NATIONAL HEALTH CARE

WASTE MANAGEMENT PLAN

FOR KENYA
Executive Summary

With the ravages caused by emerging and re-emerging morbidities and infections such as HIV and AIDS, hepatitis B and C, respectively, among others, proper management of health care waste is increasingly assuming a critical role in efforts to control health risks associated with exposure to improperly managed health care waste. The Ministry of Health (MoH) in collaboration with the National AIDS Control Council (NACC), World Bank, World Health organization (WHO), Centre for Disease Control (CDC) and John Snow Inc (JSI) Infection Safety Project plans to provide a new impetus through supporting the development of a National Health Care Waste Management Plan for the period 2006-2015 for Kenya. As a first step in setting the framework for the development of the Plan of Action on Health Care Waste Management (HCWM), a study aimed at determining and assessing the prevailing situation of health care waste management at all levels of health institutions was conducted.

The broad objective of the study was to undertake a situational analysis of health care waste management through assessment of policy, legal and administrative framework in relation to Health Care Waste Management (HCWM); including generation, segregation, storage and disposal systems of Health Care Waste (HCW), what is generally referred to as “cradle to grave” of health care waste management. The study also assessed the existing technologies, levels and presence of scavenging and recycling; established the cost benefits of public–private partnership in health care waste management and finally reviewed existing training curricula, identifying unmet needs and proposing appropriate and affordable strategies for the training at various levels.

Rapid Assessment Appraisal tools, including structured and semi-structured questionnaires, check lists and guides for participatory appraisal, among others were employed in the data collection. A sample of health care institutions ranging from those at the national, provincial, district, health centre and dispensary levels were picked randomly to cover all the 8 administrative provinces of Kenya.

The study findings indicate that to a given extent there has been some positive effort in the management of HCW in Kenya that is worth mentioning and upon which the need to develop the Plan of Action for the management of HCW has been built. Specifically, the Ministry of Health in spite of the fact that it does not have adequate resources for Health Care Waste Management, it does have in almost all the HCFs the Public Health Technicians (PHTs) and Public Health Officers (PHOs), whom the study found out are well trained in handling HCWs and are responsible for the management of HCW generated in these HCFs. These officers have been discharging their duties in respect to HCWM inspite of several challenges and constraints. Most HCFs have also employed casuals and subordinate staff who play a major role in the collection and disposal of HCWs although they have received no or inadequate training in HCWM.

The key findings at different points of HCWM were as summarised here below:

At the health care facilities, inadequate or lack of segregation of waste, there were lack of HCWM Strategy, inadequate HCW receptacles, inappropriate internal HCW storage facilities, inappropriate internal transport facilities, delay in HCW collection, lack of budgetary allocations for HCW, tedious procurement approval process, lack of Personal Protective Gears/PPE, lack of pre-treatment of HCW before final disposal, and lack of waste minimisation strategy. However in all HCFs sampled, the waste that is properly segregated are sharps, which are placed in sharp boxes.

At the HCW treatment plants, most of the HCFs have broken /dilapidated “incinerators”, there is lack of back up incinerators in cases of failure, broken down Auto Clave equipments, small capacity of incinerator and low incinerator stacks.
At the Waste Disposal Sites there were lack of sanitary landfills, presence of HCWs in public dumping sites, presence of Scavengers, poor siting of dumpsites, leachate and pollution of soil and water.

With regard to private sector involvement in HCW Management, it was found out that they lack infrastructure such as Standard Refuse Vehicles and incinerators. The current ones are open trucks, tractors, canters and pickups. The study further revealed that Personal Protective Equipment (PPE) is not provided, save for overalls and gloves in some areas. In regard to training, all the workers in the private sector have not been trained in waste management. Private sector participants seem to prefer affluent areas leaving the non affluent areas un-serviced thereby compounding the problem of HCWM. It was found out that no private firm exists specifically for purposes of handling Health Care Waste. Despite most healthcare institutions having incinerators, no private firm or council have incinerator (s) that could be commercialised. Health Care Waste is not separated by private firms and this implies that recycling and proper disposal is never practised and finally private waste collectors are not controlled or monitored by any local or central government arm.

The findings in Training and Awareness on Health Care Waste Management showed little or no awareness on HCWM among different cadres of personnel engaged in HCW including the health care workers, general public and scavengers. However, John Snow Inc (JSI) and the Ministry of Health (MoH) are running a joint project on injection safety in two districts in Kenya namely Kiambu and Bondo respectively, that to a given extent includes aspects of HCW segregation and colour coding. More so, there are existing institutions offering training in solid waste management, public health and epidemiology, though none of the training curricula focuses specifically on HCW.

The findings in Legal and Regulatory Framework indicated that there are weak institutional and regulatory framework on HCWM specifically the Public Health Act which does not make a specific mention of HCW other than making reference to nuisance. Poor enforcement of the existing laws that touch on HCWs was found to be a contributing factor to poor HCWM. There was also delay in the gazettement of the draft policies addressing HCW including the Bio-medical policy, Environmental Sanitation policy, Guidelines on Hazardous Health Care Waste and Guidelines on Injection Safety, among others.

The afore-stated findings formed the basis for development of Kenya’s National Plan of Action on Health Care Waste Management.

The National Health Care Waste Management Plan, which forms the second part of this report, has been developed based on the findings of the Situational Analysis. The Plan has in effect, for ease of reading, been detailed in separate Action Plans addressing different but mutually integrated aspects of HCWM. These are:

- Plan of Action for Training and Awareness Creation on HCW including a communication strategy.
- Plan of Action on HCW Treatment Technologies including the social concerns and risks associated with HCW.
- Plan of Action on Legislative and Institutional Framework.
- A Monitoring, Evaluation and Reporting Plan.

The process of developing the Action Plan culminated in a stakeholders’ workshop that brought together all the relevant stakeholders from the government, civil society, academia and private sector whose significant comments on the draft document were used in developing the final National Health Care Waste Management Plan for Kenya.

The Action Plan for Health Care Waste (HCW) Management in Kenya is based on the Vision of facilitating the establishment of an integrated, environmentally sustainable, occupationally healthy and safe, financially
viable, institutionally feasible and operationally practical, comprehensive “cradle-to-grave” management system for HCW, covering all HCW generators and addressing the short, medium and long-term needs over the period 2006 – 2010, with the option of extending the period by a further 5 years if circumstances dictate.

Although focussing on Health Care Risk Waste (HCRW), Health Care General Waste (HCGW) is also included in the Action Plan in as far as it would impact on the effectiveness with which HCRW is managed. All categories of HCRW other than radioactive waste are included in the HCW strategy. Radioactive waste is handled in accordance with the provision of the Radiation Protection Act, Chapter 243 and falls outside the jurisdiction of the HCRW management industry.

HCW generators, service providers (transport, treatment and disposal) as well as regulating authorities at national, provincial, district and local level are all affected by the Action Plan and are therefore identified in terms of their roles and responsibilities for effective implementation thereof.

For the sake of prioritising activities, the Action Plan is presented for implementation in four phases. Although the need was expressed during the stakeholder workshop for the overall implementation of the HCW Plan to be done over a 5-year period, there are certain reservations as to whether that will be achievable. The option for implementation is therefore presented for implementation over 5 years, but should this timeframe not be achievable, it is proposed that the process reverts back to a 10-year Action Plan as indicated in Italics below:

3 Consolidation Phase (Jan. 2006 to Dec. 2006) (Alternatively Jan. 2006 to Dec. 2007): Aimed at improving the existing HCW management systems in order to address the most urgent occupational health and safety needs. Activities to be implemented under this phase include training of staff on appropriate HCW segregation, containerisation, handling and storage, supply and maintenance (including disinfection) of appropriate reusable and disposable HCW containers, provision of appropriate internal HCW storage facilities, provision of appropriate internal HCW transport facilities and temporary revamping of existing onsite HCRW central stores, treatment facilities and disposal facilities.

3 Development Phase (Jan. 2007 to Jun. 2008) (Alternatively Jan. 2008 to Dec. 2010): The focus will, during this Phase, be on setting appropriate treatment efficiency standards as well as emission standards. Against the background of the nationally agreed upon standards, various options will be evaluated for cost effective HCW management service delivery. This phase will further include all preparations required for the roll-out (implementation) of the selected HCW management service delivery models including setting appropriate thermal and non-thermal HCRW treatment efficiency standards with corresponding timeframes for compliance; setting appropriate HCRW treatment emission standards with corresponding timeframes for compliance; investigating different options and determine the viability of Public-Private-Partnerships for HCW management service delivery; determining the viability of regionalising HCW management service delivery; develop / upgrade central HCW storage facilities at all HCW generators; develop a HCW treatment and disposal infrastructure plan, develop technical specifications, identify sources of funding and call for tenders for the supply, installation, construction and commissioning of HCW treatment and disposal facilities; develop commercial terms and technical specifications, identify sources of funding and potential business partners and invite proposals on Private-Public-Partnerships; develop commercial terms and technical specifications, identify sources of funding and potential service providers and invite tenders for the outsourcing of HCW management services.

3 Implementation Phase (Jul. 2007 to Dec. 2010) (Alternatively Jan. 2011 to Dec. 2015): Having set the standards and having selected the most appropriate models for HCW management service delivery, this phase will focus on the establishment of operational structures as well as physical supply, installation and construction of equipment and facilities required for environmentally sound, yet healthy and safe HCW treatment and disposal throughout Kenya which will include warding contracts for the supply, construction and commissioning of HCW treatment and disposal infrastructure, introduce management systems, appoint and train staff and commission HCW management facilities; entering into Private-Public-
Partnerships agreements, introduce management systems, appoint and train staff, develop HCW treatment and disposal infrastructure and commission facilities; or awarding Contracts to HCW management service providers for the outsourcing of all or selected HCW management services and finally operate fully integrated HCW management systems.

3 Monitoring and Control Phase (Jan. 2011 onwards) (Alternatively Jan. 2016 onwards): Although identified as a separate phase, monitoring and control will be executed throughout the process, i.e. starting from the consolidation phase. Progress on the implementation of the Action Plan will be evaluated and where required, adjustments are to be made to already upgraded HCW management systems to ensure optimum results. Highlighting the fact that this phase is to continue subsequent to the development and implementation of improved HCW management systems in Kenya, stresses the importance of ongoing involvement by the executing as well as the regulating authorities.

Having formulated the Vision for the Action Plan as described above, the next step in the Action Plan formulation process was to identify and evaluate problems and shortcomings in the implementation of an environmentally sound, safe and healthy HCW management system. During the status quo study on HCW management in Kenya, a number of needs were identified and recorded. In addition to this, various other shortcomings were identified and listed during consultation with a wide spectrum of stakeholders. All of the needs and shortcomings identified were categorised in accordance with what was considered to be its main impact sphere, i.e. environmental, occupational health & safety, institutional & organisational, technical, financial, legal, information & awareness as well as public health.

For each need identified, one or more activities to be undertaken to address the particular need are described. The list of Activities, including appropriate timeframes, is summarised in the main text of this document.

Against the background of the principles and criteria, the various activities have been combined to form a short term, medium term and long term Action Plan, also identifying the organisation / institution responsible for execution of the various Activities.

In order to be able to implement the Action Plan, certain resources will be required and the next phase of the Action Plan formulation was therefore aimed at estimating the financial input necessary to implement the required Action Plan. All resource requirements are presented in monetary terms, thereby allowing for the overall input to be presented in uniform and comparable units.

Having determined the resources required by each of the institutions or organisations for implementation of the Action Plan, the extent to which the activities will support the overall objective were estimated. This was done by evaluating the anticipated impacts of the various activities in terms of the environment, occupational health and safety, capacity building & awareness for improved HCW management.

The next step in the Action Plan formulation process was to set up a programme for monitoring and evaluation of the level of success with which the various Activities were undertaken. The monitoring and evaluation plan has been developed to occur as an ongoing process not only to be undertaken during the short, medium and long term, but also subsequent thereeto. Should it be found that the Activities were not effectively implemented, or should Activities implemented not provide the required results, future adjustments are to be made that would ensure compliance with the Overall Objective. A monitoring and evaluation (M&E) program will be part of the Ministry of Health Disease surveillance or Health Information Management System at no additional cost. The M&E system will be integrated in these already in place systems so as not to duplicate structures in the ministry and save costs in the implementation of Plan.

The financial resources required for implementing the plan is estimated at Kshs. 9,627,114,917 for the period 2006-2015. In the consolidation phase Kshs. 3.6 billion is required. In addition to that, a sum of approximately
Kshs 723 million will be required annually to ensure that the plan runs smoothly. These estimates will be apportioned as Kshs. 196,944,900 for National Hospital, Referral hospitals Kshs 75,225,000, Provincial Hospitals 75,225,000, District Hospitals, 49,304,900, Health Centres 2,629,250 and Dispensaries 1,449,950.

This Action Plan also proposes the formation of a National Health Care Waste Steering Committee, involving all the key stakeholders. The National HCWM Steering Committee will be primarily responsible for leading and facilitating implementation of the Action Plan. This proposed National Steering Committee is envisaged to emerge as the vehicle to ensure that the implementation of the National Plan of Action adopts a multi-sectoral and community oriented and encompassing approach.
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### Acronyms

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<th>Description</th>
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<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
</tr>
<tr>
<td>AMREF</td>
<td>African Medical Research Foundation</td>
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<tr>
<td>ANC</td>
<td>Ante Natal Care</td>
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<tr>
<td>BCC</td>
<td>Behavioural Change Communication</td>
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<tr>
<td>BSc</td>
<td>Bachelor of Sciences</td>
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<tr>
<td>CAPEX</td>
<td>Capital Expenditure</td>
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<tr>
<td>CBD</td>
<td>Central Business District</td>
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<tr>
<td>CDC</td>
<td>Centre for Disease Control</td>
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<tr>
<td>CH₄</td>
<td>Methane</td>
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<tr>
<td>CO</td>
<td>Carbon Monoxide</td>
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<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Markets for Eastern and Southern Africa</td>
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<tr>
<td>CT</td>
<td>Computerised Tomography</td>
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<tr>
<td>DHMB</td>
<td>District Health Management Board</td>
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<tr>
<td>DHS</td>
<td>Dry Heat Sterilization</td>
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<tr>
<td>DMS</td>
<td>Director of Medical Services</td>
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<tr>
<td>EIA</td>
<td>Environment Impact Assessment</td>
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<tr>
<td>EMCA</td>
<td>Environment Management and Coordination Act</td>
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<tr>
<td>EPA</td>
<td>Environment Protection Agency</td>
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<tr>
<td>EPI</td>
<td>Expanded Programme on Immunisation</td>
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<tr>
<td>ETD</td>
<td>Electro Thermal Deactivation</td>
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<tr>
<td>FP</td>
<td>Family Planning</td>
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<tr>
<td>GOK</td>
<td>Government of Kenya</td>
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<td>HCFs</td>
<td>Health Care Facilities</td>
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<td>HCGW</td>
<td>Health Care General Waste</td>
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<td>HCRW</td>
<td>Health Care Risk Waste</td>
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<td>HW</td>
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<tr>
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<tr>
<td>HIV</td>
<td>Human Immuno-Deficiency Virus</td>
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<tr>
<td>HIS</td>
<td>Health Information System</td>
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<tr>
<td>ICC</td>
<td>Infection Control Committee</td>
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<tr>
<td>IEC</td>
<td>Information Education and Communication</td>
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<tr>
<td>IMR</td>
<td>Infant Mortality Rate</td>
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<tr>
<td>JICA</td>
<td>Japan International Cooperation Agency</td>
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<td>JSI</td>
<td>John Snow Incorporated</td>
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<td>KDHS</td>
<td>Kenya Demographic and Health Survey</td>
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<td>KEMRI</td>
<td>Kenya Medical Research Institute</td>
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<td>KEMSUA</td>
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<td>Kenya Expanded Programme on Immunisation</td>
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<td>KMPDB</td>
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<td>KMTC</td>
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<td>KNH</td>
<td>Kenyatta National Hospital</td>
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<td>Kenya Radiation Protection Board</td>
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<td>MBchB</td>
<td>Bachelor of Medicine and Surgery</td>
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<td>MCH</td>
<td>Mother and Child Health</td>
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<td>MMIS</td>
<td>Making Medical Injections Safety project</td>
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<td>MoF</td>
<td>Ministry of Finance</td>
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<tr>
<td>MoH</td>
<td>Ministry of Health</td>
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<tr>
<td>MoLG</td>
<td>Ministry of Local Government</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>MPH</td>
<td>Master of Public Health</td>
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<tr>
<td>NACC</td>
<td>National AIDS Control Council</td>
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<td>NASWAMA</td>
<td>Nairobi Solid Waste Management Association</td>
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<tr>
<td>NCC</td>
<td>Nairobi City Council</td>
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<tr>
<td>NEMA</td>
<td>National Environment Management Authority</td>
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<tr>
<td>NGO</td>
<td>Non Governmental Organization</td>
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<tr>
<td>NHIF</td>
<td>National Hospital Insurance Fund</td>
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<tr>
<td>OSH</td>
<td>Occupational Safety and Health</td>
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<tr>
<td>OVC</td>
<td>Orphan and Vulnerable Children</td>
</tr>
<tr>
<td>PEPFAR</td>
<td>Presidential Emergency Program Fund for Aids Relief</td>
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<tr>
<td>PHD</td>
<td>Public Health Department</td>
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<tr>
<td>PHO</td>
<td>Public Health Officer</td>
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<tr>
<td>PHTs</td>
<td>Public Health Technicians</td>
</tr>
<tr>
<td>PLWA</td>
<td>People Living With Aids</td>
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<tr>
<td>PMCT</td>
<td>Prevention of Mother to Children Transmission</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>RoK</td>
<td>Republic of Kenya</td>
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<tr>
<td>SO₂</td>
<td>Sulphur Dioxide</td>
</tr>
<tr>
<td>TB</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>VCT</td>
<td>Voluntary Counselling and Testing</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
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<td>WHO</td>
<td>World Health Organization</td>
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1. Introduction

1.1 Background to the study
Health care waste is defined as the total waste stream from health care and includes all the waste generated by health care establishments, research facilities and laboratories, as well as waste originating from minor or scattered sources such as that produced in the course of health care undertaken in the home. Health care waste is categorized into Health Care Risk Waste (HCRW) – which includes all the waste that can be considered dangerous or hazardous to either human health or the environment, and Health Care General Waste (HCGW) – which contains no products or potential properties that are known to have either a reactive or toxic effect, either to humans or the environment. This is generated during the administrative and housekeeping functions of the health care facility and includes waste from food preparation, cleaning and sweeping, repair and replacement, clerical and office services, packaging, cardboard, damaged containers, discarded flowers, bags, tins, wrappings and plastics (Coulson and Magner, 2004).

Health care risk waste are unique forms of solid and liquid waste generated in the process of diagnosis, treatment, prevention of, or research on human and animal disease. Each year large amounts of health care risk waste are produced by hospitals, health centres, dispensaries, community based health care providing establishments, private medical and dental clinics, and research facilities, among others. These waste, when poorly managed, may compromise the quality of patient care; present occupational health risks to those who generate, handle, package, store, transport, treat and dispose of them, and environmental and public health risks through inappropriate treatment and/or disposal which may contribute to environmental pollution and the spread of infectious diseases such as AIDS, hepatitis, tuberculosis and cholera, among others. The concern over this category of waste is heightened by the existence of new and emerging pathogens as well as increasing drug resistance in re-emerging ones.

Although the management of health care risk waste has become a serious concern, few governments in the African continent have provided guidance on their effective management. Furthermore, few individuals on the health facilities’ management staff are familiar with the elements of proper waste management and in many instances waste handling is left to the poorly educated and lowest category of workers – who quite often operate without any training, guidance or supervision (WHO, 2004).

It is important that health facilities realize the fact that an effective programme of health care waste management is an integral part of a health facility’s infection control programme, and therefore critically linked to the quality of patient care and worker health and safety. When properly implemented and enforced, effective waste management can have distinct benefits, especially in economic perspectives, such as cost savings linked to waste reduction and improved purchasing practices.

Health care waste includes all the waste generated within a health care facility. These can be categorized into two, namely Health Care General Waste (HCGW) and Health Care Risk Waste (HCRW). Health Care General Waste – contains no products or potential properties that are known to have either a reactive or toxic effect, either to humans or the environment. It is generated during the administrative and housekeeping functions of the health care facility and includes waste from food preparation, cleaning and sweeping, repair and replacement, clerical and office services, packaging, damaged containers, discarded flowers, bags, tins, wrappings and plastics. Health care risk waste – is also referred to as bio hazardous waste. This category of health care waste is broken into the following components: infectious waste - which forms the largest component of health care risk waste generated in health care facilities. It consists of discarded materials arising out of activities on humans that have the potential of transmitting infectious agents to humans, such as discarded materials or equipment from the diagnosis, treatment and prevention of disease that have been in contact with body fluids; waste from infection and isolation wards, such as cultures, tissues, dressings,
excreta, swabs or other items soaked with blood; soiled nappies and blood bags; waste that has been in contact with infected patients undergoing haemodialysis e.g. dialysis equipment such as tubing and filters, disposable towels, gowns, aprons and gloves; any other utensils and materials which have been in contact with infected persons and animals, also includes infectious liquid waste such as faeces, urine, body secretions (such as sputum or lung secretions) from infected patients, usually found in isolation wards or Intensive Care Units (ICU); sharp waste, which includes syringes, needles, scalpels, blades, infusion sets, knives and broken glass that have been in contact with potentially infectious waste; pathological (anatomical) waste, which includes human tissue such as placentas, organs, body parts, non-viable fetuses, amputations, and other similar wastes from surgeries, biopsies, autopsies, among others; hazardous chemical waste, which includes all discarded solid, liquid and gaseous chemicals, for example, from diagnostic and experimental work, cleaning, housekeeping and disinfecting procedures. Examples of chemicals used include formaldehyde, gluteraldehyde, organic compounds in disinfectants, oils and pesticides, and inorganic compounds in acids, caustic and ammonia solutions; and pharmaceutical waste, which include all expired, unused, spilled and contaminated pharmaceutical products, drugs and vaccines. It also includes all sera and bottles with residues of drugs, and all drugs and equipment used for the mixing and administration of cytotoxic drugs, gloves, masks, connecting tubing and drug vials. A sub-category of pharmaceutical waste is the “genotoxic waste” – also known as anti-neoplastic drugs and includes primarily cytotoxic drugs. Other categories of health care risk waste are radioactive waste, which comprises of waste emanating from radiology departments, CT scanners, nuclear medicine services, laboratories that use unsealed radioactive sources for diagnosis, therapeutic or research purposes; waste with high content of heavy metals such as mercury which is a particular hazard in health care facilities due to its prevalent use in several devices; and pressurized containers such as gas cylinders, cartridges and aerosol cans containing many different hazardous substances. Some of them, like gas cylinders, are reusable and others, like aerosol cans, are disposable (Coulson and Magner, 2004).

1.2 Problem Statement

World Health Organization (2004) estimates that about 10 – 25% of health-care waste is regarded as hazardous and may create a variety of health risks. Infectious waste is suspected to contain pathogens (bacteria, viruses, parasites or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. Health-care waste is considered the second most hazardous waste after radioactive waste in the United Nations listing as quoted in the Basel convention to which Kenya is a member.

Health care risk waste are unique forms of solid and liquid waste generated in the process of diagnosis, treatment, prevention of, or research on human and animal disease. Each year large amounts of health care risk waste are produced by hospitals, health centres, dispensaries, home based health care providing establishments, private medical and dental clinics, and research facilities, among others. Theses waste, when poorly managed, may compromise the quality of patient care; present occupational health risks to those who generate, handle, package, store, transport, treat and dispose of them, and environmental and public health risks through inappropriate treatment and/or disposal which may contribute to environmental pollution and the spread of infectious diseases such as AIDS, hepatitis, tuberculosis and cholera, among others. Concern over this category of waste is heightened by the existence of new and emerging pathogens as well as increasing drug resistance in re-emerging ones.

Against the reality of a fast growing epidemic and the prohibitive costs of antiretroviral drugs to treat most people with AIDS, most efforts are aimed at prevention through increasing awareness about risk of transmission of HIV and promoting positive behaviour change. one such way of preventing HIV transmission is to ensure the maintenance of safe blood supply and equipment at health facilities; Poor healthcare waste management is one way through which transmission of HIV virus can occur to the uninfected especially through accidental needle- pricks within the health facilities or at the dump sites. studies have revealed that contact with infected blood or body fluid is a major risk to HIV transmission, which health workers, traditional
birth attendants, traditional male or female circumcisers and others within the healthcare delivery system can minimize by practicing universal precautions such as wearing gloves and properly disposing of different categories of healthcare risk waste such as sharps, infectious wastes and pathological wastes (RoK, 2001).

Due to numerous challenges in the area of HCW management and particularly with the emergence of diseases such as HIV and hepatitis B & C, the Kenyan Ministry of Health was giving new impetus to better HCW management practices through the development of the country’s Plan of Action. The preparation of Kenya’s Plan of Action for HCW management (for the years 2006-2015) was therefore the initiative of the Ministry of Health in collaboration with the National AIDS Control Council (NACC), the World Bank, World Health Organisation (WHO) and CDC (JSI Injection safety).

The Division of Environmental Health has over time been addressing the issue of liquid and solid waste and guidelines on hazardous wastes have been developed. However the need has been identified to address HCW separately because of its hazardous nature. It is instructive to note that the Kenya Expanded Programme on Immunization - KEPI has tried to address the problem of HCW, albeit to a limited extend and targeting only HCRW from immunisation, which only contributes between 5% and 10% of routine immunization and occasional supplemental immunization HCRW.

1.3 Rationale for the study

All individuals exposed to hazardous health-care waste are potentially at risk, including those within health-care establishments that generate hazardous waste, and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management. The main groups at risk include medical doctors, nurses, health-care auxiliaries, and hospital maintenance personnel; patients in health-care establishments or receiving home care; visitors to health-care establishments; workers in support services allied to health-care establishments, such as laundries, waste handling, and transportation; workers in waste disposal facilities (such as landfills or incinerators), including scavengers. The hazards associated with scattered, small sources of health-care waste should not be overlooked either; waste from these sources includes those generated by home-based health care, such as dialysis, and those generated by illicit drug use (usually intravenous) (WHO, 2004).

Infectious waste may contain any of a great variety of pathogenic micro organisms. Pathogens in infectious waste may enter the human body by a number of routes, i.e. through a puncture, abrasion, or cut in the skin; through the mucous membranes; by inhalation; and by ingestion. There is particular concern about infection with Human Immunodeficiency Virus (HIV) and hepatitis viruses B and C, for which there is strong evidence of transmission via health-care waste. These viruses are generally transmitted through injuries from syringe needles contaminated by human blood. This therefore calls for proper management of health-care risk waste (Coulson and Caminsky, 2004).

The existence in health-care establishments of bacteria resistant to antibiotics and chemical disinfectants may also contribute to the hazards created by poorly managed health-care waste. It has been demonstrated, for example, that plasmids from laboratory strains contained in healthcare waste were transferred to indigenous bacteria via the waste disposal system. Moreover, antibiotic-resistant *Escherichia coli* have been shown to survive in an activated sludge plant. Concentrated cultures of pathogens and contaminated sharps (particularly hypodermic needles) are probably the waste items that represent the most acute potential hazards to health (WHO, 2004).

The study was informed by the need for the national agency responsible for the disposal of health-care waste, MoH, Kenya, and the agency responsible for HIV/AIDS control and prevention, NACC, to be fully aware of current levels of waste production and of national waste management practices; this would provide the baseline information needed to develop a national programme for sound health-care waste management.
1.4 Objectives of the Study

1.4.1 General objective
To determine the status of health-care waste management in Kenya

1.4.2 Specific objectives
1. To assess the existing system of health-care waste management and characterize health-care waste in Kenya.
   a. Determine the types and quantities of health care waste generated.
   b. Assess waste segregation, labelling, storage, collection, transportation and disposal.
   c. Establish health and safety measures taken in health-care waste management.
   d. Assess the assignment of waste management responsibilities.
   e. Assess the financial implication of health-care waste management

2. To assess the Policy, Legal and Administrative Framework in place for health-care waste management.
   b. Assess legal framework in place.
   c. Assess administrative framework in place.

3. To determine the technology in use and siting of the health-care waste treatment and disposal facilities.
   a. Assess the various existing technologies for health-care waste management
   b. Recommend alternative technologies and facility sizes for health-care waste treatment and disposal.
   c. Develop a proposed model waste management plan for a dispensary, health centre and hospital with financial resource requirements.
   d. Assess the location/ siting of treatment/disposal facilities.
   e. Review the general transport and traffic systems in use relative to the sites.
   f. Analyze the site / do environmental audit.

4. To review the existing training and public awareness programmes on health care waste management.
   a. Review existing training on health care waste management at community level and in health facilities.
   b. Review public awareness on health care waste management at community level and in health facilities.
   c. Carry out training needs assessment on health-care waste management at all levels.

5. To establish the extent of private sector participation in Health-Care waste management in Kenya.

6. To assess the level of scavenging and/or recycling taking place inside the health care facilities, along the transportation routes and at the final disposal sites.
   a. Determine social issues related to scavenging.
      b. Identify points where scavenging is taking place
      c. Analyze the type and composition of wastes frequently scavenged and determine why.
c. Find out who the human scavengers were what use the scavenged materials were being put to, and the markets for the scavenged wastes.

d. Find out the quantities of wastes being scavenged on daily basis.

e. Establish current status and efforts in the various institutions towards curbing scavenging including awareness on the risks.
2.0 The Study Area

The study was carried out in the republic of Kenya. It covered all the eight provinces of Kenya, with the study facilities being selected using some predetermined sampling techniques.

2.1 Location, Size and Economy

Kenya is situated in the eastern part of the African continent. The country lies between 5 degrees north and 5 degrees south latitude and between 24 and 31 degrees east longitude. It is almost bisected by the equator. Tanzania borders it to the south, Uganda to the west, Ethiopia and Sudan to the north, Somalia to the northeast, and the Indian Ocean to the southeast.

Administratively the country is divided into 8 provinces and 72 districts. It has a total area of 582,646 square kilometres of which 571,466 square kilometres form the land area. Approximately 80 percent of the land area of the country is arid or semi-arid, and only 20 percent is arable.

The country falls into two regions: lowlands, including coastal and Lake Basin lowlands, and highlands, which extend on both sides of the Great Rift Valley. Rainfall and temperatures are influenced by altitude and proximity to lakes or the ocean. There are four seasons in a year: a dry period from January to March, the long rainy season from March to May, followed by a long dry spell from May to October, and then the short rains between October and December.

The Kenyan economy is predominantly agricultural with a strong industrial base. The agriculture sector contributes 25 percent of the Gross Domestic Product (GDP). Coffee, tea, and horticulture (flowers, fruits, and vegetables) are the main agricultural export commodities; in 2002, the three commodities jointly accounted for 53 percent of the total export earnings (Central Bureau of Statistics, 2003a). The manufacturing sector contributes about 13 percent of the total GDP and contributes significantly to export earnings, especially from the Common Market for Eastern and Southern Africa (COMESA) region. Despite recent declines, the tourism sector has also contributed to improving the living standards of Kenyans. The economy has undergone a structural transformation since 1964. There has been gradual decline in the share of the GDP attributed to agriculture, from over 30 percent during the period 1964-1979 to 25 percent in 2000-2002. The manufacturing sector has expanded from about 10 percent of the GDP in the period 1964-1973 to 13 percent in 2000-2002.

The performance of the Kenyan economy since the country became independent has been mixed. In the first decade after the country’s independence, the economy grew by about 7 percent per annum, attributed to expansion in the manufacturing sector and an increase in agricultural production. Since then, there has been a consistent decline in the economy, reaching the lowest GDP growth level of about 2 percent between 1996 and 2002. The consistent poor growth performance has failed to keep pace with population growth. The weak performance has been due to external shocks and internal structural problems, including the drought of the 1980s, low commodity prices, world recession, bad weather, and poor infrastructure.

The poor growth of the economy has contributed to deterioration in the overall welfare of the Kenyan population. Similarly, the economy has been unable to create jobs at a rate to match the rising labour force. Poverty has increased, such that about 56 percent of the population live in poverty and over half live below the absolute poverty level (Central Bureau of Statistics, 2003a). The number of poor people is estimated to have risen from 11 million in 1990 to 17 million in 2001. The worsening living standard is shown by rising child mortality rates, increasing rates of illiteracy, and rising unemployment levels. The HIV/AIDS pandemic has also had a devastating impact on all sectors of the economy, through loss of production and labour force. Against this background, the government of Kenya in 2003 launched the Economic Recovery Strategy proposes to (i) increase immunization coverage to about 75%; (ii) reduce child and mother mortality rate; (iii) reduce malaria in-patient mortality to 15% as a share of total patient mortality; (iv) put in place strategies to
reduce HIV prevalence and improve access to affordable drugs; (v) improve health service delivery through
decentralization of health care services; and (vi) increase expenditure on preventive and basic health

Ministry of Health expenditure as a share of GDP, though low internationally, has been increasing from 1.3 per
cent of GDP in 1999/2000 to an estimated 1.96 per cent in 2002/03. Expenditure as a share of the total budget
has been on a slight upward trend although it is at 9 per cent it is significantly below the Abuja Declaration
target of 15 per cent. The Ministry of Health’s share of total budget has been increasing as a result of donor
funding in the Development budget.

Expenditure within the MoH has not been consistent with Government policy priorities. Expenditures for
curative health have remained at about one half of the total. In comparison expenditures for preventive and
promotive health declined from 10.4 per 92 cent in 2000/01 to 5.5 per cent in 2001/02. Expenditures on rural
health services have increased only modestly from 9 per cent in 1999/2000 to 11.7 per cent on 2001/02. Expenditure on Kenyatta National Hospital and Moi Referral and Teaching Hospital together accounted for
14.5 per cent of the total in 2001/02.

In addition budget plans to reallocate increased resources to policy priorities for MoH have not been fulfilled.
For example, the allocation to rural health services was budgeted to increase from 13.9 per cent of total
expenditure to 35.9 per cent in 2001/02 compared to actual expenditure of 11.7 per cent of the total in
2001/02. The allocation for curative was budgeted to fall from 55.9 per cent of the total in the 1999/2000 to
32.8 per cent of the total in 2001/02. In practice actual expenditures in 2001/02 were 48.5 per cent of the total.
The allocation for Kenyatta Teaching Hospital was 9.8 per cent of the total budgeted in 1999/00 and 9.4 per
cent of the total budgeted in 2001/02. This compares to actual expenditure of 12.2 per cent of the total in
2001/02. (CBS 2003)

2.2 Demographic Trends

The population of Kenya increased from 10.9 million in 1969 to 28.7 million in 1999 (Central Bureau of
Statistics, 1994, 2001a) (see Table 1) of which 5% are under one year; 20% under five years; and 50% under
fifteen years. Women of reproductive age group i.e. 15-49 years constitute 20% of the population.

The population growth rate that stood at 3 per cent at the independence rose to a record 4 per cent in 1979,
before declining to 2.9 percent in mid-1995. Life expectancy is currently estimated at 54 years with AIDS.
Without the pandemic, however, it would have been 60. The results of the previous censuses indicate that the
annual population growth rate was 2.9 percent per annum during the 1989-1999 period, down from 3.4
percent reported for both the 1969-1979 and 1979-1989 inter-censal periods.

The decline in population growth is a realisation of the efforts contained in the National Population Policy for
Sustainable Development (National Council for Population and Development, 2000) and is a result of the
decline in fertility rates since the mid-1980s. In contrast, mortality rates have risen since the 1980s,
presumably due to increased deaths from the HIV/AIDS epidemic, deterioration of health services, and
widespread poverty (National Council for Population and Development, 2000). As a result of changing
population dynamics, the total population of Kenya was projected to be 32.2 million by 2003 (Central Bureau

The crude birth rate increased from 50 per 1,000 in 1969 to 54 per 1,000 in 1979, but has declined to 48 and
41 per 1,000 in 1989 and 1999, respectively. After a long decline, the crude death rate has increased from 11
per 1,000 in 1979-1989 to 12 per 1,000 for the 1989-1999 period. Similarly, the infant mortality rate decreased
from 119 deaths per 1,000 live births in 1969, to 88 per 1,000 in 1979, and to 66 per 1,000 in 1989, but has
since increased to 77 per 1,000 in 1999. As a result of the high fertility and declining mortality in the past, the
country is characterized by a youthful population, with almost 44 percent younger than 15 years and only 4
percent age 65 and older.
Table 1. Basic demographic indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1969</th>
<th>1979</th>
<th>1989</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>10.9</td>
<td>16.2</td>
<td>23.2</td>
<td>28.7</td>
</tr>
<tr>
<td>Density (pop./km2)</td>
<td>19.0</td>
<td>27.0</td>
<td>37.0</td>
<td>49.0</td>
</tr>
<tr>
<td>Percent urban</td>
<td>9.9</td>
<td>15.1</td>
<td>18.1</td>
<td>19.4</td>
</tr>
<tr>
<td>Crude birth rate</td>
<td>50.0</td>
<td>54.0</td>
<td>48.0</td>
<td>41.3</td>
</tr>
<tr>
<td>Crude death rate</td>
<td>17.0</td>
<td>14.0</td>
<td>11.0</td>
<td>11.7</td>
</tr>
<tr>
<td>Inter-censal growth rate</td>
<td>3.3</td>
<td>3.8</td>
<td>3.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Total fertility rate</td>
<td>7.6</td>
<td>7.8</td>
<td>6.7</td>
<td>5.0</td>
</tr>
<tr>
<td>Infant mortality rate (per 1,000 births)</td>
<td>119</td>
<td>88</td>
<td>66</td>
<td>77.3</td>
</tr>
<tr>
<td>Life expectancy at birth</td>
<td>50</td>
<td>54</td>
<td>60</td>
<td>56.6</td>
</tr>
</tbody>
</table>


Table 2. Socio-economic and Health indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP per capita (provisional estimate)</td>
<td>Kshs. 33,280</td>
</tr>
<tr>
<td>GDP growth rate</td>
<td>4.3 %</td>
</tr>
<tr>
<td>Recurrent Health budget (as % of total MoH expenditure)</td>
<td>74.7 %</td>
</tr>
<tr>
<td>Public Health expenditure (as a % of GDP)</td>
<td>2.3%</td>
</tr>
<tr>
<td>Public Health expenditure (as a % of GDP)</td>
<td>8.6%</td>
</tr>
<tr>
<td>MOH per capita recurrent Health expenditure</td>
<td>KSh 506 ($6.52)</td>
</tr>
<tr>
<td>Infant mortality rate (IMR ) per 1000 births</td>
<td>74</td>
</tr>
<tr>
<td>Maternal mortality rate (MMR)</td>
<td>365-650/1000</td>
</tr>
<tr>
<td>Under five mortality rate (U5MR) per 1000 births</td>
<td>112</td>
</tr>
</tbody>
</table>

Source: Economic Review 2005

2.3 Epidemiological Trends

The morbidity pattern over the last 10 years features malaria as a top priority disease followed by acute respiratory infections, skin conditions, diarrhoea and intestinal worm’s infestation. Peri-natal and maternal Health complications account for 27 per cent of the total burden of disease in Kenya as measured in terms of life years lost. The HIV/AIDS pandemic poses a greater challenge by taking an inappropriate share of resources meant for development of Health services. The leading causes of mortality in Kenya are related to peri-natal causes; AIDS & AIDS related diseases such as pneumonia, TB; cardiovascular; malaria and injury.

The major causes of morbidity and mortality in Kenya are due to diseases and conditions that are preventable through immunization, proper environmental management, or observing hygiene. The existing environmental problems relate to the low level of safe drinking water; poor environmental sanitation and refuse disposal, environmental pollution and food contamination. As a result, water borne diseases such as typhoid and cholera have become major threats. Closely linked to lack of safe water supply is the problem of poor sanitation resulting in poor disposal methods of facial matter near homes.

2.4 Organization of the Health Services in Kenya

The Health sector comprises of the public health system with major players being the Ministry of Health and Ministry of Local Government. Other players include religious organizations, NGOs, and the private sector. Health services are delivered through a network of about 4200 Health facilities with the public Health system accounting for 51% of the total as shown in Table 3.

The actors health sector include the formal sector are professionals who include physicians, nurses, midwives and paramedics (Helman, 1994). They operate as public health care providers under the auspices of the Ministry of Health, or as private and non-governmental workers. The informal sector is composed of the traditional health care providers and over-the-counter suppliers of medicines.
The MoH ran 80 percent of health centres and dispensaries, while 14 percent were handled by church related NGOs. The remaining primary level facilities were operated by municipalities (Ministry of Local Government) and private providers.

Table 3. List of health care facilities in Kenya

<table>
<thead>
<tr>
<th>Facility type</th>
<th>GOK</th>
<th>%</th>
<th>NGO</th>
<th>%</th>
<th>PRIVATE</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>139</td>
<td>50</td>
<td>67</td>
<td>30.7</td>
<td>42</td>
<td>19.3</td>
<td>218</td>
</tr>
<tr>
<td>Health centre</td>
<td>460</td>
<td>80</td>
<td>100</td>
<td>17.4</td>
<td>15</td>
<td>2.6</td>
<td>575</td>
</tr>
<tr>
<td>Dispensary</td>
<td>1537</td>
<td>60.9</td>
<td>595</td>
<td>23.6</td>
<td>391</td>
<td>15.5</td>
<td>2523</td>
</tr>
<tr>
<td>Nursing &amp; maternity home</td>
<td>0</td>
<td>0.0</td>
<td>11</td>
<td>58</td>
<td>180</td>
<td>94.2</td>
<td>191</td>
</tr>
<tr>
<td>Health clinics /medical centres</td>
<td>43</td>
<td>0.1</td>
<td>72</td>
<td>10.2</td>
<td>592</td>
<td>83.7</td>
<td>707</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2158</strong></td>
<td><strong>51.0</strong></td>
<td><strong>845</strong></td>
<td><strong>20.1</strong></td>
<td><strong>1220</strong></td>
<td><strong>29.0</strong></td>
<td><strong>4214</strong></td>
</tr>
</tbody>
</table>

Source: HIS, MOH, 1999, RoK, 2005

The overall mandate for health services promotion is vested with the Ministry of Health under the Public Health Act Cap. 242 of the laws of Kenya and under various subsidiary legislations dealing with specific areas by various boards and councils, which regulate the performance of service institutions and of Health workers themselves in general. The Ministry has the responsibility to formulate policies, establish and enforce standards and mobilize resources for Health services development. The provincial and district levels have the important role to implement Health programs and deliver Health services.

The structure of the health services delivery system is hierarchical with dispensaries and Health Centres at the base forming the contact with the community. The provincial and district Hospitals provide both referral and outpatient services in addition to the requisite technical backstopping to the facilities at the periphery. Kenyatta National Hospital is at the apex as the referral and teaching facility. An elaborate network of non-governmental Health providers supplements the public Health system.

The Government has remained the major source of funding to the health sector, accounting for 47 per cent of the total (Ministry of Health 42 percent and Ministry of Local Authorities 5 per cent). Private individuals account for 41 percent while the National Hospital Insurance Fund and donor agencies account for 41 percent and 3 per cent, respectively.

The annual average of government’s contribution to the sector in absolute terms is a reflection of its commitment towards supporting health services in the country. The recurrent budgetary allocations have risen from K pounds 128 millions in 1990/91 to K pounds 455 million in 1998/99; arise of over 255% in nominal terms. In real terms, however, the growth has been marginal (6%). the per capita expenditures have declined over time, from US$ 9.5 (1980/81) to US$ 3.4 (1997). This indicator is expected to grow even considering the current good performance of the economy.
2.5 Health Service Delivery and Human Resource Development Governance

The MoH has favoured centralized planning and resource allocated principally from independence. Some of the centralized activities include: planning programming and implementation of services; procurement, storage and distribution of medical supplies; publics health laboratory services including drug quality control; staff training, recruitment and development; administration and management, administration of National Hospital Insurance Fund (NHIF), coordination of activities of other Health services and overall planning and budgeting.

2.5.1 Key challenges in Governance

The centralized system has a number of operational problems constraining the delivery of efficient and effective Health services. In the majority of cases, there has been a lack of clearly defined functions, roles, schedule of duties and work plans starting from the headquarters through to the facilities at the periphery. The acceptance of donor funds by the government has always depended, among others, on the MoH ‘absorption capacity as guided by approved budget ceilings, the state ‘s assessment of the utilization of the funds and ability to co-finance if it is donor requirement. Further, the guidelines for accounting for donor funds are usually bureaucratic and cumbersome leading to long disbursement delays. Accountability and transparency in the use of donor funds have also been at the centre of controversy.

2.5.2 Ministry’s efforts to address governance issues

There have been shifts towards decentralization as part of the broad policy framework in the recent past. Evidence to this effect includes the restructuring and strengthening of the ministry’s district level management capacity under the district focus for rural development, which started in 1983. Additional evidence includes the creation of the district management boards in 1992 to represent community interests in Health planning and to co-ordinate and monitor the implementation of projects at the district level; granting of autonomy to Kenyatta National Hospital in 1987 and the decentralization of the NHIF management and AIDS surveillance.

Ministry’s attempts to decentralize financial management systems under the cost sharing program provides yet another bold step to address governance issues in the Health sector reform agenda. With introduction of cost sharing in Health in 1989, it was imperative to have more control of the respective funds at the periphery to ensure increased effectiveness and efficiency in Healthcare delivery. Simultaneously and at the request of the Moll, the Exchequer and Audit Act (cap.412) was amended to provide for the creation of health care services fund where 75% of the revenues generate are utilized by the collecting facility and 25% directed to the source districts to support primary Health care activities. Similarly, the public Health act (cap 242) has been invoked several times to provide for further decentralization of authority on the use of cost sharing revenues. The issuance of AIEs on cost sharing funds has already been delegated to the provincial level and, the DHMB’s have been empowered to superintend the management of the cost sharing and exchequer funds and, the overall delivery of district Health services. In a similar vein, boards will have authority to identify new areas for expanding the scope of the user fee initiatives in their respective facilities. The final phase of the process will entail the boards assuming total control and ownership of the entire district Health system. The centre and the provincial level will continue to provide policy and programmatic guidance.

2.6 Health Care Waste Management in Kenya

Kenya lacks a comprehensive management plan for handling and disposing domestic, agricultural, industrial and health care waste. While the rest of the waste is handled on ad hoc basis by both local authorities and the private sector, health care waste poses a more serious challenge due to the associated health risks.

However Ministry of Health in partnership with John Snow Incorporated and Centre for Disease Control has for the past two years been training health care workers in waste management under the project “Making Medical
Injections Safety (MMIS)*. The project is providing receptacles at points of generation in some selected HCFs. in the country. The piloted is being piloted in two districts: Bondo and Kiambu district and two provincial hospitals: Kisumu and Kakamega.

At institutional level, Kenyatta National Hospital and some provincial and district hospitals have been managing HCW in ad hoc basis

2.6.1 What is Health Care Waste
Health-care waste is a by-product of health care that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials. Health-care activities that generate health care waste include immunizations, diagnostic tests, medical treatments, and laboratory examinations. Almost 80% of the total wastes generated by health care activities are general waste comparable to domestic waste. The remaining approximate 20% of wastes are considered hazardous materials that may be infectious, toxic or radioactive (WHO 2000). The wastes and by-products cover a diverse range of materials, as the following list illustrates (percentages are approximate values):

- Infectious wastes — cultures and stocks of infectious agents, wastes from infected patients, wastes contaminated with blood and its derivatives, discarded diagnostic samples, infected animals from laboratories, and contaminated materials (swabs, bandages) and equipment (disposable medical devices etc.).
- Pathological/Anatomic - recognizable body parts and animal carcasses. Infectious and anatomic wastes together represent the majority of the hazardous waste, up to 15% of the total waste from health-care activities.
- Sharps - syringes, disposable scalpels and blades etc. Sharps represent about 1% of the total waste from health-care activities.
- Chemicals - for example solvents and disinfectants.
- Pharmaceuticals - expired, unused, and contaminated; whether the drugs themselves (sometimes toxic and powerful chemicals) or their metabolites, vaccines and sera. Chemicals and pharmaceuticals amount to about 3% of waste from health-care activities.
- Genotoxic waste — highly hazardous, mutagenic, teratogenic or carcinogenic, such as cytotoxic drugs used in cancer treatment and their metabolites.
- Radioactive matter, such as glassware contaminated with radioactive diagnostic material or radiotherapeutic materials.
- Wastes with high heavy metal content, such as broken mercury thermometers.

2.6.2 Sources of Health Care Waste in Kenya
The potential sources for health care waste generation in Kenya can be classified as following:

- Hospitals (university teaching hospital, central hospital, general hospital, specialist hospital e.g. leprosarium, district hospital and other health care facilities)
- Others health care establishments (emergency medical care services, health centres (urban and rural) and clinics / dispensaries, obstetric and maternity clinics, outpatient clinics, long-term health care facilities and hospices, transfusion centres and military medical services.
- Related laboratories (clinical / microbiological) and research centres
- Mortuary and autopsy centres
- Health Research Institutions such as Kenya Medical Research Institute (KEMRI), Kenya Agricultural Research Institute(KARI),
- Animal research, testing and treatment
- Blood banks and blood collection centres
• Small health care facilities (physicians’ office, dental clinic and home health care).
• Specialized health care facilities and institutions with low waste generation (psychiatric hospitals, institutions for disabled persons, immunization outreach posts, etc.)
• Non-health activities involving intravenous or subcutaneous interventions (illicit drug users, ear piercing and tattooing)
• Funeral services
• Ambulance services
• Home Based Cares
• Voluntary Counselling and Testing Centres (VCTs)

2.7 Problems related to poor health care waste management

2.7.1 Risks of infection
Improper disposal of health care wastes, syringes and needles that are scavenged and reused may lead to significant numbers of hepatitis B, hepatitis C, HIV and possibly other infections in the developing world (Simonsen 1999). In some countries (e.g., India and Pakistan), contaminated disposable needles are often scavenged, repackaged, sold and reused without sterilization. Such practices are associated with serious health implications due to the transmission of infectious disease especially hepatitis and AIDS. Several populations are at risk from poorly managed health-care waste:
1. Health workers.
2. Waste handlers.
3. Scavengers retrieving items from dumpsites.
4. People receiving injections with previously used needles/syringes.
5. Children who may come into contact with contaminated waste and play with used needles and syringes, e.g., if waste is dumped in areas without restricted access
6. The general public
3.0 Study Methodology

The orientation and design of the study was in the form of a Rapid Assessment and Appraisal. The study design opted for a descriptive cross-sectional study that was deemed suitable for the rapid assessment of the situational analysis. The study was conducted in a sample of all the Public Health Care Facilities in Kenya including a private clinic and a home based care facility in each of the 8 provinces of Kenya. The key informants were reached through the use of direct interviews, Focus Group Discussions, and direct observations. Open ended and structured questionnaires were employed in collection of data.

3.1 The study Design

This was a descriptive cross-sectional study which aimed at determining the status of healthcare waste management in the healthcare facilities in Kenya.

3.2 The study subjects

The study targeted health facilities of different categories: i.e., private clinics, dispensaries, health centres, district hospitals, provincial hospitals, referral hospitals and a national hospital.

3.3 Ethical considerations.

Being a government project, the Ministry of Health (MoH) and the National Aids Control Council (NACC), who were the clients in this project, took great control in terms of ethical issues. The Ministry of Health (MoH) headquarters did a letter of introduction and authorization to all the Provincial Medical Officers and the District Medical Officers of Health for all the provinces and the districts that were covered by the study. This facilitated the work of the research team who then proceeded and collected data smoothly in all the designated study areas.

The research team therefore had only to introduce themselves and explain more on their expectations to the In-charges of the concerned health facilities.

3.4 Sampling

3.4.1 Selection of the study facilities

The research team according to the Terms of Reference were expected to select the following health care institutions for the purpose of implementing the project. These were;

1. One National Hospital
2. Two Referral Hospitals
3. One major Provincial General Hospital-
4. Two busy District Hospitals
5. Eight Health Centers
6. Eight dispensaries
7. Eight private clinics and
8. Eight Community Based Health Care facilities

The study facilities were selected through purposive and simple random sampling. The two district hospitals that were selected were picked basing on a set criterion.

In selecting the above facilities, the research team obtained a list of all the health care facilities in the country from the Ministry of Health and stratified them into a list by type of facility i.e. Provincial Hospitals, District Hospitals, Health Centers, Dispensaries, Clinics and Community Based Health Care Facilities.
Selection of the National Hospital
The selection process for this facility was fairly straight forward because the country has only one national hospital, Kenyatta National Hospital, which was automatically selected.

Selection of Two Referral Hospitals
In selection of the two facilities, the research team listed all the existing referral hospitals in Kenya and using simple random sampling, selected two of the facilities namely;

1. Moi Referral and Training Hospital and
2. Coast Provincial General Hospital.

Selection of One Provincial Hospital
The following six provincial hospitals in the country were listed in pieces of papers and using simple random sampling method, Nyeri Provincial Hospital was picked, thereby forming our single provincial hospital sample as stated in the ToR. Coastal Province was eliminated in the sample frame because the region had already been picked in selection of a referral hospital.

Below is a list of all the 6 provincial hospitals that were considered for simple random sampling and selection in the country.

1. New Nyanza Provincial General Hospital
2. Kakamega Provincial General Hospital
3. Rift Valley Provincial General Hospital
4. Nyeri Provincial General Hospital
5. Garissa Provincial General Hospital
6. Eastern Provincial General Hospital

Selection of 2 Busy District Hospitals
To ensure effective national representation, the research team eliminated Coast Province, Rift Valley Province, Central Province and Nairobi Province in the selection process for identifying 2 busy district hospitals. This is because the health institutions in the 4 provinces had already been catered for through the selection of a national hospital, 2 referral hospitals and a provincial hospital, respectively.

The sampling frame narrowed down to the 4 remaining provinces, namely;

1. Western Province
2. Eastern Province
3. North Eastern Province
4. Nyanza Province

In selecting 2 busy district hospitals all the district hospitals in the country found only in the above mentioned 4 provinces were listed. The district hospitals were analyzed in terms of bed occupancy and outpatient service register. The consultant then segregated all the facilities that had over 300 and above bed capacity which were termed as “busy” and segregated from the rest of the other facilities. Then using the lottery method two of these facilities listed as busy were selected namely;

1. Kisumu District Hospital and
2. Machakos District Hospital
Selection procedure of 8 Health Centers
In selecting the 8 proposed health centers in the country, the consultant listed all the health centers stratified per province and thereafter segregated this list of health centers into two categories namely;

1. Health Centers found in the Urban Areas within provinces and
2. Health Centers found in Rural Areas within the provinces

Using simple random sampling the consultant picked one health center in each province found in the urban and rural areas. The following health centers were in effect selected based on this criterion. They include;

- Langata Health Center-Nairobi Province
- Limuru-Central Province
- Tiwi Health Center-Coast Province
- Kianjokoma-Eastern Province
- Garissa-North Eastern Province
- Nyahera Health-Nyanza Province
- Narok-Rift Valley Province
- Sio Port-Western Province

Selection of 8 Dispensaries
In selecting the 8 proposed dispensaries in the country, the consultant listed all the dispensaries per province and thereafter segregated the list of dispensaries into two categories namely;

1. Dispensaries found in the Urban Areas within provinces and
2. Dispensaries found in Rural Areas within the provinces

The following dispensaries were therefore selected;

- Kariobangi-Nairobi Province
- Muranga-Central Province
- Bwagamoyo-Coast Province
- Tharaka Nithi-Eastern Province
- Wajir-North Eastern Province
- Kisii-Nyanza Province
- Chepsiro-Rift Valley Province
- Shamakhokho-Western Province

Selection of 8 Private Clinics
These facilities (Private Clinics) were chosen from every province in the country. Through the assistance, advice and deliberations with the District and or Provincial Medical Officers (D/PMOs), private clinics were identified and select in each province. The consultant ensured that private clinics are not selected in the same locality where the health centres and dispensaries had been selected. Unless in the cases of exceptions where the other areas have no such facility then the former applied.

Selection of 8 Community Based Health Care Facilities
Through the assistance and deliberations with the Public Health Officers (PHOs) at the provincial or district level, home based care centres were identified and select in each region. The consultant ensured that home based care centres were not selected in the same locality with the health centres, dispensaries and clinics already in the sample.
3.5 Distribution of health facilities by type

There were 20 health facilities analysed in the study out of 32 HCFs sampled, comprising of one national hospital, two referral hospitals, one provincial general hospital, three district hospitals, six health centres three dispensaries and four private clinics.

Figure 1: Distribution of health care facilities by type

Figure 2. Distribution of health care facilities by bed capacity

Out of all the health facilities enrolled in the study, the national hospital had the highest number of beds (1800), followed by referral hospitals (1121), district hospitals (613), provincial hospitals (400), health centres
(45) and community based health care providers (8). Dispensaries did not register availability of beds possibly because of their level of health care provision, which does not include admission of patients.

3.5 Data collection methods and instruments

3.5.1 Data collection methods
Data was collected through interviews, observation, focus group discussions, practical weighing of the waste by category and desktop review.

3.5.2 Data collection instruments
As is already indicated above several methods were used to collect data. Specifically, however, the instruments & tools used in collecting data were:
- Interview schedule (self-administered questionnaire)
- Short questionnaire
- Observation /checklist
- Key Informant Interview Guide
- Focus Group Discussion Guide
- Weighing machine

Interview schedules
These were administered by the research assistants and in some cases the lead consultant to the persons in charge of health-care waste management in the different health facilities studied. They were aimed at obtaining information on major aspects of health-care waste management in their facilities, which included types and quantities of health-care waste generated, modes of waste segregation, storage, collection, transportation and disposal, occupational health and safety measures in place, as well as personal involved in health-care waste management, among others.

Short questionnaire
A short questionnaire was sent out to each District Public Health Officer for the districts which formed part of the study and who were requested to fill them back.

Observation /checklist
The consultants made observation to further capture qualitative information of importance such as the type of health-care waste collection vehicles and storage receptacles in use, availability of protective gear for those handling health-care waste, treatment of health-care waste prior to disposal, colour coding, waste segregation, etc. The information collected was useful in complementing that collected by qualitative technique. A pre-designed observation checklist was used to collect such information.

Key Informant Interview Guide
This tool which comprised of a pre-designed set as items or issues of relevance to the study was used to collect information from key informants in terms of issues related to health-care waste management and health facility administrators.

Focus Group Discussion Guide
This tool was used to assess the extent and degree of scavenging through the following ways; detailed design of structured open-ended questionnaires and direct interviews and Focus Group Discussions with the maintenance and waste disposal units and other relevant departments of the health facilities, discussions with the waste handlers, and scavengers among other key informants. Issues of concern that were focused on included; identification of points where scavenging was taking place such as in the health facilities, during
collection, along transport lines, and at the final disposal point.; analysis of the type and composition of wastes frequently scavenged and determining why; and finding out who the human scavengers were, what use the scavenged materials were being put to, and the markets for the scavenged wastes if any.

**Weighing machine**
This was used to weigh health-care waste by category and weights recorded in specially designed form for that purpose. The use of this tool was informed by the need to determine the exact quantities of health-care waste generated in the health facilities. In each health facility the health-care waste was weighed for seven days and the weight extrapolated into one month and one year respectively.

### 3.6 Field work procedures and processes

#### 3.6.1 Training of Research Assistants
A one day training session was organized for the research assistants in order to induct them in the proposed study. Under the direction of the lead consultant, assisted by other consultants, the objectives and scope the study were explained to the research assistants. They were also taken through all the study instruments to ensure that they understood them thoroughly in terms of information sought were therefore able to administer them with ease once in the field.

#### 3.6.2 Validation of research instruments
The research instruments were piloted at the Siaya District Hospital, upon which it was found to be simple and easy to understand. No ambiguities were discovered and the pilot respondents found the questions askable, acceptable and sample.

#### 3.6.3 Data management
All quantitative data collected was checked by the consultant for completeness and any other errors detectable analyzed immediately through visual scanning as soon as possible after collection to enable correction before the team left the site.

The data was then entered into computer using the SPSS data entry module and using screens with in-built checks for value ranges and consistency. Further detection of errors was carried out by running frequencies and cross-tabulations in the SPSS data analysis module.

Data analysis was carried out to highlight the relevant issues in describing the quantity and type of waste generated. Quantities of waste was disaggregated by type of waste and stratified by type of facility.

The quantity and type of waste produced nationally was estimated using multipliers which will be constructed by the consultants. These multipliers took into account:
- The proportion of facilities in the sample
- Levels of in-patient and outpatient services

A statistical model has been used to project quantities of waste that are expected to be produced up to the year 2015.
4.0 Study Findings
This section describes the findings of the status quo of the following issues of concerns namely:
- Training Needs Assessment and Awareness in HCWM
- Legal and Institutional Framework in HCWM
- Technology Assessment including disposal in HCW
- Private sector involvement in HCWM
- Social concerns in HCWM

4.1 Existing systems of HCWM

4.1.1 Types and quantities of health care waste generated

Figure 3. Type of waste by source

![Type of Waste by Source](image)

The study sought to establish type and quantities of HCW produced from various sources of the health facilities enrolled in the study. Based on this, the quantities of different categories of HCW generated were weighed to provide an adequate assessment of generation trends at selected HCFs. The result of this activity is as shown below in table 4.
Table 4. Estimated quantities of HCW by category generated by Kenya HCFs by type

<table>
<thead>
<tr>
<th>HCW Categories</th>
<th>HCF Categories</th>
<th>Daily Mean</th>
<th>Annual Mean</th>
<th>No of facilities</th>
<th>Annual Total</th>
<th>Waste per unit population per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFECTIOUS</td>
<td>NATIONAL</td>
<td>561.8</td>
<td>205072.6</td>
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</tr>
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<td>100</td>
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<td>1566139.0</td>
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<td>25209.3</td>
<td>0.001</td>
</tr>
</tbody>
</table>

4.1.1.1 General waste
Patient services generated most of general waste (43%) followed by support services (40%) and laboratories (17%).

4.1.1.2 Pathological waste
About two-thirds (65.6%) of pathological waste emanated from patient services, laboratories and support services contributed to 19.7% and 14.8% of pathological waste respectively.
4.1.1.3 Radioactive waste
Radioactive waste is the least generate form of HCW from all source points. The distribution was such that three out of four (75%) counts of radioactive waste was generated from patient services, while the rest came from support services.

4.1.1.4 Chemical waste
Over half (59.6%) of all chemical waste emanated from patient services, while 21.2% and 19.2% of this type of waste came from laboratories and support services respectively.

4.1.1.5 Infectious waste
Much of the infectious waste came from patient services (65.8). Laboratories generated 19% while support services generated 15.2% of infectious waste.

4.1.1.6 Sharps
Just as in the case of chemical and infectious wastes, sharps were mainly generated by the patient services source (78.3%). Only 16.9% and 4.8% of sharps were recorded as coming from laboratories and support services respectively.

4.1.1.7 Pharmaceutical waste
This type of waste was generated from patient services (60.9%), laboratories (21.7%) and support services (17.4%).

4.1.1.8 Pressurized containers
Just as in the case of radioactive waste, the count of generation of pressurized containers as waste was five, three from laboratories and one each from patient and support services.

4.1.1.9 Condoms
Health care used to be the domain of trained health personnel based at institutions. With an increasing burden of caring for chronically ill persons, including people suffering from diabetes, TB, HIV and AIDS, among many others, home-based care has assumed a critical role. This call for a re-assessment of awareness building strategies that are more appropriate. So far safe health waste management at the community and home levels appears limited yet exposure is real for the unsuspecting public but who may be party to the generation of health care waste. A case in point is the condom which is not only a nuisance but may in itself be a health hazard for those who come in contact with used condoms that are disposed inappropriately.

The condom has been aggressively promoted, as a public health tool to address the menace of HIV/AIDS but a growing issue of concern at the community level is the disposal of condoms. Over 3 million condoms are distributed monthly under MoH programme targeting Health Care Facilities specifically in MCH/FP Clinics. Condom packages especially the TRUST condom distributed by PSI is accompanied by guidelines for use and disposal generally encouraging flushing down the toilet.

The Ministry of Health was initially the sole distributor of condoms through the Division of Reproductive Health. This is understandably so given that the condoms was largely a family planning tool. With the declaration of HIV/AIDS as a national disaster and therefore of critical concern to the government; requiring multi-sect oral response, condom distribution was removed from the MOH and designated to the newly established National AIDS Control Council (NACC) which has an overall coordinating role. The condom had become an essential public health tool over and above family planning. To spearhead the exercise of condom distribution The AIDS Control Units have been established in ministries, reporting directly to the Permanent Secretary (PS) who then reports to NACC.
At the national level JSI/DELIVER project takes up all the logistics of condom distribution, moving them down to the district depots. At the district level condoms are distributed through the health facilities in the FP/MCH clinics through the DPHN and more recently the PHO’s office. This is a pilot under the PEPFAR funds, which has facilitated PHTs, a cadre of health personnel operating from the division up to location level. By designating the office of the PHO as in charge of condom distribution this has given the condom legitimacy and visibility as a public health tool and therefore a home from where it can be tracked. Under the Division of Environmental Health, the PHO condom distribution initiative focuses on one of the PEPFAR objectives—condom distribution. The objectives of the initiative are to:

- Promote condom uptake
- Improve condom access at community level
- Provide education on condom use at community level
- Educate on correct use and disposal

The project started off by addressing the first objective of condom distribution. The division of Environmental health has taken charge and through its structure the condoms flow down to the district, division and location. From the district level the DPHO supplies the PHTs who in turn distribute to the community especially the bars and other social places. The PHO initiative is in 4 provinces—Nyanza, Western, Coast and Nairobi. The DPHO ensures distribution and undertakes monitoring and supervision.

While condom distribution has been very successful through provision of dispensers at strategic points, however, the story is different when it comes to disposal of the used condom. Discussions with the chief public health office, Ministry of health indicates that over 30 million condoms have been distributed in four provinces over the past one year. By pushing condoms so hard in the community there was also recognition that soon condom disposal would become a major challenge. From a study that was conducted by FHI on the IMPACT project focussing on a “Programmatic Review Of Condom Distribution Channels And Mechanisms Focusing On IMPACT Supported Sites” in Western Kenya. This is also the region that that received supplies of condoms under the Ministry of Health-PHO Initiative in Condom distribution under PEPFAR project. The findings of the evaluation confirmed that as condom use becomes popular condom disposal is an issue, often causing a dilemma.

At the community level, there have been heated discussions around disposal with suggestions and counter-suggestions that remained inconclusive. In these discussion group suggestions for condom disposal included initial education particularly to address issues of stigma and rumours. For example, although burning was encouraged there was also the view that one has also to overcome the myth that in some communities burning is like burning oneself—‘some traditions discourage burning of sperms because you can “go off (become impotent!”)

Exploration of the various options for disposal would have to form a central part of agenda for discussion with communities and other stakeholders. Within the context of environmental health this issue could be addressed so that condom is viewed as part of the waste generated at community level; requiring appropriate disposal. One of the conclusions of the issues around condom disposal was the need for an independent assessment that is participatory to allow communities to contribute to appropriate modes of disposal.

4.1.2 Waste segregation, labelling, storage, collection, transportation and disposal

In all the HCFs visited with the exception of Kenyatta National Hospital, there was neither segregation nor labelling of HCW being done. In majority of health facilities different types of HCW are stored together in the same receptacles; only sharps are segregated from other types of waste. The transportation of HCW is done in different ways but mostly manually and by use of wheelbarrows where on site disposal options are
available. In situations where of-site disposal is in use, HCW are transported by use of motorised vehicles, especially lorries and open trucks.

4.1.3 Health and safety measures taken in health-care waste management

**Issuance of Personal Protective Equipment/safety items**

About 95% of the respondents reported to have safety clothing/items issued to staff in HCW management. Frequency of issuance of these items seems to depend on durability.

Figure 4. Frequency of issuance of personal protective equipment (PPE)

4.1.4 Assignment of waste management responsibilities

**Parties responsible for HCWM**

The study sought to establish the parties responsible for waste management activities relating to collection, handling, transport, incineration and disposal. The data shows that all the health facilities handle their own waste management activities, more so collection, which is handled at health centre level in total (100%). Over 75% of all health facilities manage handling, transport, incineration and disposal of waste. Outsourcing is done for transport (25%), disposal (25%), incineration (14.3%) and handling (11.1%).
Respondents were asked to indicate designation, qualifications and training of personnel responsible for organization and management of waste collection, handling, storage and disposal at various levels. The figure below shows that almost half (48%) of the persons responsible for management of health care waste are Public Health Officers/Technicians. The others are health facility in charge, and casual workers at 26% each.
Similarly, the study sought to establish the number, designation, training and experience of other personnel involved in collection, handling and storage of health care waste. It is apparent that the main qualification of the personnel involved in management of waste is clinical officers/PHO/T or enrolled community nurses at 42%. Others are qualifications in environmental sciences (29%, form four level of education/CHW (19%) and primary level/informal education (10%).

They were also asked whether these personnel have job descriptions, and whether instructions/training is given to newly hired waste management staff. The figure 9 below shows that only a minority of the health facilities have job descriptions detailing the tasks of their waste management staff (23.8%), while 76.2% do not. Health facilities that give instructions/training to newly hired waste management staff comprise 59.1%. 
Respondents were asked whether they were aware of any legislation applicable to health care waste management and documentation outlining hospital waste management policy. Over half (57.9%) of the respondents reported that they were not aware of any legislation relating to health care waste management. Similarly, an overwhelming majority (95%) reported that they were not aware of any documentation outlining waste management policies. A similar majority reported that there was no manual/guideline document on management of health care waste available at the Ministry of Health and in their respective health facilities.

4.1.5 Financial implication of health-care waste management

**Amount spent for waste management services**

Figure 10. Annual expenditure in HCWM in different types of HCFs in Kenya

<table>
<thead>
<tr>
<th>Facility type</th>
<th>Total Amount '000</th>
</tr>
</thead>
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<td>HEALTH CENTRE</td>
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</tr>
<tr>
<td>REFERRAL HOSPITAL</td>
<td>253</td>
</tr>
<tr>
<td>PROVINCIA L GENERAL</td>
<td>1,167</td>
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<tr>
<td>DISTRICT HOSPITAL</td>
<td>200</td>
</tr>
<tr>
<td>CBHC SERVICE</td>
<td>5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Amount in Kshs (’000)</th>
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<th>200</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1,000</th>
<th>1,200</th>
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<tr>
<td>HEALTH CENTRE</td>
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<td></td>
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<tr>
<td>REFERRAL HOSPITAL</td>
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<td></td>
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<tr>
<td>PROVINCIA L GENERAL</td>
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</tbody>
</table>
The total amount spent annually for waste management services is highest for provincial hospitals (Ksh. 1.16 million). The amount spent in health centres, referral hospitals and district hospitals ranged from Ksh.200,000 to Ksh.253,000.

4.2 Policy, Legal and Institutional Framework in place for HCWM in Kenya.

4.2.1 Policy Framework

Procedures for collection and handling of waste

Asked whether they have clearly defined procedures for collection and handling of waste from specified units in the health facilities, 72.7% of the respondents affirmed. About a third (31.8%) reported that they have policies/guidelines outlining steps to be taken in case of injury or contamination from handling waste. Almost 41% reported availability of emergency procedure in their respective health facilities for personnel handling health care waste. Regarding inclusion of waste management responsibilities in job descriptions of health facility supervisory staff, 41.2% reported inclusion, while 58.8% reported that they are not included.

Figure 11. Knowledge and presence of procedures and guidelines for handling HCW

![PROCEDURES AND GUIDELINES FOR WASTE MANAGEMENT](chart)

No

Yes

Procedures for collection/handling 27.3 72.7
Policy/guidelines 68.2 31.8
Emergency procedures 59.1 40.9
Management responsibilities 58.8 41.2

4.2.2 Existing Legal Framework for HCW Management in Kenya

Kenya’s policy and legal framework on health care waste management is found mainly in the following statutes: the Public Health Act, Chapter 242; the Environmental Management and Coordination Act, 1999; and the Medical Practitioners and Dentists Act, Chapter 253. Additionally there are efforts to develop regulations specifically dealing with health care waste management, and NEMA has drafted the Bio-Medical Waste (Management and Handling) Regulations, which are presently awaiting gazettement.

The health of the environment is a broad issue that should apply to any activity occasioning environmental degradation. However, what we have in Kenya is construed rather narrowly to apply only to environmental problems which affect the human body, but not including diseases.
4.2.2.1 Public Health Act Cap 242
The Act aims protects human health, prevent and guard against introduction of infectious diseases into Kenya from outside, to promote public health and the prevention, limitation or suppression of infectious, communicable or preventable diseases within Kenya, to advice and direct local authorities in regard to matters affecting the public health to promote or carry out researches and investigations in connection with the prevention or treatment of human diseases. This Act provides the impetus for a healthy environment and gives regulations to waste management, pollution and human health.

