | Highly infectious waste should be immediately pre-treated (i.e. autoclaved or chemically treated) before joining the other medical waste. |
| Packaging           | Yellow bags should be labelled with the biohazard symbol and clearly marked with the words "highly infectious waste" with a comment on whether it has been pre-treated or not |
| Labelling           | Yellow bags should be labelled with the name of the institution and department, type of waste, date, name and signature of person sealing the bag/container. |
| Storage, transport and treatment | Disinfected highly infectious waste packaged in yellow bags is no longer regarded as highly infectious and can therefore leave the medical area with other yellow-bagged waste, stored, transported and disposed of |

Procedures for the management of highly infectious waste

During the handling of HCW in medical laboratories, a number of precautions should be taken to avoid cross-contamination, such as:

- The re-useable laboratory items should never be mixed with disposable ones;
- The contaminated items must be autoclaved or alternatively chemically disinfected and should never be discarded with general waste;
- Single-use/disposable laboratory items must be autoclaved and never discarded with general waste;
- All sharps (including broken glass) must be autoclaved and never discarded with general waste. They must be disposed of in approved yellow sharps containers.
Annexe 9: Cost of Equipments of Large Heath-Care Facilities

### Dar es Salaam and Mwanza (Central Incineration)

<table>
<thead>
<tr>
<th>Unit price</th>
<th>Needs</th>
<th>Total price</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD</td>
<td>TSh</td>
<td>USD</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Segregation &amp; packaging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 l plastic bags</td>
<td>400000</td>
<td>12000</td>
</tr>
<tr>
<td>250 l polyethylene bags</td>
<td>500000</td>
<td>15000</td>
</tr>
<tr>
<td>250 l polyethylene boxes</td>
<td>600000</td>
<td>18000</td>
</tr>
<tr>
<td>Protective equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gloves</td>
<td>10000</td>
<td>0</td>
</tr>
<tr>
<td>Aprons</td>
<td>20000</td>
<td>0</td>
</tr>
<tr>
<td>Masks</td>
<td>25000</td>
<td>0</td>
</tr>
</tbody>
</table>

Sub-total I | 1255000 | 470000 |

### Annual Costs

| Segregation & packaging | | | |
| 80 l plastic bags | 400000 | 12000 | 1180000 |
| 250 l polyethylene bags | 500000 | 15000 | 1450000 |
| 250 l polyethylene boxes | 600000 | 18000 | 1780000 |
| Protective equipment | | | |
| Gloves | 10000 | 0 | 10000 |
| Aprons | 20000 | 0 | 20000 |
| Masks | 25000 | 0 | 25000 |

Sub-total II | 1255000 | 470000 |

### TOTAL

2490000 | 8220000 |

### Transportaion

| 4 m enclosed vans | 2500 | 1800000 | 13500 | 1140000 |

### District: Regional and Other Hospitals located in small urban settings

<table>
<thead>
<tr>
<th>Unit price</th>
<th>Needs</th>
<th>Total price</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD</td>
<td>TSh</td>
<td>USD</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Segregation &amp; packaging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 l plastic bags</td>
<td>400000</td>
<td>12000</td>
</tr>
<tr>
<td>250 l polyethylene bags</td>
<td>500000</td>
<td>15000</td>
</tr>
<tr>
<td>250 l polyethylene boxes</td>
<td>600000</td>
<td>18000</td>
</tr>
<tr>
<td>Protective equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gloves</td>
<td>10000</td>
<td>0</td>
</tr>
<tr>
<td>Aprons</td>
<td>20000</td>
<td>0</td>
</tr>
<tr>
<td>Masks</td>
<td>25000</td>
<td>0</td>
</tr>
</tbody>
</table>

Sub-total I | 1255000 | 470000 |

### Annual Costs

| Segregation & packaging | | | |
| 80 l plastic bags | 400000 | 12000 | 1180000 |
| 250 l polyethylene bags | 500000 | 15000 | 1450000 |
| 250 l polyethylene boxes | 600000 | 18000 | 1780000 |
| Protective equipment | | | |
| Gloves | 10000 | 0 | 10000 |
| Aprons | 20000 | 0 | 20000 |
| Masks | 25000 | 0 | 25000 |

Sub-total II | 1255000 | 470000 |

### TOTAL

2490000 | 8220000 |

### TOTAL

2873000 | 2615540000 |

Note: The costs are estimations.
- **On-site treatment using low-cost incinerator**:
  - 2.5 l polyethylene boxes (100 boxes) for 15000 liters of Clinical Waste is daily generated.
- The GMM uses the equipment of Governmental Facilities only.

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**Nation of Health Care Waste Management Plan** - 24 February 2004

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