On sanitation the Act borrows from the common law doctrine of nuisance which makes it an offence for any landowner or occupier to allow nuisance or any other condition liable to be injurious or dangerous to health to prevail on his land. A medical health officer, once satisfied of the danger, may issue an order requiring the owner or occupier of the land to remove the nuisance.

In addition, the Minister on the advice of the Central Board of Health may make rules and confer powers and impose duties for the carrying out of environmental health matters. Such matters may include inspection of building for their sanitary condition, construction standards and ventilation for buildings, drainage of land, keeping of animals etc.

Part XII of the Act makes it an offence to leave on one’s land or premises, any collection of water, sewage, rubbish, well, pool, gutter, channel cesspit, latrine, urinal or dung pit where mosquitoes may breed. Such a situation constitutes a nuisance. Any person who fails to clear such a nuisance is guilty of an offence under the Act.

Environmental health requirements are also provided for under the general powers and duties of the local authorities in the Local Government Act (Cap 265). Municipal Councils are required to provide and maintain sanitary services, sewage and drainage facilities, take measures for the control, destruction of rats, vermin, insects and pests, control or prohibit industries, factories and businesses which emit smoke, fumes, chemicals, gases, dust, smell, noise vibrations, discomfort or annoyance to the neighbourhood, and to prohibit or control work or trade of disinfect ion or fumigation by cyanide or other means.

The Penal Code (Cap 65) carries the offence of common nuisance identical to that in the Public Health Act. The offence under the Penal Code is a misdemeanour punishable by imprisonment for one year. This however is distinct from that in the Public Health Act which may require the offender to abate the offence.

The Traffic Act prohibits air pollution through Section 51 which requires that motor vehicle use proper fuels. The Rules promulgated under the Act provide that every vehicle be so constructed, painted and used as not to emit any smoke, or visible vapour.

Air pollution as a manifestation of nuisance is also prohibited under the Mining Act (Cap 306). Section 26 requires that a holder of prospecting or mining license who causes a nuisance or damage to a landowner or lawful occupier to pay reasonable compensation for such nuisance or damage.

4.2.2.2 Radiation Protection Act Cap 243
Since 1982, Kenya decided to join in the global movement for the use of nuclear energy for peaceful purposes, a movement lead by the International Atomic Energy Agency (IAEA). Most of such uses are in the fields of medicine, agriculture, energy and environmental monitoring. The dangers of injury to the public prompted the adoption of the Radiation Protection Act (Cap 243) in November 1984 to provide according to its citation, protection of the public and radiation workers from the dangers arising from the use of devices or materials capable of producing ionizing radiation and for connected purpose.
The Act prohibits the unauthorized manufacture, production, possession or use, sale, disposal, lease, loan or
dealership, import, export of any irradiating device or radioactive material. All authorized buyers, sellers, users,
of such device must be properly licensed. The Act is administered by the Chief Radiation Protection Officer
assisted by a Radiation Protection Board.

4.2.2.3 Management of Hazardous Waste
In the foregoing section, we see that radiation protection focuses largely on protection of human beings
against injury by such wastes or radiations. The Public Health Act also is concerned with the protection of
human health. Section 75 of the Constitutions whose purpose is protection from the deprivation of property,
empowers the government to acquire property "in circumstances where it is necessary to do so because
property is in a dangerous state or injurious to the health of human beings or animals or plants." This is the
closet reference to the protection of the environment. To date, Kenya does not have a statute that deals with
the management of hazardous waste (including disposal) as such.

And despite the numerous international conventions and protocols that deal with hazardous waste such as the
London Convention, the Basel Convention and the Bamako Convention, it still remains for Kenya to develop
and adopt national legislation on the management of hazardous waste. The current Environmental
Management and Co-ordination Act in Kenya, only provides for framework law for the management of
hazardous wastes. Currently, the National Environment Management Authority is in the process of developing
regulations that will prescribe for the management of waste. These Regulations will have to be gazetted by the
Minister of Environment and Natural Resources before they can be enforced as law.

4.2.2.4 Pest Products Control Act 346
The Pest Products Control Act, Chapter 346 deals with the import, export, and manufacture, distribution and
use of products used for the control of pests and of the organic function of plants and animals. The Act
establishes three classes of pest control products: a restricted class – that is a class of product presenting
significant environmental risks; a commercial class, with respect to which environmental effects are possible in
limited region; and a domestic class, for which no special precautions/equipment are required for inhalation
hazard, there are no irreversible effects from repeated exposures and the disposal of containers can be safely
done by placing in garbage.

The Act requires that the product be labelled with a label containing, among others, information on the hazards
of handling, storage, display, distribution, and disposal of the product including instructions on procedures to
alleviate the hazard, decontamination and disposal of the product and empty package.

This Act therefore may be relevant to the management of health care waste with respect to the handling of
waste arising from the use of pest control products within health care establishments. Such products must be
handled in ways that meet the requirements of this Act both in terms of classifying the products but also in
terms of labeling them.

4.2.2.5 Poisonous Substances Act 247
The Use of Poisonous Substances Act, Chapter 247 empowers the Minister to prescribe regulations which
may provide for protecting persons against risks of poisoning by poisonous substances arising from the use of
those poisonous substances; employment in places; the storage, transport, sale and disposal of those
poisonous substances. The Minster has not made regulations but the existence of this power is relevant in
considering the regulatory framework for health care waste.

4.2.2.6 Food drugs and Chemical Substances Act 254
The Food, Drugs and Chemical Substances Act, Chapter 254 makes it an offence to dispose of chemical
substances in a manner likely to cause contamination of food or water for human consumption or in a manner
liable to be an offence. The Act establishes a Public Health (Standards) Board, which would be responsible for defining the standards to be applied in judging fitness for human consumption.

4.2.2.7 Medical Practitioners and Dentist Acts 253
The Medical Practitioners and Dentists Act, Chapter 253 provides for registering medical practitioners. It establishes a Medical Practitioners and Dentists Board as the regulatory authority. Under the Medical Practitioners and Dentists (Private Practice) Rules no private practitioner shall operate a private clinic unless the premises where the clinic is situated have been approved by the Board. In the context of its responsibility to approve health care establishments the Board imposes requirements for the handling and disposal of health care waste.

The Board may inspect the clinic to satisfy itself that it meets the requirements. Nursing homes and hospitals shall also be subject to inspection by the Board. The Board has power to deregister those health care establishments which, and practitioners who, breach the conditions imposed on the licence issued by the Board. This Act is therefore an important regulatory tool for dealing with health care waste.

4.2.2.8 Environmental Management and Co-ordination Act 1999
The Environmental Management and Co-ordination Act No. 8 of 1999 is an Act of Parliament that provides for the establishment of an appropriate legal and institutional framework for the management of the environment. As earlier provided, prior to its enactment in 1999, there was no framework environmental legislation. Kenya’s approach to environmental legislation and administration was highly sectoral and legislation with environmental management components had been formulated largely in line with natural resource sectors as aforementioned.

EMCA was developed as a framework law, and this is due to the fact that the Act is thus far, the only single piece of legislation that contains to date the most comprehensive system of environmental management in Kenya. The Act provides for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya and for matters connected therewith and incidental hereto. The Act is based on the recognition that improved legal and administrative co-ordination of the diverse sectoral initiatives is necessary in order to improve national capacity for the management of the environment, and accepts the fundamental principle that the environment constitutes the foundation of our national, economic, social, cultural and spiritual advancement.

Section 3 of the Act enunciates the General Principles that will guide the implementation of the Act. Every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. It is worth noting that the entitlement to a clean and healthy environment carries a correlative duty. Hence, there is not only the entitlement to a clean and healthy environment, but also the duty to ensure that the environment is not degraded in order to facilitate one’s own as well as other persons’ enjoyment of the environment.

Part VIII of EMCA deals with environmental quality standards. Section 86 under Part VIII deals with standards for waste. It obligates the Standards and Enforcement Review Committee to prescribe standards for waste, their classification, and analysis and to formulate and advise on standards of disposal methods and means for such waste. The draft Bio-Medical Waste (Management and Handling) Regulations have been prepared under these provisions.

Section 87 prohibits the discharge or disposal of any wastes whether generated within or outside Kenya in such manner as to cause to cause pollution of the environment or ill health to any person. The section also deals with the transport of waste and prohibits the transport of waste without a licence issued by NEMA or to a waste disposal site which is not licensed by NEMA. Further the section prohibits the operation of a site or
plant without being licensed by the NEMA. Presently, there is no licensing system for waste sites and transporters, and therefore these provisions are yet to be operationalized.

The Environmental Management and Co-ordination Act, 1999 has established National Environment Management Authority (NEMA) which entitled every body to a clean and healthy environment and has the duty to safeguard and enhance the environment. The Authority has established a Standards and Enforcement Review Committee which will:

- Recommend the minimum water quality standards for all the waters of Kenya and from different uses.
- Record measures necessary for treatment of effluent before being discharged into the sewage system.
- Set quality standards and classification of hazardous waste.
- Prepare and submit draft standards for the concentration of pesticides residue in raw agricultural commodities, processed foods and animal feeds.

The Standards and Enforcement Review Committee established under Section 70 of the Act and chaired by the Permanent Secretary under the Minister responsible for environmental matters. The functions of the Committee includes advising NEMA on how to establish criteria and procedures for the measurement of water quality, recommending to NEMA minimum water quality standards for all waters of Kenya, analysing and submitting to the Director General conditions for discharge of effluents into the environment, and documenting the analytical methods by which water quality and pollution control standards can be determined and appointing laboratories for the analytical services required. Other statutory functions of the committee are advising NEMA on how to establish criteria and procedures for the measurement of air quality (Section 78), the issue of regulations and guidelines and the prescription and submission to NEMA of draft standards on pesticides and toxic substances (Section 94), recommending to the Authority standards for emissions of noise and vibration pollution into the environment (Section 101), the establishment of standards for ionising and other radiation (Section 104). In this respect the Act confers on the Standards and Enforcement Committee rulemaking powers. This is important in the light of the fact that regulations and rules are required to implement the framework provisions of the Act. In practice, the draft regulations and standards are adopted by the Board of Management for ownership and then forwarded to the Minister for promulgation and gazettement. The Committee therefore acts as the technical arm of NEMA in setting these standards.

4.2.2.9 Water Act 2002

The new Water Act (2002) of the Laws of Kenya seeks to make better provision for the conservation, control of pollution, apportionment and use of the water resources in Kenya, and for purposes they are incidental thereto and connected therewith. The Act vests ownership and control of water in the government subject to any rights of user.

4.2.2.10 Physical Planning Act

This Act provides for the preparation and implementation of physical development plans for any development whether they are HCFs or infrastructure like incinerators. It establishes the responsibility for the physical planning at various levels of Government in order to remove uncertainty regarding the responsibility for regional planning.

It provides for a hierarchy of plans in which guidelines are laid down for the future physical development of areas referred to in a specific plan. The intention is that the three-tier order plans, the national development plan, regional development plan, and the local physical development plan should concentrate on broad policy issues.
The Act also promotes public participation in the preparation of plans and requires that in preparation of plans proper consideration be given to the potential for socio-economic development needs of the population, the existing planning and future transport needs, the physical factors which may influence orderly development in general and urbanization in particular, and the possible influence of future development upon natural environment.

Any change of use of the actual development without authority constitutes an offence. Similarly, any one who deposits refuse, scrap or waste materials in a designated area without the consent of the planning authority or the relevant local authority shall be guilty of an offence under the regulations. The general sentence under the regulations is a fine of not exceeding five thousand shillings or Imprisonment not exceeding six months, or to both, such fine and imprisonment.

4.2.2.11 Land Control Act CAP 406
This law provides for the control of transactions in land, especially the machinery of the Land Control Boards. However it is of environmental interest that one of the points to consider in granting or refusal of consent by the Board is what impact the transaction is likely to have on the maintenance or improvement of standards of good husbandry within the specific agricultural area.

Government land is land owned by the government of Kenya under the Government Lands Act (cap. 280). This includes, for example, gazetted national parks and reserves. The government lands act allows the president, through the commissioner of lands, to allocate any unalienated government land

Trust land is land held and administered by various local government authorities as trustees under the constitution of Kenya and the Trust Land Act (cap. 288). National reserves and local sanctuaries as well as county council forest reserves, are in this category. Individuals may acquire leasehold interest for a specific number of years in trust land and can (in theory) be repossessed by the local authorities should the need arise. Local authorities should retain regulatory powers over trust land.

4.2.2.12 Local Government Act CAP 265
This law empowers a local authority to apply through the Minister for land to meet its different development purposes. Such requests and purposes are deemed to be public purposes within the meaning of the Land Acquisition Act (Cap 295). Such a local authority may, within such land, establish and maintain a conservation area. It may also take measures necessary for the prevention or control of land use such as dumpsite.

4.2.3 International Conventions
Kenya is a signatory to a number of international environmental agreements. The agreements relevant to HCW are:

4.2.3.1 Stockholm Convention on Persistent Organic Pollutants
The Parties to this Convention recognizing that persistent organic pollutants possess toxic properties, resist degradation, bioaccumulate and are transported, through air, water and migratory species, across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems,

Determined to protect human health and the environment from the harmful impacts of persistent organic pollutants, have agreed to institute measures to reduce or eliminate releases from both intentional and unintentional production and use, as well as reducing releases from stockpiles and wastes of the twelve persistent organic chemicals, listed in the annexes A, B and C of the convention. Among the major sources of one group of these pollutants, Dioxins and Furans (includes PCBs) are thermal processes, of which medical waste incineration is one of the contributors.
4.2.3.2 Basel Convention on the Control of Transboundary Hazardous Wastes
The Basel Convention makes specific reference to control of special HCW: sharps, pathological infectious waste, hazardous chemical waste, and pharmaceutical waste.

Annex I of the Basel Convention includes the following waste categories that specifically refer to healthcare waste:
- Clinical wastes from medical care in hospitals, medical centers, and clinics.
- Wastes from the production and preparation of pharmaceutical products.
- Waste pharmaceuticals, drugs, and medicines, and
- Waste from the production, formulation and use of biocides and phytopharmaceuticals.

4.2.3.3 Rotterdam Convention on Procedures for Hazardous Chemicals and Pesticides in International Trade
The purpose of this convention is to reduce hazards posed by chemicals and pesticides by facilitating information exchange about their characteristics by providing for a national decision-making process on their import and export and by disseminating these decisions to parties.

The convention covers pesticides and chemicals that have been banned or severely restricted for health or environmental reasons by parties and which have been notified by parties for inclusion in the Prior Informed Procedures. These include some chemicals that are used in medical practice.

The country has, however not been able to implement its political will on these conventions due to constraints of lack of financial resources, limited institutional capacity and inadequate environmental awareness.
4.2.4 National Permits
With regard to licenses, permits and approvals for facilities handling health care waste require several licences and permits for operating HCFs are required and provided for by the regulatory framework. The main stakeholders in approvals are the MoH, MPDB, KRPB and NEMA Table 5 below describes the permits and licenses required in handling HCWs in Kenya.

Table 5. Permits related to HCW Management

<table>
<thead>
<tr>
<th>ACTION</th>
<th>Issuing Agency/Authority</th>
<th>License/Permit provided</th>
<th>Period for Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating HCF</td>
<td>MoH</td>
<td>Operating Licence</td>
<td></td>
</tr>
<tr>
<td>Establishment of HCFs</td>
<td>NEMA</td>
<td>EIA/Audit Licenses for proposed infrastructure and for on-going developments</td>
<td>90 days</td>
</tr>
<tr>
<td>Establishment of Disposal sites of HCW</td>
<td>NEMA/MoH Public Health Department, Local Government</td>
<td>EIA/Audit License for construction and Siting of dumping sites.</td>
<td>90 days</td>
</tr>
<tr>
<td>Establishment of HCFs</td>
<td>Local Authority</td>
<td>Building Plans approval and Effluent Discharges</td>
<td>90 days</td>
</tr>
<tr>
<td>Disposal of HCW</td>
<td>Local Authority</td>
<td>Building Plans for dumping sites, permits for operating dumping sites/landfills</td>
<td>90 days</td>
</tr>
<tr>
<td>Establishment of HCWM Plant</td>
<td>MoH</td>
<td>Operating License for incinerator and HCFs</td>
<td></td>
</tr>
<tr>
<td>Disposal of effluent</td>
<td>NEMA/Local Government</td>
<td>Effluent Discharge permits</td>
<td></td>
</tr>
<tr>
<td>Establishment of HCFs</td>
<td>Medical Practitioners and Dentists Board</td>
<td>Provision of operating licenses for Private HCFs</td>
<td></td>
</tr>
</tbody>
</table>

4.2.5 Availability of health care waste management plan and teams
Majority of health facilities (85.7%) reportedly lack a waste management plan (85.7%) or a waste management team (78.9%)

Figure 12. Proportion of institutions with Waste Management Plan and Team

<table>
<thead>
<tr>
<th>Presence of waste management plan and team</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Bar chart showing the proportion of institutions with waste management plan and team" /></td>
</tr>
<tr>
<td>Plan</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>85.7</td>
</tr>
<tr>
<td>78.9</td>
</tr>
</tbody>
</table>
4.3 Technology Use and Sitting of HCW Treatment and Disposal Facilities

Information on HCW treatment technology use in various HCFs was sort from District Public Health Officers in ten districts of Kenya, these being Uasin Gishu, Machakos, Nyeri, Embu, Narok, Keiyo, Bondo, Garissa, Mombasa and Kisumu.

4.3.1 Availability of incinerators

All the health facilities visited reported to have incinerators. However, this is not representative of the rest of health facilities within the various districts. Out of 295 government facilities in the district, only 27 were reported to have incinerators accounting for only 9.1%. In the private/mission facilities within the districts, 201 out of 409 health facilities were reported to have incinerators, accounting for 49.1% of these facilities with incinerators.

Figure 13. Health institutions with incinerators

Most of the incinerators in these facilities are De Montfort type incinerators constructed in 2002, of which 55% are in intermittent or regular use. In Urban health centres and dispensaries, brick built incinerators were observed while in most rural facilities the most common treatment is through pit burning.
Over half (54%) of the government facilities have incinerators made of brick, followed by those made of stone (23%). Similarly, in private/mission health facilities, brick incinerators were reported to comprise 50%, while 30% were reported to be made of stone. In both government and private/mission health facilities, electric incinerators were few, reported to be 18% and 10% respectively.

The major type of incinerator fuel used in both government and public/mission health facilities was reported to be kerosene, comprising 35.7% and 36.3% respectively. The next most popular type of incinerator fuel was waste paper, used by 28.5% of the government facilities and 36.3% of the private/mission hospitals. Diesel
and wool contributed to 14.2% each in government facilities and 9% and 18% respectively in private/mission facilities. No health facility reported use of sawdust or electricity to fuel their incinerators.

4.3.2 Status of incinerators

Two-thirds (66.6%) of the incinerators were reported to be in working order and were being used. They were operated for between one and six hours per day, and have been in use for between one and three years. Half (50%) of these incinerators were reported to have scrubbers.

Figure 16. Methods of HCW treatment and disposal
• That where healthcare wastes were dumped, they generally did not include sharps. It was usually possible, however, to find some sharps and on occasion blood samples amongst the healthcare wastes. These cases are reason for concern.

• Without exception, the scavengers indicated awareness of the dangers associated with healthcare waste, and stated that they avoided contact with it.

• Regarding the scavenging or recycling of healthcare wastes, all scavengers were adamant that sharps were not recycled. They said that they sometimes used the tubing from drip apparatus, but it was never recycled back into the system.

Based on their open dumpsite status and the presence of scavengers at the public waste disposal facilities visited, would definitely not provide the potential for the safe disposal of raw or treated health care wastes at present.

Similarly, even though there are no scavengers at the private dumpsite, because of bad siting, design, and poor operation and housekeeping these too were found to be far from acceptable for the disposal of raw or treated healthcare wastes at present.

It might, however, be possible to upgrade certain private dumpsites to be reasonably acceptable landfills at which select healthcare wastes could potentially be disposed in an acceptable manner.

In the case of the large public open burning dumpsites, general upgrading would be a long and involved process, requiring inter alia planning, engineering, education and training. For this reason authorities and researchers see closure as the only option. Although beyond the scope of this project, this view is not held by the authors, consequently aspects of the rehabilitation of the Dandora dumpsite are addressed in the recommendations.

Incinerator ash samples from the dumpsites at the Kenyatta National Hospital Nairobi and the Coast Provincial Hospital in Mombassa were hazard rated.

For a very small scale, remote healthcare institution; provided the sharps, infectious and putrescible wastes are reasonably “incinerated”, it would not be inappropriate to dispose of healthcare waste in a pit. This should, however, have drainage controls, no burning other than in the incinerator and regular covering. The criteria for acceptability would be good housekeeping and the consequent absence of scavengers, odour, flies and unsightliness.

4.4 Training Needs Assessment and Awareness Creation on HWCM in Kenya

The main task of this subcomponent of the study was to establish the status of existing training and awareness creation on HCW in Kenya with a view of identifying the existing gaps. The study also set to establish current players in training, the existence of curricula and review their appropriateness. Additionally the study assessed the existence and levels of awareness creation and activities.

4.4.1 Available Training Curricula

A curriculum defines and captures relevant knowledge and skills, necessary for performance of tasks at various levels. For this exercise, curricula of Medical training colleges and schools of Environmental Health were reviewed and found to be at various levels of development in consonance with the trainees produced. For instance, the Department of Community Health, University of Nairobi trains undergraduate medical students and graduates with Masters in Public Health. Environmental health and occupational health is one of the main courses in the curriculum, covering a total of 30 hours at the undergraduate level and 60 at the postgraduate level. However, in the overall course for Environmental Health only a small component of waste
management in general is covered. Specifically, what is available is a broad listing of topics in which waste management appears as: “Categorize and differentiate all types of domestic solid waste and “describe and cite the storage, collection, transport and disposal of solid waste”. Health care waste management is not listed as a specific topic, critical as it may be, given the increasing health risks posed by new and re-emerging morbidities such as hepatitis B and C and HIV and AIDS. This course should have been revised in tandem with the new developments and requirements in Environmental Health.

It is important to note the university medical graduates form the cadres of health personnel that serve as overall health managers at district, provincial and national health institutions yet their coverage of environmental health, in particular health waste management is very much limited. This is a critical observation that raises concern over the manager’s appreciation of the need to focus on health care waste management separately from general waste. This also implies that a health manager who is not adequately equipped with the relevant skills in health care waste management will be much less involved in supportive supervision and “on job training”.

In contrast the diploma level in Environmental Health Science course at the Kenya Medical Training Centre (KMTC) is much broader, covering a wide range of related topics. For instance, Public Health officers are trained at diploma level for 3 years, covering over 4500 hours. Additionally a higher diploma level in waste management is offered for one year, a total of about 700 hours. They are deployed to health facilities and are charged with responsibilities for waste management and sanitation in general. They are also responsible for awareness creation, and enforcement of public health regulations. What is pertinent to note is that public health officers go up to the locational level and this is significant in that as the issue of waste management becomes critical there will be personnel at the lowest level to offer technical support not only in waste management and disposal but also creation of awareness at the community level. This is already underway alongside condom distribution.

Discussions with the head of department of Occupational Health and Safety at KMTC revealed that relevant curricula are instructive to note that the curriculum have undergone review in 2005. The review has taken cognizance of the recommended WHO modules. Thus; in theory the curricula are sound and adheres to international standards. The course on waste management has been boosted and the current time allocated is 80 hours. In the revised curriculum the modular system allows for flexibility in that one can come in for a relevant module and get certification. Similarly one can arrange for on-the-job training by simply selecting an appropriate module to address skills that may be lacking from facility to facility. However, the challenges are around implementation so that the practical elements of the curriculum are not fully realized due to logistical constraints. Issues of management and deployment may also affect the application of the skills.

The private hospitals such as Nairobi and Aga Khan Hospitals and Rahemtulla wing of Kenyatta National Hospital (KNH) train their own health personnel for waste management. However, it is possible that the trainees are not exposed adequately, especially with regard to practicals as the institutions aim to maximize on time and costs. The issue of standards comes to the fore and therefore the need for harmonization of curriculum under one umbrella; preferably the KMTC is pertinent. Several public universities including University of Nairobi, Kenyatta University and Moi University provide a course on environment management and planning at degree level. However, their graduates are not tailored to work in health institutions. They are mainly absorbed by parastatal bodies and non-governmental organizations.

Teaching and research laboratories generate health waste that may often pose health risks but this is not necessarily perceived or treated as different from general waste. A visit to the Chiromo campus of the University of Nairobi revealed a different scenario. This is a complex that generates a lot of Health care waste. There is an incinerator that is yet to be commissioned though it is complete. However, it was evident that the generation of waste has not been accompanied by concomitant training in handling waste. Although it was known that segregation is critical and should be done at source it was quite clear that this is not done.
Within the Ministry of Health programme based curricula have been developed, as is the case with Kenya Expanded Programme of Immunization (KEPI). The KEPI Plan of Action of 2002 emphasizes injection safety as part of all EPI training modules which are used in both pre-service and in-service training course at university, medical training colleges and other medical training institutions in both private and the public health sector in Kenya. Plans are underway for KEPI in collaboration with MOI University to train middle level health managers on injection safety. The Division of Reproductive Health, in collaboration with other organizations such as Engender Health, JHPIEGO and AMKENI has developed curricula, notable for Family Planning and Post Abortion Care. However, in each of these curricula there is module on infection prevention, which touches on health care waste management, albeit to some extent.

For the past two years, JSI in partnership with CDC and in collaboration with the Ministry of Health has produced a training manual for training health workers in waste management under the project “Making Medical Injections Safety (MMIS)”. The project adopts the intervention strategy conceptualised by WHO and SIGN emphasizing three core areas namely, behaviour change of health care workers and patients to ensure safe injection practices and reduce unnecessary injections; ensure availability of equipment and supplies; and manage waste safely and appropriately. This is being piloted in two district: Bondo and Kiambu district and two provincial hospitals: Kisumu and Kakamega. The plan is to scale up to Nyeri and Nakuru districts. (Okuku pers. comm.)

The basic approach is through training and sensitisation of all health workers by category starting with injection providers and waste handlers; largely the subordinate staff. This covers public and private facilities; the idea being to reach all health providers and who essentially generate waste. For example, a private retired nurse operating privately is invited to training and provided with a safety box. She in turn takes the filled box to the nearest health facility, which may have an incinerator or dumpsite.

In addition to the training manual the project has developed a reference manual whose overall objective is to assist health providers to ensure safe injection practices and proper management of waste on a day to day basis. It is more of a job aid that assists health workers to inculcate and practice basic skills. The manual has notes on reduction of medical wastes generation in clinical practice; universal precautions for infection prevention; behaviour change communication in both the community and clinicians and logistical support. The manual is versatile enough to be presented by a trainer; reviewed by health workers alone or in groups. Overall it contains a section that exposes the learner to various aspects of waste management and the recommended standards and guidelines.

Under the project supplies are provided specifically injections and colour-coded bin liners. The emphasis is on waste segregation at source and this has been embraced. The idea is that districts develop a functional
system of waste management depending on the technology in place. A transportation schedule is also in place to collect the waste from the peripheral facilities to a common incinerator. What is emphasized most is the waste segregation at source. But it is also important to recognize that health workers are able to put into practice what they have learnt in an environment where the infrastructure, in terms of requisite supplies is in place.

Although there is district coverage there has been no attempt yet to reach the informal handlers/scavengers. However, there are plans to reach out to the community. This will be largely through messages that address the need to appreciate the hazardous nature of hospital waste and therefore the need to minimize exposure. The strategy of rolling out messages will be through posters in market places, health centres. These will also be used for health education during outreach. Currently the project is working on media scripts for radio, TV and community theatre.

4.4.2 Findings on Training Needs Assessment

Over and above the review of curricula, key informant interviews were conducted in selected health facilities. To be able to ascertain the usability of this curriculum an instrument was developed and was administered in the selected project areas to cover the operatives at all levels in waste management. The initial step was to establish the level of training for the officers in the field. Depending on the academic and or professional level of training the operatives had various skills. This ranged from certificate level to PhD level training. The training had varied duration. For instance, one reported having had a one month course in incineration, another some units in health care waste management for a month. Under the general rubric of environmental health some units are had been covered under the BSC degree programme. Nursing takes 4 years, and aspects of clinical waste management are covered in so far as their tasks go. For the nurses the emphasis was on infection prevention and even though they work in areas where a lot of risky waste is generated, segregation is not an aspect that is clearly emphasized in their training.

In terms of the current practices in health care management the participants were able to identify two systems of waste management that were in place either singly or in combination. Open burning was not reported in most of the sites visited. However, where it was practiced it was emphasized that this is for burning of non-clinical items while clinical waste should go through the incinerator. Open Burning was carried out in most institutions that do not have incinerators. It is one of the most common practises, though not encouraged. According to the participants the common modes of waste management are as listed below:

4.4.2.1 Incinerator Operators

Operatives interviewed in the field understood the importance of incineration: that the aim is to reduce the waste volume and character so as to enable the final hygienic disposal of the non-toxic remnant (ashes). There are various options of disposing the ashes, which include burying or are collected with other wastes for disposal. It is recognized that the original waste toxicity levels also determine what should be done with the wastes. Thus, knowledge of what type of waste it originally was and separation before incineration was considered vital. Based on their description, the process involves the following steps:

- Identifying the different types of clinical waste and identifying those that should be disposed of in the incinerator.
- Separate the waste
- Weigh the waste
- Load into incinerator and burn the waste at the set temperature
- The waste can be burnt for up to 8 hours depending on the type of waste.
- Ensure that all the waste is burnt to ashes
- Package the burnt waste or the ash to be collected by the contracted company for disposal
• While carrying out the procedure, you have to wear protective clothing that is gloves, facemask and dustcoat.

4.2.2.2 Dump Site
It was noted that 90% of waste, which are generally collected from various institutions, is disposed through crude dumpsites. Many institutions do not have dumpsites. Where they exist the process involves:

• Separation of clinical waste from non-clinical waste
• The waste is usually in different coloured polythene bags to identify the waste
• The waste in dump sites mostly contains non-clinical waste
• There is a contracted person to collect and dispose the waste
• The dumpsite is guarded to ensure no scavengers enter. This is important to protect the scavengers who may not know the hazards

Shortfalls- gaps
The respondents were asked to state whether there are any shortcomings with regard to health care waste management within their institutions. The findings from the discussions point to both deficiency at the individual, institutional level and at training level in terms of the relevant skills. It was observed that:

• Training is compartmentalized to focus on specific health providers rather than being implemented for all across the board of health providers recognizing the fact that waste management should ideally start from where it is generated. A pertinent example is that of nurses who by virtue of their work generate a lot of potentially dangerous waste and therefore the initial proper handling needs to start with them. However; their training does not cater for depth in health care waste management. Rather it focuses on infection prevention

• The practical aspects are not handled adequately and this is tied to the resource base of the relevant training institutions where budgetary allocations for field exposure are limited.

• The informants felt that there should be more training on handling of clinical hazardous waste as well as on modern methods of disposal

• In spite of training there are still shortfalls in collection and disposal of waste and this deficiency is largely attributed to the facility administrative machinery that need to spearhead and facilitate this process.

• Shortfalls in disposal – open dumps pose health risks

• There is no strategy in place to address health provider and community attitude towards waste management and disposal

Role of the Ministry of Health
The Ministry of Health (MoH) is committed to addressing issues of waste disposal and hence the need for this plan. The mandate of waste management within the MoH is the responsibility of the Division of Environmental Health. In terms of the curriculum there is already a recommended version by WHO that comprises 4 modules. Each institution is expected to adopt the module and customize to suit the level of training. However this would have to be monitored by MoH to ensure that each defined level receives the appropriate level of skills concomitant with the tasks. The central role of the MoH would therefore be that of coordination of the training of component of waste management both in the tertiary institutions and other players as well as the lower levels of the community.
Challenges
Training institutions are more academic than practical yet there is no quick fix for waste management and disposal. The Kenya Medical Training College has a fully fledged training course at higher national; diploma level on waste management for PHOs with a component on HCWM. Public universities especially Kenyatta University has a training component on waste management in their diploma and masters degree programme in Public Health. On job training and supportive supervision preferably with job aids is crucial to ensure continuous medical education at the facility level. However this requires ample resources to facilitate training and retraining.

Even when training has been undertaken implementation is a major problem as often there is professional compromise on work ethics that may arise out of poor institutional infrastructure and lack of supplies. This may be amplified by understaffing

Risk involved in handling blood specimens, syringes and human body tissues from histology is evident and yet the operator has no medical cover or adequate protective clothing.

There is lack of funding to create adequate awareness among health providers as well as the general public on health care waste management.

Updates for operatives on the current changes and information on waste management are required but will largely depend on better facilitation in terms of field training.

Issues of sustainability- the need to provide commodities and the necessary infrastructure for efficient waste management and disposal.

4.5 Private Sector Participation in Health Care Waste Management in Kenya

The privatisation of healthcare waste is yet to be developed in Kenya as per the findings of this study countrywide. Urban centres have tried to introduce private sector participation in health care waste management but the same has lagged behind in rural areas where there are rates of poverty and even health care service is not highly developed. So far Nairobi, Mombasa and Kisumu have registered some success in privatisation of waste.

There is no formal policy for private sector involvement in waste management at either central government level. There are no national laws which govern private sector involvement in waste management.

In 1997 Nairobi City Council (NCC) tendered out contract to Kenya Refuse Handlers Ltd but did not specify where categories of waste to be disposed though they knew waste from CBD composed of health care waste. The contract agreement specifically prohibited delivery of hospital and industrial waste to Dandora dumpsite.

Nairobi has more than 60 private sector involved in waste collection. The number may be higher or less but due to non existence of regulation, it's difficult to know. A handful of this number (less than 10) deal in HCW. Of the overall waste generated in Nairobi for example, 1 percent is health care waste (JICA 1998). This is about 3.6 tons per day and only covers 25 % of the waste disposed by private sector.

Kenya National Hospital once contracted HCWM services when the institution incinerator broke down but due to large quantity of generated HCW, the provider could not cope (Barrack pers. comm.). This is a case of capacity of HCW service providers in Kenya.

Majority of private companies engaged in Health Care Waste Management in Kenya lack the capacity to manage HCW. The management has been hampered by the fact that:
They lack infrastructure as such refuse Vehicles, incinerators: None provision of Standard Refuse Vehicles. The current ones are open trucks, tractors, canters and pickups.

Health Safety: Personal Protective Equipment (PPE) are not provided, save for overalls and a few gloves

Training: All the workers in the private sector school leavers and have rarely been trained in waste management

Operation areas: Most private sectors seem to prefer affluent areas leaving the non affluent areas unserviced

Private sector in HealthCare Waste: No private firm was specifically for Healthcare Waste. Nairobi had one that was specifically for Placenta disposal (Sanitation Cares)

Incinerators: Despite most healthcare institutions having incinerators, no private firm or council have incinerator(s) that could be commercialised.

Separation of Waste: Waste is not separated and this implies that recycling and proper disposal is never practised

Private waste collectors are not controlled or monitored by any local or central government arm.

The above scenario can be linked to the following causes.

The initial cost of establishing HCWM infrastructure i.e. incinerator, trucks, trained manpower, Personal protective Equipment (PPE) and is too high for the general waste collectors who also double up as HCW providers. Over 90% of waste collectors are informal outfits that organise themselves to collect from residential estates in big towns.

Another obstacle facing private waste collectors in Kenya is the fact that HCW generated by some of the big well established health facilities is managed in house. It’s only in small private clinics that could use the service of private HCWM service providers.

Plate 2 Private incinerator near old Mombasa road, Embakasi

Lack of legal framework and enforcement of the available regulations also contributes to poor performance of private HCW collectors. Though the country has ad hoc policy and regulation on waste management, the subject encompasses waste management in general and does not pin-point on medical waste. This situation has led to health care waste handled and disposed as general waste.
Despite the small number of private firms in the management of waste, healthcare waste management is highly neglected and the need for separation of the same from the source, during transportation, recycling and subsequent disposal is inevitable.

Central and local governments should come up with legislation governing healthcare waste and put the necessary enforcement procedures in place.

In conclusion the private sector participation in health care waste management can be characterised as follows:

- Lack of infrastructure
- Lack of capital to invest in equipments and incinerator
- Poor management
- Lack of capacity to handle health care waste generated by health facilities in Kenya
- They operate in uncontrolled working environment without regulations

4.6 Level of Scavenging and/or Recycling

In some facilities like Machakos District Hospital, plastic medicine bottles and drip bottles were segregated from other HCW. From our investigation, it was found that drip bottles were sold as containers for storing water in the drier parts of the district. Ampoule bottles are recycled and sold to patients visiting the hospital. At the entrance of the district hospital there is a shed where these bottles are sold.

The study revealed that the demand for health care wastes was moderate at the three dump sites unlike at Kenyatta National Hospital where no recycling of health care wastes was noted since they were all incinerated. However at Nyeri, Machakos and Kisumu damping sites, empty bottles were sold to herbal medicine men with one collector at Kivoya dump site confessing that he had used an expired cough syrup to treat a cough he was suffering from. Generally the observation showed that the degree of recycling of health care wastes was low since their demand was low.

At Kisumu dump site, 15 – 20 scavengers confirmed, that they suffered competition from the town scavengers who intercepted the wastes before they reached the dump site. At Kivoya dump site, the municipal council burns the wastes scavengers needed.

4.6.1 Social Issues Related to Scavenging

The survey revealed that at all dump sites, the scavengers came from different parts of the country and lived nearby or within the damping site. Some of the respondents revealed that they decided to work at the sites due to loss of spouses, parents and the need for money to cater for their most basic needs, which included food, and entertainment.

At Nyeri dump site for instance, the scavengers were a security threat to the people living around the site with 2 stakeholders confirming that the scavengers turned to be thugs after their work on the land fill late in the evening.

At Kisumu dump site, the cabbage collectors were also reported to be a security threat to the pedestrians using the adjacent road but in Machakos the site was located far from households thus security was not an issue. At all dump sites, the study revealed that the smell and smoke from the dump site polluted the surrounding environment and thus was a health hazard.

The study also showed that at both Kisumu and Machakos dump sites, the scavengers were feeding on the kitchen wastes at the time the site was visited. The research revealed that at Kisumu dump site, the
scavengers used the expired medicine disposed at the site and as a result in the year 1997 approximately 8 people died of consuming the expired drugs.

The study also revealed that in Nyeri and Kisumu some scavengers did not work at any other place unlike in Machakos where some scavengers came from tilling lands to the sites. The Kenyatta National Hospital managed their wastes by burning them inside an incinerator but the study revealed that the incinerator was only one and incase of its breakdown, then the waste would be hard to manage since this waste does not find way into the general damping sites.

4.6.2 Type and composition of wastes frequently scavenged and why

The observation showed that at Kenyatta National Hospital, the kitchen wastes were sold to the pig keepers and this acted as a source of income to the hospital. At Kisumu dump site, the scavengers sold part of the kitchen wastes to pig keepers and this brought income to them.

The survey revealed that in all Nyeri, Machakos and Kisumu damping sites, aluminium is considered to be the most important, plastic fairly important and carton least important. All commodities are measured in kilogrammes of which at Nyeri and Machakos dump sites, their prices were:
   a) Aluminium-Kshs 50 per kg
   b) Plastic-Kshs 15 per kg
   c) Metal of carton-Kshs 5 per kg

While in Kisumu dump site;
   a) Aluminium, carton and metal cost Kshs.3.00 per kg.
   b) Plastic costs Kshs 5.00 per kg

The study showed that in both Nyeri and Machakos, the commodities are sold directly to the buyers or sometimes middlemen were used, unlike in Kisumu where only middlemen were used. In Nyeri the cartons were sold to Kenya Paper factory and plastics sold to industries in Thika for water tank construction. The research showed that at all dumping sites, the empty bottles were sold to herbal medicine men who recycle the bottles and used them to sell the herbal medicine. An observation revealed that some scavengers at Machakos damping site, tilled peoples’ land to supplement the little earnings they got from the site after selling the commodities.

At all dump sites, 20 – 30 scavengers revealed that they use the money earned after selling the commodities on buying food and entertainment whereas in Kisumu damp site two collectors confirmed that they used some of the money to pay house rent.

On average the income earned by the scavengers at the three damping sites was generally low. Ten to Twenty scavengers confirmed using the money collected to buy local brew (chang’aa) and Khart (Miraa) for their entertainment.

4.6.3 Scavengers, Scavenged materials and Markets

The observation revealed that the waste collectors at Kivoya damping site in Nyeri were mainly males aged between 11-30 years. At Matheu damping site in Machakos, there were both males and females together with children aged between 5-30 years of age.

However, in Kisumu damping site, no female was allowed into the damping site – but children found their way into the damping site to pick playing items. The observation showed that at Kisumu the males were aged between 7 to 60 years. One collector confirmed that he had worked at damping sites since childhood.
In Machakos the children and female scavengers visited the site in shifts after the males had left. The study also revealed that in Nyeri and Machakos, the scavengers had no formal training on waste handling unlike in Kisumu where the scavengers confirmed that they all had knowledge on waste handling by attending workshops on waste management in Environmental conservation.

The research revealed that in all dumping sites visited, 5 to 10 scavengers were married with 1 – 3 children to take care of while others were single. 1-3 scavengers at all dumping sites confirmed that they were orphans. At Kenyatta National Hospital, the survey revealed that there were no scavengers since the waste was burnt at an enclosed area.

Scavenged commodities are sold directly to the buyers or sometimes middlemen. In Kisumu only middlemen were used. In Nyeri the cartons are sold to Kenya Paper factory and plastics sold to industries in Thika for water tank moulding. The study showed that at all dumping sites, the empty bottles were sold to herbal medicine men who recycled the bottles and used them to sell the herbal medicine. An observation revealed that some scavengers at Machakos dumping site, tilled peoples’ land to supplement the little earnings they got from the site after selling the commodities.

4.6.4 Current and Efforts to curb Scavenging

The study showed that the employed workers at Machakos, transfer station use gloves and masks when handling the wastes but the scavengers had no protective clothing.

To prevent scavenging within the facilities disposal sites and off-site dumpsite, most facilities fence the disposal sites and burn HCW if taken out of the HCFs compound/. At Machakos and Dandora dump sites, it is reported that when HCW is delivered, it is immediately set on fire to discourage scavenging and recycling. However drip bottles from HCW composition is recycled as part of plastics

4.7 Summary of Findings on Status Quo

The study revealed the following issues of concern:

4.7.1 State of HCW disposal sites in Kenya

Based on field visits and direct observation at some ten dumpsites in Kenya, a reasonably representative database, which characterises the situation regarding healthcare waste handling on disposal sites in Kenya, has established that the existing waste disposal facilities in Kenya, meet the generally accepted criteria for dumpsites, i.e. they are not operated in any way and are thus uncovered and burning. In addition the public ones are characterised by the presence of numerous scavengers.

Key Findings at Waste Disposal Sites
- Lack of sanitary Landfills
- Presence of Scavengers
- Presence of HCW in dumps
- Poor siting
- Leachate and pollution of soil and water

4.7.2 State of HCW Management in Health Care Facilities

The assessment on health care waste management in health care facilities at all levels in Kenya reveals the following problems:

- Lack of HCW Management Plan/Policy
- Inadequate Health care waste storage receptacles
4.7.3 State of HCW Treatment Plants in Health Care Facilities

- Inappropriate Internal HCW storage facilities
- Inappropriate Internal Transport facilities
- Lack of Segregation of HCW
- Delay in HCW collection
- Lack of Budgetary allocations for HCWM
- Tedium Procurement Approval Process
- Lack of Personal Protective Gears/PPE
- Lack of Pre-Treatment of HCW before final disposal
- Lack of Waste Minimisation Strategy
- Inadequate On-site transport Facilities

4.7.4 Status on Legislative and Regulatory Framework

- Relevant Acts are weak on HCW
- Lack of Harmonized policy and legislation addressing HCW
- Delay in Gazettement of Draft Policies on HCW
- Inadequate enforcement of relevant laws

4.7.5 Status on Training and Awareness in HCWM

The findings from the discussions point to deficiency at both the individual, institutional level and at training level in terms of the relevant skills. It was observed that:

- Training is compartmentalized to focus on specific health providers rather than being implemented for all across the board of health providers recognizing the fact that waste management should ideally start from where it is generated.
- The practical aspects are not handled adequately and this is tied to the resource base of the relevant training institutions where budgetary allocations for field exposure are limited.
- Inadequate training on handling of clinical hazardous waste as well as on modern methods of disposal
- In spite of training there are still shortfalls in collection and disposal of waste and this deficiency is largely attributed to the facility administrative machinery that need to spearhead and facilitate this process.
- There is no strategy in place to address health provider and community attitude towards waste management and disposal

4.7.6 Private Sector involvement

- Lack of infrastructure such as Standard refuse Vehicles, Incinerators:
- Lack of Personal Protective Equipment (PPE)
• Majority of workers in the private sector are school leavers and have rarely been trained in waste management
• Preference of affluent areas leaving the non affluent areas un serviced
• Lack of infrastructure such as Standard refuse Vehicles, Incinerators:
• Lack of Personal Protective Equipment (PPE)
• Majority of workers in the private sector are school leavers and have rarely been trained in waste management
• Preference of affluent areas leaving the non affluent areas un serviced
• No private firm specifically offers services for Healthcare Waste.
• Majority of the private firms do not have incinerator(s).
• Poor monitoring and control of Private waste collectors by local or central government arm.

4.7.7 Condom Disposal

Condoms are mainly generated at the household level and in entertainment spots including clubs and restaurants, lodges, hotels, academic institutions, offices, among others.

Methods of Condom Disposal
The findings of this study have established that condoms after use are disposed off in the following forms namely;

Flushing in the existing sewer lines ending up in the sewage treatment plants. Personnel interviewed in the Nyeri Sewerage Treatment Plant, Kisumu Sewerage Treatment Plant, and Mombasa Sewerage Treatment Plant respectively reported that they collect over 1,000 used condoms daily from the treatment plants. Because the condoms block the lines, upon removal, they are disposed off in the existing dumpsites. In the rural areas where sewerage lines do not exist, the study found out that the condoms are disposed off in the pit latrines but at times are left strewn in the pathways creating another risk especially for children.

Disposal as domestic waste
Used condoms are also disposed off as domestic waste generally in the solid waste dustbins and end up finding its way in the municipal dumping sites. Visit to almost all the dumping sites exhibited presence of used condoms and at times the child scavengers in these dumps were found playing with these condoms.

Expired Condoms
This study has also established that expired condoms more often are also disposed as part of the general solid waste and end up in the municipal dumping sites.
5.0 Conclusions and Recommendations

5.1 Conclusions
The study concluded that there is poor management of healthcare waste by the health facilities in Kenya. This conclusion is arrived at on the basis of various factors which included lack of waste segregation and labelling in most health facilities, lack of elaborate legal, policy and institutional framework for HCWM, inadequate and substandard healthcare waste treatment and disposal facilities, inadequate training and public awareness on healthcare waste management and lack of sanitary landfills.

At the Kenya’s only National hospital Kenyatta, the public health department is responsible for HCW management. At the hospital the key people in management of waste include the generators (nurses, doctors, public health lab technicians, clinical officers, among others), cleaners, drivers and incinerator operators. Apart from Public Health Officers (PHO) and nurses to some extent, the remaining personnel lack formal training on how to handle and manage HCW, there is inadequacy of receptacles, improper segregation of waste, low capacity incinerator, HCW is transported on an open truck and there is open burning of HCW. The hospital normally has in-house training based on HCWM principles but lacks a structured curriculum or manual for undertaking the training. This quarterly training is organised and offered by the public health department of the hospital.

Provincial and district health facilities have public health departments which are supposed to be in charge of HCW and general sanitation. The general condition is that the facilities lack basic equipments, trained personnel to handle HCW, transportation to the point of treatment is by wheelbarrows, majority of these facilities have incinerator though dilapidated, HCW can be seen on the footpaths and incinerator operators have neither been trained in HCW incineration nor occupational health and safety.

Private clinics use the services of private waste collectors to manage their HCW and general waste. Even though they use private firms to manage their waste, they lack trained manpower and even the generators of HCW (nurses, clinical officers and doctors) in these establishments are not trained in HCWM. This is evident by the fact that they don’t segregate at source. In some clinics HCW is mixed with general waste and dumped in dump sites and the common receptacles are liners for non sharp HCW and sharp boxes for sharps.

All Health Centres and Dispensaries have no budget for waste management; any resources required for this purpose come from operational budgets which are passed onto the patients through the cost sharing system. Most health care workers and casuals contracted to clean and dispose of HCW, lack of basic training on how to manage HCW. Most of these facilities lack formal HCW treatment option. For those with incinerators, they are made of brick. The most common method of treatment is through open burning.

Based on the study, the general public level of awareness on risks of HCW is poor and limited. However they understand that they may contract diseases if they come into contact with HCW, specifically HIV and AIDS. The general public has a common idea of risks posed by HCW though this applies to informed masses. Children were found to be most ignorant of risks of HCW and the most affected by poor management of HCW.

The privatisation of HCWM is yet to be developed in Kenya as per the findings of this study countrywide. Urban centres have tried to introduce private sector participation in health care waste management but the same has lagged behind in rural areas where there are rates of poverty and even health care service is not highly developed.

The study revealed that there is recycling of health care wastes, although the degree was low, especially at the District and Provincial Hospital in Machakos and Nyeri respectively. Plastics are the mostly recycled HCW.
Regarding legal administrative and institutional framework on HCWM, there is as yet no dedicated law on health care waste. However regulations are proposed. In the absence of such law there is no specific standards on the air emissions or liquid discharges from bio-medical waste handling. There are requirements with regard to transport but these are not yet being enforced.

In all HCFs sampled the waste that is properly segregated are sharps, which are placed in sharp boxes provide by MoH.

The country has no single sanitary landfill. The MoLG is the one responsible for allocation and management of disposal sites. And the areas currently used in urban areas for disposal of solid waste are dump site. Most of the HCW found in the dumpsite come from private HCFs and to some extend public HCFs as is the case in Machakos. This are the very same sites are used for disposal of medical waste in urban areas. In rural areas, HCW is generally open burnt or disposed in dug out pits which are covered when full and a new once dug.

5.2 Recommendations
The major recommendation of this study is the immediate need for the development of a Plan of Action on Health Care Waste Management for Kenya. Key aspects that should be part of the Action Plan on Health Care Waste in Kenya should include:

- Plan of Action for Training and Awareness Creation on HCW including a communication strategy
- Plan of Action for Private Sector involvement in HCW Management.
- Plan of Action for HCW Management in Health Care Facilities including the social concerns and risks associated with HCW.
- A Plan of Action for Legislative and Policy on HCWM
- A Monitoring, Evaluation and Reporting Plan.
- A Plan of Action for Financial Resource requirements necessary for implementing the National Health Care Waste Management.
6.0 Background to Development of Health Care Waste Management Plan in Kenya

Increased environmental awareness results in increased focus by governments throughout the world on the potential impact that waste, and in particular HCW, can have on human health as well as the environment. The hazardous component of HCW referred to as Health Care Risk Waste (HCRW), is considered to be the second most hazardous waste stream after radioactive waste according the United Nations listing as quoted in the Basel Convention to which Kenya is a signatory.

It is imperative to note that since the 1950s HCW has changed from mostly cellulose (cotton, gauze, swabs, paper etc) to a more heterogeneous waste streams with larger percentage of disposable materials, resulting in a significant increase in the use of plastic and composite materials. The percentage of hazardous materials like mercury and other heavy metals in HCRW has also increased. Home Based Care for HIV/AIDS patients are also emerging areas of HCRW generation, which could have an impact on the composition of domestic waste if not effectively managed.

Many countries in Africa are at present grappling with how to handle HCW due to its associated risks and complexity in overall sound containment and management. Kenya is not an exception to this phenomenon and has been indeed facing problems in the sound and effective management of HCWs generated from the health care facilities in the country.

Kenya, other than lacking a comprehensive policy for management of HCRW and Health Care General Waste (HCGW) also lacks among others adequate technology and appropriate capacity for management of HCW streams. Untreated HCRW, as well as ash from poorly incinerated HCRW, is often disposed off in uncontrolled waste disposal sites where informal recovery of recyclable materials could be undertaken, thus exposing waste management workers and litter pickers to increased health and safety risks. In addition to this, disposal of untreated HCRW in uncontrolled waste disposal sites may result in spreading of infectious materials by animals as well as the contamination of groundwater.

A lack of general awareness and training capacity within health care facilities and the health care workers in Kenya, including the general public, is leading to the neglect in safe, healthy and environmentally sound HCW management practises. The Kenyan situation is further characterised by large proportions of HCW that are incorrectly segregated into the HCRW and HCGW streams that are each to be managed in its own unique manner. This not only results in HCGW being disposed of with HCRW, thus unnecessarily increasing the HCRW stream that requires costly treatment, but it also results in HCRW being disposed of with the HCGW, which creates a risk to all people coming in contact with such HCGW.

The escalating problem of the HIV/AIDS pandemic in Kenya is further complicating the issue and risks of HCW management in view of the Home Based Care and Support Intervention strategy that is currently likely to lead to the increased generation of HCRW at the household level due to the lack of adequate and appropriate infrastructure, technology and training of managing this waste at that level.

The Government of Kenya, in taking cognisance of the risks mismanagement of HCRW or use of inadequate or harmful treatment technologies may have in further compounding the threat to public health, has in effect set forth a framework for the activities aimed at jumpstarting better HCW management practices in Kenya.

Due to numerous challenges in the area of HCW management and particularly with the emergence of diseases such as HIV and hepatitis B & C, the Kenyan Ministry of Health is now giving new impetus to better HCW management practices through the development of the country’s Plan of Action.
The preparation of Kenya’s Plan of Action for HCW Management (for the years 2006-2011 {with the consideration to extend this timeframe}) is therefore the initiative of the Ministry of Health in collaboration with the National AIDS Control Council (NACC) and the World Bank.

The framework for the development of Kenya’s Action Plan for HCW Management was therefore designed to begin with the collection of information through a rapid assessment/survey about the prevailing situation in Kenya’s health facilities, culminating in the development of Kenya’s National Plan of Action on HCW Management (Annexure B).

6.1 Objectives and Vision

The objectives of this Health Care Waste Action Plan is to establish a framework for a broad course of activities designed to make the best use of resources and opportunities so as to improve on the standard of HCW management in Kenya.

Although this Action Plan is primarily directed towards the stakeholders within HCW management, it should be noted that it will also impact on other health care facility staff members as well as patients and the general public.

The Vision of the Action Plan, representing the final goal for all activities dealing with HCW management, is formulated as follows:

<table>
<thead>
<tr>
<th>Vision of the HCW Management Action Plan for Kenya</th>
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<tbody>
<tr>
<td>The Vision of the Kenya HCW Management Action Plan is to facilitate the establishment of an integrated, environmentally sustainable, occupationally healthy and safe, financially viable, institutionally feasible and operationally practical, comprehensive “cradle-to-grave” management system for HCW in Kenya, covering all HCW generators and addressing the short, medium and long term needs.</td>
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</table>

Within the context of this Action Plan, the terms used in describing the Vision will have the following meanings:

- **Comprehensive and Integrated** refers to a system covering all elements required to render a sustainable HCW management service, where all elements of the system interacts, for instance by ensuring that in avoiding pollution of one medium, it will not be at the expense of another medium. It further implies that all activities required along the HCW flow path, from generation to final disposal, are coordinated to ensure the most effective use of available resources;

- **Environmentally sustainable** HCW management systems are considered to be systems that do not affect the environment in a negative and irreversible manner in the long term, or as defined by the United Nations Environment Programme: “A system that can provide the present generation with its basic needs without compromising the possibilities of future generations to fulfil their needs”;

- **Occupationally healthy and safe** refers to the need for the implementation of the Strategy without putting the health and safety of workers, patients or the general public at risk at any time during the process;

- **Financially viable system** refers to HCW management systems that are within the financial ability of the health care facilities in general, in the short, medium and long term;
• *Institutionally feasible* means a HCW management system that is structured in such a way that it fits in with the organisational structures in which it is to be implemented, as well as with the affected stakeholders and authorities;

• *Operationally practical* refers a HCW management system that is from a technical and operational point of view feasible for implementation in an effective manner, when considered against the background of limitations and constraints that may exist in Kenya;

• “*Cradle-to-grave*” refers to a HCW management system that deals with HCW from the point of generation, through containerisation, internal and external transport, onsite or offsite storage, to treatment and final disposal of the residues.

The immediate objectives of the Action Plan are formulated as below:

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<table>
<thead>
<tr>
<th>The Immediate Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>To formulate an integrated Action Plan for sustainable HCW management in Kenya;</td>
</tr>
<tr>
<td>To highlight institutional arrangements required for the provision of sustainable HCW Management in Kenya;</td>
</tr>
<tr>
<td>To develop Activities required for implementation of the Action Plan;</td>
</tr>
<tr>
<td>To estimate financial requirements for implementation of the Action Plan; to evaluate the impacts of implementing the Action Plan, including impacts on the environment, occupational health &amp; safety, public health, employment, etc.</td>
</tr>
<tr>
<td>To evaluate the impacts of implementing the Action Plan, including impacts on the environment, occupational health &amp; safety, public health, employment, etc;</td>
</tr>
<tr>
<td>To put verification mechanisms in place.</td>
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</tbody>
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It is the ambition that the implementation of the Action Plan will result in improved HCW management in Kenya that will amongst others lead to the following results:

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<table>
<thead>
<tr>
<th>Expected Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved occupational health and safety at for all institutions and organisations involved in HCW management including the general public.</td>
</tr>
<tr>
<td>Reduced adverse environmental impact resulting from HCRW</td>
</tr>
<tr>
<td>Effective cooperation and coordination between the various government institutions as well as the various parties responsible for HCW management in both the public and private sector;</td>
</tr>
<tr>
<td>Sound, effective and appropriate technical solutions to address the various shortcomings identified in the HCW management system;</td>
</tr>
<tr>
<td>Cost effectiveness and affordability of HCW management, treatment and disposal, through for instance improved HCW segregation as well as more efficient and safer handling of the HCW;</td>
</tr>
<tr>
<td>Legal mechanisms for promulgation of the required standards as well as effective enforcement of such standards;</td>
</tr>
<tr>
<td>A sector that is well informed around the risks associated with HCW as well as staff that are well trained in effective HCW management.</td>
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</tbody>
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6.2 Targets for Achieving the Action Plan

This chapter summarises the officially formulated policies, principles, priorities and legislation that relates to the achievement of Sustainable HCW Management in Kenya, and hence to the formulation of the Action Plans. Based on these policies etc., overall Action Plan Targets have been formulated to create a framework for proposing Activities in the following chapters.

6.2.1 Overall guiding principles for Waste Management

The table below (Table 5) presents the principles from the existing relevant policy and legislative framework considered to be relevant for HCW Management in Kenya. The table furthermore includes a brief interpretation of the aforesaid principles.

Table 5. Guiding principles for HCW Management

<table>
<thead>
<tr>
<th>Environmentally Sound Waste Management Principle</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation of functions</td>
<td>All functions necessary to achieve Sustainable HCW Management in Kenya should be clearly defined and informed to ensure effective execution thereof by the responsible parties.</td>
</tr>
<tr>
<td>Alignment of resources</td>
<td>Sufficient and appropriate resources should be allocated for the various activities related to HCW Management, thus enabling its execution.</td>
</tr>
<tr>
<td>Capacity building and education</td>
<td>Effective capacity building and education can be considered to be one of the cornerstones of a well-functioning HCW Management system.</td>
</tr>
<tr>
<td>Conflict of interest</td>
<td>Conflict of interest among the various stakeholders should be analysed and addressed through consensus processes, thus ensuring a uniform approach by avoiding internal conflicts during implementation of the Action Plans.</td>
</tr>
<tr>
<td>Coordination</td>
<td>Effective coordination amongst the various stakeholders and within the respective organisations should be facilitated to ensure optimum utilisation of resources.</td>
</tr>
<tr>
<td>Cradle-to-grave</td>
<td>The HCW flow from generation to final disposal at a disposal site should be taken into consideration, thus ensuring smooth interfacing between various activities and effective addressing of the activities forming part of the overall HCW flow.</td>
</tr>
<tr>
<td>Full cost accounting</td>
<td>All costs should be analysed and taken into consideration in the further development of the HCW Management system, which is to include all costs often considered to be overhead or hidden costs.</td>
</tr>
<tr>
<td>Open information</td>
<td>All stakeholders and employees within the individual organisations should have easy access to all relevant information to allow for a transparent decision making process as well as an informed labour force.</td>
</tr>
<tr>
<td>Participation</td>
<td>All stakeholders and employees within the individual organisations should be involved in decision-making that is related to the development and implementation of the Sustainable HCW Management system.</td>
</tr>
<tr>
<td>Prevention</td>
<td>During the execution of any activities within HCW Management, prevention should have priority over curing and the necessary preventative measures are therefore to be implemented to ensure the health and safety of workers.</td>
</tr>
<tr>
<td>Polluter pays</td>
<td>The general principle of polluter pays should be applied when dealing with HCW, thus placing the responsibility for the environmentally sound, yet healthy and safe treatment and disposal of HCW on the generators of such HCW.</td>
</tr>
<tr>
<td>Waste avoidance and minimisation</td>
<td>HCW generation should be avoided and minimised to the extent possible, which also includes effective segregation of HCW at source, resulting in the amount of HCRW requiring sophisticated treatment before disposal, also being reduced.</td>
</tr>
</tbody>
</table>
6.2.2 Strategic Target on environmentally Sound Waste Management in general

The Objective of Sound Environmental Management can be described as follows:

**Objective of Environmentally Sound Waste Management**

To reduce waste and diminish the environmental impact of all forms of waste so that socio-economic development of Kenya, the health of its people and the quality of the environmental resources are not adversely affected. This objective will be achieved through the development and subsequent establishment of an integrated waste management plan which when implemented, will extend over the entire waste cycle from “cradle-to-grave”.

Several key issues related to HCW management that was identified as corner stones for Environmentally Sound Waste Management and that are to be addressed in the HCW Management Plan are listed below:

**Key issues related to HCW management**

- To bring about a paradigm shift from end-of-pipe control to HCW prevention and minimisation;
- To ensure that public health and occupational health issues receive due consideration in all HCW management practices;
- To initiate a system of integrated HCW management through the implementation of institutional arrangements and funding mechanisms;
- To ensure integration of HCW management initiatives with other government initiatives, programs and administrative systems;
- To integrate HCW management with the overarching process of environmental planning, management and protection.

6.2.3 Recommendations on HCW Management

The following recommendations relate to aspects that are to be addressed in order to achieve the objective of sound environmental management:

**Recommendation for HCW Management**

- Integrated guidelines covering the full spectrum of HCW are to be developed;
- Provincial governments to undertake surveys determining the quantities, types and locations of all categories of HCW generated within its areas of jurisdiction, as well as on the status and capacity of the available treatment and disposal facilities;
- Training and awareness raising programs must, based on the aforesaid guidelines, be developed and implemented within all health care facilities;
- Sufficient funding must be made available to undertake the required studies and implement the training and awareness programs.
The above will lay the foundation on which provinces can build in order to achieve the goal of protecting the environmental rights of all Kenyan citizens through the implementation of appropriate but effective HCW management systems.

6.3 Kenyan HCW Management

Based on the problems identified, the status quo results included a number of overall policy statements for the management of HCRW in Kenya. The Policy and Regulations furthermore laid down a number of minimum requirements dealing with a variety of HCW Management related issues, including environmental, occupational health & safety, institutional, legislative, and financial as well as information & training matters. These have been discussed below.

6.3.1 Kenya “Biomedical Waste (Management and Handling) Regulations, 2004”

These Regulations apply to all persons who generate, collect, receive, store, transport, treat, dispose of, or handle Bio-medical waste in any form. The Regulations shall however only come into force on the date of their publications in the Kenya Gazette.

The Regulations deal with the following aspects related to HCW management:

- Definitions;
- Duty of Occupier;
- Segregation, Packaging, Transportation and Storage;
- Treatment and Disposal;
- Authorisation;
- Authority;
- Annual Report;
- Accident Reporting;
- Common Disposal / Incineration Sites;
- Appeal.

The Schedules to the Regulations provide detailed information on the following:

- Categories of Bio-Medical Waste;
- Treatment Methods;
- Colour Code for Biomedical Waste (Adopted from the WHO colour code);
- Label for Transport of Biomedical Waste Container Bags;
- Standard for Treatment and Disposal of Biomedical Waste

Adherence to these Regulations will be a prerequisite in Kenya and any Action Plan developed for implementation in Kenya are therefore to be based on the principles of the Regulations.


The Kenya Injection Safety and Immunization Waste Management Plan of Action (2002) forms part of the Kenya Expanded Programme on Immunization (KEPI) and sets the standards for safe disposal of the vast number of sharps HCRW generated in the KEPI programme in particular. The Plan of Action to Improve Injection Safety and Immunisation Waste Management in Kenya deals with the following relevant aspects:
- Objective of the Strategy;
- Choice of Infection Equipment;
- Calculation of Annual Requirements;
- Distribution of Injection Equipment;
- Disposal of Used Equipment;
- Indicators to Monitor;
- Management and Operation;
- Training Requirements;
- Advocacy Requirements;
- Budget Estimates.

The section on Disposal of Used Equipment, although only dealing with sharps HCRW, describes certain requirements for the safe management and disposal of used needles and syringes. The deadline set for achieving the objectives is 2005, by which time the KEPI programme was scheduled for completion.

6.4 The Vision of the Kenyan Action Plan for HCW Management

Based on the Kenya HCW Management situation, the Kenya Injection Safety and Immunization Waste Management Plan of Action:2001-2005 as well as the Kenyan Biomedical Waste (Management and Handling) Regulations (2004), and the Vision of this Action Plan, representing the final goal for all activities dealing with HCW management, has been defined in Section 2.1.

6.5 The HCW Management Hierarchy

The HCW Management Hierarchy for Kenya, as presented in below in Figure 1, can be considered to be a general guide for planning environmental sustainable HCW management in the country.

<table>
<thead>
<tr>
<th>Overall principle</th>
<th>Process</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>Waste prevention.</td>
<td>Minimising use of disposable products</td>
</tr>
<tr>
<td></td>
<td>Substitution of materials.</td>
<td>Green procurement to eliminate PVC</td>
</tr>
<tr>
<td></td>
<td>Waste minimisation.</td>
<td>Improved segregation at source</td>
</tr>
<tr>
<td>Re-use &amp; Recycling</td>
<td>Reuse.</td>
<td>Selected disinfection / sterilisation</td>
</tr>
<tr>
<td></td>
<td>Processing.</td>
<td>Composting of organic materials</td>
</tr>
<tr>
<td></td>
<td>Recycle.</td>
<td>Segregation of recyclable HCGW</td>
</tr>
<tr>
<td>Destruction</td>
<td>Incineration.</td>
<td>Energy recovery &amp; volume reduction</td>
</tr>
<tr>
<td></td>
<td>Other treatment.</td>
<td>Volume reduction</td>
</tr>
<tr>
<td></td>
<td>Residue Disposal.</td>
<td>Final landfill of treated HCRW</td>
</tr>
</tbody>
</table>

Figure 1. The HCW Management Hierarchy for Kenya

As can be seen from the HCW management hierarchy presented above, the first objective when trying to reduce the environmental impacts associated with HCW management is to prevent HCW from being generated. One of the possibilities of achieving this is to substitute certain environmental hazardous materials and substances, e.g. PVC (in plastic articles, e.g. urine bags) and mercury (in thermometers). Such initiatives can be introduced through encouragement of Green Procurement procedures at health care facilities.
Implementation of environmental management systems for all HCW generators can in turn lead to a reduction in the amount of HCW being generated, with improved HCW segregation at the health care facilities resulting in a significant reduction in the amount of HCRW requiring costly treatment before it can be disposed of.

Reuse and Recycling is given second priority in the HCW Management Hierarchy. This includes reuse of health care equipment (e.g. glassware, linen and utensils), reuse of HCW management equipment (e.g. general infectious waste containers), as well as recycling of certain materials recovered from the HCGW (e.g. glass, metals, plastic, paper and cardboard) and processing of certain wastes (e.g. composting of organic waste). Although recycling can be incorporated to varying degrees in the daily operations of health care facilities, HCRW does not lend itself to recycling as the risk of infection outweighs the advantages achieved from recycling.

Based on the HCW hierarchy, the lowest priority is given to HCRW destruction; (thermal and non-thermal), before final disposal is undertaken. Although destruction is given lowest priority, it is often the only appropriate system for HCRW management, as the risk of infection or injuries associated with other treatment methods is too large. However, HCW prevention and proper HCW segregation can still reduce the amounts of HCRW that have to be destroyed without compromising in terms of health and safety. It is further from an environmental perspective as well as a financial point of view not advisable to treat HCGW before disposal, thus enforcing the need for effective HCW segregation at source.

6.6 Proposed Action Plan Targets

Based on the above-mentioned national Policies and Regulations, etc. the following Action Plan Targets, as shown in Table 6 below is proposed. It is to be recognised that such Action Plan Targets will only be fully achieved by the end of the 5-year (optional 10-year) Action Plan, although interim milestones and targets will be set that will ensure full compliance by the end of the 5-year (optional 10-year) Action Plan.

**Table 6. Proposed Environmental Action Plan Targets**

<table>
<thead>
<tr>
<th><strong>Overall Environmental Action Plan Targets</strong></th>
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<tbody>
<tr>
<td><strong>Overall Environmental Action Plan Target:</strong></td>
</tr>
<tr>
<td>To minimise the environmental impact resulting from HCW Management, thereby contributing towards the environmental sustainability of health care service delivery in Kenya.</td>
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</table>

**At National, Provincial and Local Authorities:**

1. Internationally recognised environmental standards prominent in all national, provincial and local authority policies, legislation and guidelines that are related to HCW Management.

2. Planning, monitoring and enforcement of HCW Management related matters prioritised by national, provincial and local authorities.

3. National, provincial and local authorities taking the lead in capacity building and training initiatives in its respective areas of jurisdiction.

**At Public Health Care Facilities:**

4. Internationally recognised standards met in terms of HCW containerisation, internal transport and storage (including colour coding, equipment design standards, etc.) that will ensure appropriate handling, treatment and disposal of HCW.

5. Effective HCW segregation in order to minimise the amount of HCRW that requires treatment, thereby limiting the potential impact on the environment.

6. HCRW managed and treated in an environmentally sound manner, thereby complying with the duty-of-care principle.
7. Environmental management systems implemented to allow for green procurement, waste minimisation and recycling.

**At Transport Operators:**

8. Reduced environmental impact by HCW collection resulting from inappropriate logistical planning for HCW collection.

9. Reduced environmental impact by HCW collection resulting from inappropriate maintenance of transport vehicles.

**At Treatment Plants:**

10. Internationally recognised HCRW treatment efficiency standards met before being disposed of at waste disposal facilities.

11. Internationally recognised emission standards met by HCRW treatment facilities.

12. Effective rotation of HCRW delivered for treatment to limit the storage time.

**At Disposal Facilities:**

13. Waste disposal facilities used that are suitable for disposal of HCGW and HCRW residues in accordance with its classification and that are appropriately designed, constructed and operated in accordance with internationally recognised standards.

**Proposed Occupational Health & Safety Action Plan Targets**

**Overall Occupational Health & Safety Action Plan Target:**

To improve the working conditions for the employees involved in the HCW Management from an occupational health and safety point of view, reduce the health and safety risks for patients and visitors at health care facilities, as well as to reduce the occupational health and safety risks for the public in general.

**At National, Provincial and Local Authorities:**

14. Effective enforcement by national, provincial and local authorities of compliance with national and internationally recognised occupational health and safety standards at HCRW generators, transporters and treatment facilities.

**At Public Health Care Facilities:**

15. Effective HCW segregation that will prevent HCRW from being disposed of in HCGW containers, thus limiting the risk of infection and needle stick injuries.

16. Compliance with existing OHS legislation by health care facilities to minimise the risk of infection, needle stick injuries, heavy lift injuries, etc.

**At Transport Operators:**

17. Compliance with existing OHS legislation by transporters to minimise the risk of infection, needle stick injuries, heavy lift injuries, exposure to dust, etc.

**At Treatment Plants:**

18. Compliance with existing OHS legislation by treatment facilities to minimise the risk of infection, needle stick injuries, heavy lift injuries, exposure before, during and after treatment processes, etc.

**At Disposal Facilities:**

19. Compliance with existing OHS legislation by waste disposal facilities to minimise the risk of infection, needle stick injuries, heavy lift injuries, exposure to poorly or untreated HCRW, etc.
### Proposed Institutional/Organisational Action Plan Targets

**Overall Institutional / Organisational Action Plan Target:**
To strengthen the institutions/organisations involved in HCW Management, thereby enabling them to improve on the standard of HCW Management.

**At National, Provincial and Local Authorities:**

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<tr>
<td>20.</td>
<td>Effective coordination between various stakeholders on matters related to environmentally sound, healthy and safe HCW management, facilitated by national, provincial and local authorities.</td>
</tr>
<tr>
<td>21.</td>
<td>Sufficient and capable staff available from national, provincial and local government to support and monitor the health care sector on matters related to environmentally sound, healthy and safe HCW management.</td>
</tr>
<tr>
<td>22.</td>
<td>Register with all HCW generators available at provincial authorities, allowing for effective monitoring whilst ensuring ongoing communication between the different stakeholders.</td>
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**At Public Health Care Facilities:**

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<tr>
<td>23.</td>
<td>Strong HCW management related organisational structures with clearly defined tasks, responsibilities and competences available at health care facility that <em>inter alia</em> includes HCW Management Committees.</td>
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**At Transport Operators:**

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<tr>
<td>24.</td>
<td>Strong organisational structures available at transport operators, enabling them to render effective HCW collection and transport services under normal working conditions as well as during emergency situations or breakdowns.</td>
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**At Treatment Plants:**

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<tr>
<td>25.</td>
<td>Strong organisational structures available at treatment plants, enabling them to render effective HCRW treatment/disposal service under normal working conditions as well as during emergency situations or breakdowns.</td>
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**At Disposal Facilities:**

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<tr>
<td>26.</td>
<td>Strong organisational structures available at disposal facilities, enabling them to handle residues from HCRW treatment facilities under all weather conditions, thus preventing a build-up of residues during rainy seasons.</td>
</tr>
</tbody>
</table>

### Proposed Technical Action Plan Targets

**Overall Technical Action Plan Target:**
To raise the standard of technical facilities, equipment and procedures, thereby making HCW Management operations more cost effective, more efficient, more environmentally sound, healthier and safer.

**At National, Provincial and Local Authorities:**

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<tbody>
<tr>
<td>27.</td>
<td>High level of technical standards for HCW Management facilitated by national, provincial and local authorities through legislation, tender specifications and guidelines.</td>
</tr>
<tr>
<td>28.</td>
<td>HCW Information System (HCWIS) implemented and maintained by provincial authorities for more effective planning and monitoring of HCW management activities.</td>
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**At Public Health Care Facilities:**

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<tr>
<td>29.</td>
<td>High standard of HCW management equipment and materials maintained at health care facilities.</td>
</tr>
</tbody>
</table>
30. Effective HCW Management procedures introduced at health care facilities.

### At Transport Operators:

31. High standard of maintenance on HCW collection vehicles to allow for high service levels, good working conditions and limited environmental impacts.

### At Treatment Plants:

32. Compliance by treatment operators with new environmental standards for efficient HCRW treatment with limited environmental impact.

### At Disposal Facilities:

33. Waste disposal facilities conforming to internationally recognised standards available for disposal of HCGW and residues from HCRW treatment facilities.

34. Effective control mechanisms introduced by disposal facilities to avoid disposal of untreated HCRW or treated HCRW residues, not being de-listed for such disposal, on general waste disposal sites.

### Proposed Financial Action Plan Targets

#### Overall Financial Action Plan Target:
To become more cost conscious in terms of HCW management practices by developing and implementing more appropriate and cost effective HCW Management systems, as well as by reducing the HCRW stream to the absolute minimum.

#### At National, Provincial and Local Authorities:

35. Information on costs associated with HCW Management disseminated by national and provincial authorities to all affected parties for increased awareness on the financial implications of HCW management.

36. Sufficient funds for both capital and operational expenditure allocated by national, provincial and local authorities for any areas of HCW Management services that are under-budgeted.

#### At Public Health Care Facilities:

37. HCW Management expenditure analysed by health care facilities as part of a process of making HCW Management systems more cost-effective.

38. Sufficient funds for both capital and operational expenditure allocate by health care facilities for any areas of HCW Management services that are under budgeted.

#### At Transport Operators:

39. Sufficient allowance made by transport operators during tender cost estimates and annual internal budgets to allow for the rendering of HCW management services that are environmentally sound, healthy and safe.

#### At Treatment Plants:

40. Sufficient allowance made by treatment plants during tender cost estimates and annual internal budgets to allow for the rendering of HCRW treatment services that are environmentally sound, healthy and safe.

#### At Disposal Facilities:

41. Sufficient allowance made by waste disposal facilities in internal annual budgets to allow for the disposal of HCGW and treated HCRW residues in an environmentally sound, healthy and safe manner.
### Proposed Legal Action Plan Targets

#### Overall Legal Action Plan Target:
To improve on the level and standard of all legislation related to HCW Management to internationally accepted norms and to strengthen the enforcement of such legislation.

#### At National, Provincial and Local Authorities:
- **42.** Strict HCW management related legislation promulgated by national authority, in particular controlling treatment efficiencies and emission standards for thermal as well as non-thermal treatment processes.
- **43.** Strict legislation concerning disposal of residues from HCRW treatment processes promulgated by national authority.
- **44.** Strict and uniform HCW management related legislation promulgated in cooperation with affected national departments (e.g. Health, Environment, Water Affairs, Transport, and Labour), to ensure compliance throughout Kenya with internationally recognised standards.
- **45.** Effective enforcement by national, provincial as well as local authorities of HCW Management related legislation.

#### At Public Health Care Facilities:
- **46.** Compliance with all HCW Management related legislation by health care facilities, and in particular the HCW Management and Occupational Health & Safety legislation, to ensure that all equipment and procedures used for HCW Management meet the required standards.

#### At Transport Operators:
- **47.** Compliance with all relevant HCW management related legislation by transport operators, and in particular the HCW Management, Occupational Health & Safety and Road Transport legislation, to ensure that all collection vehicles, equipment and procedures used for HCW Management meet the required standards.

#### At Treatment Plants:
- **48.** Compliance with all relevant HCRW management related legislation by treatment facilities, and in particular the HCW Management, Occupational Health & Safety and Environmental legislation, to ensure that all plants, equipment and procedures applied for HCW Management meet the required standards.

#### At Disposal Facilities:
- **49.** Compliance with all relevant HCW management related legislation by disposal site operators, and in particular the HCW Management, Occupational Health & Safety and Environmental legislation, to ensure that all disposal sites, equipment and procedures used for HCW Management meet the required standards.

#### Overall Capacity Building Action Plan Targets:

#### Overall Capacity Building Action Plan Target:
To ensure the development of capacity to address improved HCW Management in public health care facilities, small generators of HCW, local authorities and with service providers.

#### At National, Provincial and Local Authorities:
- **50.** Training and awareness programmes developed for national, provincial and local authorities that will assist health care facilities and other role-players in training and informing employees on correct HCW Management procedures and practices.
51. Additional print materials that will assist health care facilities and other role-players in correct HCW Management procedures and practices such as codes of practice and awareness materials printed and distributed by national, provincial and local authorities.

52. Provincial and local authority roles and responsibilities allocated within existing organisational structures to facilitate developments in HCW Management, reporting and legal compliance.

### At Public Health Care Facilities:

53. Training courses presented and information campaigns conducted to all employees involved in HCW Management.

54. Introduction of dedicated HCW Management facilitator or Safety Health and Environment co-ordinator with responsibility for HCW Management.

55. Introduction of a Code of Practice for all health care facilities.

### At Transport Operators:

56. Training courses presented and information campaigns conducted for all employees involved in HCW Management.

### At treatment plants:

57. Training courses presented and information campaigns conducted for all employees involved in HCW Management.

### At disposal facilities:

58. Training courses presented and information campaigns conducted for all employees involved in HCW Management.
7.0 Summary of the Gap Analysis

This section of the Action Plan summarises the problems and shortcomings that were identified during investigations undertaken as part of the project on selected Health Care Facilities (HCFs), HCRW treatment facilities, private sector players, human capacity, landfills, etc.

Problems are grouped into the following 8 categories:

- Environmental problems;
- Occupational health and safety problems;
- Organisational problems;
- Equipment and Technical problems;
- Financial problems;
- Legislative problems;
- Information and awareness problems;
- Public health problems.

Listing of problems is intended to follow the lifecycle of the HCW from its source, through storage, transport, treatment, to its final disposal at the landfills. The Action Plans are therefore aimed at addressing problems identified and grouped according to the categories listed above, focussing on both Health Care General Waste (HCGW) as well as Health Care Risk Waste (HCRW). Although the liquid component of the HCRW discharged to sewer with the municipal wastewater is included in the study, crematoriums and large animal carcasses are excluded. Radioactive waste is another HCRW category that is not included in this study, since it is managed according to special standards and regulations.

It is however to be appreciated that many of the irregularities could be grouped in two or more problem categories, as a result of the various potential causes. Spillage of HCRW could for instance not only result in environmental problems, but also in OHS problems and since the spillage could result from the use of inappropriate HCRW containers, the spillage could stem from technical problems or even information and awareness problems where people were not sufficiently trained to handle HCRW in an appropriate manner. Since spillage could be resulting from any of the issues mentioned above, it is important for the irregularity to be listed under all of its possible problems, which is inevitable resulting in a repetition of some irregularities, but under different problem headings.

*Note:* Although the following descriptions are presented in a format that generalises the identified problems, the problems are not necessarily applicable to all HCF’s, HCRW transporters or HCRW treatment facilities. Due to the fact that it is not intended to quantify the extent of the various problems, reference to problems are made as if they are general problems.

7.1 Existing Legislative and Regulatory legislation and problems identified

Kenya’s policy and legal framework on health care waste management is found mainly in the following statutes: the Public Health Act, Chapter 242; the Environmental Management and Coordination Act, (EMCA) 1999; and the Medical Practitioners and Dentists Act, Chapter 253. In addition, there are efforts to develop regulations specifically dealing with health care waste management, and the National Environmental Management Authority (NEMA) has drafted the Bio-Medical Waste (Management and Handling) Regulations, which are presently awaiting gazettement.
Part VIII of (EMCA) deals with environmental quality standards. Section 86 under Part VIII deals with standards for waste. It obligates the Standards and Enforcement Review Committee to prescribe standards for waste, their classification, and analysis and to formulate and advise on standards of disposal methods and means for such waste. The draft Bio-Medical Waste (Management and Handling) Regulations have been prepared under these provisions.

Section 87 prohibits the discharge or disposal of any wastes whether generated within or outside Kenya in such a manner as to cause to cause pollution of the environment or ill health to any person. The section also deals with the transport of waste and prohibits the transport of waste without a licence issued by NEMA or to a waste disposal site which is not licensed by NEMA. Further, the section prohibits the operation of a site or plant without being licensed by the NEMA. Presently, there is no licensing system for waste sites and transporters, and therefore these provisions are yet to be operationalized.

NEMA has however operationalized Part VI of EMCA which deals with environmental impact assessment licensing. This requires that project proponents to apply for and obtain an EIA licence from NEMA before commencing, carrying out or proceeding with a project which is listed in Schedule II to the Act. Among the activities appearing in Schedule II are waste disposal activities, including sites for hazardous waste disposal. Additionally, section 36 of the Physical Planning Act, Chapter 286 also gives power to local authorities to call for an EIA study with respect to applications for planning permission for among other developments, waste disposal sites.

EIA licensing is a form of waste site licensing, which can be resorted to as required. The procedure and the requirements for application are set out in the Environmental (Impact Assessment and Audit) Regulations, LN No 101 of 2003. These Regulations stipulate that EIA licensing applies to all developments commencing after June 2003. Projects which were ongoing as at that date have to carry out an environmental audit.

Environmental auditing is provided for in Part VII. This provides that NEMA may appoint environmental inspectors who may enter any premises to determine compliance with environmental management requirements. In 2004 NEMA issued requirements for all existing activities to carry out an environmental audit and submit the reports to NEMA for evaluation. Following this process, facilities were expected to carry out improvements. Waste management facilities were expected to carry out audits as part of this exercise.

Section 91 deals specifically with hazardous waste. It states that the Standards and Enforcement Review Committee shall recommend criteria for classification of hazardous waste to determine corrosive waste, carcinogenic waste, persistent waste, toxic waste, explosive waste, and radioactive waste. On the basis of the recommendations of the Committee, NEMA shall issue guidelines and regulations for the management of each category of hazardous waste. The draft Bio-Medical Waste (Management and Handling) Regulations have been prepared under these provisions.

Section 91(2) prohibits the import into Kenya of hazardous waste and the export from Kenya of hazardous waste without a permit granted by NEMA and the written consent given by the competent authority of the receiving country. Further, hazardous waste shall not be transported within or through Kenya without a valid permit granted by NEMA. The penalty for an offence under this section is imprisonment for up to two years or a fine of not less than one million shillings or both such imprisonment and fine.

The draft Bio-medical Waste (Management and Handling) Regulations imposes a duty on the occupier of premises where such waste is handled to take measures to ensure that such waste is handled without adverse effects to human health and to the environment. The facility shall have a waste management plan and should keep records. The draft regulation imposes standards for treatment and disposal of biomedical waste, including standards of air emissions from incineration and of effluent discharges.
A second statute which can be used for waste management is the Public Health Act, Cap 242. Part IX deals with sanitation and housing. It imposes duties on local authorities to take measures to maintain their areas in a clean and sanitary condition, and to prevent the occurrence or to remedy nuisances or other conditions liable to be injurious or dangerous to health. Section 118 defines nuisances, and includes any accumulation or deposit of refuse which is offensive or which is injurious or dangerous to health.

Where the medical officer of health of the local authority is satisfied that a nuisance exists he/she shall serve a nuisance abatement notice on the owner or occupier. This notice can be enforced by taking criminal proceedings against the owner, occupier or the person responsible for the nuisance. Ultimately where it is judged that a particular dwelling is unfit for human habitation it can be demolished as part of the nuisance abatement procedure.

The provisions of the Public Health Act are not really designed to deal specifically with health care waste. However, as they deal with conditions which render premises dangerous to health, there can be circumstances in which the danger to health arises from the handing of HCWW, in which case the provisions of the Public Health Act can be resorted to.

HCW may also be dealt with under provisions appearing in other statutes. These statutes deal with waste arising from health establishments only peripherally but they deserve a mention.

The Pest Products Control Act, Chapter 346 deals with the import, export, and manufacture, distribution and use of products used for the control of pests and of the organic function of plants and animals. The Act establishes three classes of pest control products: a restricted class – that is a class of product presenting significant environmental risks; a commercial class, with respect to which environmental effects are possible in limited region; and a domestic class, for which no special precautions/equipment are required for inhalation hazard, there are no irreversible effects from repeated exposures and the disposal of containers can be safely done by placing in garbage.

The Act requires that the product be labelled with a label containing, among others, information on the hazards of handling, storage, display, distribution, and disposal of the product including instructions on procedures to alleviate the hazard, decontamination and disposal of the product and empty package.

This Act therefore may be relevant to the management of HCW with respect to the handling of waste arising from the use of pest control products within health care establishments. Such products must be handled in ways that meet the requirements of this Act both in terms of classifying the products but also in terms of labelling them.

The Radiation Protection Act, Chapter 243 aims to control the import, export, possession and use of radioactive substances and irradiating apparatus. Under Section 9 a licence is required to handle any radioactive substances or irradiating apparatus. Applications for a licence shall be made to the Radiation Board.

The Act empowers the Minister who may prescribe among other things, methods of disposing of radioactive waste products; transport of radioactive material; storage; use; and maximum working hours employees working with radioactive material. As radioactive material and irradiating devices are used in health care establishments in the context of the use of x-ray technology for diagnostic purposes, and for other treatment, the requirements of the Act with regard to the disposal of the material are pertinent in considering the management of HCW.

The Use of Poisonous Substances Act, Chapter 247 empowers the Minister to prescribe regulations which may provide for protecting persons against risks of poisoning by poisonous substances arising from the use of
those poisonous substances; employment in places; the storage, transport, sale and disposal of those poisonous substances. The Minster has not made regulations but the existence of this power is relevant in considering the regulatory framework for health care waste.

The Food, Drugs and Chemical Substances Act, Chapter 254 makes it an offence to dispose of chemical substances in a manner likely to cause contamination of food or water for human consumption or in a manner liable to be an offence. The Act establishes a Public Health (Standards) Board, which would be responsible for defining the standards to be applied in judging fitness for human consumption.

The Fertilizers and Animal Foodstuffs Act Chapter 345 regulates the importation, manufacture and sale of agricultural fertilizers. Fertilizer means any substance or mixture of substances which is intended or offered for improving or maintaining the growth of plants or the productivity of the soil. The Act prohibits the import, manufacture, sale, mixing of fertilizers which have not been declared to be “approved fertilizers”. It states that any person who knowingly sells a fertilizer containing deleterious ingredients shall be guilty of an offence.

The Act empowers the Minister to make rules for prescribing standards of composition, efficiency, fineness and purity of fertilizers and foodstuffs; the prohibition of certain substances and the limitation of percentages of certain substances in fertilizers; requirements as to records and returns to be and furnished; requirements as to proper storage of fertilizers and foodstuffs; the manner of packing and binding, labelling, marking and sealing of containers of fertilizers.

The Fertilizers and Animal Foodstuffs Act is relevant because waste material is often used as fertilizer for composting purposes. It is therefore important to keep in mind that this Act imposes restrictions on the kinds of substances that may be included in fertilizers if the fertilizer is to be approved for use. Certainly compost that contains hazardous materials from health care establishments would disqualify such material from being approved for use as a fertilizer.

The Medical Practitioners and Dentists Act, Chapter 253 provides for registering medical practitioners. It establishes a Medical Practitioners and Dentists Board as the regulatory authority. Under the Medical Practitioners and Dentists (Private Practice Rules) no private practitioner shall operate a private clinic unless the premises where the clinic is situated have been approved by the Board. In the context of its responsibility to approve health care establishments the Board imposes requirements for the handling and disposal of HCWs. The Board may inspect the clinic to satisfy itself that it meets the requirements. Nursing homes and hospitals shall also be subject to inspection by the Board. The Board has power to deregister those health care establishments which, and practitioners who, breach the conditions imposed on the licence issued by the Board. This Act is therefore an important regulatory tool for dealing with health care waste.

In conclusion there is as yet no dedicated law on HCW. However regulations are proposed. In the absence of such law there is no specific standards on the air emissions or liquid discharges from bio-medical waste handling. There are requirements with regard to transport but these are not yet being enforced.

With regard to licenses and permits the facility for handling HCW would require an EIA licence, if newly constructed. The transporters of HCW would also require a licence from NEMA. The Medical Practitioners and Dentists Act imposes registration and licensing requirements for health care establishments and for medical practitioners, and in the context of this HCW related issues can be dealt with.

Among the key regulatory bodies that would be involved in the regulation of HCW are NEMA, the Medical Practitioners and Dentists Board, the local authority, such as the City Council, the Radiation Protection Board, and the Ministry of Health. Where air pollution issues are involved the Department of Occupational Health and Safety of the Ministry of Labour which enforces the factories Act, Chapter 514 would be involved as well, particularly as there are no statutory standards for air emissions from incineration presently.
7.1.1 Problems at the national / provincial level
1. The definition of HCW and its categories is not clear, thus creating confusion on the required standards for handling, treatment and disposal thereof;
2. There are no clear regulations concerning transporting of HCRW across national borders, other than the BASEL Convention that only applies to signatories, to prevent substandard treatment or illegal disposal of HCRW in neighbouring countries or vice versa;
3. Standard tender specifications are not available, resulting in different standards being applied by different parties where HCRW management services are to be outsourced;
4. Fragmented and conflicting legislation creates confusion and difficulty meeting the required legislation, resulting in standards not being met. Differing bylaws is a typical example;
5. Ineffective enforcement of legislation results in scrupulous HCW practices being used intentionally or unintentionally.
6. The Public Health Act does not give cognisance to health care waste

7.1.2 Problems at municipal level
1. HCRW management by-laws vary from one local authority to the next, resulting in confusion due to different standards being applied by neighbouring authorities;
2. Although responsible for HCRW management, local authorities are not in a financial position to provide the required facilities or services required for sustainable HCW management in Kenya;
3. Local authorities do not have the required resources to ensure adherence to the national within its areas of jurisdiction through effective enforcement.

7.1.3 Problems at health care facility level
1. There is a lack of information and understanding by senior management on legislation related to HCW management, leading to inappropriate systems being implemented;
2. The “duty-of-care” and “polluter pays” principles are not understood by senior management;
3. HCF’s lack clear internal instruction and guidance on how to manage HCW;
4. Non-conformance to the OHS legislation is making owners of HCF’s liable for prosecution;
5. Unsafe actions by staff members (whether as a result of ignorance or otherwise) can make owners of HCF’s liable for public prosecution.

7.1.4 Problems at the collection and transport contractor
1. Non-conformance to the OHS legislation is making the owners / operators of the HCRW collection / transport businesses liable for public prosecution;
2. Unsafe actions by its staff members (whether due to ignorance or otherwise) can make the owners / operators of HCRW collection / transport businesses liable for public prosecution.
3. Private waste collectors operate in uncoordinated and unmonitored environment

7.1.5 Problems at treatment facility level
1. Legal consequences of poor HCRW treatment practices resulting in pollution through either poisonous gas emissions or disposal of poorly treated HCRW, are not always considered when operational strategies are developed by owners / operators of HCRW treatment facilities;
2. Non-conformance to the OHS legislation is making the owners / operators of the treatment facility liable for public prosecution;
3. Unsafe actions by its staff members (whether as a result of ignorance or otherwise) can make the owners / operators of HCRW treatment facilities liable for public prosecution.

4. There are no standards of the treatment facility and emissions

7.1.6 Problems at disposal facility level

1. Disposal of ash from HCRW treatment facilities on hospital premises or general waste disposal sites is making the owners of the facility liable for prosecution due to its potential impact on the environment;

2. Air pollution resulting from open air burning of waste on disposal sites may make the owners / operators of the disposal facility liable for public prosecution;

3. Non-conformance to the OHS Act is making the owners / operators of the disposal facility liable for public prosecution;

4. Unsafe actions by its staff members (whether as a result of ignorance or otherwise) can make the owners / operators of HCRW disposal facilities liable for public prosecution.

7.2 Environmental Problems

7.2.1 Environmental problems at HCW sources (health care facilities)

1. HCRW generators not registered, makes it difficult to ensure environmentally sound treatment and disposal of all HCRW through performance monitoring and prevention of illegal dumping;

2. Classification of HCW is not clear, making it difficult for staff to decide what HCW items requires treatment before disposal, resulting in unnecessary treatment of HCGW as well as illegal disposal of untreated HCRW;

3. Contamination of HCGW with HCRW and visa versa due to poor segregation, results in disposal of untreated HCRW on general waste disposal sites on the one hand and an increased risk of pollution due to more HCRW being treated on the other hand;

4. Insufficient training and education results in HCW management practices not being environmentally sound;

5. Insufficient or inappropriate reusable and disposable HCW containers used results in pollution from either HCRW spillage or HCW streams being mixed with untreated HCRW disposed of on general waste disposal sites;

6. With HCW containers are not strong enough or appropriately sized for high density HCW, leading to spillage of HCRW due to container failure, which could result in pollution;

7. Storage of HCRW within HCF wards in containers not meeting the specification, results in the spread of pollutants and an unacceptable risk of exposure to patients and visitors;

8. Uncoordinated transport of HCRW within HCF’s by unqualified personnel result in spillage of HCRW and pollution of the environment when open containers are dropped;

9. No backup arrangements available for removal of HCRW by alternative party or refrigerated storage in the event of equipment breakdowns or infrequent collection, thus resulting in extended HCRW storage periods with subsequent generation of odours;

10. Insufficient and inappropriate HCRW storage capacity to accommodate abnormal HCRW generation rates or HCRW build-up during breakdowns of collection or treatment systems, with unprotected storage leading to container damage and HCRW spillage;

11. HCRW containers that are not resistant to inclement weather conditions are stored in the open, resulting in such containers being damaged by the environment, which in turn leads to spillage or in contamination of storm water;
12 No HCRW generation mass recording is done, which limits control over HCRW generation and treatment required to ensure that all HCRW is treated and disposed of appropriately;
13 Tracking of waste is not undertaken which poses the question if all HCRW generated is being treated;
14 Limited information is available on HCRW generation rates and treatment capacities, thus making planning for future environmentally sound HCRW treatment and disposal difficult;
15 Generators of small volumes of HCRW (Minor Generators) like general practitioners do not use formal collection, treatment and disposal systems, resulting in HCRW being disposed of on general waste disposal sites;
16 No systems are available for collection, treatment and disposal of HCRW generated at private residences during home based care, resulting in such HCRW being disposed of on general waste disposal sites;
17 Increased use of disposable materials results in increased amounts of HCW, thus increasing the pressure on existing treatment / disposal facilities with increased risk of pollution;
18 HCW is littered and even dumped inside and outside HCF premises due to inappropriate containerisation and storage of HCW, thus resulting in pollution of the environment;
19 Budget constraints impacts on HCW management systems adopted, equipment used as well as treatment efficiencies, all contributing towards poor treatment and disposal practices;
20 HCF staff and in particular HCW workers, are unaware of the financial and environmental implications of poor HCW management practices, often resulting in expensive environmental remediation;
21 HCF’s are unaware of possibilities for substitution of environmentally harmful materials, like PVC, with less harmful materials being purchased through green procurement policies.

7.2.2 Environmental problems during collection / transport
1. HCRW transporters used are not registered and no transporter accreditation system exists to ensure environmentally sound HCRW management operations;
2. With HCRW stored in the same area as HCGW, HCW streams get mixed up as containers are not clearly marked and subsequently inappropriately disposed of;
3. Insufficient training results in a lack of knowledge and awareness of environmentally sound HCW management practices during collection and transport;
4. No records are kept of HCRW masses or HCRW categories collected, thus making tracking of HCRW impossible, which in turn creates the opportunity for illegal dumping;
5. Frequency and collection times does not meet HCRW generator’s needs, thus resulting in longer HCRW storage periods at HCF’s with subsequent odour generation;
6. HCRW collection is not done according to sound practices aimed at reducing the risk of spillage, and where procedures exist, such procedures are not enforced, also resulting in spillage;
7. Emergency procedures for accidents or HCRW spillage are not available, conveyed to workers or implemented by workers, resulting in pollution during accidents or spills;
8. Inappropriately designed HCRW collection vehicles are used, which lead to HCRW spillage;
9. Inappropriate cleaning of HCRW collection vehicles result in the spread of pollutants;
10. HCRW collection vehicles are not equipped with the required spillage emergency equipment;
11. HCRW collection vehicles are not clearly marked, thus making identification of the load and implementation of appropriate emergency pollution prevention measures difficult in the event of an accident.
7.2.3 Environmental problems at treatment facilities (incinerators)

1. The current HCW management systems do not favour effective segregation, waste minimisation or cost-consciousness, resulting in excessive disposal of HCGW as HCRW, ultimately treated and disposed of at poor environmental standards;

2. A lack of training of HCRW treatment staff results in spillage due to insufficient understanding and awareness of environmentally sound HCRW management practices;

3. HCRW received is not recorded, thus making tracking of HCRW very difficult and thereby creating opportunities for illegal disposal;

4. HCRW mass recording is not done, resulting in a lack of accurate data being available for daily operations and future planning, which in turn leads to overloading of treatment facilities with subsequent poor incineration efficiencies;

5. Insufficient and inappropriate HCRW storage facilities results in HCRW being exposed to the elements with subsequent damage to containers and HCRW spillage;

6. Storage of HCRW at treatment facilities is not done in an organised manner to allow for “first-in first-out”, thus leading to longer HCRW storage which generates odours and attract rodents and vectors;

7. No refrigeration facilities available as backup storage for pathological HCRW in the event of a backlog in treatment due to breakdowns, thus leading to odours and attracting rodents and vectors;

8. No surplus HCRW treatment capacity as back-up for use during incinerator breakdown or during routine maintenance, resulting in open pit burning of HCRW;

9. Incinerators are not appropriately designed and where designed, not operated according to the manufacturer’s guidelines, thus resulting in pollution through emissions, with untrained operators being unaware of the consequences;

10. Poor incinerator design and operation standards leads to inefficient destruction of HCRW, thus not destroying harmful pathogens before ash is disposed of on hospital premises or removed for disposal on general waste landfills;

11. Manual feeding of incinerators results in allowable incinerator capacities being exceeded, impacting negatively treatment efficiencies;

12. HCRW treatment done during warm-up and shutdown phases of incinerators results in inefficient treatment of HCRW;

13. Manual removal of ash from incinerators results in an ash build-up, which affects the treatment efficiency;

14. HCRW Treatment facilities not operated to optimum capacity results in a loss in production with treatment becoming financially less viable with more illegal disposal methods being used;

15. Poorly designed incinerators and poor blending of HCRW with different calorific values result in variances in operating temperatures, ultimately affecting the treatment efficiency;

16. Concentrated incineration of high calorific chemical HCRW results in excessive build-up of temperatures that can cause structural damage to equipment, affecting future treatment efficiencies;

17. Poor HCW segregation results in incineration of aerosol cans and radioactive materials that can damage the equipment, affecting future treatment efficiencies;

18. HCRW treatment plants not equipped with flue gas cleaning systems emit pollutants with different impacts on the environment like CO, NOx, particles, acidic gases, noxious halogenated compounds, dioxins, furans, etc. that, depending on local conditions, can spread over long distances;

19. The low height of incinerator stacks or the absence of stacks on incinerators or open pits result in concentrated emissions being blown into hospital wards or neighbouring residences;

20. Poor siting of HCRW incinerators result in the incinerator emission being blown into hospital wards or neighbouring communities;
21. No scheduled testing of emissions is done for reporting to regulatory authorities, which prevents detection of air pollution;
22. Some materials like PVC, chlorinated solvents, mercury etc. used in HCFs represents a special environmental risk when incinerated, resulting in various forms of pollution;
23. Budget constraints influences the effectiveness with which HCRW is treated, ultimately impacting on the risk of pollution that HCRW could have on the environment;
24. In addition to regional pollution, some of the pollutants also have an impact on the environment on national and / or global level. The emission of NO₂ may result in acidic gases that may have an impact at national level, with similar affects from CH₄ (after landfilling) and CO₂ (from incineration), all having possible impacts on global warming;
25. HCW is burnt in open pits in an uncontrolled manner which result in polluting air emissions as well as water and soil pollution.

7.2.4 Environmental problems at disposal facilities
1. A lack of training and awareness by waste disposal site supervisors / operators prevent them from realising the risks associated with illegal disposal of untreated or poorly treated HCRW on general waste disposal sites;
2. Insufficient treatment capacity results in HCRW being disposed of illegally or not being treated properly, with untreated or semi-treated HCRW disposed of on hospital premises or at general waste sites;
3. Ash from HCRW incineration is disposed of on hospital premises or on general waste disposal sites, leading to the release of heavy metals into soil as well as surface and groundwater;
4. Untreated HCRW is illegally disposed of at landfills not designed for disposal thereof, resulting in release of infectious pollutants to soil as well as ground and surface water, with the added risk of spreading infectious pollutants by wind;
5. Budget constraints influences the capital invested in the development of waste disposal sites as well as the standard of operations, all of which impact on the risk of pollution;
6. Infectious and other hazardous waste dumped on poorly designed, constructed and operated landfills result in the release of leachate containing infectious and noxious materials to surface water and groundwater;
7. Disposal of untreated placentas in placenta pits is resulting in pollution of the ground water;
8. Placenta pits used are not constructed or operated in accordance with required environmental, health and safety standards.

7.3 Occupational Health and Safety Problems

7.3.1 OHS problems at Health Care Facilities
1. HCW classification creates confusion as to what is to be incinerated, resulting in HCRW being disposed of as general waste which could lead to injuries and infection of workers;
2. Carrying HCRW from point of generation to the respective HCW containers poses a potential risk to nursing staff and patients when accidentally coming in direct contact with HCRW;
3. Inadequate supply of suitable internal collection trolleys etc. results in excessive manual handling with an increased risk of for instance needle prick injuries and exposure to spillage;
4. Insufficient or inappropriate HCW containers, not meeting uniform colour codes, are used. The absence of or use of incorrect sharps containers can injure and infect workers;
5. HCRW containers are not strong enough or of the correct size for high density HCRW, which could result in container failure with injuries and infection of workers as well as patients;
6. Temporary storage of HCRW containers within the HCF’s (wards) is often not done appropriately and results in spreading of infections;
7. HCW containers are often reused without being cleaned or disinfected;
8. Insufficient training of people involved in HCRW management results in a lack of knowledge and awareness on healthy and safe HCRW practices;
9. Recapping or removal of needles at HCFs poses a special risk of needle prick injuries;
10. High workloads and staff shortages at HCFs result in healthy and safe HCW management practices being neglected since other duties are prioritised;
11. Workers are put at risk during internal transport of HCRW that is not properly containerised or if workers are not making use of personal protective equipment (PPE);
12. HCRW containers not resistant to inclement weather conditions are often stored in the open, resulting in such containers being damaged by rain, thus exposing workers to HCRW;
13. Excessive human fatigue resulting from carrying heavy HCRW containers from one point in the HCF to another, increases the risk of injuries;
14. HCRW storage areas at HCFs is not secured, allowing access to unauthorised parties, who could either get injured or infected by HCRW;
15. HCRW (including sharps) is littered within and outside HCF premises due to inappropriate handling and storage, resulting in members of the public getting injured or infected;
16. Evaporation of chemicals from chemical wastes poses a special risk to employees handling such waste when not securely packaged during storage and internal transportation;
17. Budget constraints influences the efficiency of the HCRW management system adopted as well as the efficiency with which HCRW workers are trained and equipped with PPE;
18. HCW workers are not monitored for occupational health aspects.

7.3.2 OHS problems during collection / transport
1. HCRW transporters are not registered or accredited with no system to verify whether HCRW transporters are complying with Occupational Health and Safety legislation;
2. Insufficient training of HCRW management workers results in a lack of knowledge and awareness around healthy and safe HCRW management practices;
3. Poor selection and marking of HCRW containers increases the risk of workers coming in direct contact with HCRW;
4. HCRW handling during collection and transport poses a health and safety risk to workers not equipped with personal protective equipment or with HCRW not appropriately containerised;
5. HCRW collection is not done according to set procedures ensuring the safety of workers;
6. HCRW collection vehicles not marked according to road ordinances, makes identification of load and implementation of appropriate OHS measures difficult in the event of an accident;
7. Emergency procedures to be followed in the event of accidents and injuries are not available, not conveyed to workers or not implemented by workers;
8. Carrying heavy HCRW containers results in excessive human fatigue and an increased risk of injuries;
9. Inappropriate use of HCRW containers increases the risk of injuries and infection;
10. Inappropriate or no cleaning of HCRW collection vehicles increases the risk of infection;
11. Evaporation of chemicals from chemical HCRW poses a special risk to employees handling such HCRW if not securely packaged during handling and transportation;
12. HCW workers are not monitored for occupational health aspects;
13. Although also generating HCRW, mortuary staff are not considered to be health care staff and is therefore not included in any OHS training or supply of PPE equipment.

7.3.3. OHS problems at treatment facilities
1. Insufficient training of HCRW management workers result in a lack of knowledge and awareness on healthy and safe HCRW management practices;
2. Workers at treatment facilities are exposed to infectious HCRW due to open or leaking containers, with increased risks where containers are exposed to the natural elements;
3. Poorly designed HCRW treatment facilities increase the risk of injuries and infection for HCRW management staff having to treat HCRW from open containers whilst also having to dispose of the ash of poorly treated HCRW;
4. Insufficient treatment facilities and back-up facilities, results in a build-up of HCRW which leads to increased occupational health and safety risks for HCRW workers;
5. Not all workers at treatment facilities are equipped with personal protection equipment (PPE) and where equipped, such equipment is not used effectively;
6. Poor segregation of HCRW leads to incineration of aerosol cans or radio-active materials, which results in a health and safety risk for workers;
7. Concentrated incineration of high calorific value chemical HCRW can result in an excessive build-up of heat that leads to damage of equipment and injuries to workers;
8. Incinerators not properly operated result in emission of polluting fumes, which impose health risks and nuisance to employees at the treatment facilities and neighbouring communities;
9. Manual removal of poorly treated HCRW ash from poorly designed incinerators results in increased risk of workers coming in direct contact with or inhaling incinerator ash;
10. Access to incinerators at HCFs is unobstructed, allowing unauthorised persons to come in contact with incinerators that could result in injuries and infection;
11. The low height of incinerator stacks or the absence of stacks during open pit burning results in poor dispersion of unhealthy emissions;
12. HCW workers are not monitored for occupational health aspects.

7.3.4 OHS problems at disposal facilities
1. Insufficient training of workers at waste disposal sites result in a lack of knowledge and awareness on how to deal with untreated or poorly treated HCRW disposed of on landfills in a safe and healthy manner;
2. Workers at disposal facilities are exposed to infectious HCRW due to the disposal of untreated or poorly treated HCRW;
3. Not all workers at waste disposal facilities are equipped with personal protection equipment (PPE) and where equipped, such equipment is not used effectively;
4. Landfills put on fire result in emission of polluting fumes, which impose health risks and nuisance to employees at the disposal facilities and neighbouring communities;
5. Poor operation of incinerators results in inefficient treatment of HCRW, thus not destroying the harmful elements, with workers and scavenger’s at general waste disposal sites being exposed to the ash;
6. Landfill workers are not monitored for occupational health aspects;
7. Placenta pits used are not constructed or operated in accordance with required environmental, health and safety standards.
7.4 Institutional and Organisational problems

7.4.1 Problems at national, provincial and municipal level
1. The allocation of responsibilities amongst the authorities at different levels are not clear;
2. There is not enough staff allocated at national, provincial and municipal level to undertake the improvement of HCRW management activities;
3. No single authority is responsible for ensuring proper co-ordination of the HCW management activities from cradle-to-grave, resulting in ad hoc initiatives and activities;
4. There is no coordinating body where all stakeholders from different disciplines involved in HCW management can co-ordinate their activities to form an integrated unit;
5. Current Action Plans on HCW management developed and implemented are crisis driven and not based on comprehensive and sustainable HCW management for Kenya;
6. Uncoordinated efforts are made by various authorities to set standards and guidelines, which adds to the present fragmentation and conflict in standards;
7. Animal carcasses as part of the veterinarian waste stream are not presently included, but may have to be considered in future.

7.4.2 Problems at HCFs
1. HCFs are not operating according to clear institutional / organisational HCW management structures;
2. HCFs have not established procedures to monitor and review HCW management Action Plans;
3. Financial constraints are blamed for inappropriate and ineffective HCRW management;
4. Excessive workloads and staff shortages are blamed for poor implementation of HCRW management Action Plans;
5. Uncoordinated efforts are made internally by HCFs to set standards and guidelines, which adds to the present fragmentation and conflict in standards.

7.4.3 Problems during collection and transport of HCRW
1. Low HCRW volumes generated in certain areas does not favour economies of scale, thereby making it uneconomical to implement HCRW collection rounds in such areas;
2. Long travelling distances to individual collection points makes it uneconomical to implement HCRW collection rounds in such areas;
3. Poor payloads achieved when transporting low density HCRW is counter productive for efficient fleet management;
4. Limited enforcement of road ordinances makes it difficult for HCRW transport contractors to operate their HCRW collection systems on level playing fields;
5. Variations in the types and sizes of containers used by HCFs makes it difficult to optimise HCRW collection vehicles in terms of utilisation of the available loading capacity;
6. Increasing transport costs resulting from fuel price increases makes it difficult for contractors to do financial planning, especially if escalation price increases are not based on fuel prices;
7. Fluctuations in the local currency is impacting on strategic planning as it will determine the viability of replacing old vehicles in collection fleets;
8. Uncoordinated efforts are made internally by transport contractors to set standards and guidelines, which adds to the present fragmentation and conflict in standards;
9. Cross country boundary movement of HCRW could occur from neighbouring countries not equipped with the required treatment facilities, thus making planning for Kenya complex.
7.4.4 Problems at treatment facilities
1. Limited training and capacity building amongst incinerator operators leads to limited knowledge and expertise;
2. Privately owned HCRW treatment facilities operates in the market without some co-ordination of efforts to improve the overall standard of HCRW management;
3. Limited enforcement of emission standards makes it difficult for the HCRW treatment contractors to operate their treatment facilities on level playing fields;
4. Treatment facilities and disposal sites often belong to different institutional structures, thereby affecting co-ordination for improved HCW management;
5. Uncoordinated efforts are made to set standards and guidelines, which adds to the present fragmentation and conflict in standards.

7.4.5 Problems at disposal facilities
1. No hazardous waste disposal site exist in Kenya, as recommended for the disposal of heavy metal carrying incinerator ash;
2. Limited training and capacity building amongst disposal site operators leads to limited knowledge and expertise;
3. Limited enforcement of legislation related to pollution prevention from waste disposal sites makes it difficult to ensure environmentally sound waste disposal;
4. Treatment facilities and disposal sites belong to different institutional structures, thereby affecting co-ordination for improved HCW management;
5. Uncoordinated efforts are made to set standards and guidelines for environmentally sound waste disposal, which adds to the present fragmentation and conflict in standards.

7.5 Technical Problems
7.5.1 Problems at HCFs
1. HCFs do not have HCRW and HCGW containers of appropriate design for HCW segregation;
2. Containers that are often reused at HCFs are not cleaned or disinfected after each use and no facilities are available to undertake such cleaning / disinfection;
3. The limited market for compliant HCRW management equipment result in such equipment not being available locally and if available, such equipment is very expensive due to the small local demand;
4. HCFs either lack sharps containers all together (resulting in disinfectant or other plastic bottles being used), or make use of sharps safety boxes that are not puncture resistant, thus creating a risk of injuries and infection;
5. The fact that the various sharps containers currently in use are not equipped for safe removal of needles from syringes, requires that the needles and syringes be disposed of as single units which in turn significantly increase the sharps volume and thereby the sharps container demand;
6. HCFs lack properly designed trolleys for internal collection and transport of HCW, thus creating a risk of injuries during manual handling of open containers as well as HCW spillage from open containers;
7. HCF’s lack appropriate intermediate HCRW storage facilities for use until HCRW can be collected for internal transport to the central stores or onsite treatment facilities, thus resulting in unauthorised HCRW storage in areas where patients and visitors are exposed to such HCW;
8. Central HCRW storage facilities do not meet the required standards and are not fenced, not secured, not properly ventilated where enclosed, not protected against the elements, etc.
9. Very few of the onsite HCRW treatment facilities can be classified as incinerators, with no compliant HCRW treatment facilities available in the private sector.

7.5.2 Problems at collection and transport service providers
1. There is limited private sector involvement in HCRW service delivery, thus preventing the health care facilities to focus on their core business;
2. The absence of private sector involvement limits the contribution in terms of skills and technology available to that of the public health sector;
3. Capital required for improved HCW management equipment is not accessible from the private sector due to their limited involvement;
4. Vehicles, where used for HCRW transport, do not have appropriate loading mechanisms;
5. Vehicles, where used for HCRW transport, do not meet OHS standards;
6. Vehicles, where used for HCRW transport, do not meet the road ordinances for the transport of hazardous waste;
7. Specialist maintenance for HCRW transport vehicles is not available.

7.5.3 Problems at treatment facilities
1. There is limited private sector involvement in HCRW service delivery, thus preventing the health care facilities to focus on their core business;
2. The absence of private sector involvement limits the contribution in terms of skills and technology available to that of the public health sector;
3. Capital required for improved HCW management equipment is not accessible from the private sector due to their limited involvement;
4. Treatment facility technology used by both the public and private sector is outdated and not meeting the required technical standards to ensure effective treatment of HCRW;
5. Incinerators used by both the public and private sector is not equipped with flue gas cleaning systems;
6. Poor siting and poor operation of incinerators leads to public resistance to the establishment and operation of HCRW treatment facilities.

7.5.4 Problems at disposal facilities
1. Disposal sites where untreated or poorly treated HCRW is disposed of are not developed and operated in accordance with recognised standards;
2. Slag and ashes from incinerator facilities are not disposed of on permitted hazardous waste disposal facilities and is often disposed of on the HCF premises where it is accessible to members of the public;
3. Poor siting and operation of waste disposal sites leads to public resistance to the establishment and operation of such facilities (see Annexure C);
4. Placenta pits used are not constructed or operated in accordance with required environmental, health and safety standards.
7.6 Financial Shortcomings

7.6.1 Problems at HCFs
1. Insufficient funds for appointment of staff results in an increased workload for existing workers, in turn having a negative impact on the dedication with which HCRW management is executed;
2. Insufficient funds are made available to address the various OHS needs of workers;
3. Insufficient funds for appropriate HCRW management equipment within the HCF’s;
4. The fact that the various sharps containers currently in use are not equipped for safe removal of needles from syringes, requires that the needles and syringes be disposed of as single units which in turn significantly increase the sharps volume and thereby the sharps container demand;
5. No specific budget line for HCRW management makes it difficult to monitor and control expenditure as well as to do any operational planning based on available financial data;
6. Insufficient funds to provide appropriate onsite HCRW treatment facilities, effectively operate such facilities or alternatively to outsource HCRW services, results in untreated or poorly treated HCRW being disposed of on poorly designed, operated or controlled general waste disposal sites;
7. Insufficient funds allocated for training and information dissemination on sound HCW management practices results in poor HCW management standards;
8. Ignorance around financial implications of HCW management services rendered internally or externally eliminates HCRW generator’s motivation to reduce the HCRW stream;
9. Inconsistent and vague tender (request for proposal) specifications used by different HCRW generators makes it difficult for tenderers whilst also making it difficult to adjudicate such tenders on equal footing;
10. The poor standard at which HCW management services are rendered at present is making it very cheap, which will make it difficult to obtain acceptance of improved HCW management standards that will inevitable result in significantly increased costs.

7.6.2 Problems at collection and transport service providers
1. Insufficient financial backing makes it difficult for upcoming contractors to keep their waste collection fleets properly maintained whilst repaying capital layouts;
2. Economies of scale with smaller generators and long travelling distances during collection impacts on the financial viability of collection and treatment services rendered;
3. Insufficient funds are made available to address the various OHS needs of workers;
4. Effective payloads impact on the efficiency with which HCRW collection services are rendered. Mass billing for HCRW management required for effective data collection is difficult to reconcile with current payment systems;
5. Regionalisation of HCRW treatment facilities may improve the financial viability of operations, but increases environmental risks as HCRW is transported over longer distances;
6. Increasing fuel costs have a detrimental effect on waste collection contractors where contracts do not make appropriate provision for escalation price increases based on fuel prices.

7.6.3 Problems at treatment facilities
1. Private and public HCRW treatment facilities do not have the required funds for upgrading of technology to ensure environmentally sound operations, e.g. installation of environmentally sound treatment facilities with flue gas cleaning systems;
2. HCRW treatment facility operators do not allocate sufficient funds to ensure that employees are sufficiently trained for proper operation of facilities;

3. Insufficient funds are made available to address the various OHS needs of workers;

4. Limited operational hours of HCRW treatment facilities through single shifts reduce the financial viability with which the facilities are operated;

5. Mechanisation could improve combustion, but will reduce treatment capacity of plants, which will have a financial implication, also impacting on the number of job opportunities;

6. Poorly defined operational standards and limited enforcement leads to the playing field not being level for HCRW treatment facilities intending to operate environmentally sound.

7.6.4 Problems at disposal facilities

1. Owners of disposal facilities lack the ability and funds to be upgraded to H:H waste disposal site development and operation standards that are required for disposal of incinerator ash;

2. Waste disposal site operators do not allocate sufficient funds to ensure that employees are sufficiently trained for proper operation of facilities;

3. Insufficient funds are made available to address the various OHS needs of workers;

4. Poorly defined operational standards and limited enforcement leads to the playing field not being level for waste disposal facilities intending to operate environmentally sound.

7.6.5 Problems at national and provincial level

1. National and provincial authorities responsible for HCRW treatment lack funds for implementing new initiatives that will improve the standard of HCW management in Kenya;

2. National and provincial authorities lack funds to employ more staff for monitoring of new initiatives and ongoing activities;

3. Insufficient funds are available for effective enforcement of legislation;

4. Inability of the public sector to meet the required environmental standards is making it difficult to enforce compliance by the private sector.

7.7 Information and Awareness Problems

7.7.1 Problems at HCFs

Information:

1. Lack of data recorded at HCF's on HCRW generation as well as treatment / disposal;

2. Lack of information on HCRW generation rate per patient per day or HCRW treatment cost per kg;

3. Lack of data available on previous trends of HCRW generation as well as treatment / disposal;

4. Lack of reporting to management on HCW management data required to obtain an overview of the HCW management situation, proposing ways of improving the system and planning on local, provincial as well as national level;

5. No reliable recording system to make it possible to track HCRW;

6. Lack of information materials on sound segregation and containerisation of HCW;

7. Lack of information materials on handling and sound internal transport and storage of HCW.

Awareness:

1. Limited awareness on importance of effective HCW segregation among key staff (physicians, nurses and cleaners);
2. Limited awareness amongst managers on ways of improving HCW management as well as the financial implications thereof;
3. Limited awareness on emergency procedures in the event of an accident or HCRW spillage;
4. Limited awareness on OHS standards to be adhered to;
5. Limited awareness on alternative and appropriate HCW containers available for safe and environmentally sound storage of HCW;
6. Training and awareness programmes for health care workers and HCRW handlers are not addressing the needs, are uncoordinated and are not audited to ensure uniform standards.

3.7.2 Problems at the collection and transport contractors

Information:
1. Lack of information on mass of HCRW collected due to fixed cost billing system;
2. Lack of information on running costs of different vehicles in collection fleets;
3. Lack of information on the cost per kilogram for HCRW collection from different sources.

Awareness:
1. Lack of awareness amongst managers on impact of improved payloads and collection route planning on overall efficiency of HCW collection systems;
2. Lack of awareness amongst managers on safety requirements when containers are stacked in collection vehicles;
3. Lack of awareness on emergency procedures in the event of an accident or HCRW spillage;
4. Lack of awareness on OHS standards to be adhered to;
5. Lack of awareness on alternative types of collection vehicles to be used for safe and environmentally sound HCRW collection and transport;
6. Training and awareness programmes for HCRW handlers are not addressing the needs, are uncoordinated and are not audited to ensure uniform standards.

7.7.3 Problems at treatment facilities

Information:
1. Lack of information on HCRW treatment/disposal cost per kg;
2. Lack of information on overall costs to operate a HCRW treatment facility;
3. Lack of information on categories as well as amount of HCW treated.
Awareness:
1. Lack of awareness on cost effective yet environmentally sound operation of treatment plants;
2. Lack of awareness on HCRW categories to be incinerated;
3. Lack of awareness on blending of HCRW streams to ensure optimum treatment efficiency;
4. Lack of awareness on emergency procedures to be followed in the event of plant failure;
5. Lack of emergency preparedness in the event of an accident or spillage;
6. Lack of awareness on occupational health and safety standards to be adhered to;
7. Lack of awareness of alternative treatment technologies available for environmentally sound treatment of HCRW

7.7.4 Problems at disposal facilities

Information:
1. Lack of information on disposal cost per ton;
2. Lack of information on overall costs to operate waste disposal facilities.

Awareness:
1. Lack of awareness on cost effective yet environmentally sound operation of waste disposal facilities;
2. Lack of awareness on waste categories to be disposed of on different waste disposal sites classes;
3. Lack of awareness on treatment of hazardous waste as part of delisting for disposal on general waste disposal sites;
4. Lack of awareness on emergency procedures to be followed in the event of plant breakdowns;
5. Lack of emergency preparedness in the event of an accident or spillage;
6. Lack of awareness on occupational health and safety standards to be adhered to;
7. Training and awareness programmes for waste disposal site staff not addressing the needs, are uncoordinated and are not audited to ensure uniform standards.

7.7.5 Problems at the national and provincial level

Information:
1. Lack of information on differences in HCW generation rate/patient/day for different HCFs;
2. Lack of data on mass of HCRW to be treated, available treatment capacity and availability of backup capacity;
3. Lack of data on HCRW generators for effective monitoring to ensure that all HCRW is treated and disposed of in an environmentally sound manner;
4. Lack of data on HCRW transporters for effective monitoring to ensure that all HCRW is environmentally sound treated and disposed of;
5. Lack of information on existing HCRW treatment facilities in Kenya;
6. Lack of information on HCRW mass crossing the Kenya borders in either direction;
7. Lack of information on effective implementation of a HCRW tracking system.

Awareness:
1. Lack of awareness on optimum strategy to ensure environmentally sound treatment / disposal of all HCRW generated by HCF’s in Kenya;
2. Lack of awareness on alternative treatment technologies available for implementation and environmentally sound treatment of HCRW generated in Kenya.
7.8 Public Health Problems

7.8.1 Public Health problems at Health Care Facilities
1. HCRW generators are not registered, thereby preventing the implementation of monitoring systems to ensure that HCRW is not disposed of with the domestic waste, leading to injuries and infection of waste collectors and people on disposal sites;
2. Non-conformance to the OHS legislation is making HCF’s liable for public prosecution in the event of injuries or infection of staff or patients;
3. Unsafe actions by its nursing or HCW management staff members (whether as a result of ignorance or otherwise) can make the HCF’s liable for public prosecution where the health and safety of patients or the public is put at risk.

7.8.2 Public Health problems during collection/transport
1. Non-conformance to the OHS legislation is making the owners / operators of HCRW vehicles liable for public prosecution, should it be found the their actions created a health and safety risk to members of the public;
2. Illegal dumping of untreated HCRW is creating a risk to pickers at waste disposal sites as well as to the public at large;
3. Unsafe actions by its staff members (whether as a result of ignorance or otherwise) can make the owners / operators of HCRW vehicles liable for public prosecution.

7.8.3 Public Health problems at treatment facilities
1. Non-conformance to the OHS legislation is making the owners / operators of HCRW treatment facilities liable for public prosecution, should it be found the their actions created a health and safety risk to members of the public;
2. Air pollution resulting from open air burning of HCRW where environmentally compliant facilities are not available may make the owners / operators of the facility liable for public prosecution;
3. Access to HCRW treatment facilities is unobstructed, allowing unauthorised persons to enter the premises, thus creating the risk of injuries and infection to members of the public;
4. Unsafe actions by its staff members (whether as a result of ignorance or otherwise) can make the owners / operators of HCRW treatment facilities liable for public prosecution.

7.8.4 Public Health problems at waste disposal facilities
1. Poor operation of incinerators results in inefficient treatment of HCRW, thus not destroying the harmful elements, thus putting the health and safety of workers and pickers on waste disposal sites at risk when exposed to such incinerator ash;
2. Access to waste disposal sites is unobstructed, allowing unauthorised persons to enter the premises, thus creating the risk of injuries and infection to members of the public;
3. Landfills put on fire result in emission of polluting fumes, which impose health risks and nuisance to employees at the disposal facilities and neighbouring communities;
4. Non-conformance to the OHS legislation is making the owners / operators of the waste disposal facilities liable for public prosecution;
5. Unsafe actions by its staff members (whether as a result of ignorance or otherwise) can make the owners / operators of waste disposal facilities liable for public prosecution.
7.9 Problems Identified with the Private Sector

The privatisation and the involvement of private sector players in HCW is yet to be developed in Kenya as per the findings of this study countrywide. Urban centres have tried to introduce private sector participation in health care waste management but the same has lagged behind in rural areas where there are rates of poverty and even health care service is not highly developed. So far Nairobi, Mombasa and Kisumu have registered some success in privatisation of waste.

There is no formal policy for private sector involvement in waste management at either central government level. There are no national laws which govern private sector involvement in waste management.

In 1997 Nairobi City Council (NCC) tendered out a contract to Kenya Refuse Handlers Ltd but did not specify where categories of waste to be disposed though they knew waste from CBD consisted of HCW. The contract agreement specifically prohibited delivery of hospital and industrial waste to Dandora dumpsite.

Nairobi has more than 60 private sector involved in waste collection. The number may be more or less but due to non existence of regulation, it's difficult to get exact figures.

Of the overall waste generated in Nairobi for example, 1 % is HCW (JICA 1998). This is about 3.6 tons per day and only covers 25 % of the waste disposed by the private sector.

Kenyatta Hospital once contracted HCWM services when the institution incinerator broke down but due to the large quantity of generated HCW, the provider could not cope (Barrack personal communication). This is a case of capacity of HCW service providers in Kenya. The majority of private companies engaged in Health Care Waste Management in Kenya lack the capacity to manage HCW. The management has been hampered by the fact that:

- They lack infrastructure such as refuse vehicles, incinerators, etc. The current vehicles are open trucks, tractors, canters and pickups.
- Personal Protective Equipment (PPE) is not provided, save for overalls and a few gloves.
- All the workers in the private sector are school leavers and have rarely been trained in waste management.
- Most private sector companies seem to prefer affluent areas leaving the non affluent areas unserviced.
- No private firm has specific expertise in HCW. Nairobi has had a private contractor that specialised in Placenta disposal (Sanitation Cares).
- Despite most healthcare institutions having incinerators, no private firm or council has incinerators that could be commercialised.
- Private waste collectors are not controlled or monitored by any local or central government arm.

The above scenario can be linked to the following causes.

The initial cost of establishing HCWM infrastructure i.e. incinerator, trucks, trained manpower, Personal Protective Equipment (PPE) and is too high for the general waste collectors who also double up as HCW providers. Over 90% of waste collectors are informal outfits that organise themselves to collect from residential estates in big towns.
Another obstacle facing private waste collectors in Kenya is the fact that HCW generated by some of the big well established health facilities is not outsourced. It's only in small private clinics that use the service of private HCWM service providers.

Lack of a legal framework and enforcement of the available regulations also contributes to poor performance of private HCW collectors. Though the country has ad hoc policies and regulations on waste management, the subject encompasses waste management in general and does not pin-point HCW. This situation has led to HCW being handled and disposed of as general waste.

Despite the small number of private firms in the management of waste, HCW management is highly neglected and the need for separation at source, during transportation, recycling and subsequent disposal is inevitable. Central and local governments should come up with legislation governing HCW and the involvement of the private sector and put the necessary enforcement procedures in place.

In conclusion the private sector participation in HCW management can be characterised as follows:

- Lack of infrastructure
- Lack of capital investment
- Poor management
- Lack of capacity to handle HCW generated by health facilities in Kenya
- The operation is in an uncontrolled working environment without regulations

### 7.10 Problems Identified in Training and Awareness on Health Care Waste Management

A policy for the management of HCW cannot be effective unless it is applied carefully, consistently and universally. Training health care personnel in implementing the policy is thus critical if a health care management programme is to be successful. It is essential that everyone handling and affected by the HCW should understand that HCW management is an integral part of health care.

The overall aim of training therefore is to develop awareness of health, safety and environmental issues relating to HCW and how these can affect employees in their daily work. It should highlight the roles and responsibilities of health care personnel in the overall management programme. This takes cognisance of the fact that health and safety at the work place and environmental awareness are the responsibility of all. Thus, an important aspect within the policies and plans for the safe management of HCW is training and awareness creation.

Training of health care personnel is imperative in implementing a successful health care management programme.

The training and awareness needs assessment identified gaps in the training curriculum of institutions training health care workers as well as the lack of general awareness on how to manage HCW. Gaps identified the lack of training of personnel working in health care waste management. The gaps were identified at different levels of health care personnel. The inadequacy in training is common in all levels of the Kenyan health care system which also includes the training of health care personnel both at institutions of higher learning and intermediary colleges such as Kenya Medical Training College.

### 7.10.1 Institutions of higher learning

Kenya has more than six public universities and no less than 5 private universities offering a diversity of professional training. Nairobi and Moi Universities are the main source of under graduate and postgraduate
health education. Nairobi's under-graduate programmes include Bachelor of Medicine and Surgery (MBchB), Bachelor of Dental Surgery, Bachelor of Pharmacy, Bachelor of Science degree in Nursing. While postgraduate programmes at Nairobi University include: Internal Medicine, General Surgery, Paediatrics, Obstetrics and Gynaecology, Ophthalmology, Psychiatry ENT, Anaesthesiology, Pathology, Diagnostic Radiology and Community Health. The Undergraduate programmes at Moi University are: Bachelor of Medicine and Surgery; BSc Programme for Nurses; BSc in Environmental Health; BSc - Occupational Therapy and BSc - Physiotherapy. Egerton University offers a University Diploma course for training Clinical Officers with effect from September 1999. On average, the annual intake is 30 students.

However the curriculum of the courses offered at the universities only covers solid and liquid waste. The curriculum does not categories waste to the point of HCW.

Training is compartmentalised to focus on specific health providers rather than being implemented for all across the board of health providers recognising the fact that waste management should ideally start from where it is generated. A pertinent example is that of nurses who by virtue of their work generate a lot of potentially dangerous waste and therefore the initial proper handling needs to start with them. However their training does not cater for depth in waste management. Rather it focuses on infection prevention

The practical aspects are not handled adequately and this is tied to the resource base of the relevant training institutions where budgetary allocations for field exposure are limited.

There is also no strategy in place to address health provider and community attitude towards waste management and disposal.

Training institutions are more academic than practical yet there is no quick fix for waste management and disposal. On job training and supportive supervision preferably with job aids is crucial to ensure continuous medical education at the facility level. However this requires ample resources to facilitate training and retraining.

Even when training has been undertaken, implementation is a major problem as often there is professional compromise on work ethics that may arise out of poor institutional infrastructure and lack of supplies. This may be amplified by understaffing.

7.10.2 National Hospitals
The public health department at Kenyatta National hospital is responsible for planning, budgeting, and mobilisation of resources and to ensure that all departments within the hospital manage waste. At the hospital the key people in management of waste include the generators (nurses, doctors, public health lab technicians, clinical officers, etc), cleaners, drivers and incinerator operators.

Apart from Public Health Officers (PHO) and nurses to some extent, the remaining personnel lack formal training on how to handle and manage HCW. The hospital normally has in-house training based on HCWM principles but lacks a structured curriculum or manual for undertaking the training. This quarterly training is organised and offered by the public health department of the hospital.
7.10.3 Provincial and District Hospitals

These health facilities have public health departments which are supposed to be in charge of HCW and general sanitation. The general condition is that the facilities lack trained personnel to handle HCW in wards, transportation and at the point of treatment. Incinerator operators have neither been trained in HCW incineration nor occupational health and safety.

7.10.4 Private Clinics

Private clinics use the services of private waste collectors to manage their HCW and general waste. Even though they use private firms to manage their waste, they lack trained manpower and even the generators of HCW (nurses, clinical officers and doctors) in these establishments are not trained in HCWM. This is evident by the fact that they don’t segregate at source.

7.10.5 Health Centres and Dispensaries

All Health Centres and Dispensaries have no budget for waste management; any resources required for this purpose come from operational budgets which are passed onto the patients through the cost sharing system in place in all Kenya public health facilities. Most health care workers and casuals contracted to clean and dispose of HCW lack basic training and understanding of how to manage these wastes.

7.10.6 Health Care Personnel

Health care personnel includes doctors, nurses, public health officers, pharmacists, laboratory technicians, dentists, cleaners, and other health center staff that generate medical waste.

Nurses are trained at Kenya Medical Training College (KMTC) and other private training colleges. However public health care facilities use KMTC graduates. Kenya Medical Training College in Nairobi has a department on public health and epidemiology which offers training on waste management. The curriculum of these two courses shows inadequacy in addressing HCW management and risks factors associated with it. These graduates can assist generators of HCW in separation of waste at source (generation). Despite the knowledge of risks associated with HCW, graduates do not practice the principle of Segregate of waste at source.

Kenya Medical Training College Nairobi campus is the only institution that offers a higher diploma course in solid waste management. The facility cannot accommodate training for all health care professionals. This course should be introduced in other campuses.

The institution should also develop refresher courses specifically for medical education personnel who serve as practicing health care workers.

7.10.7 Waste Handlers

The majority of waste handlers in health facilities are cleaners who have no formal training on HCW management. However, they are the ones given the responsibility of managing and handling this waste. While they do not have sufficient knowledge for this responsibility, they also do not have appropriate resources like equipment and protective clothing for handling this kind of waste. This group includes:

- The cleaners who remove waste from its point of generation (wards, out-patient section, labs, etc)
- Transporters and loaders who transport HCW from to the point incineration or disposal site
- Incinerator operators
7.10.8 General Public
Based on the study, the general public level of awareness on risks of HCW is poor and limited. They understand that they may contract diseases if they come into contact with HCW, specifically HIV and AIDS.

The general public has a common idea of risks posed by HCW though this applies to informed masses. Children were found to be most ignorant of risks of HCW and the most affected by poor management of HCW. At Machakos dump site, children were seen playing and scavenging for waste to play with it and in some cases used condoms as balloons.

Lack of awareness poses a high risk to the public and this needs to be addressed through public awareness and education campaigns.

7.10.9 Scavengers
While scavengers are generally aware of HCW risks, they do not show concern and seem complacent. The awareness is shown by the way they improvise by making shoes to prevent pricking by sharps and use of sticks to scavenge through the waste.

At both Kisumu and Nyeri dumping sites the scavengers had no protective clothing. Scavengers at Kisumu damping site said they suffered injuries from handling the sharps but denied suffering from diseases since they claimed their bodies were resistant to them. One scavenger at the site said he could not suffer from any disease because he had been feeding on the kitchen wastes since childhood.

7.10.10 Health Care workers
Health Care Workers are aware of the general need to manage HCW properly and the risks associated with HCW. However even with this knowledge, they do not practice what they know. This can be attributed to the lack of procedures, the culture of segregation and proper management and the availability of basic equipment and infrastructure.

Doctors
Doctors in many cases handle complications and in most case generate syringes and needles. In most of the facilities visited in the process of developing this plan, doctors were accused of poor management of sharps.

Nursing staff
Nurses being the most central group in medical processes, are not only aware of the requirements of standard practices, but they also know what should happen. They are limited by capacity, in terms of their numbers, required equipment and infrastructure in general.

Cleaners
These are the groups that handle waste from the generation point to the transfer station and to the final treatment destination. Out of general knowledge and common sense, they are aware that HCW can be risky and should be handled and disposed in some special way, however, since burning has been provided as an option, they normally would mix everything when transporting the waste to the treatment site. The risks are vaguely understood even though they are acknowledged. Most of the cleaners interviewed during the study lacked training on HCW. In some places casuals are used in cleaning and disposal of waste which is common practice in health centres, dispensaries and clinics.
8.0 Proposed Phasing of the Action Plan

The Action Plan covers an initial 5-year period including a short, medium and long-term phase followed by ongoing monitoring and control (see Figure 2), with the option of extending the period by a further 5 years if circumstance require this. The Action Plan allows for the implementation to start on 1 January 2006.

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Figure 2. Four Phase implementation of the HCWM Action Plan.


Investigations into the current status of HCW management in Kenya (Refer to Status Quo Report) revealed that there are a number of shortcomings to be addressed as a matter of urgency. The investigations highlighted shortcomings not only affecting staff at health care facilities but also creating a risk of infection for the patients as well as their visitors. Parties that are affected outside the hospital environment include municipal staff responsible for waste collection, landfill supervisors and even waste scavengers at landfills.

Based on the gap analysis, the primary focus of the Consolidation Phase will be on improved occupational health and safety standards. Although environmental matters will be addressed wherever feasible as part of the Consolidation Phase, that will not be the core focus. The Consolidation Phase will *inter alia* address matters like:

- Training of staff on appropriate HCW segregation, containerisation, handling and storage;
- Supply and maintenance (including disinfection) of appropriate reusable and disposable HCW containers;
- Provision of appropriate internal HCW storage facilities;
- Provision of appropriate internal HCW transport facilities;
- *Temporary revamping* of existing onsite HCRW central stores, treatment facilities and disposal facilities.

Although HCW treatment and disposal may at that stage still not meet the required environmental standards set by the NEMA, it is envisaged that the systems in use by the end of the Consolidation Phase will have the smallest possible impact on the health and safety of affected parties.


The Development Phase will be the first step towards the setting of improved environmental standards for HCW management. Assuming that the most critical occupational health and safety aspects would have been addressed during the Consolidation Phase, the focus will move towards the setting of treatment efficiency standards for both thermal as well as non-thermal treatment processes, setting of emission standards and determining the feasibility of regionalising HCRW treatment facilities.
Against the background of nationally accepted environmental standards, various options will be evaluated for cost effective HCW management service delivery. Should any of the options be considered viable, preparations will be made for the rollout (implementation) of the selected HCW management service delivery models. For any HCW services to be outsourced, technical specifications and performance monitoring mechanisms will be developed and tenders will be called for. By creating an economic environment in which the private sector can function, opportunities will be created for various private-public-partnership models, thereby allowing the health sector to focus on its core business whilst at the same time stimulating the local economy.

The following activities will, amongst others, form part of the Development Phase:

- Set appropriate thermal and non-thermal HCRW treatment efficiency standards with corresponding timeframes for compliance;
- Set appropriate HCRW treatment emission standards with corresponding timeframes for compliance;
- Investigate different options and determine the viability of Public-Private-Partnerships for HCW management service delivery;
- Determine the viability of regionalising HCW management service delivery;
- Develop / upgrade central HCW storage facilities at all HCW generators;
- Develop a HCW treatment and disposal infrastructure plan, develop technical specifications, identify sources of funding and call for tenders for the supply, installation, construction and commissioning of HCW treatment and disposal facilities;
- Develop commercial terms and technical specifications, identify sources of funding and potential business partners and invite proposals on Private-Public-Partnerships;
- Develop commercial terms and technical specifications, identify sources of funding and potential service providers and invite tenders for the outsourcing of HCW management services.


With all equipment required at source, for occupational health and safe HCW management, supplied during the Consolidation Phase, the Implementation Phase is based on the assumption that the equipment supplied previously is in good working order. Having therefore, during the Development Phase, set the standards and selected the most appropriate models for HCW management service delivery, the Implementation Phase will focus on the establishment of institutional structures as well as the supply, installation and construction of equipment and facilities required for environmentally sound HCW treatment and disposal. Although this phase is expected to be the most capital intensive of all, it is expected to lay the foundation for sustainable HCW management in the long term.

Some of the most important aspects to be addressed during the Implementation Phase will inter alia include the following:

- Award contracts for the supply, construction and commissioning of HCW treatment and disposal infrastructure, introduce management systems, appoint and train staff and commission HCW management facilities;
- Enter into Private-Public-Partnerships agreements, introduce management systems, appoint and train staff, develop HCW treatment and disposal infrastructure and commission facilities; or
• Award Contracts to HCW management service providers for the outsourcing of all or selected HCW management services;
• Operate fully integrated HCW management systems.

Although identified as the last and as a separate phase, monitoring and control is to be executed throughout the process, i.e. starting from the Consolidation Phase. Having monitoring and control identified as a separate phase simply highlights the fact that this is to be sustained beyond the implementation of improved HCW management systems in Kenya. For the process to be sustainable in the long term, the executing and regulating authorities are therefore expected to remain involved and continue with their monitoring and control functions.

The impact of any improvements made to the HCW management system is to be evaluated with a view of making adjustments where required to further improve on the HCW management systems. The intention is to further information generated during the Monitoring and Control Phase to be recorded not only for future use in Kenya, but also for future reference as a model of sustainable HCW management throughout the developing world.

8.5 Implementation of the Action Plan
This Action Plan is intended to be implemented by the Government of Kenya through the Ministry of Health. The Action Plan also gives cognizance of the expected role to be played by the communities and other sectors of the society.

8.5.1 The Role of Communities
The Action Plan proposes that the communities role to be
✓ Strong community participation and involvement in HCWM
✓ IEC-community members already educated/trained to serve as educators to others
✓ Community contribution in terms of providing required equipmet and other resources
✓ Willingness to be trained
✓ Application/practice of knowledge and or skills acquired

8.5.2 Multisectoral Approach
The government, through the MoH should develop a multisectoral approach to the management of HCW. In this respect the Action Plan proposes;
✓ The formation of National HCWM forum, which should be made up of multi sectoral stakeholders
✓ The description of roles for all the relevant agencies to be involved in HCWM


#### 9.1.1 Containers

See Annexure E, F, G, H

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<tr>
<th>Containers</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
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<td>Hospitals</td>
<td>3 5-litre safety boxes on wall and nursing trolley brackets. 3 Specicans 3 Plastic liners</td>
<td>3 Yellow plastic liners on wall and nursing trolley brackets; 3 240-litre reusable plastic wheelie bin containers.</td>
<td>3 Liquids - Containers used for supply; 3 Solids - cardboard boxes used for supply.</td>
<td>3 Specicans</td>
<td>3 Black plastic liners on wall and nursing trolley brackets; 3 240-litre reusable plastic wheelie bin containers.</td>
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### 9.1.2 Internal HCW Storage

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### 9.1.3 Internal HCW Transport

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<td>240-litre wheelie bins</td>
<td>HCW trolley</td>
<td>HCW trolley</td>
<td>240-litre wheelie bins</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 9.1.4 Central HCW Storage

<table>
<thead>
<tr>
<th>Central HCW Storage</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Central store / treatment holding area.</td>
<td>Mortuary.</td>
<td>Central store / treatment holding area</td>
<td>Central store / treatment holding area</td>
<td>Central store / treatment holding area</td>
<td>Central store</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Central store / treatment holding area.</td>
<td>Direct disposal.</td>
<td>Central store / treatment holding area</td>
<td>Central store</td>
<td>Not applicable</td>
<td>Central store</td>
</tr>
</tbody>
</table>

### 9.1.5 Onsite HCW Treatment

<table>
<thead>
<tr>
<th>Onsite HCW Treatment</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onsite HCW treatment</td>
<td>Hospitals</td>
<td>Clinics / Dispensaries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
<td>------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incineration.</td>
<td>Incineration if temperature is high enough.</td>
<td>“Incineration”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incineration.</td>
<td>Incineration if temperature is high enough.</td>
<td>“Incineration”.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incineration.</td>
<td>Incineration if temperature is high enough.</td>
<td>Not applicable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incineration.</td>
<td>Incineration if temperature is high enough.</td>
<td>Not applicable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incineration.</td>
<td>Incineration if temperature is high enough.</td>
<td>Not applicable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable.</td>
<td>Pit burning where allowed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.1.6 Onsite HCW Disposal

<table>
<thead>
<tr>
<th>Onsite HCW disposal</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Incinerator ash pit where allowed / sharps pit.</td>
<td>Incinerator ash pit where allowed / placenta pit.</td>
<td>Incinerator ash pit where allowed.</td>
<td>Incinerator ash pit where allowed.</td>
<td>Incinerator ash pit where allowed.</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

9.1.7 HCW Collection / Offsite Transport

<table>
<thead>
<tr>
<th>HCW collection / offsite transport</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
</table>
### 9.1.8 Offsite Treatment

<table>
<thead>
<tr>
<th>Offsite treatment</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Incineration.</td>
<td>Incineration.</td>
<td>Incineration.</td>
<td>Incineration.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 9.1.9 Offsite HCW Disposal

<table>
<thead>
<tr>
<th>Offsite disposal</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Municipal or private disposal sites.</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Not applicable.</td>
<td>Municipal or private disposal sites.</td>
</tr>
</tbody>
</table>

### 9.2.1 Containers

<table>
<thead>
<tr>
<th>Containers</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>3 5-litre safety boxes on wall and nursing trolley brackets.</td>
<td>3 Specicans</td>
<td>3 Yellow plastic liners on wall and nursing trolley brackets; 3 240-litre reusable plastic wheelie bin containers.</td>
<td>3 Liquids - Containers used for supply; 3 Solids – cardboard boxes used for supply.</td>
<td>3 Specicans</td>
<td>3 Black plastic liners on wall and nursing trolley brackets; 3 240-litre reusable plastic wheelie bin containers.</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>3 5-litre safety boxes on wall and nursing trolley brackets.</td>
<td>3 Specican.</td>
<td>3 Yellow plastic liners on wall and nursing trolley brackets; 3 50 and 100-litre reusable plastic box containers with yellow plastic liners.</td>
<td>3 Liquids - Containers used for supply; 3 Solids – cardboard boxes used for supply.</td>
<td>Not applicable</td>
<td>3 Black plastic liners on wall and nursing trolley brackets; 3 85-litre reusable plastic bin with black plastic liners.</td>
</tr>
</tbody>
</table>

### 9.2.2 Internal HCW Storage

<table>
<thead>
<tr>
<th>Internal HCW Storage (As Phase 1)</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Sluice</td>
<td>Not applicable</td>
<td>Sluice</td>
<td>Sluice</td>
<td>Sluice</td>
<td>Sluice</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
### 5.2.3 Internal HCW Transport

<table>
<thead>
<tr>
<th></th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal HCW Transport</strong> (As Phase 1)</td>
<td>Hospitals.</td>
<td>HCW trolley.</td>
<td>240-litre wheelie bins</td>
<td>HCW trolley</td>
<td>HCW trolley</td>
<td>240-litre wheelie bins</td>
</tr>
</tbody>
</table>

### 9.2.4 Central HCW Storage

<table>
<thead>
<tr>
<th></th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Central HCW Storage</strong></td>
<td>Hospitals.</td>
<td>Central store / treatment holding area.</td>
<td>Central store / treatment holding area</td>
<td>Central store / treatment holding area</td>
<td>Central store / treatment holding area</td>
<td>Central store</td>
</tr>
</tbody>
</table>

### 9.2.5 Onsite HCW Treatment

<table>
<thead>
<tr>
<th></th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onsite HCW treatment</strong></td>
<td>Hospitals</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>
### 5.2.6 Onsite HCW Disposal

<table>
<thead>
<tr>
<th>Onsite HCW disposal</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Incinerator ash pit where allowed.</td>
<td>Incinerator ash pit where allowed.</td>
<td>Incinerator ash pit where allowed.</td>
<td>Incinerator ash pit where allowed.</td>
<td>Incinerator ash pit where allowed.</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

### 9.2.7 HCW Collection / Offsite Transport

<table>
<thead>
<tr>
<th>HCW collection / offsite transport</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
</table>
### 9.2.8 Regional offsite HCW treatment

<table>
<thead>
<tr>
<th>Regional offsite HCW treatment</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Incineration by upgradeable double chamber incinerator.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

### 9.2.9 Offsite Disposal

<table>
<thead>
<tr>
<th>Offsite disposal</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Municipal or private disposal sites.</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Incinerator ash on disposal site.</td>
<td>Not applicable.</td>
<td>Municipal or private disposal sites.</td>
</tr>
</tbody>
</table>

9.3.1 Containers

<table>
<thead>
<tr>
<th>Containers</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>③ Plastic leak proof and puncture resistant sharps boxes on wall and nursing trolley brackets.</td>
<td>③ Specimens in different sizes.</td>
<td>③ Yellow plastic liners on wall and nursing trolley brackets; ③ 240-litre reusable plastic wheelie bin containers.</td>
<td>③ Liquids - Specimens ③ Solids – reusable plastic box containers with plastic liners.</td>
<td>③ Specimens</td>
<td>③ Black plastic liners on wall and nursing trolley brackets; ③ 240-litre reusable plastic wheelie bin containers.</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>③ Plastic leak proof and puncture resistant sharps boxes on wall and nursing trolley brackets.</td>
<td>③ Specimens.</td>
<td>③ Yellow plastic liners on wall and nursing trolley brackets; ③ 50 and 100-litre reusable plastic box containers with yellow plastic liners.</td>
<td>③ Liquids - Specimens ③ Solids – reusable plastic box containers with plastic liners.</td>
<td>Not applicable</td>
<td>③ Black plastic liners on wall and nursing trolley brackets; ③ 85-litre reusable plastic bin with black plastic liners.</td>
</tr>
</tbody>
</table>

9.3.2 Internal HCW Storage

<table>
<thead>
<tr>
<th>Internal Hospitals</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Sluice</td>
<td>Not applicable</td>
<td>Sluice</td>
<td>Sluice</td>
<td>Sluice</td>
<td>Sluice</td>
</tr>
<tr>
<td>HCW Storage (As Phase1,2)</td>
<td>Clinics / Dispensaries</td>
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<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------------</td>
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</tr>
</tbody>
</table>

9.3.3 Internal HCW Transport

<table>
<thead>
<tr>
<th>Internal HCW Transport (As Phase1,2)</th>
<th>Hospitals.</th>
<th>Clinics / Dispensaries.</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals.</td>
<td>HCW trolley.</td>
<td>Not applicable.</td>
<td>240-litre wheelie bins</td>
<td>HCW trolley</td>
<td>240-litre wheelie bins</td>
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<td></td>
</tr>
</tbody>
</table>

9.3.4 Central HCW Storage

<table>
<thead>
<tr>
<th>Central HCW Storage</th>
<th>Hospitals.</th>
<th>Clinics / Dispensaries.</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals.</td>
<td>Central HCW store / treatment holding area.</td>
<td>Central HCW store.</td>
<td>Mortuary / freezer in central HCW store.</td>
<td>Central HCW store / treatment holding area</td>
<td>Central HCW store / treatment holding area</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.3.5 Onsite HCW Treatment

<table>
<thead>
<tr>
<th>Onsite HCW treatment</th>
<th>Hospitals</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinics / Dispensaries</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td></td>
</tr>
<tr>
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<td>----------------</td>
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<td></td>
</tr>
</tbody>
</table>

### 9.3.6 Onsite HCW Disposal

<table>
<thead>
<tr>
<th>Onsite HCW disposal</th>
<th>Hospitals</th>
<th>Clinics / Dispensaries</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onsite HCW disposal</td>
<td>Hospitals</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Clinics / Dispensaries</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

### 9.3.7 HCW Collection / Offsite Transport

<table>
<thead>
<tr>
<th>HCW collection / offsite transport</th>
<th>Hospitals</th>
<th>Clinics / Dispensaries</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
</table>

### 9.3.8 Regional Offsite HCW Treatment

<table>
<thead>
<tr>
<th>Regional offsite HCW treatment</th>
<th>Hospitals</th>
<th>Sharps HCRW</th>
<th>Pathological HCRW</th>
<th>General Infectious HCRW</th>
<th>Pharmaceutical / Chemical HCRW</th>
<th>Oncology HCRW</th>
<th>HCGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional offsite HCW treatment</td>
<td>Hospitals</td>
<td>Incineration with air emission control / non-thermal treatment.</td>
<td>Incineration with air emission control / non-thermal treatment.</td>
<td>Incineration with air emission control / non-thermal treatment.</td>
<td>Incineration with air emission control / non-thermal treatment.</td>
<td>Incineration with air emission control / non-thermal treatment.</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Offsite Disposal</td>
<td>Sharps HCRW</td>
<td>Pathological HCRW</td>
<td>General Infectious HCRW</td>
<td>Pharmaceutical / Chemical HCRW</td>
<td>Oncology HCRW</td>
<td>HCGW</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>-------------------------</td>
<td>-------------------------------</td>
<td>---------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td><strong>Hospitals</strong></td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Compliant municipal or private disposal sites.</td>
<td></td>
</tr>
<tr>
<td><strong>Clinics / Dispensaries</strong></td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Incinerator ash or non-thermal treated residues on disposal site.</td>
<td>Not applicable.</td>
<td>Compliant municipal or private disposal sites.</td>
<td></td>
</tr>
</tbody>
</table>

### 9.3.9 Offsite Disposal

**Sources of used condoms** | **Storage Receptacles** | **Proposed Disposal Methods** | **Behaviour Change communication strategy**
--- | --- | --- | ---
**Offsite disposal** | **Hotels/Lodges/other institutions** | Sanitary pads receptacles (pedal operated) | Central Sanitary land fills and Incinerators | Public education and awareness creation |
| **Households** | Sanitary pads receptacles (pedal operated) | Disposal pits, Pit Latrines and incinerators | Small messages on the wrappers of condoms on how to dispose condoms |
There is need for further studies to come up with better options for disposal of used condoms as the issue of condom is sensitive and to some extent regarded as a taboo. Given the complexities associated with the use of condoms, where to a large extent its use is subjected to a lot of secrecy, a full-fledged study on condom disposal would be the best option to come up with appropriate technologies to dispose of used condoms. However, the above proposed technologies would go along way into providing a solution, meanwhile

### 9.4 HCWM Plan Options

#### 9.4. 1 Option 1. Regionalisation of HCWM

One large capacity incinerator – centrally located and run by the municipality, to treat all hazardous waste of the district. Wherever it could be located it has implication on very high transport costs for all HCFs, distance and secure vehicular requirements and thus no incentive for that kind of treatment. The capital cost for such a big capacity may also be high. The spin-offs of this arrangement are that; it would be accessible to all other hazardous waste generators at the district level. Air pollution would be localized and emission controls could be managed.

#### 9.4. 2 Option 2. Stand alone Incinerators at HCFs

All Health facilities equipped with appropriate capacity incinerators. This may be an over investment for low benefits. Inconvertible fraction of waste is not enough to warrant this capital and operation cost. his situation is the one being practiced and is still partially operative. Risk of exposure to the general public is minimized. It has the highest probability of success and cost containment. Sustainability of this option depends only on proper and timely maintenance of the incinerators.

#### 9.4. 3 Option 3. Private Sector Participation

Private sector can be involved in healthcare waste management at different levels. First, the private sector may be subcontracted directly to provide HCWM services to individual healthcare facilities. Secondly, the private sector may sign a contract to Build, Operate, and Transfer (BOT) or Build, Own, and Operate (BOO) an entire HCWM treatment or disposal facility. The private sector can play a significant role in providing waste treatment and disposal services if the contract establishes a clear set of rules about division of responsibilities between the parties involved (i.e. regulatory authority, healthcare facility, and private operator). Adequate budget provision is also required at the healthcare facility or the local authority level to pay the private operator. In the three countries described below, private contractors play differing roles in HCW management:
10.0 Action Plan for Training and Awareness in Health Care Waste Management in Kenya

Trained health care personnel as well as staff handling HCW on a regular basis is a critical component in implementing a successful HCW management programme.

10.1. Training Strategy for Health Care Personnel

10.1.1 In service Training

All health care personnel, including medical doctors, should be trained on the comprehensive HCW management plan and policy and should obtain related training. This should ensure their collaboration in the implementation of such a plan or policy. Table 7 indicates who requires training, what type of training is necessary, where it can be offered and the frequency at which courses should be held.

Separate training activities should be given with the target audience being the following main categories of health care personnel:

- Health Facility managers and administrative staff responsible for implementing regulations on HCW management
- Medical doctors
- Public Health Officers/Technicians
- Clinical Officers, lab technicians and Nurses
- Cleaners, transporters, incinerator operators and waste handlers
- Community based health providers

Since action is needed at management level by those producing the waste as well as by the waste handlers, training of all of these categories of personnel is equally important. Medical doctors may be educated through senior staff workshops and general staff through formal seminars. The training of waste managers and regulators, however, could take place outside the hospitals, at public health schools or in university departments.

At the national level, a Training of Trainers (TOT) course should be carried out to senior Public Health Officers at the provincial and district level, who in turn will roll out training courses in their areas of jurisdiction.

10.1.2 Follow-up and refresher courses

Follow-up / refresher courses should be undertaken to provide updated training (in line with new policy, legislation, etc.) as well as orientation for new employees and for existing employees with new responsibilities.

Follow-up training is instructive for trainers, indicating how much information has been retained by course participants and the likely need for future refresher courses. The training should be organised by the Public Health Department (PHD) in collaboration with the administration as the PHD will need the support of the management in implementing the plan and policy.
10.1.4 Training Content
Staff education programmes should include:

- Information on, and justification for, all aspects of the HCW plan and policy;
- Information on the role and responsibilities of each facility staff member in implementing the plan and or policy;
- Technical instructions, relevant for the target group, on the application of waste management practices and procedures.

10.1.5 Training Approaches
The training approaches such as learning through practice, and hands-on training of small groups of personnel should be undertaken. Testing the participants at the end of the course through practical and theoretical questions often provides an incentive for learning, and allows for the evaluation of the graduates in terms of knowledge and practical skills acquired.

Health Care workers need to be given training both in college and on-site training on segregation of waste at source and treatment of hazardous waste. For the subordinates, on site training would be appropriate as most of them lack formal education. This kind of training should also apply to waste. They should also be given a general knowledge of appropriate HCW management as well as the risks of inappropriate management including cost implications. This information can be given during the refresher workshops and through pamphlets, code of conduct manual as well as posters.

10.1.6 Training responsibility at HCFs
The expectation is that key personnel (Public Health Officer/consultants) should be given the responsibility for all training related to segregation, collection, storage and disposal of HCW. He or she should ensure that staff at all levels are aware both of the hospital waste management plan and policy and of their own responsibilities and obligations in this regard. A record should be kept of all training sessions, and the content of training programmes should be periodically reviewed and updated where necessary. For similar training of those concerned with smaller sources of HCW, the regional health authority may be able to make centralised arrangements for courses.

10.1.7 Training Curriculum Development
Being the prime institution for the training of health care workers in the country, Kenya Medical Training College should include modules on HCWM in their curriculum. The institution should offer this course in all their campuses to enable all graduates is equipped to handle the sub-sector. Refresher courses should be added to the curriculum.
Table 7. Training Plan for Health Care Waste Management

<table>
<thead>
<tr>
<th>Target Group</th>
<th>Area of training</th>
<th>Training Type/ Methods</th>
<th>Training Providers</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision makers</td>
<td>Principles of HCW Management, Relevance of HCW management</td>
<td>Training workshops</td>
<td>Consultants/Public Health Officers</td>
<td>Bi-annually</td>
</tr>
<tr>
<td>Medical officers</td>
<td>Principles of HCW Management, Risks associated with HCW, HCWM and Infection Control</td>
<td>Training workshops</td>
<td>Kenya Medical College and Public Health Department/Consultants</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Clinical Officers</td>
<td>Principles of HCW Management, Risks associated with HCW, HCWM and Infection Control</td>
<td>To be part of their basic training curriculum, training workshops</td>
<td>Public Health Department , Consultants</td>
<td>Bi-annually</td>
</tr>
<tr>
<td>Nurses, Technicians, Pharmacists</td>
<td>Principles of HCW Management, Risks associated with HCW, HCWM and Infection Control</td>
<td>To be part of their basic training curriculum, training workshops</td>
<td>Medical Training College &amp; Consultants</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Cleaners</td>
<td>Basics of HCW Management , Occupational Health and Safety Measures, Spillage response, Risks associated with HCW</td>
<td>Training workshops, On-job training, posters, pamphlets and learning by doing sessions</td>
<td>Public Health Department ,Consultants</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Transporters</td>
<td>Basics of HCW Management , Occupational Health and Safety Measures, Spillage response, Risks associated with HCW, Precautions during transportation of HCW</td>
<td>Training workshops, On-job training, posters, pamphlets and learning by doing sessions</td>
<td>Public Health Department</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Incinerator operators/Sanitation care</td>
<td>Basics of HCW Management , Occupational Health and</td>
<td>Workshops, posters, Manufacturer’s Manual,</td>
<td>Public Health Department, Consultants</td>
<td>Bi-annually</td>
</tr>
<tr>
<td>Takers</td>
<td>Safety Measures, Spillage response, Risks associated with HCW, Operation and Maintenance of HCWM disposal facilities</td>
<td>Attachment to suppliers, In-service training</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10.2 Awareness Creation Strategy

The following methods should be considered for public education and awareness creation on the potential risks of HCW (see Table 8 for awareness creation plan):

- Poster exhibitions on health-care waste issues, including the risks involved in scavenging discarded syringes and needles.
- Explanation by the staff of health-care establishments to incoming patients and visitors on waste management policy. This may be difficult to achieve, in which case the distribution of leaflets should be considered.
- Information poster exhibitions in hospitals, at strategic points such as waste bin locations, giving instructions on waste segregation. Posters should be explicit, using diagrams and illustrations to convey the message to as broad an audience as possible, including illiterate people.

Table 8. Awareness Creation Plan for Health Care Waste Management

<table>
<thead>
<tr>
<th>Target Group</th>
<th>Awareness Building Strategy</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Public</td>
<td>Posters, Radio, TV, participatory education, theatre and Pamphlets</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Scavengers</td>
<td>Public educational awareness meetings at the dumpsite and participatory education theatre</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Other Health Care Workers</td>
<td>Workshops, pamphlets and posters placed strategically at the HCW generation points, Brochures</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Health facilities administrators</td>
<td>Pamphlets, Code of Practice for Health Care Waste Management and Video clips</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Doctors</td>
<td>Distribute pamphlets on HCWM, Distribute Code of Practice for Health Care Waste Management, Use of relevant Video clips</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Nurses</td>
<td>Distribute pamphlets on HCWM, Distribute Code of Practice for Health Care Waste Management, Use of relevant Video clips</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Clinical officers</td>
<td>Distribute pamphlets on HCWM, Distribute Code of Practice for Health Care Waste Management, Use of relevant Video clips</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Public Health Officers</td>
<td>Distribute pamphlets on HCWM, Distribute Code of Practice for Health Care Waste Management, Use of relevant Video clips</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Transporters</td>
<td>Distribute pamphlets on HCWM, Posters, Distribute Code of Practice for Health Care Waste Management and Video clips</td>
<td>Ministry of Health/ Department of Environmental Health</td>
</tr>
<tr>
<td>Cleaners</td>
<td>Distribute pamphlets on HCWM, Code of Practice for Health Care Waste Management, Posters, Use of relevant Video clips</td>
<td>Ministry of Health/Department of Environmental Health</td>
</tr>
</tbody>
</table>
10.2.1 Proposed Awareness Activities
Awareness activities are supposed to be fun educational activities used to communicate important information with the aim of communicating one or two messages only. Unlike education and training programs awareness activities should last for a very short time, a few days to one week. Examples of common activities may include, but not be confined to, drama, poster display, information stall, “cleaner of the month” campaign, “week about waste” SMS campaign, championship waste game, reciting poems, among others.

10.2.2 Small Media
Small media include aspects such as banners, posters, pamphlets, flyers, stickers, T-shirts, raffles and lucky draws, other novelties such as pens, key rings, badges, and so forth, printed with brief messages on HCW management.

Inter-ward competition can be encouraged, for instance, on the best segregation practices. The target group in this case being medical and non-medical staff working in participating wards. The activity, the Target Group and the Message are essential areas of consideration.

Message
HCW goes into red containers, general waste goes into black containers, sharps go into sharps containers.

Each to be accompanied by a description of the activity, the target group and the message set a task team in the health care facility. Complete awareness activity plan e.g. drama. Drama serves as a powerful method to disseminate issues related to waste management. Drama brings out humour and singing as it communicates messages, such as on prevention of needle stick injuries and what to do when that happens accidentally. Messages must be clear and reinforced.

A trained facilitator could work with volunteers to produce short dramas with messages such as “Sharps go into sharps container”, “Report all needle injuries”, “Get treatment for any needle stick injury “or “It will protect you from HIV infection”

The target group are medical and non-medical staff in HCFs.

10.2.3 Poster Display
The activity – generate a display of posters about occupational hazards and safety hazards of poor HCW management.

The target group – All medical and non-medical staff, patients, visitors

The Message:
1. Everyone has a right to work in a safe environment
2. Correct waste segregation as part of occupational health and safety
3. Clean all bins and stands daily to protect our environment from germs
4. Wear gloves when working with waste
11.0 Legal and Institutional Framework Action Plan

Strong Legal and institutional framework forms a critical component in the implementation of any plan of action on HCWM.

Ministry of Health as the main implementing agency of the HCWM Plan through the Division of Environmental Health should issue permits and licenses to parties and individuals undertaking HCWM activities.

Other government agencies that are involved in the issuance of licenses for the facilities undertaking HCWM should consult with the MoH. The Department should also take notice and start enforcing the Public Health Act by taking criminal proceedings against those found to mismanage HCW or the person responsible for the nuisance. Among the key regulatory bodies that the MoH should involve in consultation in the regulation of health care waste are NEMA, the Medical Practitioners and Dentists Board, the local authority, such as the City Council, and the Radiation Protection Board Where air pollution issues are involved the Department of Occupational Health and Safety of the Ministry of Labour which enforces the factories Act, Chapter 514 would be involved as well, particularly as there are no statutory standards for air emissions from incineration presently.

Coordination of the various regulatory bodies should be undertaken in order to minimize the risk of contradictory and overlapping requirements or of duplication of inspections and monitoring. The MoH should take a key responsibility over this.

It is also important that the MoH should push for the gazettment of the proposed draft regulations touching on HCWs to be expedited in order to fill the gap presently existing in the regulatory framework. The provisions of the Public Health Act that uses the term nuisance should be amended to list all those that are referred as nuisance. This can be attached as a schedule of the Act. In this schedule, HCW should be comprehensively defined to cover all other sources of HCW that were not part of the study. This should include veterinary services. Strengthening of the Act will improve how HCW is managed by the private sector HCFs

Enforcement of the relevant statutes remains the key to ensuring that the Action Plan becomes implementable. The MoH and other government officials charged with the responsibility of enforcing the relevant Acts related to HCWs should do so as a matter of urgency.

Specific amendments to the Public Health Act must be given a high priority; this is because it is the main statute concerned with HCW and as such must have thorough mention on the same. A motion should be tabled in parliament calling for the amendment of this Act.

The table below presents a summary of the identified gaps in the exiting legal framework and the proposed improvements.
<table>
<thead>
<tr>
<th>Laws</th>
<th>Weaknesses</th>
<th>Proposed Actions</th>
<th>Actors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Health Act (Cap 242)</td>
<td>Generally makes reference to “nuisance” but makes no mention of HCWM</td>
<td>Amend to have a clause on HCWM. Should occur during the Phase 1 of the Action Plan</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td></td>
<td>Inadequate enforcement</td>
<td>Strict enforcement</td>
<td>MoH</td>
</tr>
<tr>
<td>Hazardous Health Care Waste Management Guidelines</td>
<td>Still in draft</td>
<td>Approval of guidelines by MoH during Phase 1 of the Action Plan</td>
<td>MoH</td>
</tr>
<tr>
<td>Environmental Sanitation Policy</td>
<td>Still in draft</td>
<td>Need to be gazetted during the phase 1 on the Action Plan</td>
<td>MoH</td>
</tr>
<tr>
<td>Biomedical Waste Regulations</td>
<td>Still in draft</td>
<td>Gazzetement of the Biomedical waste regulations and enforcement</td>
<td>Ministry of Environment and Natural Resources/NEMA</td>
</tr>
<tr>
<td>Local Government Act (Cap 265)</td>
<td>Lack of by-laws to address HCWM</td>
<td>Formulate by-laws to cater for HCWM</td>
<td>Ministry of Local Government/ Local Authorities</td>
</tr>
<tr>
<td>Institutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ministry of Health</td>
<td>Inadequate enforcement of Public Health Act</td>
<td>Strengthen enforcement of the law</td>
<td>MoH</td>
</tr>
<tr>
<td>National Environmental Management Authority (NEMA)</td>
<td>Inadequate coordination with Line Ministries such as MoH</td>
<td>Coordinate with MoH and other relevant Ministries and agencies (Phase 1)</td>
<td>NEMA and relevant line Ministries</td>
</tr>
<tr>
<td></td>
<td>Inadequate enforcement of Polluter-Pays-Principle</td>
<td>Enforce the P-P-P in coordination with the relevant line ministries/agencies.</td>
<td></td>
</tr>
</tbody>
</table>
11.0 Monitoring and Evaluating the Impact of the Strategy

11.1 Monitoring Plan

The development of a monitoring plan as well as adequate control procedures at national, regional and health facility levels are key issues which will aid in ensuring sustainability of implementation of the plan. Regular reporting and field visits as well as a good information system to store and analyse the data are the basis of an efficient monitoring plan (Figure 3).

The monitoring plan should aim at providing relevant information for two different but complementary objectives:

1. Monitor progress on the implementation of the HCWM plan within the HCFs and evaluate the impact of the National HCWM Plan.

2. Measure the Operation and Maintenance (O&M) performance of health services to maintain a good standard of HCWM within the HCFs.

The Monitoring Plan must provide the necessary tools to measure if these objectives have been reached. They include:

- The development of adequate indicators of achievement or performance; Qualitative should always be coupled with quantitative indicators in order to monitor and evaluate the outcome of the HCWM plan.

- A simple, regular reporting system to keep the appropriate authorities constantly informed with sufficiently accurate and relevant information that can be easily verified, enabling decision-makers to change the implementation strategy if necessary based on the practices encountered in the HCFs;

- The development of regular control and backstopping activities carried out by the Central and Regional Health Authorities, addressed to the HCFs.

Checklist of actions

- Standardise recording and management procedures for all levels (primary, secondary, tertiary health facilities, district, regional and national administrations);

- Set-up a reliable information system;

- Establish adequate control and backstopping procedures.
Figure 3. National Monitoring Plan for HCWM

**Recommendations**

The establishment of a HCWM plan should progressively lead the medical institutions and the administrative authorities to consider HCWM as a routine issue to cope with and progressively reinforce their organisational capacities. The MoH should oblige the major hospitals to formally nominate a HCW Management Officer (HCWMO) and an Infection Control Committee (ICC). The HCWMO, in coordination with the ICC 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 personnel job descriptions. The consolidation of the ongoing management and administration procedures includes:

- Annual reporting of the HCFs to the supervising administrative authorities, with the set-up of annual HCWM plans;
- The gathering and the review of the reports by districts and regional authorities and the adequate review of the HCWM Plans at their level, based on the information provided by the HCFs. These plans 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 strategy to improve the management of HCW in the region;
  5) A provisional agenda for the monitoring of the disposal facilities located in the HCFs;
- The integration of the above data in the national health information system to have a better knowledge of the status of the HCWM practices in the medical institutions and regions. They will be able to modify the National HCWM Policy and Strategy if required;
- Carrying out regular inspections to verify at least that segregation procedures are respected and safety measures applied;
- The backstopping of the different HCFs by providing feedback on the problems observed and giving appropriate training and advice to correct and improve current practices and procedures.

Reduce the pollution associated with the management of HCW
Best techniques and practices in HCWM to reduce pollution should be demonstrated in selected HCFs. This will include developing model hospitals and/or model rural health clinics. Pilot projects can demonstrate best practices for HCWM that can avoid/reduce drastically unnecessary pollution. The various experiences gained can then serve as a framework to review national HCW policies and regulations. This should be seen as an ongoing process, which aims at constantly improving HCWM practices so that they may take into account both the new types of waste as well as the innovative treatment/disposal technologies that can be found.

Checklist of actions

- Review existing HCWM practices and policies, including purchase and product utilization policies;
- Establish waste minimization and waste management objectives for each category of HCF;
- Propose and adopt modifications in current practices and policies aimed at achieving objectives;
- Establish management structures and management techniques that will ensure that new policies and practices will be properly carried out;
- Train both managers and staff to carry out the new policies and practices;
- Select and deploy appropriate waste treatment approaches;
- Monitor and review progress: provide ongoing support and assistance to ensure objectives are being met. Revise approaches as needed;
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.

**Recommendations**

Best practices in reducing HCW to avoid environmental releases of dioxins and mercury should be demonstrated in several HCFs in the country in the framework of a pilot project. Increased awareness about persistent organic pollutants (POPs) and other toxic substances within the medical and health care sector should be promoted.

**11.1.1 Monitoring and Evaluating HCW’s Safe Management**

In the following subheadings, basic aspects pertaining to waste definitions and classification, main actors, risks and ways of minimising them as well as the international agreements that underlie the legislative and regulatory principles governing the way HCW should be handled is presented.

The following headings provide more detailed information around four thematics: management, training, regulatory as well as technical aspects.

**11.2 Regulatory framework at national level**

It is the responsibility of governments to set up the necessary legal framework for the safe management of healthcare waste and to ensure that HCF managers take their share of responsibility to manage wastes safely and comply with national regulations.

**11.2.1 Legal Provisions**

National legislation is the basis for improving healthcare waste practices in any country. It establishes legal controls and permits the national agency responsible for the disposal of healthcare waste, in most cases the ministry of health, to apply pressure for their implementation. The ministry of environment or national environmental protection agency may also be involved; there should be clear designation of responsibilities before the law is enacted.

The law should be complemented by a policy document, and by technical guidelines developed for implementation of the law. This legal “package” should specify regulations on treatment for different waste categories, segregation, collection, storage, handling, disposal, and transport of waste, responsibilities, and training requirements; it should take into account the resources and facilities available in the country concerned and any cultural aspects of waste-handling.

A national law on healthcare waste management may stand-alone or be part of more comprehensive legislation such as the following:

- Law on management of hazardous wastes: application to healthcare waste should be explicitly stated;
- Law on hospital hygiene and infection control: a specific chapter or article should be devoted to healthcare waste.

The law should include the following:

- A clear definition of hazardous healthcare waste and of its various categories;
- A precise indication of the legal obligations of the healthcare waste producer regarding safe handling and disposal;
- Specifications for record-keeping and reporting;
• Specifications for an inspection system to ensure enforcement of the law, and for penalties to be imposed for contravention;
• Designation of courts responsible for handling disputes arising from enforcement of or non-compliance with the law.

Gradual implementation of the law is recommended in preference to any attempt to introduce all measures simultaneously, particularly where existing practices are inadequate.

11.2.2 Policy & Strategy document(s)
The policy document should outline the rationale for the legislation, plus national goals and the key steps essential to the achievements of these goals. It may contain the following:
• Description of the health and safety risks resulting from mismanagement of HCW;
• Reasons for sound and safe HCWM practices in HCFs;
• Listing of approved methods of treatment and disposal for each waste category;
• Warning against unsafe practices, such as disposing of hazardous HCW in municipal landfills;
• Management responsibilities within and outside healthcare establishments;
• Assessment of the costs of HCWM;
• Key steps of HCWM: minimization, segregation and containerization, transport, storage, treatment and final disposal of waste. Technical specifications for the implementation of each step should be described in separate technical guidelines;
• Record-keeping and documentation
• Training requirements
• Rules governing the protection of workers' health and safety.

Technical guidelines
These guidelines associated with the legislation should be practical and directly applicable. They should include the following specifications, with sufficient detail to ensure that safe practices are observed and appropriate standards achieved:
• Legal framework covering safe management of HCW, hospital hygiene, and occupational health and safety (limits of emission of atmospheric pollutants and measures for protection of water resources may be addressed here or in the other national guidelines);
• The responsibilities of public health authorities, of the national environmental protection body, of the heads of HCFs, of the scattered and smaller producers of HCW; and of the heads of any private or public waste-disposal agencies involved;
• Safe practices for waste minimization;
• Segregation, handling, storage, and transport of healthcare waste;
• Recommended treatment and disposal methods for each category of HCW and for waste water.

For ease of application, the definitions of HCW categories included in the law should be repeated in the technical guidelines.

11.2.3 Regulatory Framework in Large HCFs
HCFs have responsibilities and a "duty of care" for the environment and public health, particularly in relation to the waste they produce. They also carry a responsibility to ensure that there are no adverse health and environmental consequences as a result of waste handling, treatment and disposal activities.

In addition, hospitals should be run, and healthcare waste disposed of, in accordance with all other relevant national legislation, such as regulations pertaining to:
• Waste in general;
• Effects on public health and the environment;
• Air quality;
• Prevention and control of infectious disease;
• Management of radioactive materials.

Due to both the quantity and hazardous categories of HCW (highly infectious, cytotoxic, radioactive wastes) produced by large HCFs, the need for comprehensive HCWM rules are critical. These are usually found in the code of practice and evaluated.

11.2.4 HCF Code of Practice
The HCF waste management code of practice plays a critical role in the overall waste management system. This document describes the standards and procedures for the HCF based on the type of equipment used. The code of practice also describes the roles and responsibilities of each staff group members. It forms the baseline document against which the waste management system of the HCF can be monitored.

The Waste Management Officer (WMO) with the Waste Management Team (WMT) usually compile the code of practice for their healthcare facility.

A code of practice for HCWM supports supervision of waste management. Without standards, it is difficult for supervisors to reinforce good practice. If health workers are not aware of their role and responsibilities it becomes very difficult for a supervisor to manage staff effectively. This being said, recognizing and rewarding good work in relation to waste will encourage staff members to perform better when they see their efforts are acknowledged.

Studies show that after the introduction of new equipment, staff reported that better segregation was supported by training, supervision and well-placed containers “Compliance” and “reinforcement” were the words used by the WMO to describe what was needed to change the culture around healthcare waste management.

11.2.5 Regulatory Framework in Medium-sized HCFs
Despite the fact that they produce both less in terms of quantities and usually a more delimited number of different categories of hazardous HCW, medium-sized HCFs have like all healthcare establishments a responsibilities and a “duty of care” for the environment and public health, particularly in relation to the waste they produce. They also carry a responsibility to ensure that there are no adverse health and environmental consequences as a result of waste handling, treatment and disposal activities.

Healthcare waste must be disposed of in accordance with all relevant national legislation, such as regulations pertaining to:
• Waste in general;
• Effects on public health and the environment;
• Air quality;
• Prevention and control of infectious disease;
• Management of radioactive materials.

Although in a slightly more simplified manner, medium-sized HCFs need to have a set of comprehensive HCWM rules. These are usually found in the code of practice.
11.2.6 Regulatory framework in small HCFs

Although small HCFs usually produce very limited amounts of HCW out of which the hazardous part is only a small fraction, the disposal of sharps in particular is an issue of concern.

Like all other HCFs, small healthcare establishments have responsibilities and a “duty of care” for the environment and public health, particularly in relation to the waste they produce. They also carry a responsibility to ensure that there are no adverse health and environmental consequences as a result of waste handling treatment and disposal activities.

Although in amore simplified manner, small HCFs need to have a set of comprehensive HCWM rules. These are usually found in the code of practice.

Resources
The HCF waste management code of practice plays a critical role in the overall waste management system. This document describes the standards and procedures for the HCF based on the type of equipment used.

The code of practice also describes the roles and responsibilities of the staff. It forms the baseline document against which the waste management system of the HCF can be monitored.

In most cases, the code of practice is a generic document prepared at central level by the ministry of Health.

11.2.7 Legislative and Regulatory Frameworks

International agreement has been reached on a number of underlying principles that govern either public health or safe management of hazardous waste.

These principles should be taken into consideration when national legislation and regulations as well as internal HCF rules governing healthcare waste management are prepared.

11.2.8 Monitoring at National Level

A national law on HCWM is the basis for improving healthcare waste practices in any country. It establishes legal controls and permits the national agency responsible for the disposal of healthcare waste, in most cases the ministry of health, to apply pressure for their implementation.

It should define clearly the duties and responsibilities of each actor involved in the HCWM process, at central, regional and local/district levels.

11.2.9 Monitoring at HCF Level

Considering that waste producers (HCFs) have a legal and financial responsibility (polluter pays principle) for managing healthcare waste safely (duty of care), taking all necessary measures to minimize risks(precautionary principle), it is in their interest that they have internal rules and codes of practice that help them achieve these goals in the most cost effective and sustainable way possible.

As for any regulatory framework, it won’t have much impact if there is no official body that can monitor compliance and has the means of enforcing laws and regulations.
11.3 Guidance to Conduct National Sector Assessment

The development of a National HCWM plan should be strongly supported by both the Ministries of Health and Environment who should provide institutional, financial, technical and logistical support to a National Steering Committee for HCWM that should be set-up first to conduct/coordinate the national sector assessment and the to implement the HCWM plan.

Annex. F has been developed for this purpose. This tool assists in assessing the management of wastes from health activities at various levels in the country. It allows drawing a picture of current practices, understanding the level of awareness regarding risks associated with unsafe HCWM, and evaluating the existing regulatory framework. The data collected from the survey of the system provides the necessary information to design an action plan or evaluate it on the basis of the information collected so that the information can be actively followed with the aim of rectifying the system whenever it is not operating optimally.

The compilation and analysis of data collected at national level can be done using the rating system (tool F) one of the components of the HCWM assessment tool that is found in the rapid assessment tool (annex F).

The preliminary assessment should always focus on five main fields of activities that are summarized in Figure 4 below:
The development of a national HCWM plan must be based on a careful initial assessment. In order to propose realistic actions/solutions it is indispensable to have a clear understanding of political context showing how the responsibilities are shared between the state/regional authorities as well as between the MoH and MoE. Furthermore, the assessment should take into account the social, cultural and economical context of the country. Sufficient general and specific information on the health and waste management sectors must be gathered during the assessment. The initial assessment aims at identifying the most problematic issues (e.g. disposal of sharps) and prioritizing the actions (urgent, short-term, medium or long-term) of the National HCWM Plan. In other words, the initial assessment aims at distinguishing actions that should be addressed in the HCWM plan; these actions must be presented as a part of a more global framework.

During the assessment, it is particularly important to understand the role and the involvement of the main actors and stakeholders in the HCWM process in order to identify those susceptible to support and implement the actions contained in the Plan.

**Figure 4. Assessing the situation**

### 11.3.1 Conduct an Inventory of the Existing HCFs

Prior to any survey or action, the central Government has to collect/up-date basic information on all HCFs existing in the country. This information is essential for the development of the future HCWM plan and for the extrapolation of the results of the initial assessment based on a randomly selected sample of HCFs that will have to be surveyed in details.

The sample should be representative of the different categories of HCFs found in the country. Therefore it is necessary to compile data on the HCFs in the country according to their category (public or private; central, regional or local/district) in all regions/provinces of the country in order to:

- Properly quantify the amount of HCW produced in the different health establishment categories and in the different regions/provinces (see example – Figure 5); characterise the HCWM practices per category of HCF (Figure 6);
- If the human and financial resources available to carry out the inventory aren’t sufficient to carry out an extensive survey, a priority should be put on urban areas due to their high concentration of HCFs and therefore of HCW produced;
- Rural areas usually present relatively similar categories and quantities of waste produced as well as comparable HCWM practices. The number of HCFs visited in these areas can therefore be reduced in comparison to urban settings.
Checklist of actions
- Designate an officer responsible for the coordination of the inventory of the existing HCFs;
- Establish a questionnaire to be distributed in each of the municipal Health Authorities and/districts;
- Compile and analyze the data;
- Share the information with the municipal and regional Authorities, with the other National Services and the main stakeholders involved in the country.

Recommendations
The questionnaire should be able to:
- Collect the total number of HCFs per category, the total number of beds and the average occupancy rate for each HCF;
- Get the state health-care budget and the amount that is currently dedicated to HCWM;
- Gather information on the collection and treatment / disposal equipments currently in place in the different HCFs;
### Table: Regional Distribution of Health Care Facilities (HCFs)

<table>
<thead>
<tr>
<th>REGION</th>
<th>REGIONS</th>
<th>HOSPITALS</th>
<th>HEALTH CENTRES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Government</td>
<td>Voluntary</td>
</tr>
</tbody>
</table>
|        |         | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb 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Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds | Nb | Beds |Nb

Figure 5. Example of a national inventory of HCFs
At National Level

The overall production of clinical waste was estimated between 12 and 14 tons per day for the entire country. As table shows, some 50% of the HCW was generated in the 7 Regions that produce each over 5% of the total production of HCW. These regions (Western, Eastern, North-eastern, Central, Nyanza, Rift Valley, Coastal and Nairobi regions) were therefore considered as priority areas for the application of the HCWM plan.

<table>
<thead>
<tr>
<th>REGION</th>
<th>Hospitals (Kg/bed/day)</th>
<th>Health centre (Kg/bed/day)</th>
<th>Total (Kg/bed/day)</th>
<th>% Total Production</th>
<th>% Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>WESTERN</td>
<td>326,36</td>
<td>45,6</td>
<td>371,96</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>NYANZA</td>
<td>375,6</td>
<td>70,2</td>
<td>445,8</td>
<td>3%</td>
<td>10%</td>
</tr>
<tr>
<td>EASTERN</td>
<td>315,7</td>
<td>70,8</td>
<td>386,5</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td>N.EASTERN</td>
<td>164,4</td>
<td>60,4</td>
<td>224,8</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>COASTAL</td>
<td>512,5</td>
<td>74,6</td>
<td>587,1</td>
<td>4%</td>
<td>29%</td>
</tr>
<tr>
<td>RIFTVALLEY</td>
<td>446,9</td>
<td>86,2</td>
<td>533,1</td>
<td>4%</td>
<td>25%</td>
</tr>
<tr>
<td>CENTRAL</td>
<td>617,5</td>
<td>114,0</td>
<td>731,5</td>
<td>5%</td>
<td>34%</td>
</tr>
<tr>
<td>NAIROBI</td>
<td>672,8</td>
<td>76,0</td>
<td>748,8</td>
<td>5%</td>
<td>40%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3431.76</td>
<td>350.8</td>
<td>4029.56</td>
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<td></td>
</tr>
</tbody>
</table>

Figure 6. Estimation of the quantities of HCW generated the example of Kenya.
11.4 Analyze the National Legislations and the internal HCF rules

The legislative provisions constitute the backbone of the HCWM plan at national level since it enables to define clearly the duties and responsibilities of each actor involved in the HCWM process, at central, regional and local/district levels. The existing legislation related to HCWM, environmental protection and solid waste management as well as infection control within HCFs should be carefully analyzed before undertaking any action.

**Checklist of actions**

- Designate an officer responsible for the identification and the review of the legislation;
- Compile all the laws and by-laws that have been established at central and local levels; Make an inventory of the rules and regulations which may exist within HCFs related to hygiene of the premises and duties of (non-medical staff concerning HCWM; analyze and formulate objectives accordingly.

**Recommendations**

Analyze carefully:

- Whether the legislation ensures health protection;
- What are the provisions regarding duties and responsibilities of the stakeholders and more specifically how could be developed a practical legislation to ensure a good balance between responsibilities of the central and the regional / local Governments;
- How the legislation should be reinforced to impulse a real change in the HCWM practices in the HCFs of the country.

11.5 Characterize the HCW Production Nationwide

In order to be able to design correctly the treatment plants or the disposal facilities and evaluate correctly the equipment and financial needs, it is essential to quantify the HCW production at the country and regional/provincial level. The knowledge of the quantities of HCW produced per province enables also to identify the most problematic ones that should receive a priority support from the central Government for the management of their HCW. As treatment is related to the type and quantities of HCW generated, it is important to consider the categorization of HCW in order to priorities the most problematic issues by province/region. Actually, the knowledge of the daily production of hazardous HCW enables to:

**Checklist of actions**

- Designate an officer responsible for the supervision/coordination of the inventory of the HCW and the characterization of the HCWM practices;
- Select randomly a sample of HCFs (of all categories) in each province and carry out an inventory in each of them using an inventory form (see annexes h);
- Analyze the data and extrapolate to estimate: 1) the daily production of HCW generated at country level (kg/bed/day) according to the type of health-care facility and, 2) the total daily production (kg) per region and nationwide for the hazardous and infectious HCW, sharps and non-risk HCW.
- For sharps, crosscheck the estimations with the average daily number of sharps issued by the Central Pharmacies (if they exist).
Recommendations
In order to get pertinent figures:

- A careful statistical sampling strategy, using stratification, should be applied to randomly select the HCFs;
- The inventories must be carried out in the selected HCFs during one full week once during the dry season and then again during the rainy season;
- The figures obtained should be extrapolated taking into account the expected population growth rate, to help determine the capacity of the treatment facilities to be installed as well as other equipment necessary for the adequate management of HCW. Anticipating future needs is part of the planning process.

11.6 Characterize the HCWM practices
All HCWM plans should contribute in reducing the occupational risks linked to the handling and the treatment of HCW. In order to develop a realistic and step-by-step National HCWM Plan, it is essential to be able to characterize correctly the HCWM practices. This characterization enables to inventory the adequate and non-adequate practices and hierarchies the priorities that should be stipulated in the Plan.

Checklist of actions

- Describe the different types of waste streams found in the country;
- Assess per hospital category the on-site HCWM practices along the HCW stream from segregation, packaging, handling, on-site storage and transportation, off-site transportation, treatment to final disposal;
- Analyze the public health and environmental risks associated with the practices encountered in the HCFs;
- Give an indication of the kind of training on HCWM that (non) medical staff get in the health-care facilities. Assess what training /educational materials are available at all levels and if they are used /distributed properly;
- Make an inventory of the existing treatment /disposal facilities and their operational status.

Recommendations

- Always carry out separate interviews with the medical staff and the hospital administrations;
- Try to list the actions that will have to be prioritized in the HCWM plan.

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

- Director and administrator who are directly in charge of the overall implementation of a safe HCWM system inside the hospital;
- Infection control nurses who have an important role in training both medical and non-medical hospital staff;
- Store keeper in charge of the supplies of consumables;
- Nurses in charge of the segregation under the supervision of the head nurse and the matron of the hospital;
• Sanitary labourers in charge of the packaging, waste collection and on-site disposal under the direct supervision of the nurses;

• Municipal actors in charge of several health facilities and solid waste management services;

• NGOs and CBOs staff involved in waste management and recycling.

**Checklist of actions**

• Analyse the institutions/offices responsible for HCW management, hospital hygiene and infection control, budget allocations and sanitary inspection;

• Analyze their operational and financial capacities and their respective roles;

• Give an indication on how the costs are recovered within the health system and analyze the financial resources and the planning;

• Check how the monitoring (if any) of HCWM practices is ensured;

• Evaluate the awareness of staff and the training needs.

• Write a report of the assessment (see example annex F)

**Recommendations**

During the data collection and analysis, try and identify which institutions/individuals seem to be in the best position to participate actively in the monitoring process, which will have to be set-up within the HCWM Plan;

When analyzing how the costs are recovered within the health system, try to see which already operational mechanism/institution could be used to cope with the financing of the HCWM process to be implemented;

To evaluate the awareness / training needs of HCF staff, apply a standard set of questions adapted to each category of staff using a rating system. This should help identify as precisely as possible on which aspects training curricula should emphasize on;

Generally, while collecting data on the field, take note of any constructive comments/suggestions that could help to produce an effective and realistic HCWM Plan. It is also a unique opportunity to foster a participative approach from the main actors in the management of HCW and gaining their support to the project.
11.8 Methodology to estimate the quantities of hazardous HCW produced

This presentation is a simple cost effective and pragmatic methodology to estimate the daily and annual production of hazardous HCW generated within a country taking into account the standard type of context found in most developing countries in Africa like Kenya.

Since in many developing countries, hazardous and non-hazardous HCW are not segregated at source but are mixed together, it is only possible to estimate the total quantities of HCW (hazardous and non-hazardous) produced and then to apply an estimated rate / ratio (that generally varies between 0.1 and 0.3) to calculate the proportion of hazardous HCW generated per hospital category.

11.8.1 Prerequisites and Constraints

Before undertaking any survey, it is fundamental that clear and unambiguous definitions be decided upon regarding the classification of HCW for the following reasons:

- This enables to determine the quantities of hazardous HCW depending on what is to be considered as hazardous vs. non-hazardous;
- It is also indispensable, when several different teams carried out inventories in different regions / province of the country, so as to find comparable quantities between them and estimate homogenously the quantities produced at national level;

Due to often-limited funds available to carry out such a campaign, it is all the more important to plan properly the survey. Here are a few points that can help to reduce significantly the costs:

- A team leader must be designated to coordinate the campaign in each region / province. He/she must select the HCFs to be surveyed, get into touch with them to inform them of the campaign and prepare all necessary documents (administrative authorizations, questionnaires, etc...). He/she must determine the number of pollsters, that will need to be engaged (assuming each pollster should be able to survey an approximate 10 HCFs over a period of two weeks);
- It is suggested to plan circular routes: the first week is spent collecting initial data and explaining how the questionnaires must be filled in during the following 6 days by the HCF staff. The second week, the pollster will be collecting the questionnaires and cross-checking with the HCF direction the validity of the information that has been noted down since his initial visit a week earlier.
- Once the campaign is finished, the data collected should be analysed / summarized by the team leader before being sent back to the coordinating body at national level.

To help illustrate the different steps that must be taken, an example will be developed to which one can refer. The person in charge of that specific step is mentioned in [brackets].

**Step 1:** inventory of all the HCFs per category and per region / province [national steering committee]

Get an as precise as possible count of the different categories of HCFs in each region/ province in the country with the total number of beds in each facility. This information should normally be available at the MoH or at the regional / provincial level.

**Example**

To keep the example simple, we will use a fictive country made up of 4 regions / provinces, called A, B, C and D and only use four different categories of HCFs.
Step 2: select the HCFs to be surveyed [national steering committee].
According to the human and financial resources available, determine which HCFs will be visited in each region/province. Since physical parameters such as climate, annual rainfall, etc. as well as cultural/religious aspects can have an incidence on the type and quantity of HCW produced it is important not to concentrate all the surveys in one area but try to have a wide geographical coverage.

As a first approximation, one can assume that covering 10% of the existing HCFs for each category is a minimum. We will see later how, thanks to some simple statistical analysis, one can verify if the sample surveyed was large enough.

11.8.2 Important parameters to be taken into account

Apart from the variation of production of HCW between categories of HCFs (large hospitals produce more HCW/bed/day than small HCFs), it is important to have in mind that the quantities tend to vary depending on the day of the week (during week-ends for example, the quantities of HCW normally decrease) and the season (during the rainy season for instance, the probability for a person to develop malaria and water born diseases and consequently to be treated in a hospital are higher than during the dry season).

The points mentioned above lead to the following implications:

- One will tend to visit a higher proportion of large HCFs due to the important amounts of HCW they generate;
- Surveys will have to be conducted in two campaigns, once during the dry and the second time during the rainy season, and in both cases for a whole week (7 days).

Example: Number of HCFs selected to be surveyed at national level

<table>
<thead>
<tr>
<th></th>
<th>total nb of hospitals in the country</th>
<th>selected</th>
<th>% of total</th>
<th>comments on sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialised Hospital</td>
<td>10</td>
<td>5</td>
<td>50%</td>
<td>ok, should be sufficient without any problem</td>
</tr>
<tr>
<td>General Hospital</td>
<td>79</td>
<td>11</td>
<td>14%</td>
<td>ok, should be sufficient</td>
</tr>
<tr>
<td>District Hospital</td>
<td>129</td>
<td>18</td>
<td>14%</td>
<td>ok, should be sufficient</td>
</tr>
<tr>
<td>Sub-District Hospital</td>
<td>222</td>
<td>21</td>
<td>9%</td>
<td>might be too small</td>
</tr>
</tbody>
</table>
Step 3: collect data in the selected HCFs and analyze the results. Using a survey sheet such as the one found in annexe F, the HCF staff must report amongst others the production of hazardous HCW expressed in kg/bed/day for each HCF visited.

11.8.3 Quantification of HCW

In order to calculate the daily production of hazardous HCW waste generated per bed in each HCF, there are basically two methods. The first one consists in weighing all bags / bins before they are emptied/disposed of. This is the most precise option and should be used if there is an adequate scale within the HCF to perform these measurements, otherwise one can obtain a sufficiently good estimation by adding the number and estimating the volume of containers (bags, rubbish bins) used for medical waste collection in each medical unit for a defined period of time. Further discussions with the paramedical staff (overseers, nurses, etc.) would enable one to adjust the total volume of waste collected, by using a filling rate for each category of container. Finally, a volumetric mass ratio (which varies according to the type of waste thrown into the container and their humidity rate) is applied in order to estimate the total weight of HCW waste generated.

Step 4: Make a statistical analysis of the results [team leaders / steering committee]

As mentioned above, it is important to carry out a few simple statistical calculations to determine if the sample surveyed is sufficiently big and check for potentially aberrant data. One must determine:

The **average** production (kg/bed/day)

Where “n” is the number of HCFs (samples) surveyed per category and “y” the daily production of HCW found in each sample in kg/bed/day

\[
\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}
\]

The **variance**

Provides a measure of dispersion around the average. It also provides information on the “uncertainty” within the sample: the smaller the value of the variance, the lesser the uncertainty within the sample

\[
\sigma^2 = \frac{\sum_{i=1}^{n} (y_i - \bar{y})^2}{n}
\]
The **standard deviation**

Provides an absolute measure of the dispersion of the series around the average.

\[ \sigma = \sqrt{\sigma^2} \]

The **coefficient of variation**

Measures the relative dispersion (expressed in %) and provides an indication of the heterogeneity of the sample.

\[ CV = \frac{\sigma}{\bar{y}} \]

**Example: statistical analysis at national level**

<table>
<thead>
<tr>
<th>Sample</th>
<th>District H.</th>
<th>Sub-District H.</th>
<th>District H.</th>
<th>Sub-District H.</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample 1</td>
<td>2.00</td>
<td>sample 1</td>
<td>1.23</td>
<td>sample 1</td>
</tr>
<tr>
<td>sample 2</td>
<td>1.70</td>
<td>sample 2</td>
<td>1.32</td>
<td>sample 2</td>
</tr>
<tr>
<td>sample 3</td>
<td>1.80</td>
<td>sample 3</td>
<td>1.43</td>
<td>sample 3</td>
</tr>
<tr>
<td>sample 4</td>
<td>1.76</td>
<td>sample 4</td>
<td>1.25</td>
<td>sample 4</td>
</tr>
<tr>
<td>sample 5</td>
<td>1.49</td>
<td>sample 5</td>
<td>1.25</td>
<td>sample 5</td>
</tr>
<tr>
<td>sample 6</td>
<td>1.76</td>
<td>sample 6</td>
<td>1.40</td>
<td>sample 6</td>
</tr>
<tr>
<td>sample 7</td>
<td>1.42</td>
<td>sample 7</td>
<td>1.01</td>
<td>sample 7</td>
</tr>
<tr>
<td>sample 8</td>
<td>1.01</td>
<td>sample 8</td>
<td>1.25</td>
<td>sample 8</td>
</tr>
<tr>
<td>sample 9</td>
<td>1.25</td>
<td>sample 9</td>
<td>1.32</td>
<td>sample 9</td>
</tr>
<tr>
<td>sample 10</td>
<td>1.32</td>
<td>sample 10</td>
<td>1.43</td>
<td>sample 10</td>
</tr>
<tr>
<td>sample 11</td>
<td>1.43</td>
<td>sample 11</td>
<td>1.25</td>
<td>sample 11</td>
</tr>
<tr>
<td>sample 12</td>
<td>1.04</td>
<td>sample 12</td>
<td>1.14</td>
<td>sample 12</td>
</tr>
<tr>
<td>sample 13</td>
<td>1.55</td>
<td>sample 13</td>
<td>1.05</td>
<td>sample 13</td>
</tr>
<tr>
<td>sample 14</td>
<td>1.49</td>
<td>sample 14</td>
<td>1.25</td>
<td>sample 14</td>
</tr>
<tr>
<td>sample 15</td>
<td>1.93</td>
<td>sample 15</td>
<td>1.32</td>
<td>sample 15</td>
</tr>
<tr>
<td>sample 16</td>
<td>0.78</td>
<td>sample 16</td>
<td>0.89</td>
<td>sample 16</td>
</tr>
<tr>
<td>sample 17</td>
<td>0.77</td>
<td>sample 17</td>
<td>1.01</td>
<td>sample 17</td>
</tr>
<tr>
<td>sample 18</td>
<td>0.81</td>
<td>sample 18</td>
<td>1.25</td>
<td>sample 18</td>
</tr>
<tr>
<td>sample 19</td>
<td></td>
<td></td>
<td>1.32</td>
<td></td>
</tr>
<tr>
<td>sample 20</td>
<td></td>
<td></td>
<td>1.43</td>
<td></td>
</tr>
<tr>
<td>sample 21</td>
<td></td>
<td></td>
<td>1.55</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistical Measures</th>
<th>District H.</th>
<th>Sub-District H.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average production</td>
<td>1.75</td>
<td>1.33</td>
</tr>
<tr>
<td>Variance</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.16</td>
<td>0.18</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>OK!</td>
<td>9%</td>
</tr>
</tbody>
</table>
**Step 5:** Calculate the daily production of hazardous HCW [team leaders / steering committee]

Once a sufficient amount of data has been collected on the field and the statistical cross-checking shows it can be used with a sufficient degree of confidence, the team leaders will have to calculate for their region/district/province the total production of hazardous HCW produced daily per HCF category. By multiplying the daily production by the number of days that the season during which the survey was made last, one will get the total production for that season.

The same calculations will then be made at national level to determine the overall production of hazardous HCW in the country during that first season (in the example below the rainy season, which in our fictitious country is said to last 145 days).

Example: calculation of the total production of HCW at national level during the rainy season

<table>
<thead>
<tr>
<th>Specialised Hospital</th>
<th>1.75</th>
<th>672</th>
<th>1'176</th>
<th>145 days of rain</th>
<th>171</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Hospital</td>
<td>1.33</td>
<td>11534</td>
<td>15'382</td>
<td>2'230</td>
<td></td>
</tr>
<tr>
<td>District Hospital</td>
<td>0.74</td>
<td>3470</td>
<td>2'583</td>
<td>375</td>
<td></td>
</tr>
<tr>
<td>Sub-District Hospital</td>
<td>1.12</td>
<td>3085</td>
<td>3'452</td>
<td>501</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3'276</td>
<td></td>
</tr>
</tbody>
</table>

**Step 6:** Carry out second campaign during the other season [steering committee, team leaders]

**Steps 3-5** will then need to be repeated about half a year later, during the other season (dry in our example).

1 The more a sample is heterogeneous; the more it is necessary to increase the number of HCFs to be surveyed in order to get a reliable estimation. A coefficient of variation greater than 15% in the sample should always be explained: variability due to specific characteristics of the population assessed, aberrant data, etc.

**Step 7:** Cross-check and synthesize final results [steering committee / team leaders]

The total yearly production of hazardous HCW can then be determined by adding the results obtained during the rainy and dry season.

Cross-checking the results obtained with those of surveys carried out in countries with similar socio-economic characteristics is recommended and as means amongst others to verify if the results are plausible.

Analyzing the variability of the production of hazardous HCW (kg/bed/day) between the different regions / provinces can also be of some interest and help not only highlighting potential errors or simply revealing different practices which can occur for climatic, cultural, etc… reasons, but also be useful for HCWM planning.
Special provisions for needles and syringes
Syringes and needles are of particular concern because they constitute an important part of the sharps and are often contaminated with the blood of patients. Sharps may not only cause cuts and punctures but also infect the wounds by agents, which previously contaminated them. Owing to this double risk of injury and disease transmission, sharps are considered problematic. It can be therefore worthwhile to estimate specifically the amount of sharps generated in each health-care facility.

Such amounts can be estimated by following-up the quantities of syringes and needles delivered in each health-care facility or the quantities of syringes and needles produced / imported at national / provincial level. The estimations are therefore based on the amounts of syringes and needles received by the hospital/central pharmacy and the nursing department.
12.0 Treatment Technology Action plan in Health Care Waste Management for Kenya

12.1 Process Options for HCRW Treatment

Effective treatment of Health Care Risk Waste (HCRW) can be considered to be the most important objective of Health Care Waste (HCW) management, which eliminates its risk of infection.

Health Care Risk Waste Treatment

Health Care Risk Waste Treatment can be defined as being any method, technique or process for altering the biological, chemical or physical characteristics of HCRW to reduce the hazards it presents and facilitate, or reduce the costs of disposal. The basic treatment objectives include volume reduction, disinfection, neutralisation or other change of composition to reduce hazards.

The range of HCRW treatment options can primarily be grouped as burn- and non-burn technologies.

In addition to the main options for HCRW treatment described in more detail below, there are a number of process (peripheral) options associated with HCRW treatment that are dealt with in Table 9. The options are *inter alia* dealing with the location of treatment facilities, the party responsible for service rendering, the possible need for refrigerated storage, the feeding mechanism used as well as the way in which the residues are to be stored on site.

Table 10. Process (Peripheral) HCRW Treatment Options

<table>
<thead>
<tr>
<th>Element 1: Options for location of HCRW treatment facility.</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site treatment facility; Off-site (regional) treatment facility.</td>
</tr>
</tbody>
</table>

**Comments:**

① On-site HCRW treatment has the disadvantage that the smaller treatment facilities are to be established and operated to meet the same environmental standards expected from large regional treatment facilities. This will imply that the certain fixed cost (like the cost of EIA’s and air cleaning systems for incinerators) will be incurred irrespective of the size of the treatment facility. It does however have the advantage of eliminating the cost and impact of collection and offsite transport.

② Regional treatment facilities are more economic to run due to the economies of scale, but it does require that untreated HCRW sometimes be transported over relatively long distances on public roads.

<table>
<thead>
<tr>
<th>Element 2: Options for HCRW management service delivery.</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Services rendered by health care facility staff, or provincial staff from other Departments in the case of public facilities; ③ Services rendered by a private contractor.</td>
</tr>
</tbody>
</table>

**Comments:**

① The major limitation in service delivery by health care facility staff or even provincial staff from other Departments in the case of public facilities, is the fact that it is in most instances not their core business and therefore not their field of expertise, which often results in the service not being rendered cost-effectively.
effectively or to the required environmental standards or occupational health and safety requirements. These services are however rendered without any profit margin added to the cost of the service.

- A private contractor that specialises in HCRW management is normally best equipped in as far as the available equipment and expertise is concerned. Such services are however rendered with a profit incentive that offsets the savings that may have been achieved through more efficient service delivery.

<table>
<thead>
<tr>
<th>Element 3: Options for HCRW storage facility on treatment site.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No refrigeration provided for pathological waste;</td>
</tr>
<tr>
<td>2. Refrigeration provided for pathological waste;</td>
</tr>
<tr>
<td>3. Refrigeration provided for all HCRW.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Where no refrigeration is provided for pathological waste, the plant is either to be operated in such a way that, depending on climatic conditions, all HCRW is treated within 24-hours, or alternatively a system is required for the identification of pathological HCRW containers to ensure that all such HCRW is treated as soon as it is delivered to the facility;</td>
</tr>
<tr>
<td>2. Refrigeration of pathological HCRW will reduce the urgency with which such HCRW is to be treated;</td>
</tr>
<tr>
<td>3. Although it may be expensive in some instances, refrigeration of all HCRW may be required in areas with excessive high temperatures, or where HCRW is not treated on an ongoing basis.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element 4: Options for categories of HCRW treated at facility.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All HCRW excluding radioactive waste;</td>
</tr>
<tr>
<td>2. All HCRW excluding radioactive and chemical waste;</td>
</tr>
<tr>
<td>3. All HCRW excluding radioactive, chemical and pathological waste.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Radioactive HCRW requires special handling and disposal methods, which makes it unique compared to the remainder of the HCRW stream. Only a very limited number of sub-categories of this HCRW are allowed to be incinerated;</td>
</tr>
<tr>
<td>2. Although not to the same extent as radioactive HCRW, chemical (including pharmaceutical) HCRW also requires special handling and treatment before it is disposed of. The latter type of HCRW must not be treated by non-burn treatment technologies, but may be treated by incineration under certain preconditions;</td>
</tr>
<tr>
<td>3. Although technically feasible, non-burn technologies that grinds or “cook” pathological waste or that leave it recognisable should not be used, thus requiring all pathological HCRW to be incinerated. Burial of certain anatomical HCRW sub-categories may be required for traditional or religious reasons.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element 5: Options for HCRW Treatment processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Thermal Treatment Technologies:</td>
</tr>
<tr>
<td>- Multiple chamber incinerators;</td>
</tr>
<tr>
<td>- Rotary klin;</td>
</tr>
<tr>
<td>- Fluidised bed.</td>
</tr>
<tr>
<td>2. Sterilisation (inactivation) Technologies:</td>
</tr>
<tr>
<td>- Autoclave / steam sterilisation;</td>
</tr>
<tr>
<td>- Microwave;</td>
</tr>
<tr>
<td>- Electro Thermal Deactivation (ETD);</td>
</tr>
<tr>
<td>- Chemical / heat disinfection.</td>
</tr>
<tr>
<td>3. Encapsulation:</td>
</tr>
<tr>
<td>- Encapsulation in impermeable media.</td>
</tr>
</tbody>
</table>
### Element 6: Container system used for feeder mechanism

**Options:**
1. Bagged HCRW into feeder;
2. Boxed HCRW into feeder;
3. HCRW in small (two wheeled) wheelie bins;
4. HCRW in large (four wheeled) wheelie bins;
5. Flexible (versatile) feeder system.

**Comments:**
1. Manual feeding of HCRW by means of bags into the hopper is not preferred for safety reasons and is also likely to be slow. Workers will be exposed to possible needle stick injuries from poorly segregated HCRW;
2. By feeding the waste by means of disposable box containers, it could result in a need for a dedicated type of feeding mechanism that may not be suitable for feeding HCRW from other types of containers. Boxes however contribute as fuel for incinerators. Excessive manual handling is not recommended;
3. Feeding the HCRW by means of small (2-wheeled) wheelie bins should preferable be by means of a mechanised lifting- and tilting mechanism. Depending on the cycle time, this may however slow the feeding rate down due to the relative small volumes being loaded per cycle;
4. Feeding the HCRW by means of large (4-wheeled) wheelie bins should always be by means of a mechanised lifting- and tilting mechanism. The volumes loaded per cycle are however larger, still making it effective if the loading cycle times are slightly longer;
5. A flexible (versatile) feeder system that can allow for a variety of HCRW container types is the preferred option, as it will be able to handle HCRW from a variety of containers.

### Element 7: Type of energy source used

**Options:**
1. Diesel Fuel or Fuel Oil;
2. Gas;
3. Electricity.

**Comments:**
1. Diesel and fuel oil will contribute to the release of polluting emissions. Plants using fossil fuels would normally also need electricity supply during start up and for its controls;
2. Although cleaner onsite, electricity is more expensive than diesel or oil;
3. Back-up power supply may be required to for instance protect machinery in case of power failure. If piped gas is used, duel fuel burners for oil could for instance provide sufficient backup in case of disruption of the gas supply.

### Element 8: Type of flue gas cleaning system used for incinerators

**Options:**
1. Wet scrubber system for flue gas cleaning;
2. Bag filter system used for flue gas cleaning;
3. Ceramic filter system used for flue gas cleaning.

**Comments:**
All of these aspects are discussed in further detail along this Chapter and will not be considered any further under this heading.

<table>
<thead>
<tr>
<th>Element 9:</th>
<th>Type of HCRW residue storage facility required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Options:</strong></td>
<td></td>
</tr>
<tr>
<td>①</td>
<td>Uncompacted HCRW residues; open bulk container;</td>
</tr>
<tr>
<td>②</td>
<td>Uncompacted HCRW residues; closed bulk container;</td>
</tr>
<tr>
<td>③</td>
<td>Compacted HCRW residues; closed bulk container.</td>
</tr>
</tbody>
</table>

**Comments:**
① Uncompacted HCRW residues in open bulk containers are more accessible during the loading cycle, but it is also subject to the effects of wind and rain;
② Uncompacted HCRW residues in closed containers are better protected against the elements, but requires specially designed lids / covers that will provide easy access for loading / unloading of residues;
③ Compacted HCRW residues in closed containers forms part of a static compactor system that will ensure loading of the HCRW residues by means of the compaction unit, thus ensuring volume reduction for low-density HCRW residues, whilst being protected against the elements.

12.2 Technical Evaluation of HCRW Treatment Options

12.2.1 Overview
The main treatment options for this HCRW include:
- **Combustion Technologies**, i.e. thermal treatment / combustion technologies, includes:
  - Incineration which includes: excess air, controlled air, rotary kiln and fluidised bed, and
  - Pyrolysis

- **Sterilisation / Disinfection Technologies**, i.e. non-thermal treatment technologies, includes:
  - Steam sterilisation, e.g. autoclaving;
  - Chemical sterilisation, e.g. with chlorine, glutaraldehyde;
  - Gas sterilisation, e.g. with ethylene oxide, formaldehyde;
  - Dry heat sterilisation, e.g. oil heated screw feed technology;
  - Electro-thermal deactivation;
  - Microwave sterilisation;
  - Irradiation sterilisation:
    - Cobalt-60 gamma rays
    - Ultra violet
    - Electron beam sterilisation

The technologies indicated in italics are currently experimental or have internationally limited commercial application for HCRW treatment.

All of the above treatment technologies result in a residue, i.e. ash in the case of thermal technologies or a sterilised / disinfected waste in the case of non-thermal technologies. All of these residues are to be disposed to an appropriate landfill. In the following discussions, combustion technologies and selected non-thermal technologies are discussed in more detail and an approximate estimate of the investment and operating costs provided.
There are some differences between thermal and non-thermal technologies and the most important of these are the types of HCRW that can be treated and the residues that are generated, as illustrated in Figure 7. In the diagram it is assumed that the thermal treatment facilities and the non-thermal treatment technologies can accept three of the major types of HCRW, i.e. infectious HCRW (including sharps), chemical waste (including pharmaceuticals) and pathological waste, and that an air emission system is used. Note that most of the incinerators currently used in Kenya would not be able to handle chemical HCRW due to a lack of air emission systems. Pathological (anatomical) HCRW, which includes recognisable human body parts, should not be treated by non-thermal technologies, as it will not be destroyed as when incinerated. Radioactive waste is not included in Figure 7, although selected low-level radioactive HCRW that comes from health care facilities could be treated in an approved incinerator. Medium or high-level radioactive HCRW is however not to be incinerated. Non-thermal technologies should not be allowed to receive any radioactive HCRW. Radioactive HCRW that exceeds the safety limits must be disposed to special permitted radioactive waste depositories or stored safely for a number of half-lives until sufficiently low levels of radioactivity are reached before further treatment or disposal can take place.
The HCRW treatment technologies listed above are briefly described below, with their respective advantages and disadvantages. In annex F, an estimate of the cost of selected HCRW treatment technologies is presented.
12.2.2 Overview of Incineration / Thermal Technologies

Incineration\(^1\) (in many forms and with a wide variety of efficiencies) is the dominant technology for the HCRW treatment in Kenya. Steam sterilisation, microwaving and other non-thermal HCRW treatment technologies are however rapidly becoming the dominant treatment technologies in many first world countries, primarily due to stricter emission standards that are set for incinerators.

Very few incinerators visited in Kenya were equipped with external fuel sources; even less equipped with secondary chambers and none with air emission control. The primary objective to date was some level of sterilisation of the HCRW, with the impact of the incinerator on the environment as a secondary consideration. Incinerator developments over the years included the introduction of multi-chambered incinerators, both with excess air and starved/controlled air types that were specifically designed for the treatment of the infectious HCRW stream. As indicated below, such incinerators are only capable of handling small quantities of chemical (pharmaceutical) HCRW.

Other common incineration technologies include rotary kilns and fluidised beds. Rotary kilns, which are generally used in the lime and cement industries, are used for the treatment of chemical hazardous waste. Rotary kilns are versatile and are also capable of handling slurries, bulk solids and sludge. The unit treatment costs for the operation and maintenance of smaller rotary kiln plants are however expensive and therefore not frequently used in the treatment of infectious HCRW only. In some countries rotary kilns are used to treat certain types of hazardous / chemical waste as well as HCRW. Separation at source of especially chemicals, pharmaceuticals etc. is not critical where a rotary kiln is used, although radioactive HCRW is still to be separated from the remainder of the HCRW stream.

Fluidised bed technology is sometimes used for the treatment of hazardous waste, but mainly for end of pipe applications, i.e. for the destruction of a single hazardous waste stream from a chemical plant. Passing air through it fluidises a bed of sand and the rapid motion allows heat exchange to occur between the hot bed and the hazardous waste, providing effective combustion efficiencies. To date, this technology has not been used for the treatment of HCRW in Africa, although rotating fluidised bed incinerators are used in Japan, for example.

Plasma Arc Technology achieves extremely high temperatures of between 2 000\(^\circ\)C and up to 8 000\(^\circ\)C, thus resulting in effective destruction of hazardous waste. It is evident that all waste streams, except for radioactive waste, can be treated. The cost of treatment is high, thus not making this technology appropriate for cost effective treatment of infectious HCRW.

Pyrolysing incinerators or retorts operate at temperatures of ~600\(^\circ\)C in the pyrolyser, where the two products are carbon and volatiles. The volatiles are sent to an afterburner where it is burnt with excess oxygen at temperatures above 1100\(^\circ\)C. The carbon may have some commercial value, e.g. as a fuel, although the material would have to be separated from non-combustibles such as metal and its reuse evaluated in terms of the set standards. Pyrolysing incinerator facilities produce residues with very high contents of carbon and would not be able to comply with a maximum standard on ignition loss of 5\% by mass.

\(^1\) The HCRW treatment processes currently referred in Kenya to as “incineration” varies significantly in terms of its treatment efficiencies as well as its environmentally soundness. Quite a number of the facilities visited have for instance no burners or external fuel source and could at best be described as fireplaces, with combustible HCW providing the only source of fuel for treatment.
### 12.2.3 Technical Description of Incineration / Thermal Technology

The main elements of modern incineration technology are listed in Table 10 and illustrated schematically in Figure 8.

**Table 11. Elements of a Modern HCRW Incineration Plant**

<table>
<thead>
<tr>
<th>System</th>
<th>Description/Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeding System:</td>
<td>An automatic or manual lift and feeding system is used for feeding the HCRW into the incinerator. Automatic doors or similar devices restrict the input of any excess air during insertion of the HCRW into the primary chamber.</td>
</tr>
<tr>
<td>Primary chamber:</td>
<td>In the primary combustion chamber, the HCRW is combusted / pyrolysed in a stoichiometric deficit of air at temperatures ranging from 650°C to 1100°C. A support burner, usually fired by fuel oil or gas, is used both during start up and intermittently during operation to achieve and maintain the required temperatures. The result is a bottom ash or slag and a gas stream containing combustible volatile organic compounds, particulates and potential pollutants.</td>
</tr>
<tr>
<td>Bottom ash collection:</td>
<td>The bottom ash collects in the primary chamber and is manually de-ashed daily or automatically de-ashed by conveying it mechanically to a trench or sluice for removal.</td>
</tr>
<tr>
<td>Secondary chamber:</td>
<td>In the secondary combustion chamber, an excess of air is added and a secondary support burner fired by fuel oil or gas is used, if required, to maintain the temperature above 1100 °C to give complete burning of the combustible gases and solids from the primary chamber. A minimum retention time of 2 seconds is usually required.</td>
</tr>
<tr>
<td>Energy recovery:</td>
<td>In principle, energy can be recovered via a water / steam boiler providing steam or hot water for sterilisation, heating, cleaning of waste containers, personal hygiene, etc. The financial feasibility of energy recovery depends mainly on the availability / demand situation for energy produced and cost of conventional energy. Due to the limited availability of energy recovered a full back-up system based on conventional energy source would normally be required. In countries where energy prices are low, energy recovery from relatively small HCRW incinerators is only expected to be financially feasible in very particular applications.</td>
</tr>
<tr>
<td>Flue Gas Cleaning:</td>
<td>The flue gas is cleaned using either wet, dry or semi-dry flue gas cleaning, including a dust filter. Normally wet flue gas cleaning is not economical for the relatively small size HCRW incinerators. Hence, most plants make use of semi-dry or dry flue gas cleaning. Using flue gas cleaning systems, strict emission limits for acid gases, particulates, heavy metals and dioxins / furans set by many countries can be achieved. Common filters used are bag house filters or the more temperature tolerant ceramic filters. Typical neutralising agents for acid gases used are lime or bicarbonate products, possibly with activated carbon added for dioxin or heavy metal removal.</td>
</tr>
</tbody>
</table>
Figure 8. Flow Diagram of a Modern Incineration Plant.

12.2.4 Inputs and Outputs from the Incineration Process

The typical inputs and outputs of materials and energy for the modern incineration process are listed in Table 11.

Table 12. Inputs and Outputs for a Typical Modern Incineration Plant

<table>
<thead>
<tr>
<th>Item</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td>① Fuel (fuel oil or gas);</td>
<td>③ Recovered energy from the combustion of HCRW and support fuel to produce warm water and / or steam</td>
</tr>
<tr>
<td>Solid &amp; Liquids</td>
<td>② Electricity for motors, fans, etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Solids &amp; Liquids</strong></td>
<td>③ HCRW;</td>
<td>③ Bottom ash to be landfilled;</td>
</tr>
<tr>
<td></td>
<td>③ Chemicals / water for flue gas treatment.</td>
<td>③ Fly ash / chemicals to be landfilled;</td>
</tr>
<tr>
<td><strong>Gases/air</strong></td>
<td>③ Air for the combustion process.</td>
<td>③ For wet scrubber system: Waste water to be directed to sewer system after cleaning.</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>③ Replacement of air / water filtration materials as required;</td>
<td>③ Used fabric filters to be incinerated or landfilled.</td>
</tr>
<tr>
<td></td>
<td>③ Operational and maintenance costs, e.g. PPE and other consumables,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rubber parts and monitoring / auditing costs.</td>
<td></td>
</tr>
<tr>
<td><strong>Staff</strong></td>
<td>③ Plant manager, assistants and general workers; numbers depend on the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>size and type of plant.</td>
<td></td>
</tr>
</tbody>
</table>
Although only one small-scale incinerator visited in Kenya recovered energy in the form of hot water or steam, this process is usually not economically viable. However, increasing fuel costs, higher operational standards and competition from non-thermal technologies could see the introduction of energy recovery in the future. Energy recovery, which can require relatively slow cooling of combustion gases, can lead to increased dioxin formation. The ash and other solids and liquid wastes must be disposed of at an appropriate waste disposal site.

12.2.5 Advantages and Disadvantages of Incineration

The main advantages and disadvantages of incineration as a technology for HCRW treatment are listed in Table 12.

Table 13. Advantages and Disadvantages of Incineration

<table>
<thead>
<tr>
<th>Advantages of incineration</th>
<th>Disadvantages of incineration</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Safe elimination of all infectious organisms in the HCRW at temperatures above ~700°C;</td>
<td>③ Normally higher investment costs for incinerator with flue gas cleaning system than for non-thermal technologies;</td>
</tr>
<tr>
<td>② Flexible, as it can accept pathological HCRW and depending on the technology, chemical / pharmaceutical HCRW;</td>
<td>③ Point source of emissions immediately to the air (as opposed to attenuated emission of CH₄ and CO₂ from landfill waste body over a period of decades);</td>
</tr>
<tr>
<td>③ Residues are not recognisable;</td>
<td>③ Production of the highly hazardous dioxins and furans and heavy metals must be minimised and controlled;</td>
</tr>
<tr>
<td>④ Reduction of the HCRW by up to 95% by volume or 83% to 95% by mass (typically 5-17% ash remains). Depending on the type of flue gas cleaning system used, additional residues are being generated which limits the volume and weight reduction;</td>
<td>③ High cost to monitor gas emissions and demonstrate compliance to emission standards;</td>
</tr>
<tr>
<td>⑤ Well proven technology;</td>
<td>⑤ Solid and liquid by-products must be handled as potentially hazardous waste (may not apply to bottom ash if HCW is well sorted and flue gas cleaning residues handled separately);</td>
</tr>
<tr>
<td>⑥ No pre-shredding or post-shredding required;</td>
<td>③ Incineration is perceived negatively by many sectors of the community;</td>
</tr>
<tr>
<td>⑦ No special requirements for packaging of HCRW;</td>
<td>③ PVC and heavy metals in the HCRW provide a significant pollutant load on the gas cleaning system (and for heavy metals on the quality of bottom ash also).</td>
</tr>
<tr>
<td>⑧ Full sterilisation is assumed to have occurred provided the high temperatures are maintained and the ash quantity is adequate. No monitoring of sterilisation efficiency is required.</td>
<td></td>
</tr>
</tbody>
</table>

Separation at source is a key requirement for the correct management of HCRW. Incineration with flue gas cleaning is however more forgiving than many other technologies, as it can accept pathological HCRW and chemical HCRW (depending on the amount of HCRW and the type of incinerator). For many of the pyrolytic dual chamber incinerators available in the market, the amounts of chemical (including pharmaceutical) HCRW that can be accepted are low. The infectious HCRW stream must be expected to include small amounts of pharmaceuticals / chemicals used in wards, such as disinfectants, solvents, etc., even when a programme for separation at source has been introduced. An incinerator can readily accept this HCRW stream. However, almost all of the incinerators currently used in Kenya should not deliberately accept chemical (including pharmaceutical) HCRW due to the possible damage that it could cause to the incinerator. It further significantly increases the requirements for gas cleaning. Rotary kilns, fluidised bed
incinerators, plasma arc and other facilities, designed for the acceptance of chemical HCRW, should be used instead.

12.2.6 Environmental, Health and Safety Impact of Incineration

Incineration, undertaken at high temperatures, has proven to be a very effective way of sterilising HCRW and no special tests to determine the efficiency of the sterilisation process is normally required. However, the technical standard of incinerators in use in Kenya as well as the standard of operation has been poor. If the long-term objective is to meet the European Union or North American air emission standards, wet or dry gas-cleaning equipment will be needed for all incinerators in Kenya. However, problems associated with the emissions of dioxins and furans by incinerators as well as generally poor management of incineration facilities, has resulted in a significant anti-incineration lobby in many parts of Africa.

Apart from gas emissions, incinerators produce an ash, which is normally classified as hazardous due to its heavy metal content. Such ash can however be chemically stabilised with lime or treated by cementation to make it suitable for disposal on general waste landfills. Gas cleaning can be accomplished by both wet and dry scrubbing. Dry scrubbing is generally preferred as it is more economical for the typical HCRW incineration plant capacity, with the resulting hazardous solid being disposed of on a hazardous waste landfill. The liquid wastes generated by wet scrubbing are normally charged at a higher premium when disposed to landfill.

Incineration is internationally still a very common technology for HCRW treatment. It can meet the strict environmental requirements, provided the incinerators are well operated and have good emission control equipment. However, in parts of the world where no or limited mass incineration of domestic or commercial waste is done, steam sterilisation, microwave treatment and other non-burn technologies are fast becoming the more cost effective HCRW treatment technology due to increasing costs of flue gas cleaning.

12.3 Microbial Inactivation using Sterilisation Technologies

Stricter air emission standards are resulting in increased cost of flue gas cleaning for incineration plants. Such increased costs, together with the negative perception of incineration in many parts of the world, have lead to the development of a range of sterilisation / disinfection technologies for the treatment of HCRW.

Some of the non-thermal technologies recently introduced on the African continent include Autoclaving, Microwaving, Electro-thermal Deactivation (ETD) and Dry Heat Sterilisation (DHS). These four technologies will be discussed in this section, but this does not imply specific endorsement of these technologies or incineration when compared to any other technologies listed above. All these methods sterilise HCRW by heating it to moderate temperatures of between 90°C and 160°C, provided all HCRW is subjected to the required temperatures for sufficient time. These technologies have both advantages and disadvantages compared to incineration, which are discussed in more details below.

The inactivation norm generally required for non-thermal HCRW sterilisation technologies, is to demonstrated for vegetative bacteria, fungi, lipophilic / hydrophilic viruses, parasites and mycobacteria at ≥6 Log10 reduction (99.9999% or 1 survival probability in a million). Inactivation of B. sterothermophilus spores or B. subtilis spores are set at ≥ 4 Log10 reduction (99.99% or 1 survival in 10000 in a spore population)

12.4 Autoclaving / Steam Sterilisation

Steam sterilisation of HCRW has been practised worldwide for some decades, firstly as a simple sterilisation process and later by inclusion of volume reduction / shredding prior to or after treatment. In a modern autoclave, shredded / un-shredded HCRW is placed inside an autoclave, where, after evacuation of the air, steam is introduced under pressure from a boiler. Figure 9 illustrates the essential features of an autoclave plant for the treatment of HCRW. A combination of temperature (130°C to 160°C), pressure and time for
periods of around 30 minutes ensures that the numbers of pathogens are reduced to below the permitted levels.

Steam sterilisation has made progress in some markets, because compared to incineration, this technology results in no or limited emission of gases and is increasingly competitive for especially on-site HCRW treatment in countries where advanced flue gas cleaning is required.

The process is however not suitable for treatment of all categories of HCRW (e.g. pathological and pharmaceutical HCRW). Special measures are further to be introduced for the disposal of treated HCRW, as un-shredded residues should under no circumstances be accessible to waste reclaimers due to the presence of sharps as well as the remaining risk of infection.

Shredding and compaction reduce the volume of the final HCRW residue with the mass of the residue being about 80% to 90% of the original, as some drying occurs subsequent to sterilisation.

Figure 9. Flow diagram of a Typical Autoclave/Steam Sterilisation Plant

12.5 Microwave Technology

In the microwaving process, infectious HCRW is normally wetted or exposed to high-temperature steam, shredded and the moisture in the HCRW heated by a series of microwave generators for a specified period. The temperatures reach ~95°C and the microorganisms are killed in the process, resulting in a residue that is confetti-like and slightly moist. Microwaving has been used to treat items such as sharps, microbiological materials, blood and biological fluids.

The process is however not suitable for the treatment of pathological, chemical or radioactive HCRW and large quantities of metal in the HCRW stream can reduce the effectiveness of the microwaves' penetrating the HCRW. Air emissions from the shredder and treatment plant are usually treated to remove moisture and volatile organic carbon compounds. Shredding and compaction of the final product significantly reduce the volume of the final waste residue, but almost no mass reduction occurs.
12.6 Electro-Thermal Deactivation

The process of Electro-Thermal Deactivation (ETD) involves shredding of HCRW, loading it into special containers and heating it through low frequency radio waves for a period that is adequate to destroy microorganisms. The temperature used is similar to that of microwaving, i.e. ~95°C. The flow diagram would be similar to that presented for a microwaving plant except that the HCRW is exposed to a high-intensity, oscillating electric field generated by low frequency radio waves (14 MHz), rather than microwaves. Heating is caused by absorption of the electrical energy. Air and potential dust and volatile emissions from the reduction plant and treatment unit are passed through cyclones, a dust filter and finally a carbon filter to remove volatile organic compounds.

To optimise the use of this facility, HCW is segregated with some categories of HCRW not processed by ETD. Composition of the treated HCRW residue is identical to the original materials, except that it is shredded and disinfected. Disposal thereof should once again be such that it is not accessible to waste reclaimers is un-shredded. Shredding and compacting the final product significantly reduce the volume of the final waste residue with the mass being about 80% to 90% of the original, as some drying occurs.

12.7 Dry Heat Sterilisation

During Dry Heat Sterilisation (DHS), the infectious HCRW is shredded before being passed into a processor consisting of an internally heated screw conveyer where the HCRW is sterilised. The flow diagram is similar to that for Microwaving, except for the fact that the HCRW is treated by passing it over a number of screw conveyors with hot oil being passed through the centre of the screw. The HCRW reaches temperatures of around 105 °C, which is maintained for approximately 2 hours before moisture is removed and sterilisation is achieved. The moisture and other volatiles are condensed and the residual gases passed through an air filtration system, which includes passing it through carbon as a final polishing step. The sterilised HCRW residues are then compacted before being transported to landfill for disposal. The volume of the waste is significantly reduced from that of the original HCRW, but there is not a significant mass reduction.

The process is once again not suitable for treatment of all categories of HCRW (e.g. pathological and pharmaceutical HCRW). Special measures are further to be introduced for the disposal of treated HCRW, as un-shredded residues should under no circumstances be accessible to waste reclaimers due to the presence of sharps as well as the remaining risk of infection.

12.7.1 Inputs and Outputs for Sterilisation Processes

The typical inputs and outputs of materials and energy for sterilisation processes are listed in Table 13. The table does not include any resources utilised or produced other than those from the main plant itself, e.g.
water utilised for cleaning of containers or washing down of premises is excluded.

Table 14. Inputs and Outputs for Sterilisation Plants

<table>
<thead>
<tr>
<th>Item</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>③ Electricity for motors, pumps, fans etc.</td>
<td>③ Sterilised waste to be landfilled;</td>
</tr>
<tr>
<td></td>
<td>③ Electricity for Shredders;</td>
<td>③ Water to sewer for autoclaving and DHS;</td>
</tr>
<tr>
<td></td>
<td>③ Electricity for generating microwaves or the electric field for</td>
<td>③ Used filters to be incinerated or landfilled.</td>
</tr>
<tr>
<td></td>
<td>ETD;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>③ Gas, coal or oil for generating steam for Autoclaving;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>③ Electricity for heating oil for DHS.</td>
<td></td>
</tr>
<tr>
<td>Solids &amp;</td>
<td>③ HCRW;</td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>③ Carbon or similar filters for polishing of gas emissions;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>③ Water for Microwaving.</td>
<td></td>
</tr>
<tr>
<td>Gases/air</td>
<td></td>
<td>③ Fugitive emissions from waste;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>② Steam and vapour.</td>
</tr>
<tr>
<td>Others</td>
<td>③ Operational and maintenance costs, e.g. Personal Protective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equipment and other consumables, spare parts and monitoring / auditing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>costs.</td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td>③ Plant manager, assistants and general workers; numbers depend on</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the size and type of plant.</td>
<td></td>
</tr>
</tbody>
</table>

The HCRW residues generated by sterilisation technologies are either dry or in the case of microwaving slightly damp, but no longer infectious. The residues may however have to be assumed potentially hazardous until proven otherwise and should therefore not be accessible to waste reclaimers on waste disposal sites. The USA EPA’s Toxicity Characteristic Leaching Procedure can be applied and any leachable inorganic or organic species must be compared to the appropriate standard, i.e. the acceptable risk limit for the species. Treatment to reduce the toxicity of the residues may be required, particularly if inadequate separation at source has resulted in hazardous chemical HCRW being present in the original waste stream. However, the overall principle and the plant’s financial viability is based on the assumption that there will be suitable separation of chemicals and heavy metals at source, which will lead to the residue being classified as non-hazardous. This will allow for disposal on a normal general waste landfill, provided that the waste is not accessible to waste reclaimers due to the remaining risk of infection as well as the presence of treated sharps amongst the residues.

12.7.2 Advantages and Disadvantages of Sterilisation Technologies

The main advantages and disadvantages of autoclaving, microwaving, ETD and DSH technologies are in many ways similar as listed in the Row 1 of Table 14. There are however some differences that are highlighted in Rows 2 to 4 of the same Table.
Table 15. Characteristics of Autoclave, Microwave ETD and DHS Sterilisation

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Autoclaving, Microwaving, ETD and DHS (Cross cutting)</strong></td>
<td></td>
</tr>
<tr>
<td>① High sterilisation efficiency under specified conditions;</td>
<td>③ Not suitable for pathological waste and chemical waste, including pharmaceuticals and cytotoxic compounds;</td>
</tr>
<tr>
<td>② Volume reduction depending on type of shredding / compaction equipment used;</td>
<td>④ Good HCW segregation required;</td>
</tr>
<tr>
<td>③ Generation of harmful dioxins and furans very low and often below detection limits;</td>
<td>⑤ No or limited mass reduction;</td>
</tr>
<tr>
<td>④ Low risk of air pollution;</td>
<td>⑥ Shredders are subject to breakdowns and blockages and repairs are difficult when the HCRW is infectious;</td>
</tr>
<tr>
<td>⑤ Moderate operational costs;</td>
<td>⑦ It is not possible to visually determine that HCRW has been sterilised;</td>
</tr>
<tr>
<td>⑥ Easier to locate as generally more acceptable to neighbouring communities than for incineration;</td>
<td>⑧ HCRW is not rendered unrecognisable or unusable if not shredded either before or after sterilisation;</td>
</tr>
<tr>
<td>⑦ Recovery technologies can be used on sterilised waste, e.g. for plastics if not shredded and if safe for human contact.</td>
<td>⑨ Significant monitoring costs to demonstrate compliance with sterilisation standards;</td>
</tr>
<tr>
<td></td>
<td>⑩ Treated HCRW must be disposed to landfill, but it should not be accessible to humans or animals due to the presence of sharps as well as the risk of infection if not effectively treated;</td>
</tr>
<tr>
<td></td>
<td>⑪ Air filtration is needed;</td>
</tr>
<tr>
<td></td>
<td>⑫ Operation requires highly qualified technicians.</td>
</tr>
<tr>
<td><strong>Autoclaving</strong></td>
<td></td>
</tr>
<tr>
<td>① Proven system that is familiar to health-care providers;</td>
<td>③ Significant amounts of volatile organic carbon compounds produced;</td>
</tr>
<tr>
<td>② Relatively high sterilisation temperature.</td>
<td>④ Contaminated water must be discharged to sewer;</td>
</tr>
<tr>
<td></td>
<td>⑤ HCRW and containers must have good steam permeability, especially if there is no prior shredding;</td>
</tr>
<tr>
<td></td>
<td>⑥ No volume reduction.</td>
</tr>
<tr>
<td><strong>Microwaving</strong></td>
<td></td>
</tr>
<tr>
<td>① Low capacity units are available for small HCRW producers e.g. clinics and GP's;</td>
<td>③ Unsuitable for very high quantities of contaminated metal (e.g. needles from inoculation campaigns);</td>
</tr>
<tr>
<td>② Moderate investment costs;</td>
<td>④ Low sterilisation temperature increases time required for treatment.</td>
</tr>
<tr>
<td>③ Low sterilisation temperature may reduce energy costs.</td>
<td></td>
</tr>
<tr>
<td><strong>Electro-thermal Deactivation</strong></td>
<td></td>
</tr>
<tr>
<td>① Low sterilisation temperature may reduce energy costs.</td>
<td>③ Relatively high investment and operating costs;</td>
</tr>
<tr>
<td></td>
<td>④ Low sterilisation temperature increases time required for treatment.</td>
</tr>
<tr>
<td><strong>Dry Heat Sterilisation</strong></td>
<td></td>
</tr>
<tr>
<td>① Low investment costs;</td>
<td>③ Low sterilisation temperature increases time required for treatment.</td>
</tr>
<tr>
<td>② Relatively low maintenance costs for sterilizer;</td>
<td></td>
</tr>
<tr>
<td>③ Low sterilisation temperature may reduce energy costs.</td>
<td></td>
</tr>
</tbody>
</table>
Autoclave, Microwave, ETD and DHS technologies cannot accept all the HCRW streams. Pathological (anatomical) waste, chemical waste and radioactive waste should be separated at source. It is however estimated that those categories only represent 5% of the total HCRW stream, thus allowing non-thermal technologies to be effective for treating the bulk (95%) of the HCRW stream.

Although pathological waste could be treated by these technologies, it is generally considered to be unacceptable to effectively cook human and possibly animal tissue at temperatures ranging from 95°C to 160°C before being disposed of at general waste landfills.

Although some solid chemical HCRW would essentially pass through the sterilisation process unchanged and would only impact on the final disposal requirements of the HCRW, many chemicals used in hospitals cannot be treated in this way. Aerosols would for instance release their contents, including the propellant (which is usually a liquified petroleum gas or even a CFC in some pharmaceutical products), during shredding or when heated to the sterilisation temperatures used. Volatile solvents such as ether, alcohol and chloroform; disinfectants that contain phenols and/or chlorinated hydrocarbons or preservatives such as formaldehyde are common in hospitals and would volatilise at the temperatures attained during sterilisation.

Since there are no appropriately designed, constructed and operated hazardous waste disposal facilities in Kenya that could be used for the disposal of chemical (pharmaceutical) HCRW, non-thermal technologies are disadvantaged compared to incinerators by their inability to treat the full HCRW stream generated at most hospitals and clinics. Hence, separate containerisation, collection, transport, treatment and disposal of chemical and pathological HCRW is required in cases where non-burn technologies are used. This requirement necessitates, amongst others, the provision of support mechanisms in form of additional training and equipment.

Thus, good separation at source is an essential requirement for use of the non-thermal sterilisation technologies. Considering the current poor status of HCRW management in many health care facilities in Kenya, it is unlikely that good separation at source will be generally attained in the short to medium term. Allowance must therefore be made to handle HCRW received at a sterilisation facility that is likely to contain some hazardous chemicals and the facility therefore should include using absorption columns to remove potentially volatile emissions that are generated during shredding or sterilising process.

12.7.3 Environmental, Health and Safety Impact of Sterilisation Technologies

The short term environmental impacts of Autoclaving, Microwaving, ETD and DHS are potentially low compared to incineration, which generates large quantities of gas (primarily carbon dioxide) that is immediately emitted into the air. Landfilling of sterilised HCRW will however result in biodegradation of some of its components, which over a longer period of time results in the generation and emission of methane - a greenhouse gas with a much greater impact than carbon dioxide.

Table 16 below presents a general comparison of the relative environmental, health and safety impacts of the thermal and non-thermal technologies. Note that many of the disadvantages of a particular technology can be minimised / mitigated by, for instance, the application of technologies to clean or capture emissions, utilising the appropriate protective equipment, more training, etc, all of which will be included as part of an overall environmental management programme by well operated facilities.
Table 16. Comparison of Environmental Impacts Based on the Choice of Technology

<table>
<thead>
<tr>
<th>Step of process</th>
<th>Impact by incineration technology</th>
<th>Impact by sterilisation / inactivation technologies</th>
<th>Principal Difference in impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separation at Source.</td>
<td>• Except for radioactive HCRW, separation at source is not critical, provided the facility is designed to accept chemical HCRW.</td>
<td>• Radioactive, chemical / pharmaceutical and pathological HCRW must be separated at source and should not be treated with this technology.</td>
<td>• Chemical HCRW increases the toxicity of sterilised HCRW.</td>
</tr>
<tr>
<td>Generation, Sorting and Collection.</td>
<td>• Impact during production of disposable and reusable receptacles as well as impact from distribution and collection of receptacles.</td>
<td>• Impact during production of disposable and reusable receptacles as well as impact from distribution and collection of receptacles</td>
<td>• No difference other than the fact that sterilisation technologies may require the use of special temperature sensitive bags, etc.</td>
</tr>
<tr>
<td>Storage.</td>
<td>• Energy consumption for cooling (if required).</td>
<td>• Energy consumption for cooling (if required).</td>
<td>• No difference.</td>
</tr>
<tr>
<td>Transport for treatment.</td>
<td>• Emissions from vehicles (fuel consumption).</td>
<td>• Emissions from vehicles (fuel consumption).</td>
<td>• No difference.</td>
</tr>
<tr>
<td>Treatment - shredding</td>
<td>• Not required.</td>
<td>• Utilises electricity or hydrocarbon fuels resulting in emissions; Can result in gaseous emissions of VOC's, water vapour, etc. Possible health impact when cleaning or maintaining shredders</td>
<td>• Energy used and emissions generated by non-burn technologies; Difference in potential health impact on staff.</td>
</tr>
<tr>
<td>Treatment</td>
<td>• Immediate conversion of organic matter / carbon to CO\textsubscript{2} and other gases. Use of support fuel when calorific value is low; Possibility of energy recovery (waste-to-energy).</td>
<td>• Delayed conversion of organic matter / carbon to CO\textsubscript{2}, methane and other gases; Considerable use of energy (electricity); No possibility for energy recovery; Recovery technologies can be used on sterilised waste if safe for human contact, e.g. for plastics; Some non-burn technologies use electromagnetic radiation, which could have a health impact.</td>
<td>• Difference in timeframe for degradation process for organic matter and the products of this process; Difference in net energy consumption; Possible differences in radiation exposure.</td>
</tr>
<tr>
<td>Transportation of residues to landfill</td>
<td>• Mass and volume reduction resulting in reduced need for transportation of residues.</td>
<td>• Although substantial volume reduction, there is limited mass reduction resulting in higher emissions from vehicles.</td>
<td>• Increased emissions caused by more transportation required for residues from non-thermal technologies.</td>
</tr>
<tr>
<td>Disposal of residues.</td>
<td>• The volume of residues reduced to 10% and mass reduced to 20%; Residue is inert and does not lead to the formation of landfill gas (CH\textsubscript{4}, CO\textsubscript{2}).</td>
<td>• Volume reduction of 15-70% depending on technology with no or limited mass reduction; Residue is degradable and leads to formation of methane (CH\textsubscript{4}) and / or carbon dioxide</td>
<td>• Difference in volume and mass of residues; Difference in landfilling properties as well as the quality of leachate; Difference in the duration</td>
</tr>
<tr>
<td>Step of process</td>
<td>Impact by incineration technology</td>
<td>Impact by sterilisation / inactivation technologies</td>
<td>Principal Difference in impacts</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------</td>
<td>--------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td>etc.)</td>
<td>depending on quality of landfill operation and use of cover, moisture content, etc.</td>
<td>and type of gases emitted due to degradation / combustion of carbon / organic matter;</td>
</tr>
<tr>
<td></td>
<td>Leachate produced at landfill does not contain any nutrients, but only salts / metals.</td>
<td>Leachate produced at landfill contains both nutrients and salts / metals.</td>
<td>Non-burn technologies lead to higher negative impact on the greenhouse gas emissions.</td>
</tr>
<tr>
<td>Gas Cleaning</td>
<td>Significant quantities of gas produced in the short term;</td>
<td>Small amounts of water and VOC's can be produced in the short term;</td>
<td>Differences in gas volume and quality;</td>
</tr>
<tr>
<td></td>
<td>Highly toxic dioxins / furans can be produced under poor operating conditions;</td>
<td>Minor amounts of gas cleaning residues to be disposed of.</td>
<td>Differences in type and quantities of residues for disposal.</td>
</tr>
<tr>
<td></td>
<td>Solid and / or liquid gas cleaning residues for disposal.</td>
<td>Differences in gas volume and quality;</td>
<td>Differences in type and quantities of residues for disposal.</td>
</tr>
<tr>
<td>Dismantling of installations after end of use and rehabilitation of area.</td>
<td>Recycling and / or disposal of infrastructure; Land rehabilitation.</td>
<td>Recycling and / or disposal of infrastructure; Land rehabilitation.</td>
<td>None.</td>
</tr>
</tbody>
</table>

As discussed above, small amounts of gaseous emissions are likely to be released during the HCRW sterilisation and shredding process, particularly if the HCRW has been poorly segregated at source. Appropriate precautions are therefore required to limit such emissions.

Most sterilisation technologies further require HCRW to be shredded and if undertaken before the sterilisation process, there are potentially significant health and safety risks for the staff when a shredder breaks down or becomes blocked by for instance a large metal object. The cleaning procedure must be well defined, including the use of appropriate Personal Protective Equipment and disinfection or sterilisation of equipment before manual cleaning and repair is undertaken.

For the microwaving and ETD processes, special precautions are to be taken to protect personnel against the electromagnetic radiation that is used.

For all non-thermal technologies, the main operational requirement is to ensure that all the HCRW is treated to the required disinfection level, e.g. the steam used during autoclaving must be able to penetrate all HCRW items. Although the temperatures used for sterilisation are relatively low when compared to incineration, it is sufficient, provided all HCRW reaches the desired temperature for a period that is long enough to allow sterilisation to take place.

The sterilisation process does not lead to significant amounts of mass reduction compared to incineration. As indicated earlier, sterilised HCRW residues must be handled as potentially hazardous and therefore disposed of on an appropriate landfill where it will be inaccessible to humans and animals.
12.8 Generic / Relative Cost Comparison of Selected HCRW Treatment Technologies

Financial estimates for the costs of the various HCRW treatment technologies were based on data obtained during 2002 from suppliers and companies that were actually in the process of setting up or are operating such facilities in South Africa. The data has, however, been adjusted for civil works and environmental protection measures. Since time limitations did not allow for similar costs to be determined for Kenya, the information presented below should be viewed as indicative costs and therefore primarily used for cost comparisons, rather than actual costs. The assumptions used for the cost estimate are presented in the box below.

Assumptions for the Cost Estimates:

- The cost for establishment of a new building or renovation of an existing building to house the plant is included in the estimated costs;
- A standard fixed amount for consultancy fees and other expenditure required to obtain an EIA authorisation plus any other legal requirements was included;
- Salaries were based on South African rates;
- The cost of equipment was based on International / South African price levels and was obtained from suppliers, plant operators and international publications. Incinerators included gas-cleaning equipment, i.e. lime treatment plus a ceramic filter. Note that manufacturing plant in South Africa (Kenya) could considerably reduce costs and the capital cost estimates for incinerators included such an assumption.
- The costs of civil works and installation were based on South African prices
- The following costs were not included:
  i) Infrastructure at the HCRW generator’s sites;
  ii) Establishment of public facilities used, e.g. landfills.

③ Depreciation period: The model allowed the user to select depreciation periods for wheelie-bins, trucks and treatment facilities. Suggested values were: Wheelie-bins - 3 years; Trucks - 5 years; HCRW treatment facilities - 12 years. (Although land is generally not depreciated and buildings and civil works are generally depreciated over 20 years, the Scenario Cost Model depreciated land, civil works and buildings over the same period as the treatment plant. This was considered justified in this instance as (i) it leads to conservative (i.e. higher) costs, and (ii) land and buildings constitute a relatively small proportion of total facility costs).

③ The operational hours for the plants were based on operation for 26 days per month and 12 months per year. However, the maximum operational hours were varied as follows:
  i) Incinerators < 200kg/hr: 12 hrs per day with manual de-ashing;
  ii) Incinerators ≥ 200kg/hr: 20 hours per day with automatic de-ashing;
  iii) Non-burn Technologies: 24 hours per day.

- The costs for disposal of treated residues such as (i) incinerator ash (lime treated), (ii) flue gas cleaning waste from incinerators, and (iii) sterilised HCRW residues from non-burn technologies, were estimated using 2002 disposal costs.
- For non-thermal technologies an estimate of the costs was included for disposal of pathological HCRW and chemical HCRW that could not be treated by the technology.

Figure 11 below represents the costs derived for typical microwaving, autoclaving and incineration plants determined according to the criteria stipulated in the box above. Estimates of the costs of intermediate size
plants were made based on a few discrete points on the curve using the usual cost relation for mechanical plants, i.e.

\[
\text{Investment}(A) \times \text{Investment}(B) \cdot \frac{\text{Capacity}(A)^x}{\text{Capacity}(B)}
\]

The value of X in the formula for each technology was determined by fitting the curve to the few discrete points that were available. Hence, the estimated costs and the curves derived from these should be regarded as indicative only (Figure 11 and 12).

<table>
<thead>
<tr>
<th>Throughput: tons/year</th>
<th>R a n d s (m illio n s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2,000</td>
</tr>
<tr>
<td>1</td>
<td>4,000</td>
</tr>
<tr>
<td>2</td>
<td>6,000</td>
</tr>
<tr>
<td>3</td>
<td>8,000</td>
</tr>
<tr>
<td>4</td>
<td>10,000</td>
</tr>
<tr>
<td>5</td>
<td>12,000</td>
</tr>
<tr>
<td>6</td>
<td>14,000</td>
</tr>
<tr>
<td>7</td>
<td>16,000</td>
</tr>
</tbody>
</table>

Figure 11. Comparative Annual Running Costs for Various HCRW Technologies
The cost of HCRW treatment in Rand/kilogram versus the capacity of the treatment plant is plotted for incineration, microwaving and autoclaving technologies in the figure above. The data for microwaving and autoclaving technology can be taken as being illustrative of the costs expected for the other non-burn thermal technologies such as the ETD and DHS, as the investment costs and operational costs are expected to be similar for these technologies.

The results indicate the following:

a) As expected, the cost for treating one kg of HCRW decreases dramatically as the capacity of the plant increases, thereby verifying the principle of economies of scale that can be achieved through regionalisation of HCRW treatment facilities;

b) For incineration, there is a discontinuity that occurs below 200 kg/hr due to the assumptions made, i.e. the capital cost for the larger plants is increased because automatic de-ashing is included. This is however accompanied by an increase in the maximum operating hours for the larger automated plants from 12 hrs per day to 20 hrs per day. This increase in operating hours decreases the expected cost per kilogram significantly. For the 100 kg/hr incinerator as an example, an increase in operating hours from 12 hrs to 20 hrs per day decreases the treatment cost as the capital expenditure is more effectively utilised;

c) The costs presented in Figure 13 are based on operating the facility at its maximum capacity. Clearly, the treatment facility should as far as possible be operated at optimum capacity, since that will decrease the overall costs of treatment with better utilisation of spent capital. A regional treatment
facility handling HCRW from a number of sources will clearly be more cost effective than a number of small onsite plants, particularly in urban areas where transport distances are relatively short;

d) According to the available data microwaving is relatively expensive compared to the other two technologies, but the costs per kilogram treated become comparable with that of other technologies at higher capacities;

e) At low capacities, incineration is more expensive than autoclav ing, but the costs become comparable as the volumes of HCRW increase above 200 kg/hr, largely due to the increased hours of operation for incineration at capacities in excess of 200 kg/hr;

f) The capital costs for incineration appear to be relatively low compared to the other two technologies. This can, at least in part, be attributed to the fact that the cost of incinerators were based on it being manufactured in South Africa, whereas capital costs for the other two technologies are based on imported equipment which is extremely dependant on the exchange rate between the affected currencies;

g) The costs per kilogram of HCRW treatment were comparable to those charged internationally at the time.

![Graph with data points and lines representing investment per kg of capacity.](image)
13.0 Impact of HCW Action Plan

For the Action Plan to be implemented, it is import that its impact be evaluated in terms of its advantages as well as its disadvantages. This chapter therefore includes an assessment of the impact that can be expected from the implementation of the HCW Action Plan. The assessment is based on evaluation of a number of “performance indicators” that each represents essential aspects of the Vision of the Action Plan, for which the overall objective is to ensure the implementation of improved and sustainable HCW management in Kenya. The performance indicators chosen to assess the various aspects of the Vision are shown in Table 17 below.

Table 17. Performance indicators for the assessment of the impact of the Action Plan.

<table>
<thead>
<tr>
<th>Aspect of the Vision</th>
<th>Performance indicators chosen</th>
</tr>
</thead>
</table>
| Comprehensive and integrated HCW management systems. | • Number of HCFs where new HCW management systems have been introduced according to the standards set.  
• Number of HCF that have produced a HCW Management Plan for their facility.  
• Number of HCRW treatment facilities registered and compliant with the newly set standards. |
| Environmentally sustainable. | • Amount of HCRW generated.  
• Emission of air pollutants (Particulates, HCl, etc.)  
• Emission of global warming gasses (CO\textsubscript{2} & HC\textsubscript{4})  
• Green procurement procedures implemented. |
| Occupationally healthy and safe. | • Number of needle prick injuries reported.  
• Amount of HCRW lifted and manually transported over distances instead of wheeled.  
• Degree of correct segregation. |
| Financially viable system. | • HCF’s expenditures for HCW management.  
• Socio-economic effects. |
| Institutionally feasible. | • Number of staff trained and informed about the new HCW Management systems.  
• Number of HCW management officers appointed including replacement of HCW Officers that become unavailable.  
• Number of HCW management teams established. |
| Operationally practical. | • Efficiency of HCW segregation.  
• Reusable vs. disposable containers for HCRW. |
| “Cradle-to-grave”. | • Number of facilities reporting on the HCW information. |

13.1 Impact on the implementation of a new HCW management system

An important yardstick for the success of the Action Plan is the number of HCFs where environmentally sound, healthy and safe HCW managements systems are implemented. This requires that such comprehensive and integrated HCW management systems are not only to be implemented at HCFs, but also in terms of HCW collection, external transportation as well as treatment and disposal in accordance
with new standards to be agreed upon. Implementation of the Action Plan will therefore result in the introduction of improved HCW management systems in all provincial HCFs by the earliest 2011.

The remaining hospitals and clinics in Kenya not included in this Action Plan are private HCFs that are not directly affected by the Action Plan. However, it is likely that the implementation of the Action Plan in public HCFs will influence decision makers from private HCFs, leading to improved HCW management systems in the private health care sector. This will not only be as a result of the private sector identifying advantages and benefits resulting from the improved new HCW management systems, but also because potential waste management service providers would to some degree adopt the systems proposed by and tested during the Pilot Projects due to be undertaken as part of the Kenya HCW Action Plan.

13.2 Environmental impact

The implementation of the Action Plan will impact on the environment in many different ways. It was therefore important to assess the environmental impact based on indicators that are central to HCW management and that are often used to describe the overall impact of an activity on the environment. The indicators include:

- Amounts of HCRW generated;
- Emission of air pollutants (Particulates, HCl, NOx, SO2);
- Emission of global warming gasses (CO2 & HC4);
- Green procurement procedures implemented.

13.2.1 Amounts of HCRW generated

One of the central objectives of the Kenya HCW Action Plan is to improve the efficiency of the HCW segregation, thereby not only reducing the health and safety risks associated with the handling of the HCW, but also to reduce the amount of HCRW requiring treatment. The benefits associated with a reduced HCRW stream is twofold: (i) From an environmental point of view it would reduce the resulting emissions to the environment as well as the natural resources required for special collection, transport, treatment and disposal of HCGW incorrectly classified as HCRW, and (ii) from a financial point of view it would be appropriate to avoid the much more costly collection, transport, treatment and disposal of HCW that could in an untreated format be disposed of as HCGW.

Based on the findings of the status quo study undertaken for Kenya, it was found that a significant amount of incorrectly segregated HCGW requires to be placed in general infections HCRW receptacles as a result of no segregation being done between HCGW and general infectious HCRW. At most public health care facilities it was found that HCGW and general infectious HCRW is containerised without any form of segregation. This procedure results in the bulk of the HCW stream ending up being treated with “incinerators” not meeting internationally recognised environmental standards, or alternatively being disposed of in an untreated state on general waste landfills. Should internationally recognised HCW treatment standards be introduced in Kenya, such poor HCW segregation procedures will result in a significant amount of HCGW unnecessarily and at high costs being treated and disposed of as HCRW.

It was demonstrated in other developing countries that a significant improvement could be achieved in HCW segregation through interventions that included improved equipment, increased training and improved supervision. Hence, the percentage HCGW in the general infectious HCRW receptacles can be reduced significantly, not only resulting in a reduction in the amount of HCRW requiring expensive treatment, but also making the working conditions for HCW workers, landfill supervisors and informal waste reclaimers significantly safer.
10.2.2 Emission of air pollutants during treatment

The primary emission of pollutants resulting from “cradle-to-grave” HCW management includes:

- Emissions resulting from HCRW treatment;
- Emissions from vehicles transporting HCRW from the point of generation to the treatment facility, as well as from vehicles transporting treated HCRW residues from the treatment facility to the disposal site.

As described in Chapter 9 above, HCRW treatment technologies can be divided into two main categories, i.e. incineration and non-burn technologies. Incineration technologies emit a range of air pollutants during treatment, whereas the non-burn technologies will not generate noticeable air pollutants during treatment. Non-burn technologies will however indirectly result in emission of global warming gasses from the decomposition of organic materials disposed of at landfills subsequent to treatment.

Both incineration as well as non-burn treatment facilities will require power (electricity) and fuel to operate, with non-burn technologies requiring more power than burn technologies (incineration), as the latter will during the treatment process generate some supplant energy (heat from combustion), that could in some instances be utilised.

The reduction in the emission of CO$_2$, which is a global warming gas, results from the introduction of non-burn treatment technologies. This reduction in the emission of a global warming gas during treatment will however to a certain degree be neutralised by emission of another global warming gas, i.e. methane (CH$_4$), when degradation of organic matter takes place on disposal sites.

The introduction of non-burn technologies will increase the tonnage of residues to be transported by trucks, resulting in the emission of more polluting gases to the atmosphere. The increases in the emissions during transport will however be marginal in relation to the emissions from the treatment facilities.

The disposal of residues from the treatment of HCRW to landfill not only results in air emissions, but also in a number of other environmental factors such as generation and discharge of leachate and land use. It is expected that the generation of leachate as well as the emission of CO$_2$ and CH$_4$ will increase considerably where non-burn technologies are introduced. This is primarily due to the fact that non-burn technologies will generate substantial amounts of organic residues to be disposed of at landfills, whilst smaller amounts of inorganic residues will be generated.

Generally speaking, incineration will primarily result in increased air emissions during treatment, whilst the non-burn technologies will result in increased amounts of organic solid waste to be disposed of at landfills that will generate air emissions during its decomposition.

13.2.3 Emission of global warming gasses

There are two global warming gasses that are of particular importance from an environmental point of view when considering the HCW management system proposed for Kenya, i.e. CO$_2$ (carbon dioxide) and CH$_4$ (methane).

Carbon dioxide is emitted during the incineration of HCRW, from the vehicles transporting the HCRW and its treated residues as well as from the landfills where the residues from the non-burn treatment facilities are disposed of. When HCRW delivered to incinerators is treated, the total carbon content of the HCRW is converted into CO$_2$ with a small fraction being converted into CO (carbon monoxide). Similarly, the carbon content of the fuel used by the vehicles transporting the HCRW and its residues is converted into CO$_2$ and CO, but primarily CO.
Methane will be emitted from landfills where organic residues from the non-burn treatment facilities are disposed of. The generation of CO\textsubscript{2} versus CH\textsubscript{4} depends on the availability of oxygen. Where oxygen is available the organic compounds of the HCRW will degrade through emission of CO\textsubscript{2} (aerobic process). If no oxygen is available the organic materials will degrade through the emission of CH\textsubscript{4} (anaerobic process). It is however important to note that CH\textsubscript{4} has an impact on global warming estimated to be 25 times more severe than the impact of CO\textsubscript{2}. It is therefore important that a total weighted impact on the global warming, where CH\textsubscript{4} is converted into a CO\textsubscript{2}-equivalent, be considered where a comparison on is made of the environmental impact resulting from the various HCRW treatment technologies.

The introduction of non-burn treatment technologies is therefore assumed to result in an increased impact on global warming, primarily due to the assumed anaerobic digestion of organic residues. However, this is merely an assumption, resulting in the comparison only considered to be indicative.

13.2.4 Green procurement implemented.

Green procurement is a procedure to promote the purchase of equipment and materials that would be less harmful to the environment during its life cycle. Although green procurement is difficult to define, implementation of such procedures at HCFs is an indication that such HCFs are more environmentally conscious than others.

As a performance monitoring indicator, detailed recording of the following could for instance be used:

- The number of mercury containing thermometers and blood pressure meters that were replaced with non-mercury containing thermometers;
- The number of PVC containing products replaced with non-PVC containing products.

The investigation of HCFs in Kenya revealed that no public HCFs implemented any form of Green procurement programmes, which makes this an indicator that would be relevant for future monitoring.

13.3 Impact on occupational as well as public health and safety

Needle prick injuries resulting from the direct or indirect handling of infected syringe needles or cut wounds from infected sharp objects, could have serious consequences for workers, as well as members of the public being exposed to such items. The handling of HCRW containing such infected items not safely contained in puncture resistant containers or where such items are incorrectly disposed of as HCGW, are just some of the ways in which workers and the public can be exposed to such risks.

Hence, needle prick injuries or injuries from sharp objects to the formal workforce could be used as indicators on safe handling of infected sharps.

Until now only limited statistics are available on the number of needle prick and cut wound injuries in public health care facilities or the HCW management industry. Even though reporting of such injuries is required in terms of Occupational Health and Safety, only few stakeholders currently register and report on these incidents.

It is however believed that the introduction of the proposed new HCW management systems in Kenya will reduce the number of needle prick and cut wound injuries considerably. This will be achieved in particular when puncture resistant sharps containers and general infectious HCRW bins are introduced, together with effective control over HCRW treatment and disposal to minimise the risk of humans coming in direct contact with such HCRW.
Other factors that could be used as indicators of health and safety conditions in the workplace and public areas are the amount of HCRW manually handled as well as the occurrence rate for illegal disposal of untreated HCRW. The less HCRW manually handled, the better and safer the working conditions, whilst less occurrence of illegally disposed HCRW (including untreated HCRW on general waste disposal sites), the safer conditions would be for the public.

The last indicator that could be considered under Occupational Health and Safety is the number of reported infections that can be attributed to HCW management.

### 13.4 Financial implications

An important consideration in the Action Plan is the impact that implementation of the improved new HCW management system will have on the cost of rendering such services. The installation of new equipment, increased training, etc. is set to increase the cost of rendering the HCRW management services, in particularly during the initial stages when most of the capital investment in durable items is to be made.

It is however at the same time also expected that improved segregation will reduce the amount of HCRW requiring expensive treatment, thus reducing the treatment cost. The important consideration is however what the actual increased cost would be, and to extent the anticipated saving can compensate for the increased cost of service delivery, should the saving materialise.

Although the expected cost for the HCRW management service delivery was determined, it is uncertain how long it will take to achieve the level of training and awareness that would result in the HCRW stream being reduced to such an extent that it can result in a saving through improved segregation.

In addition to this, implementation of the Action Plan will also have a socio-economic impact. Some of the factors or indicators that will be relevant in this respect are:

- Creation of jobs requiring higher skills;
- Increased budget/turnover for parties responsible to render HCRW management services.

During implementation of the improved new HCW management system in Kenya, it is unlikely that more jobs will be created than before. Although it is expected that the new HCRW management systems will be more efficient, thereby not requiring more workers, it will be more sophisticated, requiring workers to be better trained. This may result in an increased workload during the initial stages, but once the required skills have been acquired and the systems have been in operation for some time, the workload will probably be the same as before due to the fact that the systems will be more efficient.

The aforesaid trends will probable apply to all of the affected HCFs and service providers.

The HCRW management market is likely to change considerably as from the implementation of the HCW Action Plan. New HCRW treatment service providers, making use of both incineration as well as non-burn treatment technologies, may be established, whilst existing HCRW treatment facility operators are likely to have to comply with more stringent emission standards.

The establishment of new HCRW treatment facilities will result in an increase of the HCRW treatment capacity, bringing about more competition in the market. Although it is expected that the amount of HCRW generated by public HCFs would reduce through improved segregation, it is estimated that a significant amount of HCRW is currently unaccounted for. By implementing improved control mechanisms allowed for as part of the new HCW management system, almost all HCRW generated will be delivered to
environmentally compliant treatment facilities. In addition to this, the onsite incinerators currently used at most public and private hospitals may not be allowed to operate any longer unless it can meet the environmental standards that are to be set.

A summary of the costs for implementation of the National HCW Action Plan is presented in chapter 11. As a result of the current state of HCW Management infrastructure, the capital required for implementation of the HCW Management Plan is estimated to be Kshs 3.6 billion. In addition to that a sum of approximately Kshs 700 million will be required annually to ensure that the plan runs smoothly. The Ministry of Health’s budget is roughly Kshs 18 billion per annum, of which 50% is spent on curative services, with only between 0.2% and 0.3% spent on the medical supplies unit (non drugs). Of the 18 billion only 1.6 billion shillings was allocated to the purchase of drugs. The recurrent budget for HCW Management would therefore be close to half of what the Ministry currently spends on drugs.

At afirst glance it is therefore not feasible for the current resource starved public health sector to fund any additional costs. The initial capital costs could be funded by donors or through more innovative ways e.g. Kenyatta Hospital launching a 10-year bond on the stock market. Alternatively the National Hospital Insurance Fund could lend health care facilities the money to upgrade their HCW management infrastructure.

Based on an average shared cost, the cost of maintaining the HCW management programme at the health care facilities would cost each patient 10 Shillings per visit, if 100% of the recurrent cost were to be recovered from the patient. This figure is high in view of the fact that in many parts of Kenya people still cannot afford even the 20 Shillings service charge. Secondly, if it was left to health care facilities to implement the HCW Management Plan through such a policy, it may not materialise due to a shortage of funds. At provincial hospital level the cost per patient visit would rise to 30 Shillings per visit as a result of reduced economies of scale.

The alternative to an average visit cost would be to load the cost to those patients that generate the greater / more hazardous waste. The major complication is arriving at such costs.

Certain or all the costs associated with the HCW Management Plan can as another option be bundled together as part of say the bed charge and paid for by third parties e.g. the National Hospital Insurance Fund or Private Health Insurance. This would be one way for health care facilities with inpatient services and those that derive a large portion of their revenue from such sources could go this route.

Certain aspects of the HCW Management Plan have a strong public good component and if the government does not take ownership for the implementation thereof, it may not materialise, ultimately resulting in suffering for the affected parties. It is therefore incumbent upon the government to take responsibility to ensure that an effective HCW management program be implemented, with legislation and regulation being possible mechanisms at government’s disposal. In addition to this, government is further to make provision for an enabling environment and / or set aside public resources for the system to work.

It can therefore be seen that direct, particularly health facility recurrent costs can be recovered to a certain extent directly from the user. However it is expensive to collect and given Kenya’s current socio-economic state, this could lead to serious equity problems. It is therefore more feasible if the money is collected centrally and then distributed to various health facilities. Without additional resources to the health sector, it is likely to be difficult to fully implement the HCW Management Plan in the near future.
13.5 Impact on institutional aspects
The most prominent indicators on the development of the institutional settings, resulting from the implementation of the Action Plan, are the following:

- Number of staff trained in the operation of the improved new HCW management systems;
- Number of HCW management officers appointed;
- Number of HCW management teams established.

Effective training and skills development are important preconditions for successful implementation of the improved new HCW management systems. Although it is difficult to predict at this stage how the staff will react to any new HCW management system, and how much effort will be required during the training, there will most certainly be an improvement on the current procedures, which is likely to be appreciated by staff.

Results from pilot projects undertaken in other developing countries clearly indicated that HCW management procedures improved amongst staff members involved with and trained during the pilot project.

Another useful indicator is the number of HCW management officers appointed. This indicator will - together with the number of HCFs that established HCW management teams - show how many HCFs that have implemented a firmer organisational structure for HCW management and thereby in principle have improved the HCW management.

13.6 Impact on HCW management operation practices
The efficiency with which HCW is segregated is one of the indicators that could be used to determine whether the HCW management system has improved, as well as the extent to which the staff has been able to use the new equipment and adapt to the new procedures.

The number of incidents where containers are overloaded, containers not being closed / marked appropriately or containers being left unattended in unsecured areas, are further indicators that could be used effectively to determine the impact that the Action Plan has on HCW management operation practices.

13.7 Tracking from “cradle-to-grave”
One way of monitoring the “cradle-to-grave” flow of HCRW is by implementing a HCW information system (HCWIS). Through effective use of the HCWIS it is possible to follow the flow of HCRW from its point of generation at HCFs, through internal transport, storage, collection, external transport and treatment, from where the treated residue is then transported for final disposal at landfills.

The number of HCFs that successfully implemented a HCWIS will serve as an indicator of how effective HCRW can be tracked from cradle-to-grave.

A further indicator that could be used is the number of HCFs that successfully implemented a HCRW tracking system to verify compliance with the HCRW generator’s “duty of care” to ensure that all HCRW generated is treated and disposed of in an environmentally sound manner.
14.0 Estimated Cost for Implementation of HCW Management Plan

The Budgetary estimates for the implementation of the Kenya National Plan of Action on Health Care Waste Management has been prepared as follows:

14.1 Capital Expenditure budget
This involves:
   a. The purchase of all equipment including consumables and maintenance for the first one year
   b. Training and creation of awareness

11.2 Recurrent (operational) budget
This would adequately run the program in a calendar year including:
   c. The cost of maintenance and consumables
   d. But excluding the cost of replacement of long lasting capital equipment.

14.3 Assumptions Made
In developing the budget, the following assumptions have been made. Some of these assumptions will be subject to a sensitivity analysis by the stakeholders involved.

1 At this stage the plan deals mainly with public sector facilities. Over the 5-year (Alternatively 10-year) period the numbers of facilities and districts have been assumed to be constant. With the continual growth of the population and changes on our governance structure. It is likely that the number of facilities and districts will change.

2 Manpower costs are taken to be close to zero as it is assumed that health care workers will not earn any additional pay for implementing this program. There will however be training costs, which are factored as part of this plan.

3 Training costs are at two levels. Ad hoc training that will be given to workers/stakeholders already existing at this point in time. And secondly students who will be in training once the program starts and will be trained once a new curriculum is effected. The cost of changes in curriculum in training institution has not been taken into account at present

4 Maintenance costs are set at the rate of 6% for large-scale permanent equipment/buildings e.g. incinerator.

5 Smaller pieces of equipment are depreciated at the rate of 25% and are to be replaced every 5th year.

6 Pricing has been taken at today’s prices and are currently available commercial (retail) prices. It is anticipated that were the plan to be implemented systematically country-wide then prices would drop owing to buyer power and economies of scales for suppliers (increased market). Prices indicated should therefore fall.

7 Where applicable the US dollar rate is taken as USD 1=Kenya shillings 75. Over the last 10 years the US Dollar / Kenya Shilling rate has fluctuated by more than 10%. However in general the Kenya Shilling has continued to gradually depreciate against the US Dollar.

8 Historically the inflation rate in Kenya has been around 10%. Inflation was not taken into account. The budget presented will be subject to a sensitivity analysis based on inflation rate greater than 0%.

9 All disposable HCW containers would be discarded on a monthly basis to avoid spread of infection.

11 Non-disposable containers are to be emptied on a daily basis from the work units.
14.4 Costing Model

The Plan proposes the number of waste containers/receptacles would be apportioned into units. A unit typically would be one clinical work area such as a consulting room or an MCH/FP room.

Allocation of different sharp boxes / special containers depends on usage.

A summary of sharp boxes / special containers needed per unit per type of facility is given below.

<table>
<thead>
<tr>
<th>Sharp Box</th>
<th>Dispensary</th>
<th>Health Centre</th>
<th>District Hospital</th>
<th>Provincial/Referral Hospital</th>
<th>National Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Type B</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Type C</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Type D</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Type E</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special Container</th>
<th>Dispensary</th>
<th>Health Centre</th>
<th>District Hospital</th>
<th>Provincial/Referral Hospital</th>
<th>National Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type F</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Type G</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Type H</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10 per hospital</td>
</tr>
<tr>
<td>Type I</td>
<td>1</td>
<td>2 per hosp</td>
<td></td>
<td>10 per hosp</td>
<td></td>
</tr>
</tbody>
</table>

No of Units per Facility 3 7 15 30 129
### Training and Awareness Costs

<table>
<thead>
<tr>
<th>Items</th>
<th>Quantity</th>
<th>Cost per unit</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posters</td>
<td>196,000</td>
<td>100</td>
<td>19,000,000</td>
</tr>
<tr>
<td>Pamphlets</td>
<td>98,000</td>
<td>50</td>
<td>4,900,000</td>
</tr>
<tr>
<td>Booklets (Code of Conduct)</td>
<td>39,200</td>
<td>150</td>
<td>5,880,000</td>
</tr>
</tbody>
</table>

The number of code of conduct booklets is based on the number of staffing of the MoH which standards at 34,633 as per human resource mapping and verification exercise undertaken by the ministry in December 19994. It is assumed that each health care worker in PHCFs will get a copy of the Code of Conduct. The posters will be distributed in all PHCFs and other strategic points to create public awareness.
14.4.1 Dispensary Level
Starting at the lowest level of facility, it has been assumed that a dispensary would generate roughly 0.5kg of waste per day. A typical dispensary would have 3 clinical areas e.g. MCH/FP, a consulting room and a treatment room.

14.4.2 Health Centre Level
A health centre should have a small inpatient facility particularly to handle uncomplicated deliveries. In addition there is a laboratory.

14.4.3 District Hospital
At the district level, there is the addition of several more inpatient wards, a theatre, radiological unit and a more comprehensive laboratory.

14.4.4 Provincial/Referral Hospital
Would typically be a 400 to 600 bed hospital. In the analysis of health care waste production, it was found that Moi Referral Hospital in terms of size would not be the largest provincial hospital. However the pattern of HCW would differ slightly due to the specialized nature of some of the services on offer.

14.4.5 National Hospital (KNH)
Due to the number of many different units within the hospital and the sheer size of the facility, the amount of waste and the cost of managing the waste at Kenyatta National Hospital is huge and varied. Certain Specialized units within KNH use a larger number of certain sharp boxes than have been allocated under this model e.g. burns, certain clinics, however in the final analysis this did not have a material effect on costs due to the relatively lower costs of the smaller sharp boxes compared to the larger specialized containers.

14.4.6 Private Hospitals
This model will require some adjustment for private health facilities since a particular private institution may have similar level of facility to a public one, the patient load at both in and outpatient care is usually lower.

14.4.6 Monitoring & Evaluation
A monitoring and evaluation (M&E) program will be part of the Ministry of Health Diseases surveillance or Health Management Information System at no cost. The M&E system will be integrate in these already in place systems so as not to duplicate structures in the ministry and save costs in the implementation of Plan
14.2 Required Financial Resources to Implement the Nation Action Plan

In general there are several ways to finance health care:

1. **General taxation.** The most common way worldwide (over 100 countries), and generally the least expensive way. However because funds are collected into a pool it is subject to political interference and bureaucratic inertia. Services provided through general taxation tend to be of poorer quality as the link between payer and user are very weak.

2. **Out of Pocket** is the most common method of funding healthcare. It is the least equitable and may deny access at time of need. Also causes problems to health institution for planning purposes.

3. **Private Insurance** is generally expensive and elitist. In Kenya less than 500,000 people can afford private health insurance of any kind.

4. **Social Health Insurance** is preferred in 27 countries worldwide. Leading exponents are Germany and Korea. Requires an urbanized large formal sector workforce to ensure that money is collected relatively easily.

In Kenya public healthcare is paid through general taxation with a tiny private health insurance. However most of healthcare is paid through out of pocket payments. The Ministry of Health funds less than 50% of the country’s health budget. Private health expenditure, although large, is almost entirely curative. I.e. private sector does not pay for any public health activities.

A summary of the costs of implementing the National HCW Action Plan is contained above. In the initial set up phase Kshs. 3.6 billion is required. In addition to that a sum of Approximately Kshs 700 million will be required annually to ensure that the plan runs smoothly. The Ministry of Health budget is roughly Kshs 18 billion a year of which 50% is spent on curative services and only between 0.2% and 0.3% being spent on the medical supplies unit (non drugs). Of the 18 billion only 1.6 billion shillings was allocated to the purchase of drugs. The recurrent budget would therefore be close to half what the Ministry currently spends on drugs.

At a glance it is therefore not feasible for the current resource starved public health sector to fund any additional costs. In terms of the initial capital costs this can be funded through the traditional donor way or can be done through more innovative ways e.g. Kenyatta Hospital launching a 10 year bond on the stock market. Alternatively the National Hospital Insurance Fund could lend health facilities the money to upgrade their HCW management facilities.

Which way to go to raise the initial capital required should depend on what the cost of the money would be.

With regard to the recurrent budget various aspects of the budget can be handled from different perspectives and this would depend on the outcome of a cost benefit analysis.

14.3 Cost Benefit Analysis

A true Cost Benefit Analysis (CBA) is difficult to do within the health sector because of problems of costing the benefit derived from a particular health intervention. This is particularly so when the benefit obtained is partly a public good and partly a private good as in the case with the handling of HCW. Who benefits from this plan and to what degree and to what stage? While in general no one with argue with the fact that amputated limbs cannot be thrown out of a hospital window, there can be arguments about who pays for its proper treatment and disposal.

The ideal solution may be to use existing funding mechanisms to fund various aspects of the HCW Management Plan.
Health Worker
It is generally expected that the health worker will be provided with protective clothing / uniforms and a safe environment to work in by the employer. PPE should include gloves, mackintosh, etc. Any changes in standards of such items would therefore be expected to be borne by the health institution. However, not all cadres get the same uniform allowance or get protection to the same levels. E.g. nurses get some uniform allowance.

Patient
Within the public sector, cost sharing introduced in the 1980’s was drastically reduced as a form of health financing. While it is practiced in all government health institutions, the amounts collected have gone down particularly since the introduction of the 20:10 policy in 2003. Health centres for example now charge just 20 Shillings for each outpatient visit and 100 shillings for a delivery.

Based on an average costing, the cost of running the HCW management programme at the health centre level would cost each patient 10 Shillings per visit, if 100% of the recurrent cost were to be recovered from the patient. This figure is high in view of the fact that in many parts of Kenya people still cannot afford even the 20 Shillings. Secondly if health facilities were left on their own to implement the plan through such a policy they might just not do it due to shortage of funds.

At provincial hospital level the cost per patient visit would rise to 30 Shillings.

The alternative to an average visit cost would be to load the cost to those patients that generate the greater / more hazardous waste. The major complication is arriving at such costs.

Health Institution
Certain or all the costs associated with HCW management plan can be bundled together as part of say the bed charge and paid for by third parties e.g. National Hospital Insurance Fund, Private Health Insurance. This would be one way for health institution with inpatient facilities and certainly those that derive a large portion of their revenue from such sources could go this route.

Certain services that are provided as part of public health / good and generate defined HCRW categories could have components to handle the HCW they generate such as KEPI, TB programs etc. This could be done in three ways:

1. Each facility charges the relevant program a predetermined amount based on the number of patients participating in that program at the facility;
2. Flat fee based on the type/category of facility e.g. district hospital can claims a certain amount per month from KEPI, a referral hospital may claim less;
3. Flat fee irrespective of type/category of facility like some kind of grant.

Public System
Certain aspects of the HCW Management Plan have a strong public good component and if the government does not take it up nobody else will and everyone will suffer as a result. It is therefore incumbent upon the government to take responsibility to ensure that the program works. This can be done partly through legislation and regulation. But will also require the provision on an enabling environment and or set aside public resources for the system to work.

Long Term Safety of HCW
For example certain wastes may require being buried in a safe area for a long period of time. It would have to be the government’s responsibility to ensure that such land is not utilized otherwise before it is considered safe. This can be done by providing such land or paying the owner of such land not to use it otherwise.
Indemnity Insurance/Fund
In addition the government would have to provide a system / insurance fund that would indemnify various actors when things go wrong. For example if a truck carrying HCW overturns onto private land, who should pay for the cost of clean up/compensation? The health institution it was coming from? The owner of the truck? The owner of the land?

Conclusion
It can therefore be seen that direct, particularly health facility recurrent costs can be recovered to a certain extent directly from the user. However it is expensive to collect and given Kenya’s current socio-economic state, this could lead to serious equity problems. It is therefore more feasible if the money is collected centrally and then distributed to various health facilities. Without additional resources to the health sector, it would be difficult to fully implement the HCW Management Plan.
Table 18. National Health Care Waste Management Implementation Budget

### CAPEX EQUIPMENT COSTS (KSHS) INITIAL SET UP

<table>
<thead>
<tr>
<th>Facility</th>
<th>Dispensary</th>
<th>Health Centre</th>
<th>District</th>
<th>Provincial</th>
<th>Referral</th>
<th>National</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Per Facility</strong></td>
<td>654,795</td>
<td>756,645</td>
<td>18,530,990</td>
<td>24,233,380</td>
<td>24,233,380</td>
<td>39,635,110</td>
<td>30,380,000</td>
</tr>
<tr>
<td><strong>No of Facilities</strong></td>
<td>1,464</td>
<td>383</td>
<td>112</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Cost per category</strong></td>
<td>958,619,880</td>
<td>289,795,035</td>
<td>2,075,470,880</td>
<td>169,633,660</td>
<td>48,466,760</td>
<td>39,635,110</td>
<td>30,380,000</td>
</tr>
</tbody>
</table>

**Total Cost**

<table>
<thead>
<tr>
<th></th>
<th>Kshs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Cost</strong></td>
<td>3,612,001,325</td>
</tr>
</tbody>
</table>

### CAPEX EQUIPMENT COSTS (KSHS) OVER PLAN PERIOD 2006 - 2010 (Alternatively 2006 – 2015)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Dispensary</th>
<th>Health Centre</th>
<th>District</th>
<th>Provincial</th>
<th>Referral</th>
<th>National</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Per Facility</strong></td>
<td>1,449,950</td>
<td>2,629,250</td>
<td>49,304,900</td>
<td>75,225,000</td>
<td>75,225,000</td>
<td>196,944,900</td>
<td>101,266,667</td>
</tr>
<tr>
<td><strong>No of Facilities</strong></td>
<td>1,464</td>
<td>383</td>
<td>112</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Cost per category</strong></td>
<td>2,122,726,800</td>
<td>1,007,002,750</td>
<td>5,522,148,800</td>
<td>526,575,000</td>
<td>150,450,000</td>
<td>196,944,900</td>
<td>101,266,667</td>
</tr>
</tbody>
</table>

**Total Cost**

<table>
<thead>
<tr>
<th></th>
<th>Kshs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Cost</strong></td>
<td>9,627,114,917</td>
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</table>
## Recurrent Costs (KShs) Annual

<table>
<thead>
<tr>
<th></th>
<th>Dispensary</th>
<th>Health Centre</th>
<th>District</th>
<th>Provincial</th>
<th>Referral</th>
<th>National</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Facility</td>
<td>112,515</td>
<td>197,925</td>
<td>3,402,315</td>
<td>6,126,030</td>
<td>6,126,030</td>
<td>16,590,585</td>
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</tr>
<tr>
<td>No of Facilities</td>
<td>1,464</td>
<td>383</td>
<td>112</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Training &amp; Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost per category</td>
<td>164,721,960</td>
<td>75,805,275</td>
<td>381,059,280</td>
<td>42,882,210</td>
<td>12,252,060</td>
<td>16,590,585</td>
<td>29,780,000</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Kshs</strong> 723,091,370</td>
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</table>

Table 19. National Hospital HCWM Plan Expenditure

<table>
<thead>
<tr>
<th>Capex</th>
<th>Year One</th>
<th>Recurrent Costs Per Annum</th>
<th>Over Plan Period 2005-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Per Month</td>
<td>Initial Unit Cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incinerator</td>
<td>1</td>
<td>1</td>
<td>15,000,000</td>
</tr>
<tr>
<td>Incinerator installation</td>
<td>1</td>
<td>1</td>
<td>50,000</td>
</tr>
<tr>
<td>Truck</td>
<td>1</td>
<td>1</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Weighing Machines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>Trolleys</td>
<td>65</td>
<td>1</td>
<td>2,000</td>
</tr>
<tr>
<td>Sharp Boxes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type A</td>
<td>387</td>
<td>12</td>
<td>325</td>
</tr>
<tr>
<td>Type B</td>
<td>258</td>
<td>12</td>
<td>465</td>
</tr>
<tr>
<td>Type C</td>
<td>129</td>
<td>12</td>
<td>785</td>
</tr>
<tr>
<td>Type D</td>
<td>65</td>
<td>12</td>
<td>1,160</td>
</tr>
<tr>
<td>Type E</td>
<td>129</td>
<td>12</td>
<td>1,275</td>
</tr>
<tr>
<td>Sharp box installation</td>
<td>968</td>
<td>1</td>
<td>4,200</td>
</tr>
<tr>
<td>Special Containers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type F</td>
<td>387</td>
<td>12</td>
<td>785</td>
</tr>
<tr>
<td>Type G</td>
<td>258</td>
<td>12</td>
<td>1,160</td>
</tr>
<tr>
<td>Type H</td>
<td>10</td>
<td>12</td>
<td>4,180</td>
</tr>
<tr>
<td>Type I</td>
<td>10</td>
<td>12</td>
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<tr>
<td>Special containers installation</td>
<td>278</td>
<td>4,800</td>
<td>1</td>
</tr>
<tr>
<td>Receptacles</td>
<td>129</td>
<td>4,185</td>
<td>1</td>
</tr>
<tr>
<td>Liners</td>
<td>258</td>
<td>7</td>
<td>360</td>
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## Table 20. Referral Hospital HCWM Plan Expenditure

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<tbody>
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<td>Per Month</td>
<td>Initial Unit Cost</td>
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</tr>
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<td>Type C</td>
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<td>785</td>
</tr>
<tr>
<td>Type D</td>
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<td></td>
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<tr>
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|                     | 15 | 12 | 1,160 | 208,800 | 208,800 | 1 | 10 | 2,088,000 |
Table 21. Provincial Hospital HCWM Plan Expenditure

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<td>Recurrent Costs Per Annum</td>
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Table 23. Health Centre HCWM Plan Expenditure

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<th>Over Plan Period 2005-2015</th>
</tr>
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<tbody>
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<td>785</td>
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<tr>
<td>Type G</td>
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<tr>
<td>Type H</td>
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**Table 24. Dispensary HCWM Plan Expenditure**

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<th>Recurrent cost Per Annum</th>
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</tr>
</thead>
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<td>Per Month</td>
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</tr>
<tr>
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<td><strong>Total Cost</strong></td>
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</tr>
</tbody>
</table>

* Liners and receptacles should be colour coded as per WHO colour code

**Note**
1. For health centres and dispensaries, brick built incinerator is proposed.
2. Waste transportation trucks are only envisaged in national, referral, provincial hospitals and district hospitals
3. See equipment specification for further details on specifics
4. District and Sub District hospitals are categorized together
5. Incinerator specification include 100kg/day Manual loading and de-ashing, secondary combustion chamber (temperature >1000°C, residence time >1s), without flue-gas cleaning
6. Training and Awareness costs include costs of producing 196,000 posters, 98,000 pamphlets and 39,200 code of conduct as well as sub contracting costs for consultants
15.0 Conclusion and Recommendations

The Action Plan for Health Care Waste (HCW) Management in Kenya is based on the Vision of facilitating the establishment of an integrated, environmentally sustainable, occupationally healthy and safe, financially viable, institutionally feasible and operationally practical, comprehensive “cradle-to-grave” management system for HCW in Kenya, covering all HCW generators and addressing the short, medium and long-term needs over the period 2006 - 2015.

This Action Plan is informed by and developed against related activities like a Status Quo Study that resulted in the development of the Gap Analysis, the Draft “Bio-Medical Waste (Management and Handling) Regulations for Kenya, the Kenya Injection Safety and Immunization Waste Management Plan of Action: 2001-2005 as well as inputs and comments received as a consequence of the numerous interviews held during visits to HCW generators throughout Kenya.

Although focussing on health care risk waste (HCRW), health care general waste (HCGW) is also included in the Action Plan, in as far as it would impact on the effectiveness with which HCRW is managed. All categories of HCRW other than radioactive waste are included in the HCW strategy. Radioactive waste is handled in accordance with the provision of the Radiation Protection Act, Chapter 243 and falls outside the jurisdiction of the HCRW management industry.

For the sake of prioritising activities, the Action Plan is presented for implementation in the following four phases:

1. **Phase 1: Consolidation (Jan. 2006 – Dec. 2006):** *(Alternatively Jan. 2006 to Dec. 2007)* Aimed at improving the existing HCW management systems in order to address the most urgent occupational health and safety needs;

2. **Phase 2: Development (Jan. 2007 – Jun. 2008):** *(Alternatively Jan. 2008 to Dec. 2010)* The focus during this Phase, will be on setting appropriate treatment efficiency standards as well as emission standards. Against the background of the nationally agreed upon standards, various options will be evaluated for cost effective HCW management service delivery. This phase will further include all preparations required for the roll-out (implementation) of the selected HCW management service delivery models;

3. **Phase 3: Implementation (Jul. 2008 – Dec. 2010):** *(Alternatively Jan. 2011 to Dec. 2015)* Having set the standards and having selected the most appropriate models for HCW management service delivery, this phase will focus on the establishment of operational structures as well as physical supply, installation and construction of equipment and facilities required for environmentally sound HCW treatment and disposal throughout Kenya;

4. **Phase 4: Monitoring and Control (2011 onwards):** *(Alternatively Jan. 2016 onwards)* Although identified as a separate phase, monitoring and control will be executed throughout the process, i.e. starting from the consolidation phase. Progress on the implementation of the Action Plan will be evaluated and where required, adjustments could be made to already upgraded HCW management systems to ensure optimum results. Highlighting the fact that this phase is to continue subsequent to the development and implementation of improved HCW management systems in Kenya will stress the importance of ongoing involvement by the executing as well as the regulating authorities.
15.1 Specific Recommendations

15.1.1 Cross Cutting Needs

Box 1. Cross Cutting Needs.

- Set up Coordination Committee with representation from major stakeholders to monitor and control implementation of HCW Plan;
- Arrange international study tour to developing as well as developed countries for Coordination Committee members to investigate successful HCW management systems;
- Identify and secure financial resources to allow for implementation of HCW Plan in a sustainable manner;
- Develop a year-on-year activity list with clearly defined milestones for progressive implementation of the HCW Plan;
- Identify pilot project topics and implement the pilot projects that will address a range of Needs. Replicate results from pilot projects during final rollout of HCW Plan;
- Monitor an control implementation of the HCW Plan and make adjustments where needed;
- Investigate the current state of waste disposal sites with a view of continued upgrading that will allow environmentally sound and safe disposal of treated HCRW residues;
- Develop overall waste awareness and capacity building programme for Kenya, with particular emphasis in HCW.

15.1.2 Environmental Needs:

Box 2. Environmental Needs.

The environmental needs can be classified according to the following sub-headings:

**Generation:**
- Consider the toxicity of products used and implement “green-procurement” that would for instance minimise packaging and also require elimination of PVC products wherever available;
- Investigate the possibility of re-use and recycling of Health Care General Waste (HCGW);

**Containerisation:**
- Appropriately designed and manufactured HCW containers to be supplied and used;
- Development and enforcement of a uniform colour coding and labelling system to effectively mark, record and track HCRW.

**Internal Transport:**
- Prevention / limitation of HCW spillage inside and outside health care facilities during handling, storage, transport and treatment, with immediate removal of spillage and disinfection of contaminated areas, should spillage occur.

**Storage:**
- Provision of sufficient appropriate HCW storage facilities at health care facilities as well as treatment facilities to prevent HCW from being exposed to the elements during storage;
• Provide guidelines prohibiting unrefrigerated storage of pathological HCRW (placentas) for extended periods of time.

External Transport:
• Reduce the risk of pollution in the event of accidents when transporting HCRW over long distances.

Treatment:
• Setting appropriate norms and standards for both thermal and non-thermal HCRW treatment technologies;
• Ensuring that all HCRW treatment facilities in operation are registered / permitted and in compliance with the required standards and that those facilities that are not in compliance, be upgraded or shut down;
• Securing sufficient compliant treatment capacity at affordable rates;
• Allow for incineration temperatures to be high enough to ensure killing of pathogens in waste residues as well as from the air emissions;
• Ensuring acceptable ambient air quality contributions are achieved by limiting emissions and securing the adequate dispersion of flue gasses / emissions;
• Considering the potential and cost implications for future upgrading when installing new HCRW treatment facilities, both in terms of capacity as well as environmental compliance;
• Ensuring that HCW incineration be limited to such categories of HCRW that are to be incinerated for the sake of disinfection and that HCGW be disposed of on an appropriate waste disposal sites without any form of burning;
• Introducing control systems and the provision of appropriate training for HCRW treatment facility staff.

Disposal:
• Ensuring appropriate disposal of residues from various HCRW treatment processes;
• Ensure that placenta pits, whilst for the interim still to be used at clinics, are positioned in such a way that it will not impact on any underground potable water sources.

Monitoring:
• Ensuring effective monitoring of operational parameters, with uniform reporting to the regulatory authorities
• Developing guidelines for the safe disposal of mercury emanating from damaged thermometers, blood pressure meters and florescent light tubes;
• Ensuring compliance for handling and disposal of radioactive HCRW;
• Developing a strategy outside the HCW Management Plan for environmentally sound disposal of large animal carcasses (other than pets), particularly in the event of a disease outbreak that is resulting in the need for animals to be put down;
• Setting standards outside the HCW Management Plan for burial of human bodies in an environmentally sound manner, due to its high risk of subsurface water pollution.
15.1.3 Occupational Health and Safety Needs:

Box 3: Occupational health and safety needs.

The occupational health and safety needs are summarised as follows:

**Generation:**
- Ensure effective HCW segregation that will prevent injuries or infection to HCW management staff during HCW handling as a result of HCRW (and in particular sharps) being disposed of incorrectly;
- Evaluate the use of small scale needle destruction equipment for possible implementation where such equipment can be used effectively to destroy needles at source;
- Prevent the inclusion of HCRW in soiled linen, resulting in laundry staff being exposed to HCRW that is putting their health and safety at risk.

**Containerisation:**
- Design, manufacture, supply and effectively use an appropriate range of reusable and disposable HCW containers that will prevent injuries to and infection of workers, patients and visitors;
- Appropriately disinfect re-usable containers after every use.

**Internal Transport:**
- Transport HCW in a manner that will prevent spillage from containers, damage to property or injuries to workers;
- Ensure regular collection of all HCW generated, with special emphasis on frequent removal of pathological HCRW.

**Storage:**
- Provide suitable HCW storage areas, protected against the elements with safe and sheltered access, with effective security and access control that will prevent the need for HCW containers to be stored inside wards or where it is accessible to patients or visitors;
- Prevent prolonged storage of HCRW (in particular pathological HCRW) that can result in the release of odours and pathogens.

**External Transport:**
- Provide external HCRW transport that will ensure effective containment of the HCW along the route to prevent contact through spillage or access to such HCW by humans or animals;
- Reduce the risk of injuries or infection in the event of accidents by developing and implementing appropriate emergency procedures.

**Treatment:**
- Ensure effective access control at HCRW treatment facilities to prevent unauthorised entry;
- Ensure appropriate training of operating staff to allow for the safe use of HCW treatment facilities.

**Disposal:**
- Prevent disposal of poorly segregated HCGW, as well as untreated or poorly treated HCRW on waste disposal sites where humans or animals are at risk of coming in contact with it;
15.1.4 Organisational Needs

Box 4: Organisational Needs.

Regarding Organisational needs, the following items were listed:

**Generation:**
- Senior management of health care facilities are to be included in discussions around HCW management, in order for them to have a better understanding of the problems experienced and to ensure more appropriate budget allocations for HCW management service delivery;
- HCW management strategies should be integrated with other health care strategies by identifying any synergies that may exist between the different strategies;
- A HCW monitoring committee is to be established to ensure that the required HCW management objectives are met;
- Nappies and sanitary pads generated in hospitals are to be considered to be HCRW due to its quantities and the resulting concentration;
- Data on HCRW generation is not available from generators and health care facilities are to keep records of HCRW generation for reporting, budgeting and strategic planning;
- HCRW from mortuaries is to be addressed.

**Containerisation:**
- There is a lack of capacity in terms of staff involved in HCW, particularly due to the additional strain that HIV Aids put on the resources.

**Internal Transport:**
- Develop internal transport systems that will prevent HCW from contaminating a variety of areas throughout the health care facilities.

**Storage:**
- Provide internal storage areas where the HCW will be well secured and out of reach of patients.
and visitors.

External Transport:

- Enable authorities to control the movement of HCRW to and from neighbouring countries where more or less stringent HCRW treatment standards may apply;

- HCW management at clinics is problematic due to small volumes being generated as well as long transport distance to the nearest hospital where HCRW can be treated in bulk. Systems are therefore to be developed to render cost effective, yet safe, healthy and environmentally sound HCW management services at clinics;

- A tracking system is required in particular for body tissue and expired pharmaceuticals, with appropriate protocols put in place;

- The “duty-of-care” principal should apply where HCRW is handed over to a third party for treatment and disposal, or where a placenta is handed over to a mother for burial at home.

Treatment:

- Generate sufficient data and provide monitoring tools to plan the available HCRW treatment capacity in the short, medium and long term;

- Secure the establishment of sufficient compliant treatment capacity with optimum utilisation of available resources to enable closure of non-compliant facilities;

- The problem of some hospitals not being supportive of surrounding clinics in terms of HCRW from such clinics being treated by the hospital, is to be addressed;

- Private contractors service very few health care facilities in terms of HCRW management. The benefits of outsourcing HCW management service to specialist service providers is to be investigated as it could allow health care facilities to focus on their core business;

- Public clinics and hospitals could be included in one overarching HCRW management tender for uniformity in standards as well as for economies of scale;

- Sufficient legal and fiscal tools as well as tendering mechanisms are to be provided for HCRW management service delivery to public health care facilities;

- Where HCRW management services are outsourced, effective tender specifications as well as contract management is required to ensure that service standards are maintained as per the tender specifications.

Disposal:

- Local authorities are to become more actively involved in HCRW management service delivery and performance monitoring activities, irrespective of whether for HCRW or HCGW.

Monitoring:

- All relevant stakeholders are to be identified for participation in the consultation process;

- Clearly define the roles and responsibilities for executing as well as regulating authorities that deals with health and the environment respectively on national, provincial and local level;

- Develop and implement an effective registration and reporting system, recorded according to agreed categories and measured by mass, for HCRW generators, transporters and treatment facilities. Ensure that the required reports are submitted as and when required;

- Provide sufficient regulatory authority capacity, with trained staff to receive, audit, control and
manage registrations and reporting submitted, as well as for enforcement of legislation;

- Provide a management system that link permits, permit conditions and annual reports with registrations;
- Monitoring of facilities in terms of their HCW management standards are to be done extensively with reports compiled and remedial action taken where required. There is a need for performance monitoring and evaluation.

15.1.5 Equipment and Technical Needs

Box 5. Equipment and technical needs.

The equipment and technical needs are summarised as follows:

**Generation:**

1. Provide the required human and physical resources at health care facilities as well as at HCRW treatment facilities and ensure that realistic backup is provided for such resources;
2. Consider the quality of all products used for health care, as some poor quality disposable products issued at hospitals results in increased volumes of HCRW;
3. Modify nursing trolleys that are generally not equipped with brackets to contain HCRW and HCGW containers, since that is leading to HCW being collected in plastic liners tied to the trolley handles or open bowls / cardboard boxes placed on the trolleys.

**Containerisation:**

1. Set minimum standards, in consultation with representatives from health care facilities that will ensure safe containerisation of HCW by providing appropriate HCW containers of a good quality. The HCW containers currently used vary significantly in terms of type, appropriateness and quality, without any guidelines being followed for uniformity in systems;
2. Ensure that HCW management equipment is designed and selected by health care professionals in accordance with their needs;
3. People in health care facilities that are on the operational level of HCW management should be included in tender document drafting and tender review processes, should HCW management services be outsourced. Also keep them informed about the terms and conditions of the final contract to allow them to do effective contract management subsequent to the award of service contracts;
4. Address stock management and procurement problems which in some instances lead to plastic liners (intended to be used as a particular colour bin liner) or sharps safety boxes not being available;

**Internal Transport:**

1. Provide appropriate trolleys for internal transport of HCW to prevent HCW containers from having to be carried manually between the source and the storage / treatment area. Trolleys are to be designed to limit the manual handling of HCRW and reduce the risk of damage to containers that could result in spillage.

**Storage:**

1. Provide appropriate internal and/or external HCW storage facilities that will prevent patients and visitors from being exposed to HCW and ensure safe and effective access for internal transport of HCRW between the generation areas, intermediate storage areas, collection areas and treatment areas. Also provide appropriately designed HCRW storage at HCRW transfer and/or treatment facilities;
2. Pathological HCRW is to be refrigerated or preserved if stored for extended periods of time before treatment and disposal;
3. Prevent uncontrolled dumping of HCGW outside health care facilities by providing suitable bulk
HCGW storage facilities that is compatible with municipal waste collection vehicles.

External Transport:
1. Prevent the use of private cars, ambulances or open light delivery vehicles for transport of HCRW between clinics and larger hospitals or regional HCRW treatment facilities;
2. Provide safe and appropriately designed collection vehicles for HCRW transport that has enclosed loading bays and that are equipped with the required dangerous goods signage. Containers used for onsite HCRW storage should be compatible with the collection vehicles;
3. Provide appropriately designed collection vehicles for HCGW transport. Containers used for onsite HCGW storage should be compatible with the collection vehicles;
4. Ensure that HCGW collection, transport and disposal services are rendered by municipalities;
5. Develop transport systems that are appropriate for the particular application and by which HCW can be transported between the source and the treatment / disposal facility in a cost effective manner;
6. Provide appropriately refrigerated vehicles where HCRW is to be transported over long distances;
7. Provide appropriately positioned, designed and operated HCRW transfer facilities where HCRW is to be bulked up for collection with bigger vehicles for long distance transport.

Treatment:
1. Locate HCRW treatment facilities in accordance with the type of HCRW treatment technologies being used;
2. Ensure availability and accessibility of appropriate and environmentally sound HCRW treatment facilities that will prevent the use open pit or “fireplace” incinerators, which results in ineffective disinfection of HCRW as well as the emission of amongst others hazardous dioxins and furans;
3. Ensure that any new HCRW treatment facilities installed will be upgradeable to meet the air emission standards ultimately aimed for in Kenya.

Disposal:
1. Address the poor standard of development, management and control at municipal waste disposal sites for it to become suitable for the disposal of HCGW as well as delisted HCRW residues, thereby preventing onsite burning and disposal of HCGW and HCRW residues at health care facilities;
2. Provide appropriately designed, constructed and operated hazardous waste disposal site(s) in Kenya for the disposal of amongst others hazardous HCRW residues.

Monitoring:
1. Personal Protective Equipment (PPE) is to be made available and the effective use thereof enforced, since PPE is not always available for people having to handle HCRW, thereby increasing the risk of needle prick injuries and infection;
2. Provide monitoring equipment for the detection of radioactive HCRW at treatment facilities where such HCRW could be present, in order for it to be sent back to the generators that are required to ensure that it is safely disposed off;
3. Ensure effective and regular maintenance of equipment to avoid the need for frequent replacement.

15.1.6 Financial Needs


The following financial needs were identified:

Generation:
1. Ensure existence of sufficient financial incentives for health care facilities to optimise the HCW segregation and use of equipment;
2. Introduction cost effective HCRW management systems to health care facilities that are healthy, safe and environmentally sound;
3. Ensure senior management awareness of the negative effects that poor HCW management has
on health care service delivery and support for improved HCW management, as this is ultimately reflected in the funds allocated in the budget for HCW management;

- Generate information on HCW generated for effective budgeting, particularly where injections resulting from family planning and immunisation programmes significantly increase the number of sharps being generated;
- Identify all sources of HCRW to ensure that the required financial allowance is made for effective management, treatment and disposal of such HCW.

**Containerisation:**

- Make sufficient funds available for the required supply and maintenance (including disinfection) of appropriate HCW containers to all health care facilities;
- Facilitate the implementation of an appropriate pricing system that will facilitate accurate data recording whilst preventing overloading of containers, should HCW management services be outsourced.

**Internal Transport:**

- Make the required funds available for the supply and maintenance of appropriate trolleys to be used for internal transport of HCW.

**Storage:**

- Make the required funds available to provide internal and / or external HCW storage facilities at health care facilities and treatment facilities, that will prevent the risk of physical contact or the spread of pathogens to humans or animals;
- Make the required resources available for the ongoing maintenance, including cleaning and disinfection, of HCW storage areas.

**External Transport:**

- Develop and implement cost effective HCW management systems with appropriate logistics that can accommodate small volumes of HCW being transported over long distances between HCW generators and treatment / disposal facilities;
- Level the playing field by setting uniform standards for HCW management and do effective internal segregation of HCW to draw a more realistic comparison on the costs for onsite treatment versus outsourcing of HCRW management services;
- Assist rural areas in buying vehicles that complies with legislation related to road transport of HCRW;
- Ensure effective allocation and management of available resources that will ensure HCW management standards are not deteriorating towards the end of the financial year.

**Treatment:**

- Ensure that the standards set are meeting the environmental, health and safety requirements whilst being affordable, to give effect to the right of all citizens to have a clean and healthy environment, whilst having access to affordable health care services;
- Ensure sufficient funding to public health care facilities to be able to render environmentally sound HCRW treatment onsite or alternatively to enter into affordable, yet environmentally sound, HCRW management service agreements with outside service providers;
- Ensure the commissioning and operation of financially viable and environmentally sound regional HCRW treatment facilities that will enable the closure of non-compliant, poorly designed facilities.

**Disposal:**

- Although it is sensible for the hospitals to provide a service to the smaller HCW generators, fair payment should be recovered for such services. General Practitioners sometimes take HCRW generated at their private practices to hospitals for treatment and disposal at the cost of the hospital;
- Exercise more effective control over waste disposal sites in order to generation an income for local authorities, which should in turn be used to upgrade the standard of infrastructure and operations at the waste disposal sites.

**Monitoring:**
Ensure sufficient funding for regulating authorities to undertake the required registration, permitting and auditing functions;

Although it is appreciated that there is a need for a drastic improvement in the current state of HCW management in Kenya, the available funding is insufficient to address all of the problems in the short term and an Action Plan for systematic improvement, starting with the most critical aspects, is therefore required.

15.1.7 Legislative Needs

Box 7. Legislative Needs.

The most important legislative needs are as follows:

**Generation:**

1. Develop and agree through consultation on a national HCW Management Policy for Kenya that will inform all further actions from the national level down to individual HCW generators as well as service providers;
2. The duty-of-care principle is to be introduced that will ensure that any party generating HCW will be held liable for the appropriate treatment and disposal thereof. Even if such services are outsourced, the generator of the HCW should remain responsible for ensuring that the treatment and disposal is ultimately undertaken in accordance with set standards and regulations;
3. Provide measures that will prevent victimisation of law enforcement officers taking action against senior managers in public or private health care facilities, making themselves guilty of contravening HCW management legislation on Environmental or Occupational Health and Safety grounds.

**Containerisation:**

1. Regulate the required minimum standards for containerisation of HCW to protect the health and safety of all persons coming in contact with containerised HCW.

**Internal Transport:**

1. Ensure the required minimum standards for internal transport of HCW is in compliance with existing Occupational Health and Safety standards.

**Storage:**

1. Regulate the required minimum standards for storage of HCW to protect the health and safety of patients, visitors and staff.

**External Transport:**

1. Authorities to control the export / import of HCRW generated inside / outside of Kenya and neighbouring countries for treatment / disposal at facilities that may be allowed to operate at reduced environmental as well as occupational health and safety standards;
2. Legislation dealing with the transport of hazardous substances is to be complied with for vehicles that are to be used for the transport of HCRW.

**Treatment:**

1. Authorities to be guided in terms of the requirements and standards that should be set as permit conditions as well as performance monitoring procedures required subsequent to commissioning of HCRW treatment facilities;
2. Authorities to be able to demand adjustment and renewed application for permitting in case of non-compliance or development of the “Best Practical Environmental Option” (BPEO).
3. Authorities to be able to decline applications for establishing treatment capacity / facilities if government assesses there is sufficient compliant capacity in place.

**Disposal:**

1. Authorities to be able to prosecute people that illegally dispose of untreated or poorly treated HCRW in any area or facility, including landfills, not designated for the that purpose;
A regulation is to be developed outside of the HCW management Plan on the disposal of large animal carcasses.

Monitoring:

- Promulgate requirements for the registration and / or permitting of HCRW generators, transporters, treatment and disposal facilities and ensure compliance with the permit conditions;
- Authorities to be able to prescribe the use of a particular HCRW reporting and record-keeping system by HCRW generators, transporters, treaters and disposers;
- Authorities to be able to insist on effective implementation of external performance monitoring and reporting by permit holders, using accredited laboratories and approved monitoring systems;
- Address the lack of legislation on all spheres of government that should effectively deal with HCW management through uniform standard setting.

15.1.8 Information and Awareness Needs

Box 8. Information and awareness needs

The following are information and awareness needs:

Generation:

- Implement extensive training on HCW segregation and containerisation, as that is currently not effectively done. General infectious HCRW and HCGW are mostly mixed, with sharps often disposed of in any of the HCW streams. Clinics were found to be recapping needles and separating needles from syringes in an attempt to save on the amount of HCRW sharps generated. There is a need to improve the standard of HCW segregation for safer management and more cost effective treatment and disposal of the respective HCW streams;
- There is a need for separation of ampoules from infectious sharps;
- Pressurized containers are to be separated from the HCRW stream;
- Adjust the curricula of training institutions to include training on HCW management;
- Address the lack of awareness on the purchase of environmentally friendly products (green procurement);
- Clarify the roles and responsibilities in terms of HCW management for the various staff members;
- Empowerment at health care facilities should not only be on operational level, but also on management level.

Containerisation:

- Codes / guidelines from other developing countries are to be considered for interim use in Kenya until national HCW management Guidelines are developed;
- Staff should be trained not to overfill HCRW containers;
- Colour coding for HCRW containers needs to be standardised and effectively used since the variety of colours currently in use creates confusion amongst health care staff as well as HCW management workers.

Internal Transport:

- Address the vast amount of ignorance amongst HCW workers in terms of the risks associated with inappropriate HCRW management through formal and refresher course training programmes;
- Provide awareness and capacity building materials to HCW management staff, supplemented by the required guidance.

Storage:

- Develop a culture for HCRW and HCGW containers to be well marked and separated when stored within the storage areas in order to prevent unintentional mixing of the 2 HCW streams.
External Transport:
- Provide training on the safe handling and loading of HCRW containers;
- Develop and communicate an emergency procedure that is to be implemented in the event of spillage or a traffic accident.

Treatment:
- Hospital staff should be informed that foodstuff, together with other consumable items coming from isolation wards, should all be treated and disposed of as HCRW;
- Provide formal training followed by refresher courses for staff operating HCRW treatment facilities, thereby improving the efficiency with which HCRW is treated;
- Develop and communicate an emergency plan that is to be implemented in the event of spillage or an accident at the treatment facility.

Disposal:
- Provide public training and awareness programmes that will prevent illegal dumping of HCGW as well as untreated or poorly treated HCRW on unauthorised waste disposal sites.

Monitoring:
- Provide sufficient human and material resources and monitor the development and effective implementation of capacity building and training programmes for all stakeholders, to address the limited awareness on all aspects related to HCRW management as well as the potential impacts of HCRW on humans and the environment;
- Improve the skills and awareness of planning and enforcement officers.

15.1.9 Public Health Needs

Box 9. Public Health Needs

The public Health needs are:

Generation:
- Prevent patients, visitors and uninformed workers from having access to HCRW within health care facilities and within wards in particular;
- Prevent small HCRW generators from creating a risk to society through poor HCRW management practices of uncontrolled disposal of HCRW (in particular sharps) into the domestic waste stream;
- Set HCW management standards for people undertaking traditional circumcision.

Containerisation:
- Ensure that adequate minimum standards and guidelines are in place to avoid spillage and leakage due to the use of unsafe containerisation and packaging for HCRW.

Internal Transport:
- Ensure that HCW is internally transported under supervision and that such HCW is not left unattended by HCW collectors.

Storage:
- Prevent patients and visitors from having unobstructed access to the sluice rooms / areas where HCRW is stored.

External Transport:
- There is no system currently in place to do the collection of HCRW from small HCRW generators like general practitioners, traditional healers and home based care;
- Prevent the use of passenger vehicles or ambulances for transportation of HCRW from clinics to central hospitals where it is to be treated.

Treatment:
- Reduce emissions from existing poorly performing and poorly sited HCRW incinerators and burning pits and ensure environmentally sound siting of new HCRW treatment facilities.

Disposal:
1. Prevent disposal of untreated HCRW in the general waste stream, thereby reducing the exposure to HCRW for the waste collectors, waste recyclers and litter pickers;
2. Introduce mechanisms that can accommodate cultures like a tradition for placentas to be buried at home, whilst at the same time ensuring the health of people potentially affected with recognition being given of the potential risks of pathological waste being used by traditional healers;
3. Ensure that residues from incinerator and autoclave HCRW treatment facilities only be disposed of on well controlled waste disposal sites that are immediately covered to prevent informal reclaimers from coming in contact with the disinfected, but dangerous sharps items.

**Monitoring:**

1. Monitor and control illegal dumping of untreated or poorly treated HCRW.
Glossary

**Action Plan.** Is the process of drawing up a scheme for defining targets, methods, tasks, responsibilities, timing, control procedures and the results expected. In this document the HCW Short-Term (Phase 1) Action Plan covers 1.0 years (alternatively 2.0 years), Medium-Term (Phase 2) Action Plan 1.5 years (alternatively 3.0 years) and the Long-Term (Phase 3) Action Plan 2.5 (years alternatively 5.0 years), based on the Action Plan implementation date of 1 January 2006. Phase 4 will be the ongoing monitoring and control that is required subsequent to the completion of Phase 3.

**Awareness.** Raising of awareness of HCW in specific and defined target groups e.g. communities, litter pickers and households. Implemented by means of instruments like awareness campaigns, folders, public meetings, television spots, etc. The term is normally not used in relation to formal training programmes.

**Bracket.** A device for holding a disposable container such as a Sharps Container or a Specican Container.

**Chemical Waste.** Expired pharmaceuticals from pharmacies at HCFs, HCRW from oncological wards, cytotoxic waste, and other chemical waste generated at health care facilities. Chemical Waste includes liquids and solids and can include flammable substances.

**Container.** A bag, or a puncture resistant and leak resistant container in which HCW is placed. Containers may be reusable or disposable.

**Containerisation.** The packing and storing of HCW in dedicated containers specially designed and manufactured for the purpose, thereby ensuring the minimum risk of infection or injuries to persons responsible for handling the HCW.

**Controlled combustion treatment.** Any method, technique or process for microbial inactivation or for otherwise altering the biological, chemical or physical characteristic of HCRW so as to render the material unrecognisable and render all sharps unusable, and ensure that all blades are broken, and in order to reduce the hazards which the HCRW presents and to facilitate disposal by means of, typically, a controlled combustion technology.

**Cradle-to-grave.** A policy of controlling a HCRW from its inception to its final disposal.

**Disinfection.** Treatment aimed at reducing the number of vegetative microorganisms to safe or relatively safe level.

**Disposable Container.** Disposable Containers shall include the following: Sharps Containers, including containers for long sharps; Specican Containers for pathological waste; Red liners for general infectious waste; Black liners for HCGW.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Domestic HCRW generator.</td>
<td>A household or other facility which generates reasonably minimal quantities of HCRW, such as plasters, bandages, nappies or sanitary pads, during the course of daily life; but does not include households or facilities which generate HCRW such as sharps waste, or households where there is one or more chronically ill persons requiring the use of equipment such as a dialysis machine.</td>
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<tr>
<td>Duty-of-Care principle.</td>
<td>Means the principle through which generators of HCW remain responsible for the healthy, safe and environmentally sound management of such HCW, from the point of generation through all required processes to its final disposal. Using a third party to undertake certain HCW management activities required does not relieve the generator of his / her responsibilities in terms the duty-of-care principle.</td>
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<tr>
<td>Exposure.</td>
<td>The intake of radiation or pollutant by organisms present in a particular environment (i.e. human, natural), which represents a potential health threat to the living organisms in that environment.</td>
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<tr>
<td>Flue gas (or exhaust gas).</td>
<td>Gases and suspended particles emitted from an incinerator or industrial stack or generally through a chimney.</td>
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<tr>
<td>Framework Strategy and Action Plans.</td>
<td>Conceptual or draft strategy and action plans on an outline basis also dealing with the short term and urgent HCW Management needs for Kenya.</td>
</tr>
<tr>
<td>General Infectious Waste.</td>
<td>Means Infectious Waste, other than Sharps and Pathological Waste, which is suspected to contain pathogens and normally causes, or significantly contributes to the cause of increased morbidity or mortality of human beings. It <em>inter alia</em> includes items such as blood, contaminated dressings, contaminated diapers or any other disposable items suspected of being infectious.</td>
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<tr>
<td>Genotoxic waste.</td>
<td>Includes certain cytostatic drugs, vomit, urine, or faeces from patients treated with cytostatic drugs, genotoxic substances or chemicals that have mutagenic, teratogenic or carcinogenic properties.</td>
</tr>
<tr>
<td>Health Care Facility (HCF).</td>
<td>Means a national hospital, provincial general hospital, district hospital, health centre, dispensary, mortuary or any other HCF that generates HCW.</td>
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<tr>
<td>Health Care General Waste (HCGW).</td>
<td>The non-hazardous component of HCW and can include liquids, but excludes any HCW generated from isolation wards;</td>
</tr>
<tr>
<td>Health Care Waste (HCW)</td>
<td>The combination of HCGW and HCRW.</td>
</tr>
<tr>
<td>Health care waste generator.</td>
<td>Any person, whose acts or processes produce HCW</td>
</tr>
<tr>
<td>Health care risk waste disposal facility.</td>
<td>Any site or premises including a landfill site (when treated) used for the ultimate disposal of HCRW.</td>
</tr>
</tbody>
</table>
Health care risk waste transfer station. Any person who receives but does not treat HCRW. HCRW transporters who store HCRW are also HCRW transfer stations;

Health care risk waste treatment facility. Any premises where HCRW is treated.

Health care risk waste Vehicles. Vehicles used by the HCRW transporter to transport HCRW.

Home based care. Provision of health services by formal and informal caregivers in the home in order to promote, restore and maintain a person’s maximum level of comfort, function and health, including care for the duration that that person suffers from an illness or disease.

Incineration. A form of both treatment and disposal. It is the controlled burning of solid, liquid or gaseous combustible wastes to produce gases and residues containing little or no combustible materials such as carbon dioxide and water.

Infectious agent. Any type of micro organisms including, spores, bacteria, fungi, parasite, or virus that normally causes, or significantly contributes to the cause of, increased morbidity or mortality of human beings.

Infectious waste. HCRW which is suspected to contain pathogens and which normally causes, or significantly contributes to the cause of increased morbidity or mortality of human beings, and includes but is not limited to sharps waste and anatomical waste; but excludes baby-nappies and sanitary pads.

In-service training. The training provided by the party in the HCF responsible for organising training programmes for HCW workers, nurses and doctors.

Institutions. Governmental as well as non-governmental bodies actively involved in HCW management and that will have a contribution to make towards achievement of both the Immediate Objectives as well as Development Objective.

Integrated. Refers to a system where all elements of the system interacts, for instance by ensuring that in avoiding pollution of one media, it will not be at the expense of another media.

Integrated Health Care Waste Management. Is a holistic and integrated course of action that specifies the institutional, infrastructural and technological support, as well as human and financial resources required to establish and implement an integrated HCW management Action Plan.

Internal transport. The movement of HCRW from one point within any premises or facility to another point within that facility.

Landfill. To dispose of waste on land, whether by use of waste to fill in excavations or by creation of a landform above grade, where the term ‘fill’ is used in the engineering sense.

Leachate. Liquid from a landfill containing substances that were present in the waste,
<table>
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<tr>
<th><strong>National Health Care Waste Management Plan 2006-2015</strong></th>
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<tbody>
<tr>
<td>either as liquid or as solids, and were dissolved by the water passing through the waste.</td>
<td></td>
</tr>
<tr>
<td><strong>Manifest System.</strong></td>
<td>A system for documenting and controlling the fate of HCRW from “cradle-to-grave”.</td>
</tr>
<tr>
<td><strong>Major generator.</strong></td>
<td>A HCRW generator that generates more than 10 (ten) kilograms per day of HCRW calculated as a monthly average.</td>
</tr>
<tr>
<td><strong>Micro-organisms.</strong></td>
<td>Any microbiological entity, cellular or non-cellular, capable of replication or of transferring genetic material.</td>
</tr>
<tr>
<td><strong>Minor generator.</strong></td>
<td>A HCRW generator that generates up to 10 (ten) kilograms per day of HCRW calculated as a monthly average, but does not include a domestic HCRW generator.</td>
</tr>
<tr>
<td><strong>Monitoring.</strong></td>
<td>Continuous or periodic surveillance of the physical implementation of a project to ensure that inputs, activities, outputs and external factors are progressing according to plan.</td>
</tr>
<tr>
<td><strong>Municipal solid waste.</strong></td>
<td>General waste for collection by municipalities, generated mainly by households, commercial activities, non-hazardous industrial activities and street sweeping.</td>
</tr>
<tr>
<td><strong>Non-combustion treatment.</strong></td>
<td>Any method, technique or process for microbial inactivation or for otherwise altering the biological, chemical or physical characteristic of HCRW so as to render the HCRW unrecognisable and in order to reduce the hazards it presents, and facilitate disposal by any means of technology which does not constitute controlled combustion treatment, including but not limited to autoclave treatment.</td>
</tr>
<tr>
<td><strong>Occupationally healthy and safe.</strong></td>
<td>Refers to the need for the implementation of the Action Plan without putting the health and safety of the workers, the patients or the general public at risk.</td>
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<tr>
<td><strong>Operationally practical.</strong></td>
<td>Refers a HCW management system within which practical operations can be conducted in the most efficient manner.</td>
</tr>
<tr>
<td><strong>Output.</strong></td>
<td>The tangible results that can be guaranteed by the project as a consequence of its activities.</td>
</tr>
<tr>
<td><strong>Pathological waste.</strong></td>
<td>Pathological waste includes tissues, organs, body parts, human foetuses and deceased animals infected with zoonotic diseases, blood, and body fluids, but excludes teeth, hair and nails.</td>
</tr>
<tr>
<td><strong>Performance testing.</strong></td>
<td>The testing conducted at a non-combustion HCRW treatment facility prior to the facility being issued with an authorisation in terms of the Kenyan HCRW Management Regulations, which testing is carried out using typical and representative HCRW or a challenged load.</td>
</tr>
<tr>
<td><strong>Pharmaceutical waste.</strong></td>
<td>All pharmaceutical products and medicinal chemicals that are no longer usable in patient treatment and which have been returned to patient care areas, and that have become outdated or contaminated or are no longer required, and</td>
</tr>
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</table>
items contaminated with cytotoxic pharmaceuticals.

**Polluter Pays principle.** The principle of any person or party responsible for the generation of waste or pollution, to be held responsible for all costs associated with the environmentally sound treatment and disposal of waste generated, or for the remediation of pollution that already occurred.

**Pyrolysis.** The decomposition of organic material by heat in the absence of, or with limited supply of oxygen.

**Radioactive waste.** Material that contains, emits, exhibits or being contaminated with radionuclides at concentrations or activities greater than clearance levels and for which no use is foreseen. Radioactivity substances must be disposed of in particular in accordance with the EMCA that regulates radioactive substances used for medical, scientific and industrial purposes.

**Residue.** Any solid or liquid product derived from the treatment of HCRW at the treatment plant such as ash or slag.

**Risk.** The scientific judgement of probability of harm.

**Sanitary landfill.** An engineering method of disposing of solid waste on land in a manner that protects the environment, e.g. by spreading the waste in thin layers, compacting it to the smallest practical volume, and covering it with soil by the end of each working day, constructing barriers to infiltration, evacuating the gases produced, etc.

**Scavenging / picking.** The manual sorting of solid waste at a landfill or at other places where waste is dumped, and recovering the valuable (recyclable) materials.

**Segregation.** The systematic separation of solid HCW into designated categories of HCGW and HCRW respectively.

**Sharps container.** A disposable puncture resistant container which, when sealed, cannot be opened without great difficulty, and which is spill proof under normal handling conditions, used for the storage and transport of infected sharps items.

**Sharps safety box.** A disposable cardboard container that provides limited resistance to puncturing, with limited ability to prevent spillage under normal handling conditions, used in the absence of sharps containers for the storage and transport of infected sharps items.

**Sharps HCRW.** Includes any device having acute rigid corners, edges, or protuberances capable of cutting or piercing, including, but not limited to, all of the following:

- Hypodermic needles, syringes, blades and needles with or without attached tubing; and
- Broken glass items, such as Pasteur pipettes and blood vials contaminated with HCRW.

**Sludge.** The accumulated solids that separate from liquids such as water or wastewater during processing, or deposits on the bottom of streams or other bodies of
Specican Container. A disposable puncture resistant and leak resistant container which, when sealed, cannot be opened without great difficulty, and which is spill proof under normal handling conditions, used for the storage and transport of infected pathological waste or waste generated in isolation wards.

Sterilisation. A reduction in micro-organisms of more than $10^6$ (more than 99.9999% of the micro-organisms are killed), achieved by physical, chemical or mechanical methods or by irradiation.

Storage. The holding of HCW in a manner that does not constitute treatment or disposal thereof.

Strategy. A broad course of action designed to make the best use of resources and opportunities and to offer the best prospect of achieving the defined objectives whilst dealing with the risks that may be involved in the course of action.

Sustainability. A sustainable project should lead to improvements that will persist and spread beyond the project boundaries. Hence, any donor-financed project should create structures and solutions that will remain institutionally, economically, socially and environmentally viable when the external assistance comes to an end.

Technical Specifications. Specifications designed and developed to lay down the specific and uniform rules to be adhered to and the requirements to be met in undertaking any particular activity related to HCW Management.

Tender Material. Tender material includes all relevant Conditions, Specifications, Schedules and Annexures required for contractors to be able to submit a tender for the sound execution of any function to be undertaken in the HCW management process, developed for use to meet the needs of any number of sites or facilities.

Tracking document. HCW tracking documents are used for the tracking of HCRW from the point of generation (source) to the treatment plant, thereby ensuring adherence to the duty-of-care principle that is to ensure the healthy, safe and environmentally sound management, treatment and disposal of all HCRW generated.

Transport Operator. A person, organisation, industry or enterprise engaged in or offering to engage in the transportation of HCRW. A transport operator shall be registered with the provincial government as well as the local authorities in whose area of jurisdiction it proposes to operate.

Treatment. Any method, technique, or process designed to change the biological character or composition of any HCRW so as to eliminate its potential for causing disease, pollution impact on the environment or risk to health.

Treatment Plant. The plant or plants used to treat HCRW.

Verifiable Indicators. Mechanisms used to monitor the success with which activities, outputs and objectives are fulfilled.
Waste Information System (WIS). A system developed for ongoing recording and reporting of all HCRW generated, transported and treated in Kenya.

Waste management. All activities, administrative and operational, associated with the handling, transport, storage, treatment and disposal of HCW. Where applicable, this also includes the supply, distribution and maintenance of all disposable as well as reusable containers.

Waste Management System. Means collectively the supply of disposable containers, supply of reusable containers, the collection, transport, treatment and disposal of HCW.

Waste Officer. Means for each HCF a person appointed and authorised to verify and sign the registration sheet, also being the transport operator’s contact person at HCF level.

Zoonotic disease. Is a disease that can be spread from animals to humans.
References

Annex A. Health Care Facilities Visited

A.1 Health Care Waste Management for Selected Health care Facilities in Kenya

This section illustrates the findings with regards to HCW management in selected HCFs in Kenya. It gives a detailed description of the general statistics of the facility including institutional and organisational structure, the type of wastes generated and how the wastes are managed. This section also provides the findings of the quantities of HCRW that were weighed for a period of one week to ascertain quantities of wastes generated.

A.1.1 Kenyatta Hospital-Nairobi

Kenyatta National Hospital, the only National Health Care Facility in Kenya and was formerly called King George. The hospital is a 10-storey building that is divided into 4 wings. The Hospital has a total of 1 800 beds, of which 1 600 are in the general wards and the remaining 200 in the private wards, making it the biggest hospital in East and Central Africa. The occupancy rate in general is in excess of 100% with people having to be placed on separate mattresses. The hospital has 41 units which include a burn unit, a cancer treatment unit as well as an X-ray unit. The total workforce at the hospital is approximately 5 000 people.

The full Health Care Waste (HCW) stream (all possible categories) is generated at Kenyatta National Hospital, which is the biggest single producer of HCRW in Kenya; All Health Care Waste (HCW), which includes both Health Care Risk Waste (HCRW) as well as Health Care General Waste (HCGW), is treated and disposed off on the hospital premises. Radioactive waste is however removed from the hospital site. The HCRW incinerator in use at hospital is over 30-years old and although there is an identical unit used as backup, that unit is no longer operational. The situation is very difficult to manage at times when the remaining incinerator breaks down, since there is no other facility available in Nairobi that can deal with the amount of HCRW generated by Kenyatta National Hospital;

Kenyatta National Hospital has developed a HCW management strategy. The strategy was developed to provide direction on the way in which HCW is to be managed over the following 5 years. According to the written hospital guidelines, HCW from Kenyatta National Hospital is segregated into 6 main categories, all of which is treated and disposed off onsite: The categories are as below;

Table 6. Categories of waste generated from KNH

<table>
<thead>
<tr>
<th>Category of Waste</th>
<th>Examples</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharps</td>
<td>Needles and syringes, razor and scalp blades, broken ampoule bottles etc. Any waste capable of puncturing skin.</td>
<td>All syringes in 5 and 20-litre jerry cans.</td>
</tr>
<tr>
<td>Pathological Waste</td>
<td>Amputations, histological specimen, biopsies, and autopsies, rejected blood, placentas, foetuses, “tissue organs”.</td>
<td>Placentas macerated; others stored in red bins with red liners.</td>
</tr>
<tr>
<td>Clinical waste</td>
<td>Used gloves, soiled cotton, wool, bandages, POPC, pads, giving lines.</td>
<td>Yellow dustbins lined with yellow liner bags.</td>
</tr>
<tr>
<td>General waste</td>
<td>Unsold cartons, papers, pieces</td>
<td>Black dustbins lined with black</td>
</tr>
<tr>
<td>Waste Type</td>
<td>Description</td>
<td>Container Type</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Wood</td>
<td>Wooden, broken bottles</td>
<td>Liner bags</td>
</tr>
<tr>
<td>Food remains</td>
<td>Food left overs, peels, etc.</td>
<td>White dustbin lined with white liner bags</td>
</tr>
<tr>
<td>Cytotoxic waste</td>
<td>Expired, unfinished drugs</td>
<td>20 litre buckets “tilly buckets”</td>
</tr>
<tr>
<td>Radioactive waste</td>
<td>Removed from the hospital</td>
<td></td>
</tr>
</tbody>
</table>

Kenyatta National Hospital reportedly has a written Policy on HCW management for the hospital. A copy of such a document could not be obtained; A Solid Waste Management Officer as well as Public Health Officers were appointed to oversee the effectiveness of HCW management in the hospital. The hospital generates its income by means of a lump sum national grant as well as payments by patients. Although there are no allowance made for HCW management on the national budget, Kenyatta Hospital makes provision for HCW management in its annual budget.

**Training and awareness**

Kenyatta National Hospital conducts at least 4 formal HCW Management training sessions per year, with particular emphasis on the importance of effective HCW segregation at source. HCW management training is done formally as well as in service with infection control training being done monthly, consisting of 2 hour training sessions. Although there are some training sessions with all disciplines attending the same training, there are other sessions when groups are split according to disciplines;

Other than a few photo copied notices on appropriate HCW segregation positioned above some of the HCW containers, no HCW awareness or training posters have been observed in the hospital. Such black and white photocopies are normally not attracting a lot of attention.

**HCW segregation and containerisation**

All reusable HCRW and HCGW containers used in the hospital is disinfected at regular intervals. The study has found out that HCW is not properly segregated in the wards. HCRW containers, and in particular sharps containers, are placed in areas where the patients and visitors have access to such containers.

Procurement problems are reportedly addressed upfront, thereby reducing the number of problems that result from unavailability of coloured plastic liners. It was however often found during the inspection to the wards that incorrect coloured plastic liners were used, which was blamed by staff on the unavailability of the correct liners from the central stores.

HCRW collected and transported in different coloured liners are placed on the floor in the passages, sluice rooms, the transfer area as well as outside the incinerator, resulting in possible contamination of such areas.

HCRW and HCGW containers are placed side by side, which tends to increase the occurrence of incorrect segregation. Some reusable containers were observed without liners, which were increasing the risk of contamination when reusable containers are not disinfected after every use.

There is no national standard set for colour coding of HCW containers or liners, which resulted in confusion when staff was transferred from one health care facility to another;
Sharps
Sharps are collected in 5-litre and 20-litre jerry cans, originating from chemicals delivered to the hospital. Since such containers could be manufactured from PVC, it could result in the possible emission of dioxins and furans during incineration. The hospital has a policy to dispose of needles and syringes as a single unit without recapping needles. Commercially available puncture proof and leak resistant (plastic) sharps containers are not used as it could cost in the order of Kshs. 200-500. Sharps were occasionally found amongst the soiled linen which created a health and safety risk for laundry workers. Sharps containers (jerry cans) were not closed when full, which was resulting in spillage of sharps when containers overturned. No brackets were provided for sharps containers against walls in selected areas or on nursing trolleys, which created the risk of overturning and spillage. It was observed that Sharps containers were often overfilled with sharp items protruding from the opening. Furthermore needles were found to be recapped and removed from syringes which is a dangerous practice due to the high risk of needle prick injuries.

Pathological wastes (other than placentas) are immediately moved from the source, through the internal transfer area, to the incinerator without interim storage. Placentas are however macerated before being disposed to sewer. It is uncertain as to whether the Nairobi City Council’s treatment facilities can accommodate the disposal of placentas to sewer by means of maceration; the macerator did not seem to be disinfected at regular intervals. Foetuses are taken to the mortuary for ultimate burial. Even though segregation was generally found to be poor, general infectious HCRW is collected in yellow dustbins with yellow liners. Although liners were tied to some nursing trolleys, there was no liner brackets provided against the walls in selected areas or on the nursing trolleys.

Expired medicines are returned to the central drug stores. Cytotoxic waste is collected in 20-litre buckets that are covered, sealed and labelled before dispatch to the incinerator. Radioactive liquid waste is stored onsite (behind lead protection shields) for its half-life, after which it is disposed to sewer. While liquid HCRW is disinfected with a chlorine-based product, before being disposed to sewer.

Florescent tubes were observed to be stockpiled outside the incinerator since there was no facility for the safe and environmentally sound disposal of old florescent tubes. The incinerator ash disposed off outside the incinerator was likely to contain heavy metals. Samples were taken for testing and taken to South Africa. The results are not yet available. HCGW, other than food remains, is disposed of in black liners that are placed in black dustbins. HCGW food remains from the kitchen and wards go into white liners placed within white bins. Such food remains are then transported to a central point from where a pig farmer collects it within the white plastic liners. The hospital received Kshs. 30 000 per month from the farmer for the pigsmeat collected. Visits to the wards indicated that the white liners placed within the wards contained very little foodstuffs and were mainly used for the disposal of HCGW.

Radioactive solid waste is removed by the supplier of the X-ray equipment, who is then charged with the responsibility for the environmentally sound disposal thereof. X-ray films were collected from the hospital for silver recovery. There is no dedicated isolation ward in the hospital, although a facility with 6-beds was available that could at short notice be converted into an isolation ward in the event of an outbreak of for instance Congo Fever or SARS.
Waste generation quantities

It was estimated that around:

- 800 – 1 200 kg of HCRW is generated daily;
- 800 – 1 000 kg of HCGW food remains is generated daily;
- 500 kg of other HCGW (excluding foodstuffs) is generated daily.

No form of reuse is implemented, other than the 5-litre and 20-litre jerry cans that are being used as sharps containers. Reuse of food waste used as pigswill can also be considered as reuse. There is no form of recycling of wastes other than the recovery of silver from the X-rays materials. The hospital is however investigating potential recycling opportunities. HCRW is transported from the wards to the sluice where it was placed and stored in 85-litre plastic liners.

The HCW bags are manually moved from the sluice to 2 dedicated elevators used for the transport of soiled linen, HCW and corpses. From the 2 dedicated elevators, the HCW is transported by trolley to an internal transfer area where the HCW is accumulated until such time that the tractor, with its open trailer, collects the HCRW and HCGW for transport to the onsite incinerator and onsite disposal site respectively.

![Plate 3 Transportation of HCW by tractor to the incinerator](image)

The internal transfer area is used for both HCRW as well as HCGW. The internal transfer is also used as a point of verification on the effectiveness of HCW segregation.

The hospital has a gate preventing members of public from getting access to the internal transfer area; however the effectiveness thereof is questionable. No cover (protection against the elements) is provided for the HCW stored in the open transfer area until collection. Even pathological waste (other than placentas that are macerated), are stored in this manner until when they are collected. It was however claimed that pathological waste was stored for a maximum period of 1 hour before it was removed for incineration.

There is a person responsible for doing ongoing mass recordings of all HCRW delivered to the transfer area. At the time of the visit, there was no HCW available to verify the mass recording process. Although limited, there were needle prick injuries reported due to sharps incorrectly disposed of in HCRW as well as HCGW plastic liners;

A tractor with open trailer is used to transport the HCRW and HCGW (combined but in different coloured bags) from the transfer area to the incinerator / disposal area (plate 3). Pathological wastes, other than placentas that are macerated, are also transported on the open trailer.
HCRW and HCGW are manually loaded at the transfer area. The HCRW are placed on top for manual removal thereof at the incinerator before the remaining HCGW is hydraulically tipped at the nearby disposal area for open burning. No incidents of scavenging during transport of HCW from the transfer area to the treatment / disposal areas were reported to date.

HCRW contained in red and yellow liners, together with 5-litre jerry can “sharps containers” are incinerated. The holding area where the HCRW is off loaded is not concrete lined, and does not provide no protection for the HCRW against the elements. There were clear signs of previous HCRW spillage not removed in the area.

The 30-year old HCRW incinerator unit (one of the two units is no longer operational) is of the double chamber type, but without any flue gas cleaning system. The incinerator is labelled as a silent glow incinerator and was supplied by NTG Ltd. Darlington: Serial number 03-03 59(Plate 5). The industrial oil fired incinerator’s operating temperature was reported to be 800 °C in the primary chamber and 1 200 °C in the secondary chamber. The incinerator capacity is 1-m³ in the primary chamber, which can accommodate approximately 8 plastic liners per cycle. Fans were used to direct the airflow during loading of the incinerator. The incinerator stack is relatively low (around 8-10 metres) which results in smoke being dispersed into a recently erected college lecture rooms immediately next to the incinerator.
Difficulties in obtaining the required spares and maintenance result in long delays during breakdowns when no HCRW can be incinerated, as there is no other facility in Nairobi with sufficient capacity to handle HCRW from Kenyatta Hospital. The lack of backup facilities result in HCRW being stockpiled until such time that the incinerator is operational. The government chemists as well as some of the surrounding hospitals are occasionally making use of the Kenyatta incinerator for treatment of HCRW.

Serious oil spillage was noticed in the area where amongst other incinerator oil was delivered by a truck. The situation is worsened by the fact that there are no spillage collection facilities provided to prevent such spillage.

The HCGW is transported in black bags, together with a number of red and yellow bags that is for some reason not offloaded at the incinerator holding area, but instead was put on fire once dumped on the disposal site adjacent to the incinerator as shown on plates 6). The uncontrolled burning of HCGW is resulting in complaints from neighbouring communities due to the emission of smoke.

Incinerator ash together with HCGW is disposed off on a daily basis on the informal dump adjacent to the incinerator. No chemical analysis of the incinerator ash has been done to date. Leachate from the dump (where HCGW is burnt and HCRW incinerator ash is disposed off) drains towards a nearby water stream.

No storm water diversion or polluted runoff control systems have been put in place at the waste dump and there are no design done for the installation of any liners. There is no scavenging as scavengers are not given access to the HCW dump.
Although there is always a risk of poorly segregated HCRW being present in the HCGW steam, thus making it desirable for such HCGW not to be accessible to scavengers on municipal waste disposal sites, the practice used to burn HCGW within built-up areas was not acceptable as it also resulted in the emission of dioxins and furans from the PVC within the HCGW stream;

A.1.2 Langata Health Center

The health centre is located in Langata and has a total of 27 beds in then maternity wing. The facility on average serves 1,700 outpatients per month. The health centre deals with HIV / AIDS, Family Planning and has a maternity ward that provides a 24-hour service to the public. The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, and placentas) and Health Care General Waste (HCGW). All HCW, which included both HCRW as well as HCGW, is “incinerated” and disposed of on the dispensary premises. Placentas are however removed from site by a private contractor who reportedly transported it to the city morgue for final disposal. On average there facility generates 14 placentas per month.

The Langata Health Centre serves as a KEPI (Kenya Expanded Programme on Immunization) Depot to various clinics for the supply of vaccines and sharps safety boxes. An ambulance is available at the dispensary to transport referral patients to the nearest suitable hospital.

There was reportedly no HCW management training available to Dispensary staff and no HCW awareness or training posters were observed in the health centre.

General infectious HCRW and HCGW is not segregated and disposed of in the same reusable open containers. All reusable containers used in the health centre is washed at regular intervals but not disinfected due to shortage of disinfectant. The health centre has sufficient stocks of sharps safety boxes (with the Dispensary serving as a KEPI Depot), however only black bags were supplied to the health centre. HCRW containers and in particular sharps containers, are placed in areas where the patients and visitors have access to such containers. All reusable containers are used without liners, which increases the risk of contamination when reusable containers are not disinfected after every use. There is no national standard set for colour coding, which results in confusion when staff was transferred from one health care facility to another.

Sharps are collected in 5-litre safety boxes that are issued as part of the KEPI programme. The policy in this health centre is to dispose of needles and syringes as single units without recapping of needles. Since the Dispensary serves as a KEPI depot, sharps safety boxes were readily available for use. Sharps containers (safety boxes) it was noted are not effectively closed when full, which could result in spillage of sharps when containers overturned. No brackets are provided for sharps containers against walls in selected areas or on nursing trolleys, thus creating the risk of overturning and spillage. Empty ampoules and vials are stored on the paved area adjacent to the incinerator with the intention of having it collected for recycling in future.

Blood is reportedly drained from placentas in the sluice (with the blood released to sewer) before being stored in an 85-litre bin with a black plastic liner. The bin is placed in the open area adjacent to the onsite brick incinerator where it is exposed to the sun. Placenta storage could reportedly be for a period of up to 2 weeks before a private contractor removes the plastic bag with placentas. Complaints are reportedly often received from neighbours about the odours generated during un-refrigerated storage of placentas.

General infectious waste is collected in a variety of open buckets without liners, before being carried to the onsite “incinerator” for treatment. The reusable HCRW containers are reportedly washed but not disinfected due to a shortage of disinfectant. (JIK® is primarily used as a disinfectant). Segregation of
HCW was generally found to be poor and there are no brackets provided against the walls in selected areas to place liners for collection of HCW. Expired drugs are reportedly returned to pharmacies from which they are issued. HCGW is mixed with general infectious HCRW when collected in the Dispensary.

The HCRW “incinerator” (which was at the time of visit out of service, resulting in another small facility being used onsite) was very small and more likely to be called a furnace. It can only destroy general infectious HCRW and HCGW that is easily combustible since it does not have any burners with any external fuel source. The small size of the “incinerator” prevents it from being used for the destruction of placentas (as there are no burners with external fuel sources) or sharps (as the facility would clog when large quantities of plastics are burnt).

The holding area where the HCRW is placed before “incineration” or removal by the placenta contractor does not provide protection against the elements. The “incinerator” stack is relatively low (approximately 4 metres) which resulted in the smoke being dispersed into the neighbourhood. The “incinerator” operator was not available to evaluate the use of Personal Protective Equipment (PPE). All general infectious HCRW and HCGW are “incinerated”.

The “incinerator” ash as well as the untreated sharps collected in the sharps safety boxes are disposed of in the sharps pits provided adjacent to the “incinerator”. Quite a number of fluorescent tubes were stored adjacent to the incinerator due to the unavailability of appropriate disposal mechanisms for such waste. A pit dug onsite was reportedly for the development of a placenta pit, but has never been completed or commissioned.

A.1.3 Woodley Dispensary

The Clinic located in Woodley, Nairobi Province has outpatients who were reportedly on average around 100 per day. The clinic is a Nairobi City Council Maternal Child Health and Family Planning centre.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (sharps,) and Health Care General Waste (HCGW). All HCW, which included both HCRW as well as HCGW, is disposed and burnt in a protected pit within the clinic premises. This Clinic serves as the main clinic to the local residents of Woodley estate. Most of their HCWM equipments including sharps safety boxes, protective gear and consumables are supplied by the Nairobi City Council.

There is reportedly no HCW management training available to health centrer’s staff and no HCW awareness or training materials were observed in the health centre. However there was orientation to disposal of waste according to the clinic’s guides, and this was done by the Clinical Officer in charge to all the newly employed staff. Waste is handled by domestic waste handlers employed by NCC for the Clinic.

General infectious HCRW and HCGW is not segregated and is disposed of in the same reusable open containers. All reusable containers used in the health centre is washed at regular intervals and disinfected through the use of JIK. The health centre has sufficient stocks of sharps safety boxes. HCRW containers and in particular sharps containers, are placed in areas where the patients and visitors have access to such containers. All reusable containers are used without liners, which increases the risk of contamination when reusable containers are not disinfected properly. There is no national standard set for colour coding, which results in confusion when staff was transferred from one health care facility to another.
Sharps are collected in sharps safety boxes that are issued by the provincial health offices. Sharps containers (safety boxes) it was noted are not effectively closed when full, which could result in spillage of sharps when containers overturned. No brackets are provided for sharps containers against walls in selected areas or on nursing trolleys, thus creating the risk of overturning and spillage. Empty ampoules and vials are thrown in the protected pit within the centres compound and later burnt.

No pathological waste a part from used blood samples is generated and which are burnt together with other wastes in the pit. General infectious waste is collected in a variety of open buckets without liners, before being carried to the onsite open air pit for disposal. The reusable HCRW containers are reportedly washed but not disinfected due to a shortage of disinfectant (JIK is primarily used as a disinfectant). Segregation of HCW was generally found to be poor and there are no brackets provided against the walls in selected areas to place liners for collection of HCW.

The general form of HCW treatment is through the use of disinfectant where waste blood is treated with disinfectant and placed in buckets before being thrown in the open pit. Used containers are also disinfected and rinsed before being reused. Other wastes were disposed in the pit and burn. No other form of treatment was observed or reported. All other wastes that are not pathological are dumped in the protected pit nearby and burnt. When the pit becomes full, it is buried and another pit dug for the same purpose. Plans have been underway for the development of an incinerator but funds have never been available for this purpose.

A.1.4 Acacia Medical Centre

Acacia Medical centre is located in Upper Hill area of Nairobi. This is an outpatient clinic with a patient flow of 120 on average per day. The facility has a lab, outpatient wing, and x ray department. Being a private clinic it’s visited by people from all over Nairobi and some are referred to the facility for specimen testing and investigation. The centre also accepts specimen from other facilities for investigation.

The management undertakes an informal training on handling of waste but there are no general rules governing HCW in the institution. The staff are aware of the dangers of HCW but there are no awareness creation materials within the facility.

Waste from the laboratory is mostly pathogenic and is handled separately from waste from other departments. Used sharps and syringes as a rule are placed in the sharp boxes provided by as private collector. Clinical waste from the outpatient department is placed in receptacles with liners. There is no colour coding of the liners.

Used sharps from the clinic and the lab are placed in the sharp boxes provided by the contracted private firm. These are different boxes as those used by public facilities. The boxes are tougher that the once provided by the government. The sharp boxes are produced by the private firm in their offices in industrial area. The facility pathological waste comes from the laboratory in form of specimen and samples. This waste is disinfected in sluice room and then drained through a sink that is connected to the sewer line.

Normal disinfection of specicans is done in house by washing with disinfectants and by Autoclaving before disposing in the liner bags. Disposal of waste from the facility is through a contracted private firm.
A.1.5 Kibera Community Self Help Programme-KICOSHEP

This Community Based facility founded in the early 1990's is located in Kibera, Mashimoni, the largest informal settlement in Kenya and sub-Sahara Africa. With a population of over one million people, this slum is ravaged by the HIV/AIDS pandemic, Kibera Community Self Help Group has been providing HIV/AIDS related intervention programmes in this slum for over a decade now including behaviour change, home care and support, Voluntary Counselling and Testing, and school feeding and nutrition programmes for Orphans and Vulnerable Children (OVC).

A.1.6 Kisumu District Hospital – Kisumu

The Hospital had a total of 186 beds with an occupancy rate in excess of 100% making it necessary to put some patients on the floor on mattresses. An average of 2,000 outpatients are treated every month. All Health Care Waste (HCW), which include both Health Care Risk Waste (HCRW) as well as Health Care General Waste (HCGW), is “incinerated”, except for placentas that are disposed of in the placenta pit and kitchen waste that is collected by the municipality for disposal at the landfill. Other than sharps that are containerised in sharps safety boxes and placentas that are carried directly to the placenta pit. No segregation of HCW is done at source. All remaining HCRW and HCGW are collected in the same containers. Amputations and radio-therapy are referred to the provincial hospital.

There is no existing budget line dedicated for HCW management. The hospital yard has been turned to storage of HCW

There is no HCW awareness or training posters. The cleaner removing HCW from the source wears PPE including latex gloves and a facemask. Although the gloves are able to prevent the spread of infection, it is uncertain what intervals the gloves were exchanged. They would however not have provided any protection against injuries. There are no reported cases of needle prick injuries in the hospital wards, although there are such incidents amongst HCW management staff in the HCW disposal area

All reusable HCW (HCGW combined with general infectious HCRW) containers are washed at regular intervals but not disinfected. It was however observed that cardboard boxes were inter alia reused for HCW collection, which could not be washed. No liners were used for any of the reusable containers, which increased the risk of contamination particularly since reusable containers were not washed and disinfected after every use. The reusable containers in use consisted of a variety of buckets, bowls, cardboard boxes, etc.

Sharps are collected in 5-litre safety boxes supplied by UNICEF. It was reported that there was no shortage of sharps safety boxes. The hospital has a policy reportedly to dispose of needles and syringes as single units without recapping of needles. Sharps containers (safety boxes) are not effectively closed when full which could result in spillage of sharps when containers overturn. Sharps containers it was observed were often overfilled with sharp items protruding from the opening.

It was found that HCW was not segregated in the wards, other than the sharps collected in safety boxes and placentas carried in buckets to the placenta pit. Sharps were however found to be disposed off in the general infectious containers. HCW containers, and in particular sharps containers, are placed in areas where the patients and visitors have access to such containers. There was no national standard set for colour coding of HCW containers and liners, which could resulting in confusion when staff was transferred from one health care facility to the next.

Needles were found removed from the syringes and recapped which is a dangerous practice due to the high risk of needle prick injuries. There were no brackets were provided for sharps containers against walls in selected areas or on nursing trolleys, which created the risk of overturning and
spillage. Sharps were occasionally found amongst the soiled linen, which created a health and safety risk for laundry workers.
Placentas are the only pathological waste generated in the hospital since all amputations are cases referred to the provincial hospital. Placentas are disposed off in the placenta pit behind the hospital once a day or when the placenta container became full. Placentas are placed inside stainless steel containers for carrying to the placenta pit. The containers are reportedly disinfected with JIK. No pathological waste is generated in the mortuary since no post mortems are performed at the hospital.

The unavailability of fridges / freezers at the mortuary resulted in all corpses being injected with Formalin as a form of preservation. The needles were removed from the syringes and disposed off in open containers when they became too blunt for further use. Workers were reportedly also not aware of the availability of sharps safety boxes or informed on the safe management and disposal of sharps.

General infectious HCRW is collected together with HCGW in a variety of reusable containers without the use of liners. Bowels and cardboard boxes used for general infectious waste, together with sharps safety boxes, are placed on nursing trolleys for use during patient visits on ward rounds. Blood stained linen and clothes from the bodies in the mortuary are “incinerated”.

Expired medicines are reportedly returned to the central drug stores. There is no cytotoxic HCRW generated at the hospital. Patients requiring such treatment are referred to the provincial hospital.

The incinerator ash is disposed off on a pile behind one of the wards. Incinerator ash is likely to contain heavy metals. However due to time constraints testing for heavy metals was not done. HCGW is collected together with general infectious HCRW inside the wards for combined “incineration”. The municipality reportedly collects HCGW food remains from the kitchen for disposal.

The facility “incinerator” is very small appearing more like a furnace. It can only destroy sharps, general infectious HCRW and HCGW that are easily combustible since it does not have any burners with any external fuel source other than a wood fire.

HCW is loaded from the collection wheelbarrow into the incinerator by using a spade, thus not requiring any holding area for HCW. Significant problems are experienced with smoke emissions into a nearby ward as a result of the incinerator as well as the open burning of garden waste. The “incinerator” stack is relatively low (approximately 3 metres). All ash from the “incinerator” is disposed off on the hospital premises. The “incinerator” operator was not available to facilitate evaluation of use of Personal Protective Equipment (PPE).

The placenta pit is reportedly sometimes treated with a disinfectant. Incinerator ash is disposed of on a daily basis on the informal dump adjacent to the incinerator. No chemical analysis of the incinerator ash was done to date.

There is no storm water diversion or polluted runoff control systems put in place at the ash dump and there is no design done for the installation of any liners. There is no scavenging or scavengers since there are no recyclable materials that can be recovered from the ash dump. Untreated HCRW was identified on the garden waste dump adjacent to the “incinerator”.

Although there is always a risk of HCRW being present in the HCGW stream, thus making it desirable for such waste not to be accessible to scavengers on municipal waste disposal sites, burning of general waste within built-up areas is also not acceptable since it resulted in the emission of dioxins and furans from the PVC within the HCGW stream.
A.1.7 Nyahera Health Centre - Kisumu

The Health Centre has a total of 15 beds with an occupancy rate and number of outpatients was not available on request. All Health Care Waste (HCW), including both Health Care General Waste (HCGW) as well as Health Care Risk Waste (HCRW), except for sharps, is treated and disposed off on the health centre premises. Sharps are reportedly removed from the site for treatment and disposal at the district hospital whenever supplies are delivered from the hospital. The HCW stream consists of HCRW (general infectious waste, sharps, and placentas) and HCGW. On average 20 placentas generated per month at the Health Centre.

General infectious HCRW and HCGW are not segregated and are collected in the same reusable open containers. It was reported that reusable containers used to carry placentas to the placenta pit was washed and disinfected at regular intervals. HCRW containers and in particular sharps containers are placed in areas accessible to patients and visitors. All reusable containers are used without liners, which increases the risk of contamination when reusable containers are not disinfected after every use.

Sharps are collected in 5-litre safety boxes supplied by UNICEF. There was reportedly a shortage of sharps safety boxes, resulting in capped needles and syringes being disposed off with general infectious waste in open reusable containers. On inspection it was however found that such unsafe management practices existed directly next to an empty sharps container. Sharps containers (safety boxes) are not closed effectively when full which could have resulted in spillage of sharps when containers overturn.

A limited number of brackets are provided for sharps containers in selected areas against walls or on nursing trolleys, thus increasing creating the risk of overturning and spillage. Although it was reported that sharps are taken offsite for incineration at a nearby hospital, the inspection however revealed sharps being burnt as part of the HCW stream behind the health centre.

Placentas are placed inside open reusable containers for manual carrying to the placenta pit behind the health centre. The reusable containers used for the placentas are reportedly disinfected at regular intervals. General infectious waste is collected in a variety of open buckets without liners, before being carried to the onsite pit where all HCW is burnt on a daily basis. The reusable HCRW containers are reportedly washed, but not disinfected after every use. Segregation is generally found to be poor, with recapped needles being disposed off together with other general infectious HCRW and HCGW. There were no brackets provided in selected areas against the walls to place liners. Expired drugs are reportedly returned to pharmacies from which they were supplied.

The HCW containers are manually carried from the point of generation to the waste pit when full. There is no central waste storage area in use, since the sharps containers did not seem to be stored separately for collection and incineration at the district hospital as reported. With the sharps apparently not being removed from site, there was no external transport required.

No form of incinerator exists onsite. All general infectious HCRW, sharps and HCGW are disposed off in the central HCW pit where it is put on fire on a daily basis. It was found that the low temperature at which the HCW was burnt is insufficient to melt the syringes.

A.1.8 Milmani Hospital –Private Hospital in Kisumu

The Hospital had a total of 13 beds; with occupancy rate of 60%. The outpatients are reportedly on average between 50 and 70 per month. The hospital consisted of a double-storey building, which was initially used as a residence. All Health Care Waste (HCW), which included both Health Care General
Waste (HCGW), as well as Health Care Risk Waste (HCRW) is “incinerated” except placentas that are disposed off in the placenta pit. The hospital has a brick “incinerator”.

The hospital administration reported that all reusable HCRW and HCGW containers used in the hospital are disinfected at regular intervals. There is no segregation of general infectious HCRW from HCGW, but sharps and placentas are segregated for separate disposal. Sharps were however observed amongst the general infectious HCRW. HCRW containers, and in particular sharps containers, are placed in areas that were accessible to the patients and visitors. There is no national standard set for colour coding, which could result in confusion when staff transfer from one health care facility to another. No liners are used inside reusable containers, which increased the risk of contamination when reusable containers are not disinfected after every use.

Sharps are collected in 5-litre safety box containers supplied through the KEPI programme, but instances were observed during the inspection where sharps were disposed of in half height plastic bottles that did not provide any protection during use. None of the sharps containers used are effectively sealed when full to prevent spillage when transported from the hospital to the “incinerator”. Commerically available puncture resistant and leak proof (plastic) sharps containers could cost in the order of KShs. 200-500 and was therefore not used. It was observed that needles were recapped before disposal, which was a very unsafe practice due to the high risk of needle prick injuries. Needles were found to be removed from syringes which a dangerous practice is due to the fact that the sharps containers were not purpose made to assist in safe removal of needles. No brackets for sharps containers were provided in selected areas against walls or on nursing trolleys, which increased the risk of overturning and spillage;

Placentas (between 10 and 20 per month) formed the bulk of the pathological waste generated at the hospital. Placentas as well as the body tissue removed in the theatre are placed in a bucket with a lid and immediately carried to the placenta pit where it is disposed. General infectious HCRW are collected together with the HCGW in open reusable containers without liners for combined onsite treatment / disposal.

The HCRW “incinerator” is very small and more likely to be called a furnace. It could only destroy HCGW and general infectious HCRW that was easily combustible since it did not have any burners with any external fuel source. The small size of the “incinerator” prevented it from being used for the destruction of placentas (as there were no burners with external fuel sources). The “incinerator” stack is relatively low (approximately 3 metres) which resulted in the smoke being dispersed into the neighbourhood. All HCRW and HCGW, other than placentas, have paraffin poured over it before it is put on fire on a daily basis. The ash from the “incinerator” was disposed of in a pit adjacent to the incinerator.

A.1.9 Kericho Nursing Home Ltd. – Kisumu

This is a private facility owned and operated by a private practitioner. It has no inpatient services. On average about 500 patients are treated every month. Black plastic liners placed in metal pedal bins are used to collect HCGW and general infectious HCRW separately. HCW is segregated into HCGW, general infectious HCRW and sharps are placed in sharps safety boxes.

Sharps are collected in 5-litre safety boxes that are supplied by UNICEF through the Kisumu District Hospital. The policy is to dispose of needles and syringes as single units without recapping. No pathological wastes are generated in the clinic since it did not have a theatre or maternity ward.

General infectious HCRW is collected separate from HCGW in black plastic liners placed inside pedal bins while expired medicines are disposed of with general infectious HCRW. The 1 to 2 X-rays that
are taken daily generate radioactive waste on a limited scale. The equipment supplier manages the radioactive waste.

A central storage facility in the hospital when full is stored until transported to the hospital or collected by the municipality. HCRW are transported by private vehicle to the nearby Kisumu District Hospital for incineration together with the HCW generated at the hospital. The municipality collects HCGW for disposal at their landfill.

A.1.10 Machakos District Hospital-Eastern Province

Machakos has a population of in excess of 3 million people. The Hospital has a total of 500 beds, of which 200 are in the general wards and the remaining 300 are maternity beds. The occupancy rate is in excess of 100% with the excess lying on mattress on the floor

Table 7. Types of wastes emanating from the Machakos District Hospital

<table>
<thead>
<tr>
<th>Category of Waste</th>
<th>Examples:</th>
<th>Storage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharps</td>
<td>Needles and syringes</td>
<td>All syringes in KEPI sharps boxes.</td>
</tr>
<tr>
<td>Pathological Waste</td>
<td>Amputations, histological specimen, biopsies, and autopsies, rejected blood, placenta, foetuses, “tissue organs”.</td>
<td>General Dustbins</td>
</tr>
<tr>
<td>Clinical waste</td>
<td>Used gloves, soiled cotton, wool, bandages, POPC, pads, giving lines.</td>
<td>Dustbins not segregation</td>
</tr>
<tr>
<td></td>
<td>Razor and scalp blade, broken ampule bottles etc.</td>
<td></td>
</tr>
<tr>
<td>General waste</td>
<td>Unsoiled cartons, papers, pieces of wood, empty broken bottles.</td>
<td>Dustbins not segregation</td>
</tr>
<tr>
<td>Food remains</td>
<td>Food left over, fruit peels, etc.</td>
<td>Dustbins not segregation</td>
</tr>
<tr>
<td>Cytotoxic waste</td>
<td>Expired, unfinished drugs.</td>
<td></td>
</tr>
</tbody>
</table>
| Radio-active waste is removed from site

The institution has no written policy on HCW management. Public health officers and a department of Environmental Health are available to oversee the effectiveness of HCW management in the hospital.

The facility use reusable HCRW and HCGW containers which are disinfected at regular intervals. Waste is not segregated in the wards save for sharps. HCRW containers, and in particular sharps containers, are placed in areas where the patients and visitors have access to such containers.

The hospital has an old incinerator which is used to treat sharps and pathological waste. However due to poor segregation of HCW, most of HCRW is mixed with HCGW which is collected by the Municipal Council.

The incinerator site which also serves as transfer station for HCGW is fenced to prevent scavenging though birds manage to scavenge.
A.1.11 Machakos Medical Clinic

The Clinic is located in Machakos (Eastern). The average outpatient number is 20 persons per day. The facility does not offer inpatient services. The clinic has a theatre which is not busy most of the time. It has been in existence since 1987 and has a total of 10 medical and subordinate staff.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The outpatients’ services generate both general wastes and sharps. All HCW, which includes both HCRW as well as HCGW, is burnt or collected by the council.

General infectious HCRW and HCGW is not segregated and is disposed of in the same reusable open plastic containers with the exception of sharps which are segregated and collected in sharps boxes. However there was a separate plastic container for the collection of soiled bandages and swabs. Polythene bags were also used for waste packaging and disposal and these were then taken to the crude open burning site for burning or collected by the council for disposal elsewhere. There is no national standard set for colour coding, which results in poor waste segregation and management.

Sharps are collected in sharps boxes. Segregation occurs at the point of generation. These sharps boxes when full are then taken to Katoloni dumpsite where they are dumped and set on fire. All other pathological wastes are dumped in common plastic containers and disposed off collectively with sharps and eventually burnt in a drum.

General infectious waste is collected in a variety of plastic containers after which they are disposed in open pit or burnt in a different open pit. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

Cytotoxic wastes are returned to the provincial medical offices (unexpired). The expired drugs were diluted and drained through the normal sink.

Average waste generation per day is found to be approximately 2.0 kg for general waste, 1.5 kg for sharps and pathological waste. No form of reuse or recycling is undertaken.

Wastes from the hospital is removed from the site on a daily basis both manually and burnt in the pit. Other waste is collected by the municipal council also on a daily basis.

A.1.12 Nyeri Provincial General Hospital-Central Province

The Hospital is located in Nyeri and has a total of 400 beds including 24 in psychiatric ward, 77 in maternity ward, 59 in medical ward and 82 in surgical ward. The hospital has an inpatient of approximately 380 and outpatients of about 412 per day.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The total measure of combined HCW produced here amounts to approximately 3 tones per day. All HCW, which includes both HCRW as well as HCGW, is “incinerated”. Placentas were however dipped in an existing placenta pit. Again wastes are removed from the site on a daily basis with the aid of wheelbarrows.

There is no HCW management training available to the Hospital staff. Newly employed staff are normally given orientation on the hospitals routine disposal procedures and also cautioned on care when handling these wastes.
General infectious HCRW and HCGW is not segregated and is disposed in the same reusable open containers. Only the placentas were dipped in the placenta pit. The health centre has sufficient stocks of sharps safety boxes, however only black liner bags are available. HCRW containers were observed to be plastic in nature. All these plastic reusable containers are used with the black liners, which increases the risk of contamination. There is no national standard set for colour coding, which results in poor waste segregation and management.

Sharps are collected in Sharps safety boxes. There segregation occurs at the point of generation (their source). These sharps boxes when full are then taken to the incinerator together with other wastes for disposal. Placentas are dumped in the placenta pit. All other pathological wastes are dumped in common dust bins with black polythene liners and disposed off collectively with other wastes to the incinerator. General infectious waste is collected in a variety of open buckets the black liners together with other wastes, before being carried to the onsite “incinerator" for treatment. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW. Expired drugs are returned to store for further directive. The last time this was disposed was through burning in the dumpsite.

The HCW containers are manually carried or carried by the use of wheelbarrows from the point of generation to the “incinerator" when full. After which all HCW is “incinerated”. Placentas were however dipped in an existing placenta pit. Again wastes are removed from the site on a daily basis both manually and also with the aid of wheelbarrows.

A.1.13 Limuru Health Centre

Limuru Health centre has a maternity wind with six beds. On average the centres serves 100-125 outpatient per day. The facility has 8 nurses, a clinical officer, 2 lab technician, a clerk, and 2 PHOs. The facility is one of the centres of JSI MMIS project

The types of wastes generated from the centre include swabs, sharps, bandages, placenta and expired drugs. Collection is daily and the staffs have protective gears.

Plate 7 Autoclave technology in Limuru Health Centre

Sharps-Safety Boxes are incinerated together with swabs and bandages. The centre has pedal receptacles for contaminated waste. Uncontaminated wastes are placed in black bins provided by JSI. There are separate containers for ampoules, vials which are recycled at times.

One member of staff was trained at Kiambu on HCW. On the walls of the centre, JSI Awareness posters are posted. The facility has a brick built incinerator. The management of HCW is handled by untrained casual
Plate 8. Colour coded receptacles supplied by JSI

The receptacles supplied by JSI are colour coded i.e. Yellow for hazardous and Black for non

A.1.14 Muranga Dispensary
The dispensary located in Muranga town was established in 1965 and provides curative services to outpatients reportedly on average around 1 500 per month. The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps,) and Health Care General Waste (HCGW). All HCW, which included both HCRW as well as HCGW, is disposed in an open fenced pit within the compound and burnt accordingly.

The dispensary has 2 nurses, 1 public health technician, 1 subordinate staff and a clerk. The dispensary has a MCH, Pharmacy, Dressing and Injection section, Laboratory and out patient.

General infectious HCRW and HCGW is not segregated and disposed of in the same reusable open containers. All reusable containers used in the health centre is washed at regular intervals but not disinfected due to shortage of JIK. All reusable containers are used without liners, which increases the risk of contamination when reusable containers are not disinfected after every use. There is no national standard set for colour coding, which results in confusion when staff was transferred from one health care facility to another.

Sharps are collected in 5-litre safety boxes that are issued as part of the KEPI programme. The policy in this health centre is to dispose of needles and syringes as single units without recapping of needles. There are no pathological wastes emanating from this facility. General infectious waste is collected in a variety of open buckets without liners, before being carried to the onsite open burning pit. The reusable HCRW containers are reportedly washed but not disinfected due to a shortage of disinfectant (JIK is primarily used as a disinfectant). Segregation of HCW was generally found to be poor and there are no brackets provided against the walls in selected areas to place liners for collection of HCW. Expired drugs are reportedly returned to pharmacies from which they are issued. However, used bottles are recycled after being thoroughly cleaned and disinfected.

A.1.15 Coast Provincial General Hospital
Coast General Hospital is located in Mombassa and has a total of 612 beds including 122 in obstetrics and gynaecology ward, 10 in ICU ward, 152 in medical ward, 27 in Rhamtulla ward, 153 in Paediatrics and 148 in Surgical Ward. The hospital has an inpatient of approximately 460 and outpatients of about 800 per day. The Hospital serves as a provincial general hospital for the local communities (Coast Province) as well as referred cases from other institutions in the province.
The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). All HCW, which includes both HCRW as well as HCGW, is "incinerated". Placentas were however dipped in an existing placenta pit. Again wastes are removed from the site on a daily basis with the aid of steel trolleys.

Most of the staff members are not trained on HCWM. However the PHO/PHT has received undergraduate training on public health technology. Newly employed staff are given orientation on the hospitals routine disposal procedures and also cautioned on care when handling HCW.

General infectious HCRW and HCGW are not segregated and are disposed of in the same reusable open containers with the exception of sharps which are segregated and collected in the sharps boxes. Placentas are collected in plastic containers after which they are dipped in the placenta pit. HCRW containers were observed to be normal standard dust bins, with a few cases being plastic containers. There is no national standard set for colour coding.

Sharps are collected in Sharps safety boxes and plastic containers. Some form of segregation (sharps) occurs at the point of generation. These sharps boxes when full are taken to the incinerator together with other wastes for treatment. Pathological wastes from the mortuary are disposed through a chute. All other pathological wastes are dumped in common standard dustbins and disposed off collectively with other wastes.

General infectious waste is collected in a variety of bin containers after which they are collected from the hospital collection points by the city council for disposal. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

No form of internal storage exists in this facility as all bins were carried to the "incinerator" when full. Other bins are emptied at a collection pit where they were burnt. Other form of waste is collected by the municipal council. The HCW containers are manually carried or carried by the use of steel trolleys from the point of generation to the "incinerator" or pits when full.

A.1.16 Tiwi Primary Rural Health Training Centre

Tiwi Health Centre is located in Kwale District and has a total of 16 beds including 3 in female ward, 3 in male ward, 4 in pediatrics ward and 3 in maternity ward. The Health Centre has an average inpatient of 6 and outpatients of about 100 per day. The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). All HCW, which includes both HCRW as well as HCGW, is "incinerated". Placentas were however dipped in an existing placenta pit. Again wastes are removed from the site on a daily basis with the aid of wheelbarrows.

General infectious HCRW and HCGW are not segregated and are disposed in the same reusable open containers with the exception of sharps which are segregated and collected in the sharps plastic containers. Placentas are collected in plastic containers then disposed in the placenta pit. There is no national standard set for colour coding, which results in poor waste segregation and management.

Sharps are collected in plastic containers. There segregation occurs at the point of generation (their source). These sharps containers when full are then taken to the incinerator where they are burnt with other wastes. Placentas are dumped in the placenta pit. Pathological wastes from the mortuary are disposed off through a chute. All other pathological wastes are dumped in common standard dustbins and disposed off collectively with other wastes. Infectious waste is collected in a variety of bin.
containers after which they are collected form the Health Centre collection points by the city council for disposal. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

A.1.17 Bwagamoyo Dispensary

The Dispensary is located in Kilifi District and has an outpatient of approximately 60 per day. The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The outpatients' services generate both general wastes and sharps. All HCW, which includes both HCRW as well as HCGW, is burnt in a pit.

General infectious HCRW and HCGW is not segregated and is disposed of in the same reusable open containers with the exception of sharps which are segregated and collected in the sharps boxes. Only the placentas are collected in plastic containers after which they are dipped in the placenta pit. Plastic bags are also used for waste disposal and these were then taken to the crude burning site for burning. There is no national standard set for colour coding, which results in poor waste segregation and management.

Sharps are collected in sharps boxes. The sharp boxes are burnt in waste pits with other wastes. All other pathological wastes are dumped in common plastic bins and disposed off collectively with other wastes. Infectious waste is collected in a variety of bin containers after which they are burnt. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

No form of reuse or recycling is undertaken and there is no any form of internal storage in the facility as all bins are carried to the waste pit when full.

A.1.18 AL- Hazar Medical Clinic

The Clinic is located in Majengo (Mombasa) and has an outpatient of approximately 20 per day. The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The outpatients' services generate both general wastes and sharps. All HCW, which includes both HCRW as well as HCGW, is burnt in a pit.

HCRW and HCGW is not segregated and is disposed of in the same reusable open containers with the exception of sharps which are segregated and collected in special plastic containers. Plastic bags were also used for waste disposal and these were then taken to the crude burning site for burning. There is no national standard set for colour coding, which results in poor waste segregation and management.

Sharps are collected in plastic containers. There segregation occurs at the point of generation (their source). These sharps boxes when full are then taken to the incinerator where they are burnt with other wastes. Pathological wastes are dumped in common plastic bins and disposed off collectively with other wastes. Infectious waste is collected in a variety of bin containers. A few of these are lined with plastic bags while others are not after which they are disposed in open pit or burnt in the incinerator. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

Wastes are removed from the site on a daily basis both manually and burnt in the pit. Others are collected by the municipal council irregularly.
A.1.19 Moi Referral and Training Hospital

The Hospital is located in Eldoret along Nandi road and has a total of 509 beds. These include 90 in medical ward, 79 in paediatric ward, 82 in surgical ward, 43 in obstetric ward, 32 in gynaecology ward, 11 in renal ward, 12 in orthopaedic ward, 48 in Amenity (memorial wing), and 20 in psychiatric ward, 20 in New Born Unit, and 22 in Eye Ward.

The hospital reports inpatient numbers of approximately 494 and outpatients of about 620 per day and serves as a teaching and referral hospital. It is the only of its kind in Kenya and serves both the local communities, referral cases as well as for medical training purposes.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). All HCW, which includes both HCRW as well as HCGW, is “incinerated”. Placentas are dipped in an existing placenta pit. Again wastes are removed from the site on a daily basis with the aid of wheelbarrows or manually.

There is no HCW training available to the Hospital staff. However newly employed staff are given training on the hospitals routine disposal procedures and also cautioned on care when handling these wastes. This is done monthly.

General infectious HCRW and HCGW is segregated and is disposed of in the different reusable containers. The point of segregation is in the generation rooms, laboratories, wards or theatre. Generally, the types of containers used for collection of the wastes are plastic in nature. In some cases, types of wastes such as pathological waste containers are lined with lining waste paper. Only the placentas were dipped in the placenta pit. Sharps are disinfected and then disposed through incineration. There segregation occurs at the point of generation (their source).

![Plate 9. Sharp safety box hanging on the medicine trolley](image)

Sharps are kept in special containers prior to disposal. Those that require further examination are put in separate containers containing formalin. Placentas are dumped in the placenta pit. All other pathological wastes are dumped in common plastic containers with refuse liners and disposed off collectively with other wastes to the incinerator.
General infectious waste is collected in a variety of containers with tight lids, before being carried to the onsite “incinerator” for treatment. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

The quantities of HCW produced are as indicated below:

Table 8. Quantities of HCW generated in Moi Referral and Teaching Hospital by type

<table>
<thead>
<tr>
<th>Patient services</th>
<th>Kgs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>90.2</td>
</tr>
<tr>
<td>Surgical</td>
<td>83.2</td>
</tr>
<tr>
<td>Operating theatre</td>
<td>90.8</td>
</tr>
<tr>
<td>Intensive care</td>
<td>-</td>
</tr>
<tr>
<td>Isolation ward</td>
<td>-</td>
</tr>
<tr>
<td>Dialysis unit</td>
<td>22.3</td>
</tr>
<tr>
<td>Oncology unit</td>
<td>24.7</td>
</tr>
<tr>
<td>Emergency</td>
<td>54.5</td>
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<tr>
<td>Outpatient clinic</td>
<td>68.4</td>
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<tr>
<td>Autopsy room</td>
<td>40.5</td>
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<td>Radiology</td>
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</table>

<table>
<thead>
<tr>
<th>Laboratories</th>
<th></th>
</tr>
</thead>
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<tr>
<td>Biochemistry</td>
<td>25</td>
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<td>Microbiology</td>
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<tr>
<td>Haematology</td>
<td>18</td>
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<tr>
<td>Research</td>
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Nuclear medicine

Support services

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<td>Public areas</td>
<td>70</td>
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<td>Long term healthcare</td>
<td>12</td>
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</tbody>
</table>

The HCW containers are manually carried or carried by the use of wheelbarrows from the point of generation to the “incinerator” when full.

Plate 12. Wheel barrows propped with boxes for internal transportation of HCWs

The hospital uses its incinerator to dispose off HCWs for private clinics in Eldoret town at a fee. The HCRW “incinerator” was used for treatment of some wastes. Placenta are not treated but dipped in the placenta pit. Other liquid wastes were sluiced.

Plate 13. Incinerators in Moi Referral Hospital
All HCW is “incinerated”. All wastes are removed from the site on a daily basis both manually and also with the aid of wheelbarrows.

A.1.20 Sosiot Health Centre
The health centre located in Kericho, Rift Valley Province and has a total of 7 beds. On average the outpatient’s number is 80 per day. The health centre has a maternity ward that provides a 24-hour service to the public.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, and sharps,) and Health Care General Waste (HCGW). All HCW, which included both HCRW as well as HCGW, is disposed and burnt in a protected pit within the centre’s premises.

Most of the HCW management facilities including sharps safety boxes, protective gear and consumables are supplied by the provincial health offices.

General infectious HCRW and HCGW is not segregated and is disposed in the same reusable open containers. All reusable containers used in the health centre is washed at regular intervals and disinfected with JIK. There is generally lack of adequate disinfectant. The health centre has insufficient stocks of sharps safety boxes. HCRW containers have no specific colour coding or lining to distinguish them. All reusable containers are used without liners, which increases the risk of contamination when reusable containers are not disinfected properly. Healthcare waste is handled with subordinate staff but under supervision.

Sharps are collected in sharps safety boxes that are issued by the Provincial Health Officer. No brackets are provided for sharps containers against walls in selected areas or on nursing trolleys, thus creating the risk of falling and spillage. The sharp boxes are burnt in the open air while ampoules and vials are thrown in the protected pit within the clinics compound and later burnt. Pathological wastes are segregated and sluiced. General infectious waste is collected in a variety of open buckets without liners, before being burnt in the open air. The reusable HCRW containers are reportedly washed and disinfected using disinfectant.

Expired drugs are reportedly burnt under the supervision of the Officer in Charge. Records of expired drugs and disposed are kept by the facility administration. Unexpired drugs are given to other health facilities nearby when they run out of stock.

The general form of treatment of HCW is through the use of disinfectant. Waste blood is mixed with disinfectant before being poured in the placenta pits. Used containers were also washed with disinfectant and rinsed before being reused. Other wastes are disposed in the pit and burnt. No other form of treatment was observed or reported. All other wastes that are not pathological were being dumped in the protected pit nearby and burnt. When the pit becomes full, it is buried and another pit dug for the same purpose.

A.1.21 Narok Prison Dispensary
The dispensary is located in Narok district and most of the patients are prisoners in the prison. The main services here are simply diagnostics, prophylaxis and routine simple medication. This dispensary is managed by a Clinical Officer. For critical health cases, patients are referred to the Narok District Hospital. Health Care waste management equipment in the facility including sharps safety boxes, protective gear and liners supplied by the Narok District Hospital.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (sharps,) and Health Care General Waste (HCGW). No pathological wastes are generated on routine dispensary operations. All
HCW, which included both HCRW as well as HCGW, is disposed and burnt in a pit within the dispensary premises.

There is no HCW management training available to health dispensary staff and no HCW awareness or communication and information materials in the dispensary. General infectious HCRW and HCGW is not segregated and is disposed in the same reusable open containers. Sharps are disposed in the sharps boxes. There is no standard set for colour coding.

Sharps are collected in sharps safety boxes that are issued by the district hospital. No brackets are provided for sharps containers against walls in selected areas or on nursing trolleys, thus creating the risk of overturning and spillage. Empty ampoules and vials are thrown in the pit within the dispensary compound and later burnt.

All wastes were being dumped in the pit nearby and burnt. When the pit becomes full, it is buried and another pit dug for the same purpose.

A.1.22 St Mary’s Medical Centre-Uasin Gishu
The Centre is located in Uasin Gishu District. It is a community health facility serving the surrounding and nearby communities.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The outpatients’ services generate both general wastes and sharps.

HCRW and HCGW is not segregated properly and is disposed of in the same reusable plastic bins having no lids with the exception of sharps which are segregated and collected in the sharps boxes. The containers used have no specific colours and nature to differentiate them. Again there is no standard set for colour coding, which results in poor waste segregation and management. Wastes are just bundled in liners before disposal.

Sharps are collected in sharps boxes. There segregation occurs at the point of generation (their source). They are then burnt in an open pit. Pathological wastes are not common in the facility however the ones generated are collected in plastic bins and burnt later in an open pit. General infectious waste is collected in a variety of buckets and pedal bin containers after which they are burnt. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

It was found that total average medical wastes medical waste per day were 2.75 kg for general waste, 3.0 kg for infectious waste and 1.75 kg for sharps. Health care waste is removed from the site on a daily basis both manually and burnt in the pit.

A.1.23 Kapchelal Dispensary-Keiyo
The Dispensary is located in Keiyo District. Kapchelal dispensary is a community health facility serving the surrounding and nearby communities of Kapchelal. The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The outpatients’ services generate both general wastes and sharps.

General, infectious HCRW and HCGW is not segregated properly and is disposed of in the same reusable plastic bins having lids with the exception of sharps which are segregated and collected in
the sharps boxes. The containers used have no specific colours and nature to differentiate them. Again there is no national standard set for colour coding, which results in poor waste segregation and management. Wastes are just bundled in liners before disposal. Sharps are collected in sharps boxes. There segregation occurs at the point of generation (their source). They are then burnt in an open pit.

Pathological wastes are not common a part from specimen. These are collected in plastic bins and burnt later in an open pit. General infectious waste is collected in a variety of buckets and pedal bin containers after which they are burnt. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

A.1.24 Sio-Port Health Centre-Western Province

The health centre is located in Funyula, Western Province. It has a total of 11 beds, with an average outpatient of 80 per day. The Health Centre has a VCT, PMCT, ANC, MCH, Family Planning, Male Ward, Female Ward a maternity ward that provides a 24-hour service to the public. Sio-port Health centre serves as the main health centre to the local communities at both Funyula and Sio Port. Most of their facilities including sharps safety boxes, protective gear and consumables are supplied by the provincial health offices.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, and placentas) and Health Care General Waste (HCGW). All HCW, which included both HCRW as well as HCGW, is disposed and burnt in a protected pit within the centre’s premises. Placentas were however dipped in the placenta pit which is within the hospital compound.

General infectious HCRW and HCGW is not segregated and disposed of in the same reusable open containers. All reusable containers used in the health centre is washed at regular intervals and disinfected with JIK. The health centre has sufficient stocks of sharps safety boxes. HCRW containers and in particular sharps containers, are placed in areas where the patients and visitors have access to such containers. All reusable containers are used without liners, which increases the risk of contamination when reusable containers are not disinfected properly. There is no national standard set for colour coding, which results in confusion when staff was transferred from one health care facility to another.

Sharps are collected in sharps safety boxes that are issued by the provincial health office. Sharps containers (safety boxes) it was noted are not effectively closed when full, which could result in spillage of sharps when containers overturned. No brackets are provided for sharps containers against walls in selected areas or on nursing trolleys, thus creating the risk of overturning and spillage. Empty ampoules and vials are thrown in the protected pit within the centres compound and later burnt.

Placenta and waste Blood are reportedly stored in a 20-litre plastic bin without a liner. The bin is placed within the area of generation after which the wastes are rapidly disposed in the placenta pit. Placenta storage could reportedly be for a period of up to 2 hours before being dumped in the placenta pit.

General infectious waste is collected in a variety of open buckets without liners, before being carried to the onsite placenta pit for disposal. The reusable HCRW containers are reportedly washed but not disinfected due to a shortage of disinfectant (JIK is primarily used as a disinfectant). Segregation of HCW was generally found to be poor and there are no brackets provided against the walls in selected areas to place liners for collection of HCW.
All expired drugs are reportedly returned to provincial health offices from which they are issued. However, unexpired drugs are given to other health facilities nearby which have run out of stock of the same.

All other wastes that are not pathological were being dumped in the protected pit nearby and burnt. When the pit becomes full, it is buried and another pit dug for the same purpose. Plans have been underway for the development of an incinerator but funds have never been available for this purpose.

A.1.25 Likindu Dispensary

The dispensary is located in Vihiga district, western province. The average daily out-patient attendance stands at 50 while there are no inpatients. The HCW stream in this facility consists of HCGW which include papers, commodity wrappers, milk packets among others and HCRW which include sharps, infectious waste and pharmaceutical waste.

There is no segregation of waste done in this facility. It was observed that sharps are stored in own separate receptacles while all the other wastes are stored together in the same receptacle without being segregated. The receptacles used included safe boxes for sharps and improvised plastic containers. However, no liner bags were supplied to the facility. More colour-coding is not done, either.

Sharps are stored in safe boxes which are adequately available. The composition of sharps here mainly includes used needles, syringes and blades. Infectious waste is stored in improvised bucket containers from where it is taken for burning on the open ground. The reusable containers were reportedly disinfected after being emptied, though this could not be confirmed. No liner bags were used.

A.1.26 Diana Medical Clinic

Diana Medical Clinic is private clinic located within Shinyalu Division, Kakamega District. The facility offers only outpatient medical services, with average daily outpatient of 6. The health care waste (HCW) stream consists of health care risk waste which include infectious wastes, sharps and pharmaceutical waste, and the health care general waste.

Waste segregation is not done in this facility. Sharps are stored in improvised containers i.e. empty 5 litre containers while all the other waste are stored in improvised bucket containers. Safe boxes were not available in this facility.

Sharps are stored in empty 5 litre containers/ Containers. No pathological wastes were generated from this facility. All forms of health care waste from this clinic were disposed of by burning on the open ground.

A.1.27 Matangwe Community Health and Development Programme

The centre is located in Bondo District. The average outpatient is approximately 20 persons per day and inpatients of 6. The total numbers of beds are 8 with 3 in the female ward, 3 in the male ward and 2 in the paediatric ward. The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placenta) and Health Care General Waste (HCGW). The outpatients’ services generate both general wastes and sharps.

General, infectious HCRW and HCGW is not segregated and is disposed using reusable pedal bins having lids with the exception of sharps which are segregated and collected in the sharps boxes.
Placentas are immediately disposed off in a pit. The containers used have specific colours and nature to differentiate them. However there is no standard set for colour coding.

General infectious waste is collected in a variety of buckets and pedal bin containers after which they are incinerated. Segregation of HCW was generally found to be poor and there is no procedure or specifications provided against the walls in selected areas for collection of HCW.

Total HCW generated is 8.5 kg per day. In outpatient clinic 1.5 kg per day. In the microbiology lab, they generated 1 kg, in pharmacy 2 kg, in laundry 1 kg, and within administration and public areas 3kgs. This wastes (HCW) is removed from the site on a daily basis both manually and burnt in the pit. Other wastes are collected by the MoH workers.

A.1.28 Nyamusi Health Centre

The health centre is located within Nyamira district. It provides both inpatient and outpatient medical services. It has a total of 7 beds and an average daily inpatient attendance of 3, mainly maternity cases. The HCW stream in this facility consists of both HCGW and HCRW. The HCGW here compromises of papers, commodity wrappers, pieces of cloth among others while the HCRW compromises of sharps, infectious waste, pathological waste and pharmaceutical waste.

There is no comprehensive waste segregation within the facility. The only semblance of waste segregation was seen in the practice of sharps being stored separately in the safe boxes while all other forms of waste are stored together in pedal-operated bins and improvised bucket containers.

Sharps are stored in safe boxes, which we were told were adequately available within the facility. It was observed that needles were removed from the syringes while being stored, a practice which can be injurious due to possibility of pricking the handler. Pathological waste is mainly in the form of placentas from the maternity unit. These are carried by the bucket receptacle and thrown into the placenta pit.

General infectious waste included used cotton wools, gauze, dressings, and hand gloves, among others these are disposed in the incinerator which is available within the facility.

The HCRW were not subjected to any treatment before final disposal. All the other wastes are incinerated directly while the placentas were disposed of into the placenta pit. Main mode of disposal was incineration for all the other waste while the placentas were thrown into the placenta pit.

A.1.29 Kianjokoma Health Centre

This facility is located in Kaganri north location, Runyenjes in Embu, and has a total of 6 beds in the labour ward. The average number of outpatients visiting the facility is around 144 per day. The number of inpatients was reported to be only one per day.

The HCW stream consists of Health Care Risk Waste (general infectious waste, and sharps,) and HCGW. All HCW, which included both HCRW as well as HCGW, is disposed and burnt in a protected pit within the centre’s premises. However, some selected types of wastes are burnt in the incinerator.

Kianjokoma Health centre serves as a local health clinic to the local communities at Kagahari north location. Most of their facilities including sharps safety boxes, protective gear and consumables are supplied by the provincial health offices. There is reportedly some training on hospital waste management that was undertaken by the health centre’s public health technician, who is also in
charge of HCW management. This was through college training as a unit which was covered in two weeks.

General infectious HCRW and HCGW is not segregated and is disposed off in the same type of plastic bags. Pathological, infectious and pharmaceutical wastes are all collected in red bags. The health centre has insufficient stocks of sharps safety boxes. HCRW containers have no specific colour coding or lining to distinguish them. Healthcare waste is handled with casuals without supervision.

Sharps are collected in sharps safety and then dumped in a separate room. No brackets are provided for sharps containers against walls in selected areas or on nursing trolleys, thus creating the risk of overturning and spillage. They are then eventually burnt in a composite pit together with other clinical wastes. Pathological wastes are placed in a green polythene bags after which they are dumped in a secured pit. General infectious waste is collected in red polythene bags and then burnt together with the sharps. Expired drugs are collected in red plastic bags after which they are burnt in an incinerator. However, unexpired drugs are given to other health facilities nearby which have run out of stock of the same or reportedly returned to the Embu provincial medical offices. Chemical wastes are placed in isolated safety tank specifically for this type of wastes.

The estimated quantities of waste generated per day is 20 kg in the medical unit, 10 kg in the surgical unit, 20 kg in the outpatient clinic, 5 kg in the microbiology unit, 2 kg in the pharmacy, 30 kg in the laundry and one kilogramme each in the administration and public areas.

Before the wastes are finally disposed off, they are temporarily stored in a converted toilet room. This room is specifically used as temporary internal storage. The HCW containers are manually carried from the point of generation to the disposal site when full. The waste is then disposed in the pit and burn while others are taken to the incinerator at the Runyenjes sub District Hospital. No other form of treatment was observed or reported.

A.1. 30 Iftin Sub District Hospital-North Eastern Province

The Hospital located in Iftin, Garissa in North eastern Province has a total of 24 beds. The hospital receives an average of 200 patients per day. The number of inpatients was reported to be 20 per day. The health centre has a general ward and a maternity ward that provides a 24-hour service to the public. The general ward has 12 beds while the maternity ward also has 12 beds. The hospital serves the local communities at both Iftin and Garissa town. Most of their HCW equipments including sharps safety boxes, protective gear and consumables are supplied by the provincial health office.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, and placentas) and Health Care General Waste (HCGW). All HCW, which included both HCRW as well as HCGW, is disposed and burnt in a protected pit within the centre’s premises. Placentas are however dipped in the placenta pit which is within the hospital compound.

General infectious HCRW and HCGW is not segregated. All reusable containers used in the Hospital are washed at regular intervals and disinfected. The Hospital has insufficient stocks of sharps safety boxes and disinfectants. All reusable containers are used without liners, which increases the risk of contamination when reusable containers are not disinfected properly.

Sharps are collected in sharps safety boxes that are issued by the provincial health offices. Sharps containers (safety boxes) it was noted are not effectively closed when full, which could result in spillage of sharps when containers overturned. No brackets are provided for sharps containers against walls in selected areas or on nursing trolleys, thus creating the risk of overturning and spillage. Placenta and waste Blood are reportedly stored in a 20-litre plastic bin without a liner. The bin is
placed within the area of generation after which the wastes are buried. General infectious waste is collected in a variety of open buckets without liners, before being carried to the onsite pit for disposal. The reusable HCRW containers are reportedly washed but not disinfected due to a shortage of disinfectant. Segregation of HCW was generally found to be poor and there are no brackets provided against the walls in selected areas to place liners for collection of HCW.

Expired drugs are reportedly returned to provincial health offices from which they are issued. However, unexpired drugs are given to other health facilities nearby which have run out of stock of the same.

There was no elaborate central storage area a part from the small 20 litre plastic containers that were immediately emptied when full.

**A.1.31 Eriyows Home Based Care**

The Clinic is located in Iftin (Garissa) and has an outpatient of approximately 20 per day. It does not offer inpatient services. It is a home based care facility in Iftin.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The outpatients’ services generate both general wastes and sharps. All HCW, which includes both HCRW as well as HCGW, is burnt in a drum or in the open crude burning site.

Sharps are collected in sharps boxes. Segregation of sharps occurs at the point of generation. These sharps boxes when full are then taken to a drum where they are burnt with other wastes.

General infectious waste is collected in a variety of plastic containers after which they are disposed in open pit or burnt in a different open pit. Segregation of HCW is generally found to be poor and there is no procedure or specifications provided for collection of HCW. Pharmaceutical waste from the facility is burnt in the open.

Wastes from the facility is removed from the site on a daily basis by hand and burnt in the pit. Others are collected by the municipal council but irregularly.

**A.1.32 Iftin Medical and Laboratory Services**

The Clinic is located in Iftin (Garissa) and has an outpatient of approximately 11 per day. It does not offer inpatient services.

The Health Care Waste (HCW) stream consists of Health Care Risk Waste (general infectious waste, sharps, pathological, chemical and placentas) and Health Care General Waste (HCGW). The outpatients’ services generate both general wastes and sharps. All HCW, which includes both HCRW as well as HCGW, is put in a box and burnt in a pit.

Sharps are collected in sharps boxes. Segregation for sharps occurs at the point of generation. The sharps boxes when full are then taken to the open pit where they are burnt with other wastes. Pathological wastes are dumped in common plastic containers and disposed off collectively with other wastes in an open pit.

Average waste generation per day in the facility is approximately 1.2 kg for general waste, 0.7 kg for sharps and pathological waste.
Wastes are removed from the site on a daily basis both manually and burnt in the pit. Others are collected by the municipal council after every two weeks.
Annex B. Dumpsites

Annex B.1 Dumpsites Visited

The following dumpsites, which comprise a selection of public and private, and urban and rural facilities were visited and assessed. They are presented in the same sequence as the visits.

1. Riruta Dumpsite – Nairobi*
2. Kenyatta Hospital Dumpsite – Nairobi
3. Dandora Dumpsite – Nairobi*
4. Langata Dispensary Dumpsite – Nairobi
5. Moi Teaching Referral Hospital Dumpsites – Eldoret
6. Huruma Dumpsite – Eldoret*
7. Kachok Dumpsite – Kisumu*
8. Coast Provincial Hospital Dumpsite – Mombasa
9. Tiwi Health Centre Dumpsites – Kwale District
10. Kibarani Dumpsite – Mombasa*
11. Machakos District Hospital
12. Machakos Municipal Dumpsite*
13. Nyeri Municipal Dumpsite*

* Dumpsites at which scavenging occurred and where scavengers were interviewed.

The general or common dumpsite findings are presented in Section 3 below, whereas the site specific findings are listed and discussed for each respective dumpsite in Section 4 below.

B.1.1 Riruta Dumpsite – Nairobi

The site is situated about 10km to the west of the Nairobi city centre on the Naivasha road, in the vicinity of Riruta Satellite, in an area locally known as Carwash, where the Kabuthi River passes under the road. It occupies an area of approximately 4 ha. it is understood to be owned by three private owners and to have been operational since the 1980s. There are housing estates in the area.

The site geology is light coloured igneous rock, possibly a Rhyolite. This has been quarried on the northwest bank of the river. The quarry formed the original waste repository, which has long since been filled. There is scarce soil and leachate from the base of the landfill enters the Kabuthi River, and in some instances the waste encroaches on associated water bodies. Both situations must contribute to water pollution.

There are two access points, no fencing and no engineering in the form or drainage control, so that run-off enters the waste body, resulting in the observed leachate.
The waste received at the site was predominantly municipal solid waste, but may have contained industrial and even hazardous waste. The working or tipping face was a series of 20m high slopes on the river side if the dump, formed by the angle of repose of the dumped waste. There were no site roads, so that access to the slopes seemed restricted to vehicles that could traverse the waste. Unloading was generally manual and there was no plant on site, so that no spreading and compaction was observed. What was observed, was men loading dumped waste onto tarpaulins or into sacks and then dragging it to the tipping face and throwing it over down the slope. Although no plant was present, it was surmised that a machine would come occasionally and push the remaining accumulated waste over the extended slopes in a classical end tipping operation.

There was no covering, so there was litter, but no burning, as one of the owners stated it was not policy at this dump. Also there was no smell of landfill gas, although pigpens on the site did emit odour.

It was estimated that there were about 100 scavengers on and around the site. These comprised men women and children. They were extracting the normal recyclables, none were wearing protective clothing and the children were bare footed.

These scavengers were not communicative and would not permit the taking of photographs.

One of the owners stated that medical wastes were not accepted on this site and indeed, only a few old plastic syringes, with no needles could be found.
B.1.2 Kenyatta Hospital – Nairobi

This small private site is located in a fenced-off area of about 300 m² on the hospital property, adjacent to the incinerator. The actual disposal site, which covers some 100 m², is in the lower section of the property. The surroundings comprise the hospital on one side and built-up areas including apartment buildings all around.

The geology of the site is unknown, but is likely to undifferentiated sediments (e.g., shale’s and sandstones) covered by fairly deep sandy soil. The drainage was determined by the slope of the site from the incinerator to the road. Runoff water would thus run from the incinerator area, through the dump area, into the road system and into the stream.

There was fencing and access control, and also engineering in the form of a retaining wall at the toe of the dump and a drainage system for condensate from the incinerator. There was, however, no storm water diversion or polluted runoff control systems, so that the area at the toe was marshy. Leachate from the dump could therefore draining down to the nearby stream.

Waste arriving at the site was incinerator ash and non-hazardous healthcare waste in black bags. The tipping face was a 20m wide, 2m high slope, formed by the angle of repose of the dumped waste. There was a good track right up to this point, so that the tractor could end tip over the edge.

There was no compaction and covering, and the non-hazardous healthcare waste in black bags was immediately set alight. On the day of the visit it was noted that there were both red and yellow, risk healthcare waste bags amongst the black bags.

The aesthetics of the site were typical of an uncontrolled burning dump, unsightly and with smoke and smouldering resulting in complaints from neighbouring communities. Burning could result in emissions of dioxins and furans, which could have adverse affects in the built-up environment under consideration. A number of fluorescent tubes were stored in the area, because there was no way to safely dispose of them.

On account of the fencing and general awareness of hospital staff, there were no scavengers at the waste dump.

Incinerator ash was disposed at the site on a daily basis, together with non-risk healthcare waste. Although there is always a risk of poorly segregated healthcare waste, the lack of scavengers and burning made this a low-risk site. However, since no chemical analysis had been done on the incinerator ash and because the dump is in such close proximity to the hospital and built-up areas, it was decided to take a sample of incinerator ash and have it hazard rated. The results of the analyses are included in Appendix 4 and indicated in the conclusion.

B.1.3 Dandora Dumpsite – Nairobi

The Dandora dumpsite, Nairobi’s main dumpsite, is located about 15 kilometres northeast of the City Centre, off the Komarock road. It is about 25 to 30 ha. in extent and is surrounded by low-income residential estates. The Korogocho, Dandora and Kariobangi estates, which comprise over 700,000 people, and include some of the poorest people communities in Nairobi, are situated immediately adjacent to this dumpsite.

From observable outcrops in the adjacent Gitathuru and Rui Rwaka Rivers, it would appear that the geology underlying the site is basalt. It is understood that dumping at this site commenced in a disused quarry on the bank of the river (often referred to as the Nairobi River) in the mid 1980’s. This is, however, no longer visible.
The soils observable from a distance in the river bank profiles to the north of the site appear to be deep sandy, clayey, reddish soils. No virgin soil was observable on site, although there was a lot of rich organic soil present, as a result of the composting and decomposition of vegetable matter in the waste.

Site drainage is determined by the east flowing river which bounds the site on both the western and northern sides, see. The whole site therefore slopes and drains towards the river. The waste, which is dumped in very rough terraces, extended right to the banks in places.

The main access to the dump was via Muigai Kenyatta Road, however as there was no fencing, vehicle access was possible at other points on the south and eastern boundaries. There was no restriction on pedestrian access.

From the point of view of engineering design, there are no surfaced roads or infrastructure, no liner or leachate collection systems and nor gas control systems. Drainage control was also completely absent, so that upslope surface water entered the site and ponding occurred in the low lying areas of the waste body. There were also pools of leachate at the toe of the dump and these drained into the river.

The waste received at the site is predominantly municipal solid waste, but also contained industrial, including tannery and foundry waste and also hazardous waste. Record keeping does appear to occur but the site supervisor who met the team on the way out informed them that about 40 trucks (20 private and 20 municipal) entered the site each day.

As noted, there is no proper roads on the dumpsite. Apparently, over the years, a bulldozer had cut access roads through the waste, so that with successive cutting, these roads had become flanked by 2m high banks of waste. Because of the rough terracing, and the derelict bulldozer at the entrance, it was evident waste was occasionally spread so that trucks could drive over it. On the day of the visit, there was a large Cat front end loader was pushing waste over the slope at the end of a terrace, (end tipping). Notwithstanding the presence of plant on the site, there was such a backlog of material handling that the roads were impassable even in dry weather, resulting in congestion and indiscriminate dumping in any place where a truck could unload. In most instances it appeared that the trucks were without hydraulics, so that they had to be unloaded manually by scavengers.

No waste spreading, compacting or covering, as require by sanitary land filling, takes place at the site. As a result, most parts of the dumpsite exhibited open burning or smouldering. It is on this site that the
associated hazard of areas being rendered unsafe by undermining on account of the burning was observed.

The most obvious aesthetic problem at Dandora, cited in all the complaints about the dumpsite, is the pall of smoke resulting from the burning, smouldering waste. This can often be seen from the Jomo Kenyatta Airport when taking off or landing. People have dramatically described this pall as a “toxic cloud”. On the actual dumpsite the odour is one predominantly of burning and smouldering waste. In one portion however, there is a strong odour of ammonia. There was however, no landfill gas odour.

As one approached the dumpsite there is definitely odour problems, as well as other aesthetic problems such as dust, spilled waste and litter. Such conditions adversely affect on the quality of life and even health of the adjacent communities. Because of this there are frequent complaints in the press about Dandora Dumpsite.

Scavenging from the Dandora dumpsites provides a livelihood for many. During the visit there was no means of and there appeared to be no desire to prevent scavenging. Consequently, there were probably about 600 scavengers on the site. These included men woman and children.

While some scavengers lived in the surrounding residential areas, others lived on the site in shelters constructed from waste materials. All around are stockpiled recyclables, including bones, glass, plastic of various grades including PET, paper, cardboard and ferrous and non-ferrous metal. No accurate information was available about the quantities of recyclables collected and sold; however, earnings of about Ksh 300 per day were quoted by several scavengers interviewed.

A speciality at Dandora is recycling polythene bags. These are collected from the dump then washed in the sewage and leachate contaminated Nairobi River. While it was thought that these were recycled as garbage bags, it has been found that many go directly back to the market and are used for storing food amongst other things.

All scavengers interviewed indicated that they scavenged for their livelihood, and were in it for the long term. Some had spent their entire lives on the dumpsites. The men, women and children are sometimes together, but more often segregated into groups. There seem to be conflicting opinions regarding the scavenger social structure at the Dandora dumpsite. Personal interviews and the site supervisor indicated that they are community, all knowing one another and often working together for their common welfare. This is however not what is reported in the literature. For example, Kathrin Senner, representing the Mukuru Recycling Centre in 2001, states: “In the [Dandora] dumpsite everybody is working individually and there exists no support or solidarity among the scavengers.”

Regarding security, a police escort was deemed necessary at Dandora dumpsite. This is because of the gangs, murder, alcoholism and prostitution associated with the dump. While this is not disputed, no evidence of such conduct was observed during the visit.
Regarding health and safety, the scavengers all indicated that apart from normal illness such as flu, they were generally healthy, and were not in any way ill because of ongoing contact with the waste. They also indicated that there were no safety risks. However, as none of them wore protective clothing, they must be at risk. As always, the worst manifestation of this was barefooted children walking in waste, which contained broken glass and sharps amongst other things. There are also the highly unsuitable slip slops as footwear and the absence of gloves. Although the scavengers interviewed did not admit to scratches, cuts and puncture wounds, these must have existed.

Despite the scale, lack of order and diverse wastes being disposed of on the site, there are no significant deposits of healthcare waste identified in any of the active working areas during the visit. Without exception, everyone questioned in this regard, stated that the wastes were burned elsewhere. Based on this, it had to be concluded that even if healthcare waste had been dumped on this site in the past and could be in future, it did not represent a problem on the day of the visit.

The Dandora Dumpsite has become internationally recognised as one of the notorious dumpsites of Africa and in fact the world. Because it is indeed disgraceful, much has been written about it and as is often the way of non scientific writers, the situation has tended to become dramatized. For example statements like “The mere mention of the name Dandora sends chilling cold down the spines of many people.” appear and in fact all the quotes in this chapter relate to Dandora.

In the past there have been numerous requests to close the dump down and various people have stated that it has reached capacity. In September of 2002, the Mayor of Nairobi announced the intention to close it down and move the operation to Ruai, where recycling plant would be built.

The Ruai project is not expected to materialize because it is some 5.5 kms from Nairobi, it is in the flight path of Jomo Kenyatta International Airport and there are currently financial constraints and public acceptance problems associated with the development.

An alternative is that of the Nairobi Solid Waste Management Association (NASWAMA). The NASWAMA has forwarded a long-term action plan to convert the Dandora dumpsite into a state of the art recycling and waste disposal facility.

While not directly part of the scope of the current project, it is noted that the NASWAMA view is supported. This is because there is in fact plenty of capacity left at Dandora, and plenty of rich soil on site for sanitary landfilling, derived from years of breakdown of organic waste. The site is also very strategically situated relative to the waste generation areas of Nairobi. Probably the most relevant argument in favour of Dandora is that nothing is ever going to take the in situ waste away, and the site badly needs rehabilitation.
Experience teaches us that such rehabilitation is most economically and effectively achieved when done in conjunction with proper ongoing operation and upgrading. The danger of not doing this is that if a closed dump is not properly secured and rehabilitated, waste haulers who do not wish to travel 55Kms to the new facility, will use it illegally and the problems persists.

Advantages of the envisaged Upgrade and Operate approach would be, the scavengers would not lose their livelihood as they would have to part of the solution.

Although the landfill itself would not be “state of the art” in terms of a liner, it would certainly comply with the concept of appropriate technology and sanitary landfilling, and would certainly bring about a significant improvement in terms of environmental impact and quality of life.

Finally, it would be far easier to do an Environmental Impact Assessment (EIA) and licence the upgrading of a dumpsite to a sanitary landfill, than to introduce and develop an unwelcome land-use into a completely new environment. It would also be less costly, short, medium and long term.

In the event that the Dandora Dumpsite can be upgraded to a sanitary landfill and a state of the art recycling facility, the formal disposal of properly segregated healthcare waste, or incinerator ash could be considered.

**B.1.4 Langata Dispensary Dumpsite – Nairobi**

This was a very small private site located in the fenced off dispensary property. The surroundings comprised the dispensary and residential areas. The actual disposal site was only a pit of a few square metres in area. It was situated in the upper section of the property next to the “incinerator”.

The geology is likely to be shales or sandstones covered by fairly deep sandy soil. Drainage, which was toward the dispensary, was not a consideration, as the catchments and the site were so small.

The “incinerator” ash as well as the untreated sharps contained in the sharps safety boxes where dumped into the pit. As much of the waste was burned, there was no regular covering. Although there was not much impact from the dump itself, there were evidently complaints about placenta storage and incineration.

Since there was no odour from the dump, or scavenging, it was felt that had the sharps also been incinerated, the dump was in fact an acceptable solution for the disposal of healthcare waste on this scale. Incineration of sharps, better housekeeping, regular covering and drainage controls would however be recommendations.

**B.1.5 Moi Teaching and Referral Hospital Dumpsite-Eldoret**

This hospital had two dumpsites within 100m of each other. They are thus both sited in the same location and surroundings. They are several hundred metres down slope of the hospital towards a tributary of the Sosiani River. The area close to the river is bushy.

The geology is basalt, covered with a thin layer of soil. Both sites comprised a shallow excavation that has been fenced off; however, the fences are broken down. Drainage is down slope towards the river. No surface water drainage controls are in place, but this is not considered to represent a big issue, because of the minimal catchments areas.

Both sites are operated in a similar manner in that waste is carried, probably by wheelbarrow, via a well defined path and dumped into the excavation, where it would decompose and eventually
smoulder and burn. The waste is not compacted or covered and emitted bad odour and air pollution. There is also scattered litter, and the dumpsites attract disease vectors such as rats and flies.

The Staff Quarter site, which is sited within 25 metres of the houses, does not officially receive any healthcare waste. It is mentioned here, however, because it is such an unacceptable and unhygienic operation, and it is so close to houses. What is worse in that the houses are occupied by trained healthcare staff, who must have found the situation acceptable, otherwise they would have had something done about it. This situation is viewed with concern.

The Hospital site is sited closer to the river in a bushy area and is the main repository for all healthcare waste. The site receives incinerator ash from the two incinerators used, as well as untreated healthcare waste from the hospitals. The latter is considered to represent a problem. This is because the waste segregation at the hospital is not good, so that risk wastes such as sharps, blood and infectious waste are deposited on the site. These are thus left in the open.

Plate 19. Moi Training and Referral Hospital dumpsite

Although no scavengers were observed during the visit, the hospital official stated that scavengers have been seen at the site in the early mornings. The informant did not know what they were scavenging for but he could not guarantee that they were not removing healthcare wastes from the site. This situation is also viewed with concern.

B.1.6 Huruma Dumpsite – Eldoret

The site is situated about 7km to the northwest of Eldoret on the Kitale road, and is called the Huruma Dumpsite. It is in the vicinity of the Eldoret wastewater treatment plant, separated from it by the Sosiani River. On the northern side of the dump, there are houses, otherwise the immediate area around the dump, is relatively unpopulated.
The dump occupies an area of approximately 5 ha, and is understood to be owned by the local authority. Evidently the earlier city dump closed down in the past five years and the dump has been operational since then.

The site geology is basaltic lava covered with scarce soil. The lava has been quarried on the bank of the river and the quarry has formed the original waste repository. The base of this has since been filled, but the upslope cliffs remain. The natural drainage is towards the Sosiani River. Leachate from the base of the landfill could be seen entering the river, a situation which must contribute to water pollution. In some instances the waste had been deposited right on the bank of the river. People were seen to be washing and recreating in this river.

There is no site design, i.e. no fencing or access control. A road ran along the ridge above the quarry and trucks could dump anywhere. There was no engineering in the form or drainage control, so that run-off entered the waste body, resulting in the observed leachate.

The waste received at the site is predominantly municipal solid waste, but also include spent oil, healthcare, industrial and even hazardous waste. It is understood that between 10 and 15 trucks per day visited the site. The working or tipping face was originally the 15m high quarry face, but dumping had extended laterally on both sides of the quarry. The extended slope into the quarry is a result of end tipping, and spent oil could be seen oozing through the dumped waste into the quarry.

![Plate 20. Huruma Dump site and syringes found in the dump.](image)

There were no proper roads on the dumpsite. However, it appeared that a bulldozer or some other plant was used to push waste over the slope and spread it so that vehicles that could traverse it. Unloading is both manual and tipping and there was no evidence of compacting and covering of waste. An exception is in a rehabilitated area, in the base of the quarry. This has been flattened and covered with soil, possibly for a football field. However, it was being dump on again.

Because of lack of compaction and cover, on areas all over the dumpsite, the waste were burning and smouldering. The aesthetic of the site is thus characterised by a burning, smouldering odour, as well as waste and litter scattered everywhere.

It was stated by the scavengers that there are about 40 of them on and around the site. They comprise men women and children, who all knew one another and work together. The scavenging did not however, appear to be as well organised as at other dumps visited and there were no stockpiles of recyclables. No one was wearing protective clothing and there are glue sniffers at the site.
During the visit one of the main focuses was to ascertain the situation with regard to healthcare wastes disposed.

In contrast to the other public dumpsites, it was found that there were many deposits of healthcare wastes on this dump. They were not segregated at the healthcare facility and thus included sharps. These loads included syringes needles and blood samples, and are reason for the concerns associated with the disposal of healthcare wastes, as they were simply left out in the open.

When questioned, the scavengers indicated awareness of the dangers associated with healthcare waste and said they and the children on site avoided them. None reported injury from healthcare waste, and all professed to be in good health.

On the issue of scavenging or recycling of healthcare wastes, the scavengers said they were not aware that this happened.

The Huruma dumpsite in Eldoret is typical of the situation that gives reason for concern. The town has several incinerators which are known to offer a service to healthcare waste generators. However, these wastes still arrive at the totally unsuitable dumpsite, in considerable quantities.
B.1.7 Kachok Dumpsite –Kisumu

The site is located within the city limits in south. It occupies a vacant area measuring some 2 Ha. in total and is flanked by a sports field on the east, industry to the east, south and west, and the town to the north.

The geology is recent sandy alluvium, which also determines the nature of the soils. There was what could have been a stockpile of darker soil on site, which was planted with crops. Drainage is with the slope of the land to the south and west, and there is probably drainage to a watercourse along the servitude between the sports field and the industry in wet weather.

There is no design, access control or fencing. Pedestrians could enter the site at will and trucks could enter it where accumulated waste permitted. There is also no engineered drainage control.

The site receives all manner of waste, including municipal, industrial and healthcare waste. The quantities are not known, however, for the main dumpsite for Kisumu, this site did not appear to be large enough or accepting sufficient waste. It was said the site had been there since the 1960’s, and this was possibly why it was quite overgrown in places.

There are no site roads and no working fence. The site evidently received from 10 to 15 loads per day and dumping and unloading just takes place wherever access is obtained. There is no spreading, compaction, or covering of the waste. The result is numerous burning, smouldering heaps all over the site.

Aesthetically, the site was a disaster, with waste strewn everywhere, and the odour of burning and smouldering. It was a typical of an open burning dumpsite.

The scavengers on site were very much in evidence. Some lived in shelters on the site. They were very aggressive at first; however, they later provided a lot of information. They confirmed that there were about 30 of them, that they were a community and welcomed newcomers. They had all been on the site for a protracted period and considered themselves as career scavengers. There were large piles of stockpiled cullet on the site, collected over a long period. Evidently, there was no market. They did not have protective clothing and wore slip slops; however, all claimed to be in good health and did not consider daily contact with the waste to be a problem.

Plate 23. Scavengers in Kachok Dump in Kisumu
When questioned, the scavengers acknowledged that there was healthcare waste dumped on the site. They led the team to a secluded area where it had been dumped. At this location there was incinerator ash and other healthcare segregated waste. Although it was possible to find the old needle in the waste, this was the exception. The scavengers also said that they always tried to put such waste to one side, burn it and keep the children away from it. They also assured the team that scavenging and recycling healthcare waste was something unheard of on the site.

Plate 24. Health care waste found in the dump

The above all seemed very acceptable. However, more thorough traversing of the site revealed numerous piles of healthcare waste, most of it unburned and most of it comprising sharps. This in itself was highly unacceptable but also cast a question mark over the validity on the information obtained.

**B.1.8 Coast Provincial Hospital Dumpsite-Mombasa**

This small private site is located in fenced off area of about 300 m² on the hospital property. On one side was the hospital, the other the estuary where there was bush and on the other two sides there were staff dwellings. The incinerator was off to one side in this enclosure. The actual disposal site, which covered some 80 m² was in the central section of the property.

The geology of the site is Pleistocene marine deposits, mainly coral, overlain by sandy soils. The drainage was very gentle slope, generally towards the estuary. However, the dumpsite excavations and soil heaps had disturbed the flow of runoff water.

There is fencing on the non hospital boundaries of the property and there was also access control to the outside, by means of a gate. There is however no engineering of the dumpsite, which is simply a shallow pit, and neither is there any surface water drainage control system.

Waste arriving at the site is incinerator ash and supposedly non hazardous healthcare waste, which was not in bags. The latter, however, was not properly segregated and contained some sharps and infectious waste. Waste was tipped into the pit, probably by wheelbarrow. There was no compaction and covering, and the waste was left in the open to decompose and smoulder and burn. It was noted that this situation attracted a lot of birds and flies.

The aesthetics of the site were typical of an uncontrolled burning dump, unsightly and with smoke, smouldering and decomposition resulting in odour problems which must have impacted adversely on
the neighbours. Also burning could result in emissions of dioxins and furans, which could have adverse affects in the built up environment under consideration.

On account of the fencing and general awareness of hospital staff, there were no scavengers at the waste dump. It would have been possible for people to access the site if they really wanted to, as the gate was not always locked.

Incinerator ash was disposed at the site on a daily basis, together with mainly non risk healthcare waste. Even with the poorly segregated healthcare waste being disposed of, the evident lack of scavengers made this a relatively low risk site. However, since no chemical analysis had been done on the incinerator ash and because the dump was in such close proximity to the hospital, it was decided to take a sample of in incinerator ash and have it hazard rated. The results of the analyses are included in Appendix 4 and indicated in the conclusion.

**B.1.9 Tiwi Health Centre Dumpsites – Kwale District**

These were two a very small private sites located on the fenced off rural dispensary property. Apart from the dispensary buildings on the property, the surrounding area was bush, with occasional widely spaced residences. The actual disposal sites were only pits, each with an area of only a few square metres. One was a general waste pit, some 50m north of the kitchen area and the other was for ash and was adjacent to the “incinerator”, some 150m east of the complex.

In both cases, the geology is probably course Triassic sandstone overlain by sandy soil. Drainage was generally eastward towards the sea, but as the slope was flat and the sites very small, this was not a consideration.

The general waste pit was adjacent to an old disused placenta pit. Poorly segregated healthcare wastes were dumped into both these repositories and burned without covering. Although this site was inappropriate for a healthcare institution, being unsightly and having flies odour problems; because it was so small and remote, the impact was negligible.

The “incinerator” ash pit was simply a pit into which ash was dumped. The impact of this facility was also deemed negligible.

On account of the size, remoteness and rural environment of the general waste pits, it is highly unlikely that scavengers would frequent it. This was confirmed by the dispensary staff. Since there was nothing to scavenge at the ash pit, this was not a consideration.

**B.1.10 Kibarani Dumpsite – Mombasa**

The Kibarani dumpsite is one of Mombassa’s two dumpsites. It was supposed to be closed, according to a certain Mr Musyoka, “because of the offensive smell being emitted from the area [it represented] a stumbling block to the development of tourism besides being a shame to the country.” The site was in fact relocated to the Mwakirunge area but, as with so many dumpsites, it has continued to operate. (Although not visited, it is understood that the new Mwakirunge facility is also poorly managed.)
The Kibarani dumpsite is central to the waste generation areas of Mombasa. It is sited on a sort of peninsula which extends into Mombassa’s Makupa Creek. It is therefore flanked by the creek on two sides, where limited mangroves were reported (but not seen); and bush, wasteland and roads on the other sides. Although the general area is industrial, there are inevitably some informal dwellings in the immediate area, and residential areas, further away.

The geology of the site is Pleistocene marine deposits, mainly coral, overlain by sandy soils. No virgin soil was observable on site, although there is a lot of rich organic soil present, as a result of the composting and decomposition of vegetable matter in the waste.

The drainage of the site is towards the Makupa Creek. The waste, which had been dumped and pushed down the natural slope, extended right into the creek in places. (See Plate).

Access to the dump is off the main road and along the peninsula. There is no fencing; however, as it is a peninsula, vehicle access is only possible along the approach road. At the actual entrance to the site, there is a prefab structure that was used as a gate house. There is no restriction on pedestrian access.

From the point of view of engineering design, there is a surfaced road up a steep incline in one part of the site, but there is no liner, leachate collection or gas control systems. Drainage control is also completely absent, so that upslope surface water enters the site and ponding occurs in the low lying areas of the waste body. There is leachate at the toe of the dump which was observed to drain into the creek.
The waste received at the site is predominantly municipal solid waste, but also include industrial, healthcare and hazardous waste. Record keeping does take place, and a daily list of trucks entering the site is kept. From this list, it appeared that between 50 and 60 trucks use the site each day (7 trips for 7 trucks, plus others).

The site supervisor assured the team that the waste is managed daily with a bulldozer. However, because of the backlog and lack of an operating machine and fresh tracks on site, this was probably not the case. Nonetheless, the waste had definitely been spread and pushed over the slope at the end of a terrace, into the creek in some instances. Because of the spreading, the trucks could drive over it and deposit their loads in dry weather. Unloading is both hydraulic and manually by the scavengers.

No waste compacting or covering, as require by sanitary landfilling, takes place at the site. As a result, many parts of the dumpsite, particularly next to the creek exhibited open burning and/or smouldering.

As indicated in the opening paragraph, the most obvious aesthetic problem is odour from the decomposing, burning, smouldering waste. The smoke could be seen, driving from the airport to the hotel area. On the actual dumpsite the odour is predominantly of burning and smouldering waste. There was however, no landfill gas odour.

The approach road to the dumpsite on the peninsula had aesthetic problems such as dust, spilled waste and litter, but this did not extend to the public roads.

As with most public dumpsites in Kenya, scavenging from the Kibarani dumpsite provides a livelihood for many. There is no means of preventing scavenging and it was reported that there were about 400 scavengers on the site. These included men woman and children.

While some scavengers lived off site, others lived on site in shelters and shacks constructed from waste materials. All around are stockpiled recyclables, glass, plastic of various grades including PET, paper, cardboard and ferrous and non-ferrous metal. There were also scales. No accurate information was available about the quantities of recyclables collected and sold; however, a survival income of Ksh 200-300 per day was quoted by several scavengers interviewed, as well as the site supervisor.
All scavengers interviewed indicated that they scavenged for their livelihood, and were in it for the long term. The supervisor had been a scavenger on the dumpsites since the 1970’s. There are men, women and children on the site, sometimes together, and sometimes segregated. Both the supervisor and the scavengers interviewed confirmed that there is a scavenger social structure at the dumpsite. They indicated that the scavengers mostly knew one another and looked out for one another’s welfare and that of the group. A case was cited, where the scavengers had collected money to send one of their fellow scavengers to hospital.

Regarding health and safety, the supervisor and scavengers all indicated that they are in good health. The scavengers were adamant that their ongoing contact with the waste did not adversely affect them and that they only got normal illness such as flu. Safety risks from plant were denied, but must have existed when the bulldozer was on site.

The main safety risk is because of the lack of protective clothing. There were barefooted children on the dumpsite and scavengers wearing slip slops and working in waste which contained broken glass and sharps amongst other things. No gloves were seen to be worn. On this site some of the scavengers admitted to scratches, cuts and puncture wounds which they dismissed as part of the job and not significant.

An exception to the above when questioned about the presence of healthcare wastes on the dumpsites, the scavengers, without exception, indicated awareness of the dangers associated with healthcare waste. In some instances they claimed that they burned or buried it of their own violation. There was, however, no real evidence to support this.

Regarding injury from healthcare waste, the supervisor was the “senior scavenger” referred to in Section 3, who had had a needle puncture in the foot (Plate 29). Apart from the fact that the scar persisted, he insisted that there had been no other adverse affects and that he was in fact in excellent health, which he definitely appeared to be for a man in his 60’s.
The main focuses of the visit was to ascertain the situation with regard to healthcare wastes disposed. It was found that there were many deposits of healthcare wastes on this dump. Many of these were dumped along the surfaced road on the actual dumpsite, along which the scavengers walked. The wastes had obviously not been segregated at the healthcare facilities and thus included syringes, needles and blood samples. These were simply left out in the open and are the reason for the concerns associated with the disposal of healthcare wastes.

The scavengers indicated awareness of the dangers associated with healthcare waste and said they and the children on site avoided them. None other than the supervisor reported injury from healthcare waste. On the issue of scavenging or recycling of healthcare wastes, the scavengers said they were not aware that this happened. It was at this site, however, that the scavengers admitted to sometimes using the tubing from drip apparatus for their own purposes.
C 1.0 List of Institutions Studied/Consulted

C.1.1 Health Care Facilities

1. Nairobi Hospital
2. Acacia Medical Clinic
3. Kenyatta National Hospital
4. Moi Referral and teaching Hospital
5. Coast Provincial General Hospital
6. Nyeri Provincial General Hospital
7. Kisumu District Hospital
8. Langata Health Centre
9. Woodley Dispensary
10. Limuru Health Centre
11. Sosiot Health Centre
12. Tiwi Rural Health Training and Demonstration Centre
13. Garissa District Hospital
14. Bwagamoyo Dispensary
15. Al Hazar Medical Clinic
16. Sosiot Health Centre
17. Iftin Medical Services
18. Iriyows community Based Facility
19. Iftin Sub District Hospital

C.1.2 Training Institutions

1. Nairobi University, Department of Environmental Engineering
2. Kenyatta University, Department of Public Health
3. Moi Referral and Teaching Hospital
4. Kenya Polytechnic
5. Eldoret polytechnic
6. Bandari College
7. Mombasa Polytechnic
8. Kisumu polytechnic
9. Maseno University
10. Egerton University
11. Kenya Medical Training College
12. Aga khan University Hospital

C.1.3 Private Waste collectors

1. Ivory Consultants
2. Environment and Combustion Consultants
3. Health Care Service(Private Incinerator company)
4. Bins (Nairobi Services)
5. Prime Bins Limited
6. Shades Limited
7. Domestic Refuse Disposal Limited
C.1.4 Health Care Non Governmental Organizations

1. John Snow Inc
2. Centre for Disease Control
3. Kenya Medical Research Institute

C.1.5 Government Departments

1. Ministry of Health
2. Kenya Expanded Programme On Immunization (KEPI)
3. Kenya Radiation Protection Board
4. Nairobi City Council
5. Mombasa City Council
6. Kisumu City Council
7. Eldoret Municipal Council
### Annex D Data Collection Instruments

#### D.1 Data entry form

**Generic Data Entry Form**  
**Health-Care Waste Weighing Form**

- **Number of Beds in the Hospital**:  
- **Number of out-patients per day/Month**:  

<table>
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<th>Point of generation</th>
<th>Quantity generated by Waste Category/Type (in Kgs)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Area</td>
</tr>
<tr>
<td>Out-patient</td>
<td></td>
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<tr>
<td>Ward 1</td>
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<td>Ward 2</td>
<td></td>
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<tr>
<td>Ward 9</td>
<td></td>
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<tr>
<td>Ward 10</td>
<td></td>
</tr>
</tbody>
</table>
Categories of wastes defined

1. **Box:** Sharps include needles and syringes, razor and scalpel blades, broken ampule bottles etc.
2. **Red Bags:** Pathological waste include amputations, histological specimen, biopsies and autopsies, rejected blood, placenta, foetuses and other tissues organs
3. **Yellow Bags:** Clinical waste include used gloves, soiled cotton wool, bandages, POPC, pads, giving lines etc
4. **Purple Bags:** Cytotoxic wastes include expired drugs, unfinished drugs, spilled drugs, radioactive wastes etc
D.2 Survey Questionnaire for HCWM

Survey Questionnaire for Health-care Waste Management

QUESTIONNAIRE

Health Facility (name, location):

[ ] Specialist Hospital
[ ] National Hospital
[ ] University (teaching/referral)
[ ] Provincial General Hospital
[ ] District Hospital
[ ] Sub-district Hospital
[ ] Health Centre
[ ] Dispensary
[ ] Private Clinic
[ ]
<p>| | |</p>
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<td><strong>No. of outpatients:</strong></td>
<td>________/day</td>
</tr>
<tr>
<td><strong>No. of beds (total):</strong></td>
<td>________/day</td>
</tr>
<tr>
<td><strong>Including</strong> (no.)</td>
<td>in (type of ward) in ward</td>
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<td>(type of ward) (type of ward)</td>
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<td>(type of ward) (type of ward)</td>
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<td></td>
<td>(type of ward) (type of ward)</td>
</tr>
</tbody>
</table>
## Type of solid waste produced and estimated quantity

(Consult classification and mark X where waste is produced)

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<th>Waste category</th>
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<tr>
<td></td>
<td>Pathological</td>
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<tr>
<td></td>
<td>Radioactive</td>
</tr>
<tr>
<td></td>
<td>Chemical</td>
</tr>
<tr>
<td></td>
<td>Infectious</td>
</tr>
<tr>
<td></td>
<td>Sharps</td>
</tr>
<tr>
<td></td>
<td>Pharmaceutical</td>
</tr>
<tr>
<td></td>
<td>Pressurized containers</td>
</tr>
<tr>
<td></td>
<td>Est. quantity (kg/day)</td>
</tr>
<tr>
<td></td>
<td>Est. Quantity (vol./day)</td>
</tr>
<tr>
<td><strong>Patient services</strong></td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td></td>
</tr>
<tr>
<td>Surgical</td>
<td></td>
</tr>
<tr>
<td>Operating theatre</td>
<td></td>
</tr>
<tr>
<td>Recovery/intensive Care</td>
<td></td>
</tr>
<tr>
<td>Isolation ward</td>
<td></td>
</tr>
<tr>
<td>Dialysis unit</td>
<td></td>
</tr>
<tr>
<td>Oncology unit</td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td></td>
</tr>
<tr>
<td>Outpatient clinic</td>
<td></td>
</tr>
<tr>
<td>Autopsy room</td>
<td></td>
</tr>
<tr>
<td>Radiology</td>
<td></td>
</tr>
<tr>
<td><strong>Laboratories</strong></td>
<td></td>
</tr>
<tr>
<td>Biochemistry</td>
<td></td>
</tr>
<tr>
<td>Microbiology</td>
<td></td>
</tr>
<tr>
<td>Haematology</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td></td>
</tr>
</tbody>
</table>
### Waste segregation, collection, storage, and handling

Describe briefly what happens between segregation (if any) and final disposal of:

<table>
<thead>
<tr>
<th>Sharps</th>
<th>Pathological waste</th>
<th>Infectious waste</th>
<th>Radioactive waste</th>
</tr>
</thead>
</table>
## Waste segregation, collection, labelling, transport, and disposal

<table>
<thead>
<tr>
<th>1. Handling of segregated waste</th>
<th>Sharps</th>
<th>Pathological waste</th>
<th>Infectious waste</th>
<th>Radioactive waste</th>
<th>Chemical waste</th>
<th>Pharmaceutical waste</th>
<th>Pressurized containers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicate by X the type of waste (if any) that is segregated from general waste stream.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is the segregation taking place (i.e. operating room, laboratory, among others)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What type of containers/bags (primary containment vessels) are used to segregate waste (bags, cardboard boxes, plastic containers, metal containers, among others)? describe accurately.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What type of labelling, colour-coding (if any) is used for marking segregated waste?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
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<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Who handles (removes) the segregated waste (designation of the hospital staff member)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Is the waste handler using any protective clothing (gloves, among others) during waste handling? Yes/No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What type of containers (plastic bins, bags, cardboard boxes, trolleys, wheelbarrows, safe boxes, metal containers, among others) are used for collection and internal transport of the waste? Describe.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is the segregated waste stored while awaiting removal from the hospital for disposal? Describe.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe briefly the final disposal of segregated waste (taken to municipal landfill, buried on hospital grounds, incinerated (external incinerator, own incinerator), open burned, removed from</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
(premises, among others)

If removed from premises; who is responsible for removal?
Health facility/self, private collector, council, among others

If removed from premises; what form of transport is used?
Enclosed waste track, open waste track, open pick-up, among others

How often is the waste removed from site?
Daily
3 – 4 times per week
1 – 2 times per week
Once a week
Every two weeks
Once a month
Less often

2. Is safety clothing issued to staff involved in medical waste collection, i.e. gloves, aprons, among others

3. If yes, please list the safety clothing/items issued to medical waste collectors and the frequency of issue:
4. Which of these waste collection, handling, transport and disposal activities are undertaken by Health-care staff and which are outsourced? List the party responsible for that activity, where the activity is outsourced and the start and end dates of the contract entered into:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>RESPONSIBLE PARTY (self/facility, Council, Private collector, among others)</th>
<th>NAME OF THE RESPONSIBLE PARTY/PRIVATE COLLECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incineration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Personnel involved in the management of Health-care waste**

1. (a) Designation of person(s) responsible for organization and management of waste collection, handling, storage, and disposal at the hospital administration level.
(b) General qualification and level of education of designated person.

(c) Has he/she received any training on hospital waste management?  
If yes, what type of training and of what duration?

2. Indicate the number of persons involved in the collection, handling, and storage of Health-care waste, their designation, their training in solid waste handling and management, and the number of years of experience of this type of work.

<table>
<thead>
<tr>
<th>Number</th>
<th>Designation</th>
<th>Training</th>
<th>Experience</th>
</tr>
</thead>
</table>

iii. Do the waste management staff have job descriptions detailing their tasks?  

iv. Are instructions/training given to newly hired waste management staff?
v. If yes, please indicate what form of instructions/training is given to newly hired waste management staff?

- A – If external training, the name of the training institution
- B – The duration of the training
- C – The qualifications of the training instructor

<table>
<thead>
<tr>
<th>A – Name of external training institution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B – Duration of training</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 3 months</td>
</tr>
<tr>
<td>3 to 6 months</td>
</tr>
<tr>
<td>6 months to 1 year</td>
</tr>
<tr>
<td>18 months</td>
</tr>
<tr>
<td>2 years</td>
</tr>
<tr>
<td>Others (state)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C – Instructor Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma in Waste Management</td>
</tr>
<tr>
<td>Diploma in Public Health</td>
</tr>
<tr>
<td>Others (state)</td>
</tr>
</tbody>
</table>

Health-care waste management policy

1. Are you aware of any legislation applicable to Health-care waste management?

  Yes ☐  No ☐
If yes, please list the legislative Acts:

__________________________________________________________

2. Are you aware of a document outlining the hospital waste management policy?
   If yes, give title of document (and attach a copy if possible):

__________________________________________________________

3. Is there a manual or guideline document on management of Health-care waste available?
   (a) In the Ministry of Health?
      If yes, give title of document:

   ________________________________________________________

   (b) In your Health facility?
      No
      If yes, give title of document:

   ________________________________________________________

4. (a) Does your Health facility have a Waste Management Plan?
      If yes, please attach a copy.

      (b) Does your Health facility have a Waste Management Team (or Teams)?
          If yes, please list the members by designation:

          | Designation | No. |
          |-------------|-----|
          | Team leader |     |
          | Team members: |   |
          | Waste handling staff: |   |
5. Are there clearly defined procedures for collection and handling of wastes from specified units in the Health facility?  
   Yes  No

6. Do you have a Policy/Guideline outlining the steps in case of injury (e.g. needle-stick injury) or contamination of a medical waste worker?  
   Yes  No

7. Is there any emergency procedure available in your Health facility for Staff members handling Health-care waste?  
   Yes  No

8. Are there waste management responsibilities included in the job descriptions of Health facility supervisory staff (Head of Health facility, Departmental Heads, Matron/Senior Nursing Officer, Public Health Officer, Hospital Engineer, Infection Control Officer, Pharmacist, Laboratory Supervisor, among others)?  
   Yes  No
9. Please indicate how the present waste collection, handling, transport, and disposal responsibilities are defined in the job descriptions of the staff involved: (Cite appropriate statement or provide copies if possible).

10. How are the present waste collection, handling, and disposal responsibilities defined in the job descriptions of the staff involved? (Cite appropriate statement or provide copies.)

__________________________________________
__________________________________________
__________________________________________
__________________________________________

Financial implications of Medical Waste Management

1. How is your medical waste management funded?
2. Please provide details of amount spent for the last financial year (2004/2005) and amounts allocated for the present financial year (2005/2006)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical waste management allocation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vote number/Item number</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. What are the average annual costs incurred to render the following specific components of medical waste management services?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Containers/bins/boxes e.t.c</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handling Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective Clothing’s</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collection Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL ANNUAL COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General aspect**

1) Give a brief general account of the problems you encounter in relation to medical waste management in the health facilities within your area of jurisdiction

2) Comment on the financial implications of Health-care waste management with respect to adequacy and/or limitation of the same

**Observation /Checklist**
1. Type/design of vehicle used for the collection and transportation for waste

2. Type/design of waste storage receptacles used

3. Availability of protective gear for the waste handlers

4. Visible waste disposal option within the health facility compound (e.g. waste burial pit, crude burning site, e.t.c).

5. Presence of an incinerator either within the health facility compound or elsewhere.

6. Treatment of waste prior to disposal

7. Colour-coding/labelling of waste prior to disposal

8. Carrying out of waste segregation within the health facility

9. Packaging of waste destined for disposal
D.3 Short Questionnaire for District Public Health Officers

MINISTRY OF HEALTH

HEALTH CARE WASTE MANAGEMENT QUESTIONNAIRE

Short Questionnaire for District Public Health Officers

District.............................................. Province...........................................

Instructions:
. Please give correct information about your district and where possible make verification visits to ascertain the correct position on the ground. Use your Divisional Public Health Officers where appropriate.
. Circle the correct option or write your answer where appropriate.

1) Does your district have an incinerator? a. Yes  
   b. No

2) What type of incinerator(s) do you have in GoK facilities?

<table>
<thead>
<tr>
<th>Type of incinerator</th>
<th>Number of Combustion Chambers</th>
<th>Number functional</th>
<th>Number not functional</th>
<th>Number Repairable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Stone built</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b Brick built</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c Electric powered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d Others (Specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3) What type of fuel is used in GoK Health facilities?

<table>
<thead>
<tr>
<th>Type of fuel used</th>
<th>Number of Incinerators involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Kerosene</td>
<td></td>
</tr>
<tr>
<td>2 Diesel</td>
<td></td>
</tr>
<tr>
<td>3 Wood</td>
<td></td>
</tr>
<tr>
<td>4 Waste paper</td>
<td></td>
</tr>
<tr>
<td>5 Saw Dust</td>
<td></td>
</tr>
<tr>
<td>6 Electric powered</td>
<td></td>
</tr>
</tbody>
</table>

4) What type of incinerator(s) do you have in Private and Mission facilities?

<table>
<thead>
<tr>
<th>Type of incinerator</th>
<th>Number functional</th>
<th>Number of chambers</th>
<th>Number not functional</th>
<th>Number Repairable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Stone built</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b Brick built</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c Electric powered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5) What type of fuel is used in Private and Mission Health facilities?

<table>
<thead>
<tr>
<th>Type of fuel used</th>
<th>Number of Incinerators involved.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Kerosene</td>
<td></td>
</tr>
<tr>
<td>2 Diesel</td>
<td></td>
</tr>
<tr>
<td>3 Wood</td>
<td></td>
</tr>
<tr>
<td>4 Waste paper</td>
<td></td>
</tr>
<tr>
<td>5 Saw Dust</td>
<td></td>
</tr>
<tr>
<td>6 Electric powered</td>
<td></td>
</tr>
</tbody>
</table>

6) Please provide the following details for each incinerator:

<table>
<thead>
<tr>
<th></th>
<th>Incinerator 1</th>
<th>Incinerator 2</th>
<th>Incinerator 3</th>
<th>Incinerator 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>In working order</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kilowatt Rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours operated per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage Downtime</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How long in use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does it have scrubbers - Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil used per week - Litres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7) How many GoK Health Facilities do you have in the district? .......... 

8) How many of these Health Facilities (Q7) have incinerators? .......... 

9) How many of these facilities have fenced off waste disposal areas? 

10) How many Private and Mission Health Facilities do you have in the district? 

11) How many of these Health Facilities (Q 10) have incinerators? .......... 

12) What is the percentage coverage of incinerators in your district?

\[
\text{No. of HFs with incinerators} \times 100 = \text{Percentage}
\]

13) What percentage of incinerators are functional? .......... 

14) Why do you think the situation is as in (13) above? 

......................................................................................................
15) What method(s) do you use in disposing of medical waste in your Hospital? 
a. Incinerator  
b. Crude dumping  
c. Burning in shallow pits  
d. Collected by municipal councils  
e. Others (specify)  

16) What method(s) do you propose for your district in the disposal of health care waste?  
a. Incinerator  
b. Burning and burial  
c. Reverse Logistics  
d. Others (specify)  

_Filled in by (Name)_  

Desigitation

_Date_
Annexure E – Health Care Facilities Visited During the Survey

E.1 List of Facilities Visited

1. Kenyatta Hospital-Nairobi
2. Langata Health Centre
3. Woodley Dispensary
4. Acacia Medical Centre
5. Kibera Community Self Help Programme-KICOSHEP
6. Kisumu District Hospital – Kisumu
7. Nyahera Health Centre - Kisumu
8. Milmani Hospital –Private Hospital in Kisumu
9. Kericho Nursing Home Ltd. – Kisumu
10. Machakos District Hospital-Eastern Province
11. Machakos Medical Clinic
12. Nyeri Provincial General Hospital-Central Province
13. Limuru Health Centre
14. Muranga Dispensary
15. Coast Provincial General Hospital
16. Tiwi Primary Rural Health Training Centre
17. Bwagamoyo Dispensary
18. AL- Hazar Medical Clinic
19. Moi Referral and Training Hospital
20. Sosiot Health Centre
21. Narok Dispensary
22. St Mary's Medical Centre-Uasin Gishu
23. Kapchelal Dispensary-Keiyo
24. Sio-Port Health Centre-Western Province
25. Likindu Dispensary
26. Diana Medical Clinic
27. Matangwe Community Health and Development Programme
28. Nyamusi Health Centre
29. Kianjokoma Health Centre
30. Iftin Sub District Hospital-North Eastern Province
31. Eriyows Home Based Care
32. Iftin Medical and Laboratory Services
Annexure F- HCW Rapid Assessment Tool

Health-Care Waste Management
Rapid assessment tool for Kenya

<table>
<thead>
<tr>
<th>Section</th>
<th>Scope</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction</td>
<td>Provides basic information on this Rapid assessment tool</td>
</tr>
<tr>
<td>2.</td>
<td>Preparation</td>
<td>Checklist for chronological preparation of the assessment</td>
</tr>
<tr>
<td>3.</td>
<td>Planning</td>
<td>Plan for a two week field assessment with a few hints of what to do when</td>
</tr>
<tr>
<td>4.</td>
<td>Contacts</td>
<td>Contact list to help you keep track with all your main interlocutors</td>
</tr>
<tr>
<td>5.</td>
<td>Terminology</td>
<td>Listing of all specific terms used</td>
</tr>
<tr>
<td>6.</td>
<td>Tool A</td>
<td><strong>National</strong> Questionnaire to collect data from associations, NGOs and universities or other research institutes which have had relevant activities in HCWM in different settings of the country.</td>
</tr>
<tr>
<td>7.</td>
<td>Tool B</td>
<td><strong>National</strong> Questionnaire to collect data at Ministerial level</td>
</tr>
<tr>
<td>8.</td>
<td>Tool C</td>
<td><strong>Local/District</strong> Questionnaire to collect data at Municipal and District level</td>
</tr>
<tr>
<td>9.</td>
<td>Tools D</td>
<td><strong>Local/District</strong> Questionnaires to collect data from personnel of health care facilities (HCF)</td>
</tr>
<tr>
<td>10.</td>
<td>Tool E</td>
<td><strong>Local/District</strong> Personal observations made during visits of health care facilities</td>
</tr>
<tr>
<td>11.</td>
<td>Tool F</td>
<td><strong>National</strong> Rating system for the HCWM situation assessed by main headings</td>
</tr>
<tr>
<td>12.</td>
<td>Questions</td>
<td>Complete listing of all questions existing within the different tools</td>
</tr>
</tbody>
</table>
Health-care waste management • Rapid assessment tool

1 Introduction

- In many (mainly low income) countries, improper management of wastes generated in health care facilities causes direct health impacts on the community, the personnel working in health care facilities, and on the environment. In addition, pollution due to inadequate treatment of waste can cause indirect health effects to the community.
- Health-care wastes (HCW) include sharps (syringes, disposable scalpels, blades, etc.), non-sharps (swabs, bandages, disposable medical devices, etc.), blood and anatomic waste (blood bags, diagnostic samples, body parts, etc.), chemicals (solvents, disinfectants, etc.), pharmaceuticals, and others, and may be infectious, toxic, create injuries or be radioactive.
- This rapid assessment tool is a part of an overall strategy developed and aims at reducing the disease burden caused by poor health care waste management (HCWM) through the promotion of best practices and the development of safety standards.

2 Basic assumptions and objectives

- The basic assumption is that it is possible - in a short period of time (10-15 days), by questioning main stakeholders and by selecting a number of health care facilities representative of the country - to gather the essential data necessary to have a sufficient understanding of the situation regarding HCWM at a national level.
- By analysing the role of each stakeholder along the HCWM stream it should be possible to identify where problems remain and what simple, practical actions should be undertaken to solve them.
- The aim of this tool is to gather sufficient relevant information so as to provide decision makers/experts, etc. with the necessary data to help them elaborate a national action plan and or monitor and evaluate its performance.
### 3 Who can/should use this rapid assessment questionnaire?

- **Senior management personnel** (or other trained personnel) responsible for the design, implementation, evaluation and update of national policy and plans for health care waste management constitute the primary audience of this rapid assessment toolbox. Assistance from appropriate national or international persons or group should be sought before conducting the proposed assessment if senior management staff do not have the required expertise and experience.
- **Outsiders/independent experts** will find this simple toolbox useful when being asked for assistance to conduct assessments or evaluations of waste management systems in countries where poor health-care waste management is suspected.
- **National policy makers** may find this rapid assessment tool useful to better understand data for decision-making requirements in safe and appropriate waste management.

### 4 How to use this rapid assessment questionnaire?

- Assessment of health care waste management practices should follow 4 steps to ensure that the procedure will be useful, feasible, ethical and accurate.
  1) **Engaging all relevant stakeholders** by using tools A, B 1-2, C, D 1-4.
  2) **Describing the situation** by using tool E.
  3) **Gathering credible evidence** of defined quality and quantity by filling in as precisely and completely as possible all questions in each tool.
  4) **Justifying conclusions** in your final report by giving access to readers of field data collected with each tool.

- To ensure that information collection is a process conducted and analysed appropriately, this toolbox has been organised in several parts, which follow a logical and chronological frame which you are invited to follow. This frame goes from national (organisations, ministries…) to local/districts (the health facilities) and from the start of the HCWM stream (waste generation) to the end (final disposal).

- It is recommended that you start by going through each tool to make sure you understand the questions. Data collected should be as complete, short and precise as possible. It can be of several types: [C] multiple choice; [N] numerical (quantitative); [Q] qualitative (ranking from 1-5); Boolean [B] (yes/no) or [T] text.

### 5 Description of the tools

- The tools are all structured in the same way and the numbering of topics and questions are made in such a way that data can be easily retrieved and analysed.
- Each tool is described shortly below with its’ main stakeholder and the kind of information which it is hoped they can provide you.

- **Associations, NGOs, Universities**: these actors can provide interesting elements which can help you complete your understanding of how the system works linked to their practice of how HCWM is practised in places they have visited/worked in.

- **Ministries (Health, Environment, Education)**: these key interlocutors should assist you and provide you with a complete picture of how the system (should) function on both a practical, technical, financial and legislative level.
**C Municipal/local/district authorities:** confronted on a daily basis with general waste management issues, they can provide good information about waste collection, transport and final disposal as well as eventual recycling habits, etc.

**D1 Hospital managers:** often caught between several “conflicting” requests (national legislation / limited financial means at their disposal…), they are in a good position to give you an overall view of how the HCF functions and how HCWM is dealt with.

**D2 Head nurse:** she will be in the best position to give information regarding waste generation and segregation.

**D3 Person responsible for HCWM:** this person will be the best source of information regarding HCW collection, transport, treatment and final disposal.

**D4 Person handling HCW:** these people will provide interesting information on actual practices regarding HCW collection, transport; treatment and final disposal (if done on-site)

**E Personal observations:** so as to be able to cross-check information given by all health care facility personnel, your own observations and comments are necessary.

**F Rating system:** this last tool is made to help you rate the HCWM situation by topic.

### 6 Identifying & engaging relevant stakeholders

- Most problems stem from and solutions are found at a human level. It is therefore essential to identify all relevant stakeholders, consult them and engage them by convincing them of the importance/interest of having a simple and efficient HCWM system.
- The existing tools deal with the major stakeholders. Nevertheless it may be possible that, for example other important injection providers outside health care establishments should be included in the analysis, etc. In such cases, we recommend you use the listing of all questions and choose those you believe are the most relevant.
- In certain (especially small) facilities, you may find out that the same person will have to be interviewed for several tools!

### 7 Selection of health care facilities

- So as to be able to extrapolate collected data, a sufficient number of health care facilities representative of the country must be visited.
- To keep things simple, choose between one and two health care facilities per size and category of structure (private, public, religious), type of area (urban, peri-urban, rural) and by distinct ethnic and/or geographical area (topographic or climatic zone). This should normally lead you to visit between 6 and 12 health establishments.
- Specialised health care facilities such as psychiatric, geriatric institutions etc. are not considered as important HCW producers and are therefore left out of this study.

### 8 Information & Contacts

- To comment on this tool, please contact MOH:P.O BOX 30016-00100 NAIROBI, KENYA.
- Potential partners with international or regional outreach who are interested in advancing the agenda of safe HCWM and wish to cooperate in the further development and implementation of activities can contact Ministry of Health, Box 30016-0000, NAIROBI-KENYA.
<table>
<thead>
<tr>
<th>Weeks</th>
<th>Time needed</th>
<th>Action</th>
<th>Done</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before</strong></td>
<td>Count about 15-20 hours in total</td>
<td><strong>The success of your field assessment will depend greatly on how well it has been prepared beforehand. Having all logistical aspects settled; meetings with key interlocutors agreed upon and authorisations from the ministry of Health provided or promised in a written form will save you lots of time… and energy. The following points are not exhaustive, but give most of the main points.</strong></td>
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<td>8</td>
<td>3 hours</td>
<td>Go through the entire Rapid assessment tool (RAT) to make sure both its structure and content are clear for you.</td>
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<td><strong>If you have any questions don’t hesitate to contact us!</strong></td>
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<td>8 - 7</td>
<td>6 x 30 min.</td>
<td>Get in touch with the Ministry of Health (if not already done), so check when is the most appropriate period to perform the field assessment. Ask for their support in the preparation of this assessment: can they suggest a list of HCF (health care facilities) that you could visit…</td>
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<td>7</td>
<td>2 - 5 hours</td>
<td>Try and find a local counterpart both for the organisation of the logistics (driver, hotel, etc), assistance during the mission and follow up once it is finished (there are always some bits of information one would need and can only get if someone is on the spot.</td>
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<td>7</td>
<td>2 hours</td>
<td>Once you have a fair amount of information about where you will be going, try to make up a realistic plan according to distances to be driven, road status, size of HCF to be visited, etc.</td>
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<td>6</td>
<td>2 hours</td>
<td>Make a list of all the key interlocutors you should/must meet. Enter their coordinates in the contact sheet so as to have it at all times with you.</td>
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<td>6</td>
<td>2 hours</td>
<td>Request from the Ministry of Health that they provide you with a document giving you full access to all documentation you may need.</td>
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<td>1</td>
<td>1 hour</td>
<td>According to the number of HCFs you intend to visit, make the corresponding number of paper copies of the tools you will need (D1-D4), unless you are sure to be able to make photocopies on site.</td>
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<td><strong>During</strong></td>
<td>1-2 hours per day to sum up and prepare the next day</td>
<td><strong>The success of your field assessment will depend greatly on how well it has been prepared. Having all logistical aspects settled, meetings with key interlocutors agreed upon and authorisations from the ministry of Health will save you lots of time… and energy.</strong></td>
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<td>At the end of each day, make a summary of the day and check your field notes. Prepare the plan of the next day according to data collected, planned meetings…</td>
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<td>Confirm the meetings for the next day</td>
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<td>Enter data collected on your computer on a daily basis. Sending this information on regularly by e-mail ensures data to be stored in any other place than your computer only (for security reasons).</td>
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</table>
2 days before the end of your field mission, go through the entire documentation you have managed to collect. Think about any information you believe would be important to have and try and get hold of it while you are in the study area.

<table>
<thead>
<tr>
<th><strong>After</strong></th>
<th>Count about 2-3 weeks of full time work</th>
<th>The quality of your report and proposals depends on both the quality and amount of representative data you managed to collect during your field visits as well as the possibility to get, via a local counterpart, any further data needed.</th>
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<tbody>
<tr>
<td>1</td>
<td>Go through the entire documentation.</td>
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<td>1 - 2</td>
<td>Write the report. See example of report (annex ….xy)</td>
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<td>Envisage organising a workshop 3-6 months after your field assessment so as to implement it. People convened to this reunion are both local (Ministry of Health + Environment; resp. of medical staff training; representatives of the medical staff…) and foreign (potential donors, cooperation agencies already working in the country…)</td>
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<td>14</td>
<td>Collection of eventual missing information</td>
<td>Ministry of Health</td>
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<td>Feedback on how the mission went to Ministry of Health</td>
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<td>+ eventual request for assistance in gathering some more information</td>
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Participants: xx (first letter of first and last name of participant); …eg PR For Patrick Kenya
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<th>No.</th>
<th>When</th>
<th>Workshop</th>
<th>Person</th>
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<th>First Name</th>
<th>Institution</th>
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<tr>
<td>1</td>
<td>Anatomic waste</td>
<td>Consists of recognizable body parts.</td>
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<td>2</td>
<td>Auto Syringe</td>
<td>A specially modified disposable syringe with a fixed needle which is automatically disabled by plunger blocking after a single use.</td>
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<td>3</td>
<td>Bloodborne pathogens</td>
<td>Infectious agents transmitted through exposure to blood or blood products.</td>
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<td>4</td>
<td>Burden of disease</td>
<td>The health and socio-economic cost of a given medical condition on a society.</td>
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<td>5</td>
<td>Chemical waste</td>
<td>Consists of/or containing chemical substances. [Includes: laboratory chemicals; film developer; disinfectants expired or no longer needed; solvents, cleaning agents and other].</td>
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<tr>
<td>6</td>
<td>Colour coding</td>
<td>Designates the use of different colours for the storage of various categories of HCW.</td>
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<td>7</td>
<td>Container</td>
<td>Vessel in which waste is placed for handling, transportation, storage and/or eventual disposal. The waste container is a component of the waste package.</td>
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<td>8</td>
<td>Cytotoxic waste</td>
<td>Drugs possessing a specific destructive action on certain cells.</td>
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<td>9</td>
<td>Disinfectant</td>
<td>Chemical agent that is able to reduce the viability of microorganisms.</td>
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<td>10</td>
<td>Disposable syringe</td>
<td>An all-plastic syringe designed for a single use, with a separate, steel needle. Because there is no mechanism to prevent re-use, this type of syringe may be used more than once.</td>
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<td>11</td>
<td>Disposal</td>
<td>Intentional burial, deposit, discharge, dumping, placing or release of any waste material into or on any air, land or water.</td>
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<td>12</td>
<td>Handling</td>
<td>The functions associated with the movement of waste materials.</td>
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<td>13</td>
<td>Health-care wastes with high content of heavy metals</td>
<td>Consists of materials and equipment which include heavy metals and derivatives in their structure. [Includes: batteries; broken thermometers; manometers].</td>
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<td>14</td>
<td>Hepatitis B</td>
<td>Hepatitis caused by a virus and transmitted by exposure to blood or blood products or during sexual intercourse. It causes acute and chronic hepatitis. Chronic hepatitis B can cause liver disease, cirrhosis, and liver cancer.</td>
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<td>Hepatitis C</td>
<td>Hepatitis caused by a virus and transmitted by exposure to blood or blood products. Hepatitis C is usually chronic and can cause cirrhosis and primary liver cancer.</td>
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<tr>
<td>16</td>
<td>HIV / AIDS</td>
<td>Human Immunodeficiency Virus, a virus transmitted through exposure to blood or blood products or during sexual intercourse. HIV causes the Acquired Immunodeficiency Syndrome (AIDS).</td>
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<tr>
<td>17</td>
<td>Incineration</td>
<td>The controlled burning of solid, liquid or gaseous wastes to produce gases and residues containing little or no combustible material.</td>
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<tr>
<td>18</td>
<td>Infection control</td>
<td>The activities aiming at the prevention of the spread of pathogens between patients, from healthcare workers to patients, and from patients to healthcare workers in the healthcare setting.</td>
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<tr>
<td>19</td>
<td>Infectious health-care waste</td>
<td>Discarded materials from health-care activities on humans or animals which have the potential of transmitting infectious agents to humans. These include discarded materials or equipment from the diagnosis, treatment and prevention of disease, assessment of health status or identification purposes, that have been in contact with blood and its derivatives, tissues, tissue fluids, or wastes from infection isolation wards. [Includes: cultures and stocks; tissues; dressings, swabs or other items soaked with blood; blood bags. Sharps, whether contaminated or not, should be considered as a subgroup of infectious health-care waste].</td>
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<tr>
<td>20</td>
<td>Open dump</td>
<td>Characterized by the uncontrolled and scattered deposit of wastes.</td>
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<tr>
<td>21</td>
<td>Pharmaceutical waste</td>
<td>Consisting of/or containing pharmaceuticals. [Includes: pharmaceuticals expired, no longer needed; their containers, items contaminated by or containing pharmaceuticals (bottles, boxes…)].</td>
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<tr>
<td>22</td>
<td>Pathogen</td>
<td>A microorganism capable of causing disease.</td>
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<tr>
<td>23</td>
<td>Pressurized containers</td>
<td>Consists of containers (full or empty) with pressurized liquid, gas or powdered materials. [Includes: gas cylinders and cartridges; aerosol cans].</td>
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<tr>
<td>24</td>
<td>Radioactive health-care waste</td>
<td>Consisting of/or containing radioactive substances. [Includes: unused liquids from radiotherapy or laboratory research; contaminated glassware, packages or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources].</td>
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<tr>
<td>25</td>
<td>Recycling</td>
<td>A term embracing the recovery and reuse of scrap or waste material for manufacturing or other purposes.</td>
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<tr>
<td>26</td>
<td>Risk</td>
<td>Probability that a hazard will cause harm and the severity of that harm.</td>
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<tr>
<td>27</td>
<td>Safe injection</td>
<td>An injection that does not harm recipients neither exposes health workers to risks nor results in waste that puts communities at risk.</td>
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<tr>
<td>28</td>
<td>Safety (sharps) box</td>
<td>A puncture proof/liquid proof container designed to hold used sharps safely during disposal and destruction.</td>
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<tr>
<td>29</td>
<td>Safety syringe</td>
<td>Modified, disposable plastic syringe designed for the HC worker to disable it in a way that the needle is protected &amp; cannot be re-used.</td>
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<tr>
<td>30</td>
<td>Sanitary landfill</td>
<td>Characterized by the controlled and organized deposit of wastes, which is then covered regularly (daily) by the staff present on site. Appropriate engineering preparations of the site and a favorable geological setting (providing an isolation of wastes from the environment) are required.</td>
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<tr>
<td>31</td>
<td>Segregation</td>
<td>The systematic separation of waste into designated categories.</td>
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<tr>
<td>32</td>
<td>Sharps</td>
<td>Sharps are a subcategory of infectious health care waste and include objects that are sharp and can cause injuries. [Includes: syringe needles, scalpels, infusion sets, knives, blades, broken glass].</td>
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<tr>
<td>33</td>
<td>Sterilisable syringe</td>
<td>Either all plastic or all glass syringe with steel needle. This type of syringe is designed for re-use after proper cleaning and sterilisation in a steam sterilizer or autoclave.</td>
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</tbody>
</table>
### Storage
The placement of waste in a suitable location where isolation, environmental and health protection and human control (e.g. radiation control, limitation of access) are provided. This is done with the intention that the waste will be subsequently retrieved for treatment and conditioning and/or disposal (or clearance of radioactive waste).

### Treatment
Any method, technique or process for altering the biological, chemical or physical characteristics or waste to reduce the hazards it presents and facilitate, or reduce the costs of, disposal. The basic treatment objective include volume reduction, disinfection, neutralization or other change of composition to reduce hazards, including removal or radionuclides from radioactive waste.

### Waste management
All the activities - administrative and operational - involved in the handling, treatment, conditioning, storage, transportation and disposal of waste.

### Abbreviations

<table>
<thead>
<tr>
<th>#</th>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HCW</td>
<td>Health-care waste</td>
</tr>
<tr>
<td>2</td>
<td>HCWM</td>
<td>Health-care waste management</td>
</tr>
<tr>
<td>3</td>
<td>HCF</td>
<td>Health care facility</td>
</tr>
<tr>
<td>4</td>
<td>=</td>
<td>Only necessary to ask question when HCW is segregated</td>
</tr>
<tr>
<td>5</td>
<td>&lt;&gt;</td>
<td>Only necessary to ask question when HCW is taken off-site</td>
</tr>
<tr>
<td>6</td>
<td>MOH</td>
<td>Ministry of Health</td>
</tr>
</tbody>
</table>
# Health-care waste management • Rapid assessment tool

**Tool** | B-1 | Interview | person in charge of Ministry of Health | duration: 1h00
---|---|---|---|---
**Ministry:** | | | | |
**Department:** | | | | |
**Name of interviewee:** | | | | |
**Function:** | | | | |
**Tel. n°:** | | | | |
**Date of assessment:** | | | | |

<table>
<thead>
<tr>
<th>C</th>
<th>N°</th>
<th>Topic</th>
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<th>Type</th>
<th>Data</th>
<th>Comments / multiple choice</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Geographical situation &amp; population</td>
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<tr>
<td>104</td>
<td>Population</td>
<td>Could I get detailed demographic data of the country?</td>
<td>B</td>
<td></td>
<td>If possible by category &amp; type (Nbr. of beds), by locality / district</td>
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<tr>
<td>2</td>
<td>Health care facility (HCF)</td>
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<tr>
<td>202</td>
<td>HCFs</td>
<td>Could I obtain a list of all HCFs in the country?</td>
<td>B</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Staff</td>
<td></td>
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<tr>
<td>300</td>
<td>Medical staff training</td>
<td>Is training of med. staff available regarding HCWM?</td>
<td>B</td>
<td></td>
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<tr>
<td>306</td>
<td>Medical staff numbers</td>
<td>Could I have a break down of the medical staff?</td>
<td>B</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>HCW generation</td>
<td></td>
<td></td>
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<tr>
<td>400</td>
<td>Quantities of HCW produced</td>
<td>Do you have any figures at the national/local level?</td>
<td>B</td>
<td></td>
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<td>6</td>
<td>HCW storage containers</td>
<td></td>
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<td>603</td>
<td>Colour coding</td>
<td>Do you have a specific colour coding system?</td>
<td>B</td>
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<td>&lt;&gt;</td>
<td>9</td>
<td>HCW off-site transport</td>
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<tr>
<td>&lt;&gt;</td>
<td>900</td>
<td>Transport services</td>
<td>Are there any control measures?</td>
<td>B</td>
<td></td>
<td>[0] None; [1] transport form; [2] other (specify)</td>
</tr>
<tr>
<td>11</td>
<td>HCW final disposal</td>
<td>Ask to be allowed to take photos of the place!</td>
<td>C</td>
<td></td>
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</tr>
<tr>
<td>1201</td>
<td>National HCWM regulations</td>
<td>Can we have copies of existing (draft) documents?</td>
<td>B</td>
<td></td>
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<tr>
<td>1202</td>
<td>National HCWM regulations</td>
<td>Does their application cause any problems?</td>
<td>T</td>
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</table>

**13 Policy and budget**

| 1300 | Health system | Could you outline how it is organised? | T | Try to obtain a flowchart of the health system + responsibilities… |
| 1301 | Budget allocation for HCWM | Do you think sufficient funds are allocated to HCWM? | B |
| 1302 | Budget allocation for HCWM | Which % of the national health budget do you allocate? | N | If there is no specific budget allocation, put 0. |
| 1304 | Purchase practices | Is there a national policy for items used in HCWM? | B |
| 1305 | Relations with other ministries | With which ministry(ies) do you work on HCWM? | T |
| 1306 | Cooperation with agencies | With which bi(multi)lateral agencies do you cooperate? | T |
| 1308 | Annual report of activities | Could I obtain a copy of your annual report(s)? | B | Try to obtain copies of the last 2-3 years |

**Explanations**

- **Type:** data is either quantitative [N] (enter a number or percentage); qualitative [Q] (see legend); Boolean [B] (yes/no); multiple choice [C] (write down one or several numbers which correspond to the answer) or text [T] (write essential relevant points told to you by the interviewee).
- **Legend for [Q]**
  - Excellent (high) = 5
  - Good = 4
  - Satisfactory = 3
  - Insufficient = 2
  - Bad (low) = 1
  - Non-existent = 0

- **Comments:** enter any relevant comments made by the interviewee, which can help better understand the problematic.
- **Never leave a field empty!** If something doesn't exist or is not applicable, put a "0" (zero); if the interviewee doesn't know, put a "?".

**Personal comments/remarks of the interviewer**

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308
<table>
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<th>C</th>
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<td></td>
<td>400</td>
<td>Quantities of HCW produced</td>
<td>Do you have any figures at the national/local level?</td>
<td>B</td>
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<tr>
<td>10</td>
<td></td>
<td>HCW treatment</td>
<td>Ask to be allowed to take photos of the system!</td>
<td>B</td>
<td></td>
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<tr>
<td></td>
<td>1007</td>
<td>Domestic waste</td>
<td>How is it generally treated?</td>
<td>T</td>
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<tr>
<td>11</td>
<td></td>
<td>HCW final disposal</td>
<td>Ask to be allowed to take photos of the place!</td>
<td>T</td>
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<tr>
<td>12</td>
<td></td>
<td>HCWM regulations (code of conduct; management plan, policy…)</td>
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<td></td>
<td>1200</td>
<td>Hazardous waste regulations</td>
<td>Can we have copies of existing (draft) doc.?</td>
<td>B</td>
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<tr>
<td>13</td>
<td></td>
<td>Policy and budget</td>
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<td></td>
<td>1305</td>
<td>Relations with other ministries</td>
<td>With which ministry(ies) do you work on HCWM?</td>
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<tr>
<td></td>
<td>1306</td>
<td>Cooperation with agencies</td>
<td>With which bi(multi)lateral agencies do you cooperate?</td>
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<td>1308</td>
<td>Annual report of activities</td>
<td>Could I obtain a copy of your annual report(s)?</td>
<td>B</td>
<td></td>
<td>Try to obtain copies of the last 2-3 years</td>
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*Your personal comments* are to be put separately in the box below!
- **Never leave a field empty!** If something doesn’t exist or is not applicable, put a "0" (zero); if the interviewee doesn’t know, put a "?".
- C (code): questions only necessary to ask when: HCW is segregated (≠); when HCW in taken off-site (<>).

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</table>
## Health-care waste management • Rapid assessment tool

### Municipality: A

### Person in charge of Municipal Authority: B

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<td>Geographical situation &amp; population</td>
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<tr>
<td></td>
<td>103</td>
<td>Population</td>
<td>How many people live in your locality?</td>
<td>N</td>
<td></td>
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<tr>
<td></td>
<td>400</td>
<td>Quantities of HCW produced</td>
<td>Do you have any figures at the national/local level?</td>
<td>B</td>
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### Legend for [Q]

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### Personal comments/remarks of the interviewer

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<tr>
<td></td>
<td>204</td>
<td>Bed capacity</td>
<td>How many beds do you have in total?</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>Medical staff training</td>
<td>Is training of med. staff available regarding HCWM?</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>301</td>
<td>Medical staff training</td>
<td>If yes, what kind of training is given?</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>302</td>
<td>Staff for HCWM</td>
<td>Who is in charge of HCWM in your facility?</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>303</td>
<td>Training of responsible of HCWM</td>
<td>What kind of training has this person followed?</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>305</td>
<td>Medical staff numbers</td>
<td>Could I have a break down of the medical staff?</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>900</td>
<td>HCW off-site transport</td>
<td>Are there any control measures?</td>
<td>B</td>
<td></td>
<td>[0] None; [1] transport form; [2] other (specify)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1000</td>
<td>HCW treatment</td>
<td>Ask to be allowed to take photos of the system!</td>
<td>C</td>
<td></td>
<td>[1] On-site; [2] off-site</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>&lt;&gt; 1001</td>
<td>Off-site HCW treatment</td>
<td>Who’s in charge with the off-site treatment?</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&lt;&gt; 1002</td>
<td>Off-site HCW treatment</td>
<td>Does this organisation offer satisfactory options?</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>HCWM regulations (code of conduct; management plan, policy...)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1203</td>
<td>HCF HCWM regulations</td>
<td>Can we have copies of existing (in preparation) doc.?</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Policy and budget</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1301</td>
<td>Budget allocation for HCWM</td>
<td>Do you think sufficient funds are allocated to HCWM?</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1303</td>
<td>Budget allocation for HCWM</td>
<td>Which % of the HCF budget do you allocate?</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1308</td>
<td>Annual report of activities</td>
<td>Could I obtain a copy of your annual report(s)?</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Explanations**

- **Type**: data is quantitative [N] (enter a number or percentage); qualitative [Q] (see legend); Boolean [B] (yes/no); multiple choice [C] (write down one or several numbers which correspond to the answer) or text [T] (write essential relevant points told to you by the interviewee).
- **Legend for [Q]**:
  - Excellent (high) = 5
  - Good = 4
  - Satisfactory = 3
  - Insufficient = 2
  - Bad (low) = 1
  - Non-existent = 0

**Personal comments/remarks of the interviewer**

---

### Health-care waste management • Rapid assessment tool

**Kenya**

<table>
<thead>
<tr>
<th>Tool</th>
<th>D-2</th>
<th>Interview</th>
<th>Head nurse</th>
<th>Duration: 20”</th>
</tr>
</thead>
</table>

Health care facility: 

Address:  

District:  

Name of interviewee: 

Function:  

Tel. n°:  

Assessment made by:  

Date of assessment:  

<table>
<thead>
<tr>
<th>C</th>
<th>N°</th>
<th>Topic</th>
<th>Question</th>
<th>Type</th>
<th>Data</th>
<th>Comments / multiple choice</th>
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<tbody>
<tr>
<td>2</td>
<td>205</td>
<td>Health care facility (HCF)</td>
<td>Occupancy</td>
<td>How many beds are currently occupied?</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

| 206 | Occupancy | What is the average bed occupancy? | N |
| 207 | Outpatients | How many outpatients come each day on average? | N |

| 3 | | Staff | | |
| 306 | | Hepatitis B and tetanus | Do you vaccinate your personnel against them? | B |

| 4 | | HCW generation | | |
| 408 | Number of injections performed | How many are done in average per day? | N |

| 5 | | HCW segregation & handling | | |
| 500 | Segregation categories | Into which categories are HCW separated? | C | [0] No segregation;  
[4] pharmaceutical waste; [5] chemicals (liquid and solid);  

| 501 | Needle stick injuries | How many cases reported in the past 12 months? | N |
| 502 | Needle stick injuries | If yes, what measures do you take when it happens? | T |

| 503 | Needle handling | If needles are taken off syringes, where do they go? | T |


| 6 | | HCW storage containers | | |

---

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>602</td>
<td>Shortage of sharps containers</td>
<td>For what reasons are there shortages, if any?</td>
<td>C</td>
<td>[0] No shortages; [1] budget; [2] logistical; [3] other (specify)</td>
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<tr>
<td>603</td>
<td>Colour coding</td>
<td>Do you have a specific colour coding system?</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

12 HCWM regulations (code of conduct; management plan, policy…)

1204 HCF HCWM regulations Are there displayed written instructions? B

**Explanation**

- **Type**: data is either quantitative [N] (enter a number or percentage); qualitative [Q] (see legend); Boolean [B] (yes/no); multiple choice [C] (write down one or several numbers which correspond to the answer) or text [T] (write essential relevant points told to you by the interviewee).

- All the information noted down corresponds to what the interviewee tells you. **Your personal comments** are to be put separately in the box below!

- **Comments**: enter any relevant comments made by the interviewee, which can help better understand the problematic.

- **Never leave a field empty!** If something doesn’t exist or is not applicable, put a “0” (zero); if the interviewee doesn’t know, put a “?”.

- **C (code)**: questions only necessary to ask when: HCW is segregated (≥); when HCW in taken off-site (≠).

**Legend for [Q]**

- Excellent (high) = 5
- Good = 4
- Satisfactory = 3
- Insufficient = 2
- Bad (low) = 1
- Non-existent = 0

**Personal comments/remarks of the interviewer**

---


316
## Health-care waste management • Rapid assessment tool

<table>
<thead>
<tr>
<th>Tool</th>
<th>D-3</th>
<th>Interview</th>
<th>Person responsible for HCWM</th>
<th>Duration: 1h00</th>
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**Kenya**

<table>
<thead>
<tr>
<th>Health care facility:</th>
<th>Address:</th>
<th>District:</th>
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</thead>
<tbody>
<tr>
<td>Name of interviewee:</td>
<td>Function:</td>
<td></td>
</tr>
<tr>
<td>Assessment made by:</td>
<td>Date of assessment:</td>
<td></td>
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</tbody>
</table>

### C N° Topic Question Type Data Comments / multiple choice

#### 3 Staff

<table>
<thead>
<tr>
<th>304 Staff for HCW awareness</th>
<th>Awareness of risks of person(s) handling HCW?</th>
<th>Q</th>
<th></th>
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</table>

#### 4 HCW generation

<table>
<thead>
<tr>
<th>401 Domestic waste</th>
<th>Quantity produced/day (estimated, in kg or litres)</th>
<th>N</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>402 Sharps</td>
<td>Quantity prod/day (in kg or number of sharps boxes)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>403 Infectious (non-sharp) waste</td>
<td>Quantity produced/day (estimated, in kg or litres)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>404 Anatomic waste</td>
<td>Quantity produced/day (estimated, in kg or litres)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>405 Pharmaceutical waste</td>
<td>Quantity produced/day (estimated, in kg or litres)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>406 Chemicals (liquid and solid)</td>
<td>Quantity produced/day (estimated, in litres)</td>
<td>N</td>
<td></td>
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</table>

#### 5 HCW segregation & handling


<table>
<thead>
<tr>
<th>700 Storage area</th>
<th>Do you have a specific area for HCW?</th>
<th>B</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>701 Storage area access</td>
<td>Is the area secured?</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>702 Storage area organisation</td>
<td>Is waste stored according to specific rules?</td>
<td>B</td>
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</table>

### 8 HCW collection & on-site transport

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
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</thead>
<tbody>
<tr>
<td>800</td>
<td>HCW on-site transport</td>
</tr>
<tr>
<td>802</td>
<td>Injuries/accidents</td>
</tr>
<tr>
<td>10</td>
<td>HCW treatment</td>
</tr>
<tr>
<td>1003</td>
<td>Type of HCW treatment system</td>
</tr>
<tr>
<td>1004</td>
<td>Capacity of HCW treatment system</td>
</tr>
<tr>
<td>1005</td>
<td>Operation of HCW treatment system</td>
</tr>
<tr>
<td>1006</td>
<td>Failure of HCW treatment system</td>
</tr>
<tr>
<td>1007</td>
<td>Domestic waste</td>
</tr>
<tr>
<td>11</td>
<td>HCW final disposal</td>
</tr>
<tr>
<td>1100</td>
<td>HCW final disposal site</td>
</tr>
<tr>
<td>1101</td>
<td>Type of disposal site</td>
</tr>
<tr>
<td>1102</td>
<td>Protection of disposal site</td>
</tr>
<tr>
<td>1103</td>
<td>Domestic waste</td>
</tr>
<tr>
<td>1104</td>
<td>Segregated HCW disposal</td>
</tr>
<tr>
<td>14</td>
<td>Sanitation &amp; wastewater</td>
</tr>
<tr>
<td>1400</td>
<td>Use of toilets</td>
</tr>
<tr>
<td>1401</td>
<td>WC connection</td>
</tr>
<tr>
<td>1402</td>
<td>Sewer connection</td>
</tr>
</tbody>
</table>

Explanations

Legend for [Q]
• **Type:** data is either *quantitative [N]* (enter a number or percentage); *qualitative [Q]* (see legend); *Boolean [B]* (yes/no); *multiple choice [C]* (write down one or several numbers which correspond to the answer) or *text [T]* (write essential relevant points told to you by the interviewee).

- Excellent (high) = 5
- Good = 4
- Satisfactory = 3
- Insufficient = 2
- Bad (low) = 1
- Non-existent = 0

<table>
<thead>
<tr>
<th>Personal comments/remarks of the interviewer</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
# Health-care waste management • Rapid assessment tool

## Kenya

### Tool
D-4

### Interview
Person handling HCW

### Duration: 15"

### Health care facility:

### Address:

### District:

### Name of interviewee:

### Function:

### Assessment made by:

### Date of assessment:

<table>
<thead>
<tr>
<th>C</th>
<th>N°</th>
<th>Topic</th>
<th>Question</th>
<th>Type</th>
<th>Data</th>
<th>Comments / multiple choice</th>
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<tbody>
<tr>
<td>5</td>
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<td>HCW segregation &amp; handling</td>
<td></td>
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<tr>
<td></td>
<td>501</td>
<td>Needle stick injuries</td>
<td>How many cases reported in the past 12 months?</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>502</td>
<td>Needle stick injuries</td>
<td>If yes, what measures do you take when it happens?</td>
<td>T</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Explanations

- **Type:** data is either *quantitative* [N] (enter a number or percentage); qualitative [Q] (see legend); Boolean [B] (yes/no); multiple *choice* [C] (write down one or several numbers which correspond to the answer) or text [T] (write essential relevant points told to you by the interviewee).

- **All the information noted down corresponds to what the interviewee tells you. Your personal comments are to be put separately in the box below!**

- **Comments:** enter any relevant comments made by the interviewee which can help better understand the problematic.

- **Never leave a field empty!** If something doesn’t exist or is not applicable, put a "0" (zero); if the interviewee doesn’t know, put a “?”.  

- **C (code):** questions only necessary to ask when: HCW is segregated (≥); when HCW in taken off-site (≤).  

### Personal comments/remarks of the interviewer

---

*National Health Care Waste Management Plan 2006-2015*  

320
<table>
<thead>
<tr>
<th>C</th>
<th>N°</th>
<th>Topic</th>
<th>Question</th>
<th>Type</th>
<th>Data</th>
<th>Comments / multiple choice</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>Geographical situation &amp; population</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>101</td>
<td>Area geography</td>
<td>In which area is the facility located?</td>
<td>T</td>
<td>Climatic, topographical specifications if relevant…</td>
<td></td>
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<tr>
<td></td>
<td>102</td>
<td>Cultural practices</td>
<td>Are there any that must be taken into consideration?</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>HCW storage containers</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td></td>
<td>HCW storage area</td>
<td>Ask to be allowed to take photos of the place!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>HCW collection &amp; on-site transport</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td>HCW treatment</td>
<td>Ask to be allowed to take photos of the system!</td>
<td></td>
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<tr>
<td>&lt;&gt;</td>
<td>1002</td>
<td>Off-site HCW treatment</td>
<td>Does this organisation offer satisfactory options?</td>
<td>B</td>
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<tr>
<td>11</td>
<td></td>
<td>HCW final disposal</td>
<td>Ask to be allowed to take photos of the place!</td>
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<tr>
<td></td>
<td>1102</td>
<td>Protection of disposal site</td>
<td>Is the area secured?</td>
<td>B</td>
<td></td>
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<tr>
<td></td>
<td>1105</td>
<td>Syringes present on site</td>
<td>Is there evidence of partially treated syringes?</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1106</td>
<td>Infectious waste present on site</td>
<td>Is there evidence of partially treated inf. HCW?</td>
<td>B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explanations

- **Type**: Data is either quantitative [N] (enter a number or percentage); qualitative [Q] (see legend); Boolean [B] (yes/no); multiple choice [C] (write down one or several numbers which correspond to the answer) or text [T] (write essential relevant points told to you by the interviewee).

Legend for [Q]

- Excellent (high) = 5
- Good = 4

• All the information noted down corresponds to what the interviewee tells you. **Your personal comments** are to be put separately in the box below!  
**Satisfactory = 3**

• **Comments:** enter any relevant comments made by the interviewee, which can help better understand the problematic.  
**Insufficient = 2**

• **Never leave a field empty!** If something doesn’t exist or is not applicable, put a "0" (zero); if the interviewee doesn’t know, put a “?”.
**Bad (low) = 1**

• **C (code):** questions only necessary to ask when: HCW is segregated (=); when HCW in taken off-site (<=>).  
**Non-existent = 0**

<table>
<thead>
<tr>
<th>Personal comments/remarks of the interviewer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Health-care waste management • Rapid assessment tool

Explanations

• This rating system is here to give you a set of indicators of how good/bad is the situation regarding HCWM per topic (staff, HCW generation, segregation, etc.) for health care facilities according to their size (big, medium and small) as well as at national level (to be read in the last column “total”).

  The column “national level” is there to take into account what exists or doesn’t exist in terms of technical support, monitoring capacities and regulatory framework at national level.

• For example, if there is no staff working specifically on HCWM issues at national level within the Ministry of Health or Environment, put a “1”.

• Health care facilities are divided into three size categories (see question n° 200): large hospitals (big); (sub-)district hospitals (medium); ambulant services (small).

• For each question, add up per HCF category size the number of points you have “assessed” during your field visits and enter the figure in the appropriate column.

• The figures you will enter are then automatically summed (total points) and calculated according to the percentage of HCFs visited to give an equivalent number of points at national level (national equivalent points).

• The national equivalent percentage is calculated as follows: “national equivalent points” / (total number of HCFs for each size category * number of questions in the topic). This produces a result in percentage that can be read as follows: 0-10% (excellent situation); 11-30% (good situation); 31-60% (satisfactory situation); 81-100% (problematic situation); >81% (critical situation).

• At the bottom of the page a summary per topic can be found.

• This evaluation is based on key issues that need to be fulfilled to ensure a safe management of HCW.

Data entry table

<table>
<thead>
<tr>
<th>N°</th>
<th>Topic</th>
<th>Question</th>
<th>Answer</th>
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<th>National Level</th>
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<td>Number visited</td>
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<td>0</td>
<td>HCFs by category</td>
<td>Number visited</td>
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Date of rating: [Date]

Rating made by: [Name]
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<th>Total</th>
<th>Percentage visited</th>
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<th>#DIV/0!</th>
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</tbody>
</table>

### 3 Awareness and training of staff

| Question | | | | | |
|----------|-----------------|-------|-----------------|-------|-------|-------|-------|
| 302      | Staff for HCWM  | Who is in charge of HCWM in your facility? | If nobody | 1 | 0 | 0 | 0 |
| 303      | Training of responsible of HCWM | What kind of training has this person followed? | If none | 1 | 0 | 0 | 0 |
| 304      | Staff for HCW awareness | Awareness of risks of person(s) handling HCW? | If the value of Q = 2 | 1 | 0 | 0 | 0 |
| 305      | Hepatitis B and tetanus | Do you vaccinate your personnel against them? | No | 1 | 0 | 0 | 0 |

| Total points | | | | |
|--------------|-----------------|-------|-----------------|-------|-------|-------|-------|
|              |                 |       |                 |       |       |       |       |

### 5 HCW segregation & handling

| Question | | | | | |
|----------|-----------------|-------|-----------------|-------|-------|-------|-------|
| 500      | Segregation categories | Into which categories is HCW separated? | No segregation | 1 | 0 | 0 | 0 |
| 505      | Protective equipment | Which equipment does the staff handling waste have? | If none | 1 | 0 | 0 | 0 |

| Total points | | | | |
|--------------|-----------------|-------|-----------------|-------|-------|-------|-------|
|              |                 |       |                 |       |       |       |       |

### 6 HCW storage containers

| Question | | | | | |
|----------|-----------------|-------|-----------------|-------|-------|-------|-------|
| 600      | Infectious waste containers | What kind of containers do you use? | If no specific container | 1 | 0 | 0 | 0 |
| 601      | Sharp containers | What kind of containers do you use? | If no rigid container | 1 | 0 | 0 | 0 |
| 602      | Shortage of sharps containers | For what reasons are there shortages, if any? | If any shortages | 1 | 0 | 0 | 0 |

<p>| Total points | | | | |
|--------------|-----------------|-------|-----------------|-------|-------|-------|-------|
|              |                 |       |                 |       |       |       |       |</p>
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<td>Is area secured (only accessible for authorised pers.)</td>
<td>No</td>
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<td>HCW collection &amp; on-site transport</td>
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<td>801</td>
<td>HCW collection &amp; on-site transport</td>
<td>Do you think current practices offer sufficient security?</td>
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<td>900</td>
<td>Transport services</td>
<td>Are there any control measures?</td>
<td>No</td>
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<td>1002</td>
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<td>Does this organisation offer satisfactory options?</td>
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<td>1008</td>
<td>Sharps</td>
<td>How are they treated?</td>
<td>If no treatment</td>
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<td>Infectious (non-sharp) waste</td>
<td>How is it treated?</td>
<td>If no treatment</td>
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<td>If no treatment</td>
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<td>HCW final disposal</td>
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<td>1101</td>
<td>Type of disposal site</td>
<td>Which kind of disposal site is used for the HCW?</td>
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<td>1105</td>
<td>Syringes present on site</td>
<td>Is there evidence of partially treated syringes?</td>
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| National equivalent % | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! |

<table>
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<th>12</th>
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<tr>
<td>1201</td>
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| National equivalent % | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! |

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| National equivalent % | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! |

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| Total points | 0 | 0 | 0 | 0 |

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**Personal comments/remarks of the interviewer**

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Estimation of the number of items issued by the pharmacy of the health facility

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<tr>
<th>Item</th>
<th>Number of items</th>
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<tbody>
<tr>
<td>Needles</td>
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<tr>
<td>Needles and syringes assembled</td>
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<tr>
<td>Intravenous catheter</td>
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<tr>
<td>Lancets</td>
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<tr>
<td>Scalps</td>
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</tr>
<tr>
<td>Blades</td>
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<tr>
<td>Sutures</td>
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<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
<th>total (week)</th>
<th>average used per day</th>
<th>Average used per bed per day</th>
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divide by 7  
divide by nb of beds
Estimation of the number of items issued by the pharmacy of the health facility

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<thead>
<tr>
<th>Item</th>
<th>Number of items</th>
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<tr>
<td>Needles</td>
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<tr>
<td>Needles and syringes assembled</td>
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<td>Intravenous catheter</td>
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<td>Lancets</td>
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<td>Blades</td>
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divide by 7 divide by nb of beds
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<th>C</th>
<th>N°</th>
<th>Topic</th>
<th>Question</th>
<th>Type</th>
<th>Data</th>
<th>Comments / multiple choice</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
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<td>1</td>
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<td>Geographical situation &amp; population</td>
<td>Area type: In which area is the facility located?</td>
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<td></td>
<td>[1] Urban; [2] peri-urban; [3] rural</td>
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<tr>
<td>1</td>
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<td>Area geography: In which area is the facility located?</td>
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<td>Climatic, topographical specifications if relevant...</td>
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<td>Cultural practices: Are there any that must be taken in consideration?</td>
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<td>x</td>
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<tr>
<td>1</td>
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<td>Population: How many people live in your locality?</td>
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<td>Population: Could I get detailed demographic data / country?</td>
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<tr>
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<td>Health care facility (HCF)</td>
<td>HCF: Which category is it (are they)?</td>
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<td></td>
<td>[1] Ambulance service; [2] (sub-)district hospital; [3] large hospital</td>
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<td>x</td>
</tr>
<tr>
<td>2</td>
<td>201</td>
<td></td>
<td>HCF: Which type is it (are they)?</td>
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<td>[1] Public; [2] private</td>
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<td>x</td>
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<tr>
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<td>HCFs: Could I obtain a list of all HCFs in the country?</td>
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<td></td>
<td>If possible by category &amp; type (Nbr. bed); by locality / district</td>
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<td>How many beds do you have in total?</td>
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<td>205</td>
<td>Occupancy</td>
<td>How many beds are currently occupied?</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>206</td>
<td>Occupancy</td>
<td>What is the average bed occupancy?</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>207</td>
<td>Outpatients</td>
<td>How many outpatients come each day on average?</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
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<tr>
<td>3</td>
<td>208</td>
<td>Staff</td>
<td></td>
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<td>x</td>
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333
<p>| | | | | | |</p>
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<th></th>
<th></th>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>Medical staff training</td>
<td>Is training of med. staff available regarding HCWM?</td>
<td>B</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>301</td>
<td>Medical staff training</td>
<td>If yes, what kind of training is given?</td>
<td>T</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>302</td>
<td>Staff for HCWM</td>
<td>Who is in charge of HCWM in your facility?</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>303</td>
<td>Training responsible of HCWM</td>
<td>What kind of training has this person followed?</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>304</td>
<td>Staff for HCWM awareness</td>
<td>Awareness of risks of person(s) handling HCW?</td>
<td>Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>305</td>
<td>Medical staff numbers</td>
<td>Could I have a break down of the medical staff?</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>306</td>
<td>Hepatitis B and tetanus</td>
<td>Do you vaccinate your personnel against them?</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>HCW generation</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>Quantities of HCW produced</td>
<td>Do you have any figures at the national/local level?</td>
<td>B</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>401</td>
<td>Domestic waste</td>
<td>Quantity produced/day (estimated, in kg or litres)</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>402</td>
<td>Sharps</td>
<td>Quantity prod/day (in kg or nbr. of sharps boxes)</td>
<td>N</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>403</td>
<td>Infectious (non-sharp) waste</td>
<td>Quantity produced/day (estimated, in kg or litres)</td>
<td>N</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>404</td>
<td>Anatomic waste</td>
<td>Quantity produced/day (estimated, in kg or litres)</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>405</td>
<td>Pharmaceutical waste</td>
<td>Quantity produced/day (estimated, in kg)</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>406</td>
<td>Chemicals (liquid and solid)</td>
<td>Quantity produced/day (estimated, in litres)</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>407</td>
<td>Radioactive waste</td>
<td>Quantity produced/day (estimated, in kg)</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>408</td>
<td>Number of injections performed</td>
<td>How many are done in average per day?</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>HCW segregation &amp; handling</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Needle stick injuries</td>
<td></td>
<td></td>
<td>![7] radioactive waste; ![8] other (specify)</td>
<td></td>
</tr>
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<td>---</td>
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<td>---</td>
<td>---</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>501</td>
<td>How many cases reported in the past 12 months?</td>
<td>N</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>502</td>
<td>If yes, what measure do you take when it happens?</td>
<td>T</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>503</td>
<td>If needles are taken off syringes, where do they go?</td>
<td>T</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>505</td>
<td>Which equipment does the staff handling waste has?</td>
<td>![0] None; ![1] gloves; ![2] boots; ![3] apron; ![4] trousers; ![5] mask</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>HCW storage containers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>What kind of specific containers do you use?</td>
<td>![0] No specific container; ![1] plastic; ![2] metallic; ![3] cardboard; ![4] bag; ![5] box; ![6] other</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Sharp containers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>601</td>
<td>What kind of specific containers do you use?</td>
<td>![0] No specific container; ![1] puncture-proof; ![2] not puncture-proof; ![3] single use; ![4] multiple use</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Shortage of sharps containers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>602</td>
<td>For what reasons are there shortages, if any?</td>
<td>![0] No shortages; ![1] budget; ![2] logistical; ![3] other (specify)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Colour coding</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>603</td>
<td>Do you have a specific colour coding system?</td>
<td>B</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td><strong>HCW storage area</strong></td>
<td></td>
<td></td>
<td>ask to be allowed to take photos of the place!</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>Do you have a specific area for HCW?</td>
<td>B</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>701</td>
<td>Is the area only accessible for authorised pers.?</td>
<td>B</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>702</td>
<td>Is waste stored according to specific rules?</td>
<td>B</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Code</td>
<td>Options</td>
<td>Notes</td>
<td>Answer</td>
<td>Column 1</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>802 Injuries/accidents - Any reported cases in the past 12 months?</td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE <strong>HCW off-site transport</strong></td>
<td>BCE</td>
<td>[0] None; [1] transport form; [2] other (specify)</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 10 Off-site HCW treatment - Is it treated on-site or off-site?</td>
<td>BCE</td>
<td>[1] On-site; [2] off-site</td>
<td>x x x x x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1003 Type of HCW treatment syst. - Which kind of system is used?</td>
<td>BCE</td>
<td>[1] The HCF; [2] municipal service; [3] private company (name?)</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1004 Capacity of HCW treatment syst. - What is the current capacity of the system(s)?</td>
<td>BCE</td>
<td>[1] The HCF; [2] municipal service; [3] private company (name?)</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1007 Domestic waste - How is it generally treated?</td>
<td>BCE</td>
<td>T</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1008 Sharps - How are they treated?</td>
<td>BCE</td>
<td>T</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1009 Infectious (non-sharp) waste - How is it treated?</td>
<td>BCE</td>
<td>T</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1010 Anatomic waste - How is it treated?</td>
<td>BCE</td>
<td>T</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1011 Pharmaceutical waste - How is it treated?</td>
<td>BCE</td>
<td>T</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1012 Chemicals (liquid and solid) - How are they treated?</td>
<td>BCE</td>
<td>T</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1013 Waste recycling - Can you list any HCW recycled (by whom &amp; how)?</td>
<td>BCE</td>
<td>T</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 11 HCW final disposal - Ask to be allowed to take photos of the place!</td>
<td>BCE</td>
<td>[1] The HCF; [2] municipal service; [3] private company (name?)</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCE 1101 Type of disposal site - Which kind of disposal site is used</td>
<td>BCE</td>
<td>[1] The HCF; [2] municipal service; [3] private company (name?)</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### National Health Care Waste Management Plan 2006-2015

| 1102 | Protection of disposal site | Is the area secured? | B | x | x | 75 |
| 1103 | Domestic waste | Where is it disposed off? | T | x | x | x | 76 |
| 1104 | Segregated HCW disposal | Where are the different types of HCW disposed of? | T | x | 77 |
| 1105 | Syringes present on site | Is there evidence of partially treated syringes? | B | x | 78 |
| 1106 | Infectious waste present on site | Is there evidence of partially treated inf. HCW? | B | x | 79 |
| **12** | HCWM regulations (code of conduct; management plan, policy...) | | | x | x | x | | 80 |
| 1200 | Hazardous waste regulations | Can we have copies of existing (draft) documents? | B | x | 81 |
| 1201 | National HCWM regulations | Can we have copies of existing (draft) documents? | B | x | 82 |
| 1202 | National HCWM regulations | Does their application cause any problems? | T | x | x | 83 |
| 1203 | HCF HCWM regulations | Can we have copies of existing, in preparation doc.? | B | x | 84 |
| 1204 | HCF HCWM regulations | Are there displayed written instructions? | B | x | 85 |
| **13** | Policy and budget | | | x | x | x | | 86 |
| 1300 | Health system | Could you outline how it is organised? | T | Try to obtain a flowchart of the health system + responsibilities… | x | 87 |
| 1301 | Budget allocation for HCWM | Do you think sufficient funds are allocated to HCWM? | B | x | x | 88 |
| 1302 | Budget allocation for HCWM | Which % of national health budget do you allocate? | N | If there is no specific budget allocation, put 0. | x | 89 |
| 1303 | Budget allocation for HCWM | Which % of the HCF budget do you allocate? | N | x | 90 |
| 1304 | Purchase practises | Is there a national policy for items used in HCWM? | B | x | 91 |
| 1305 | Relations with other ministries | With which ministry(ies) do you work on HCWM? | T | x | x | 92 |
| 1306 | Cooperation with agencies | With which bi(multi)lateral agency do you cooperate? | T | x | x | 93 |
| 1307 | Hazardous waste management | Which national agencies work on this topic? | T | | | 94 |
| 1308 | Annual report of activities | Could I obtain a copy of your annual report(s)? | B | Try to obtain copies of the last 2-3 years | x | x | x | x | 95 |
| 14 | Sanitation & wastewater | | | | | | | | 96 |
| 1400 | Use of toilets | Do all patients have access/use toilets in the HCF? | C | [0] No facility available; [1] yes; [2] no | x | x | x | 97 |

**Explanations**

- **Type:** Data is either quantitative [N] (enter a number or percentage); qualitative [Q] (see legend); Boolean [B] (yes/no); multiple choice [C] (write down one or several numbers which correspond to the answer) or text [T] (write essential relevant points told to you by the interviewee).
- **Comments:** enter any relevant comments made by the interviewee, which can help better understand the problematic.
- **Never leave a field empty:** If something doesn’t exist or is not applicable, put a "0" (zero); if the interviewee doesn’t know, put a "?".
- **C (code):** questions only necessary to ask when: HCW is segregated (=); when HCW in taken off-site (<>).

**Legend for [Q]**

- Excellent (high) = 5
- Good = 4
- Satisfactory = 3
- Insufficient = 2
- Bad (low) = 1
- Non-existent = 0

**Personal comments/remarks of the interviewer**

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Annexure G – Specification for Training and Consultancy Support

G.1 Training Programme and Consultancy Support

The Contractor shall during the Mobilisation Period develop a Training Programme which shall be submitted for approval to the MoH Representative by no later than one month after the Contract Date. The Ministry shall respond to the Training Programme within 10 working days of receiving it. If the Contractor has not received a response within 10 days of submitting the Training Programme, the Contractor shall prompt the Ministry’s Representative in writing for a response. The Training Programme shall be deemed approved by the Ministry if no response is received within two working days of the Contractor having prompted the Departments Representative for a response.

The Training Programme shall contain the following:

- Methodology for the training;
- Programme for the training;
- Examples of all training materials to be used by the Contractor.

Contractors will be required as part of the training and consulting service to enrol a minimum of 3 persons (per region awarded), who will be responsible for and directly involved with the training during the Rollout as well as thereafter, on the HCW Management course presented by KMTC Nairobi. This requirement is aimed at ensuring uniformity in the training materials and training methods already developed and used for the training of HCW Officers, with the Sustainable HCW Management Project having previously participated in the development of the course.

G.2 Background

In most facilities in Kenya, there has been no training or consultancy support for the management of HCW, which resulted in the following poor practices in Facilities:

- The available equipment is sometimes poorly deployed in Facilities;
- There is inadequate problem solving, resulting in reoccurrence of problems;
- Containers and equipment is sometimes incorrectly used;
- Containers and equipment is sometimes not available in sufficient numbers or of the required quality;
- Segregation of HCW is ineffective and poses a health hazard to the general waste collectors as well as scavengers at the landfill site. Poor segregation is further resulting in excessive HCRW treatment and disposal costs;
- There is inadequate linkage between HCW management and the occupational health and safety aspects of Waste such as wearing of protective clothing and reporting. Senior management is inadequately informed about effective Waste management and therefore seldom involved with any aspect of Waste management;
- There has been no promotion of any Policies, Standards or Codes of Practice for HCW management in Facilities.

As part of a programme aimed at addressing these problems, the Department will appoint a HCW Officer under Public Health Office for each HCF. Having received five days intensive training in health care waste management, such HCW Officers are required to facilitate the development of improved HCW management practices in their respective HCFs. This is achieved by working with infection control, the cleansing department, occupational health and safety committee, HCF management and the HCW management Contractor.

However the role of the HCW Officer will be a part-time responsibility and it is therefore essential that these individuals be supported in the task. The Contractor shall provide the HCW Officer with technical and training
support. Such technical and training support to clinics will be delivered through their cluster managers who are part of regional MoH management structures.

The Training Programme and Consultancy Support shall ensure that there is an ongoing programme of support to HCFs through liaison with the HCW Officer and regional clinic managers. The purpose of this support is to ensure the following:

- That all HCFs are prepared for the introduction of new equipment;
- That all staff are trained in the correct use of equipment, effective segregation of HCW and in occupational health and safety aspects related to Waste management;
- That there is ongoing support to HCFs for problem solving;
- That there is an ongoing programme of training and awareness activities for the Facilities.

The Training Programme and the Consultancy Support shall be integrated to form a comprehensive support package for each Facility.

The Training Programme and Consultancy Support shall reflect the approach adopted by the Kenya Health Care Waste Management Action Plan. All materials developed, as part of the aforesaid project, will be based on the outcomes of an extensive survey and execution of pilot studies. The Contractors shall make use of these materials and adapt it as considered necessary.

**G.3 Specifications for the Training Programme**

The Training Programme shall be facilitated through the Waste Officer in each Hospital and community health centre and through regional managers for Clinics. The Training Programme shall interact with In-service Training programmes in the Region as required to ensure maximum impact, publicity and support. Training venues will be made available by the Department. The Training Programme shall be conducted on-site at health facilities or locally to minimize trainee transport costs.

**G.4 Scope of supply for the Training Programme**

The Contractor shall provide a Training Programme that allows for intensive training during the Rollout Period, followed by Training at regular intervals throughout the remainder of the Services Period.

The training shall be divided into Training Cycles, with each Training Cycle for any particular Hospital or Cluster of Clinics consisting of a 5 day training period. The Contractor shall during the first year of the Services period provide 3 Training Cycles, with the first Training Cycle being delivered during the Rollout Period. During the second year of the Services Period, the Contractor shall provide 2 Training Cycles, whilst in the third, fourth and fifth years of the Services Period a single Training Cycle will be provided annually.

As the first year’s training programme, the Contractor will therefore provide 5 days of training for each Hospital and for each Cluster of Clinics during Rollout Period, followed by further 5 day Training Cycles during the 6th and 12th month of the Services Period. In year two, the Contractor is to provide Training Cycles during the 6th and 12th month only, whereas for the remaining 3 years of the Services Period the Contractor shall provide a single series of 5 days Training Cycles for each Hospital and each Cluster of Clinics during the 6th month of each year.

The Contractor shall ensure that the training resources are utilised efficiently and shall on the basis of the experiences gained during the Rollout, within the overall scope of supply, suggest reallocation of training resources to address differences in the size of Hospitals and Clusters of Clinics as well as differences in the skills level and motivation experienced at the different Facilities.

The Contractor shall prior to commencement of a new calendar year, submit a proposal for the allocation of training resources during the following calendar year to the Department’s Representative.

**G.6 Target groups for training**
The Training Programme shall target the following staff groups at the Facilities:

- Hospital management (administration and medical services);
- Clinic management, including Regional clinic managers;
- Occupational Health and Safety Committees and representatives at Facilities;
- Regional environmental health as well as occupational health and safety representatives;
- All categories of medical and allied medical staff in Facilities;
- All categories of non-medical staff with specific attention to general assistants in Facilities;
- Health sciences students who are on placement in Facilities.

G.7 Training content
The Training Programme shall address existing gaps identified in knowledge, skills and attitude. Collectively these will contribute to the behaviour required for sustainable health care waste management. The following priority areas are therefore to be addressed by the Training Programme:

G.8 Knowledge gaps
- The hazards associated with health care waste;
- Offsite treatment / disposal of Waste;
- Offsite disposal of health care general waste;
- The different categories of health care waste;
- Correct segregation of waste;
- The types of containers and liners for the collection and storage of health care waste;
- The role of the Kenya Code of Practice for Health Care Waste Management;
- The correct use of personal protective clothing;
- The importance of reporting on internal performance monitoring and external auditing.

G.9 Attitude Change
Attitude change must be promoted as part of Training Programme. Important aspects to promote shall include, but not be limited to:

- The importance of protecting the environment;
- The importance of recycling;
- Everyone who works in a health facility is responsible for effective health care waste management;
- Good health care waste management protects everyone’s health and safety.

G.10 Skills teaching
Demonstration is an important component of introducing a new waste management system. There are new skills required for the use of new equipment; at the point of generation, during intermediate storage, during internal transport as well as at the central store.

G.11 Methodology
The Contractor’s approach to training must be outcomes based and participatory. The Training Programme shall make use of simple picture based teaching tools that encourage discussion without being overly technical.

To ensure fast but effective training inside Facilities the Training Programme shall utilise a “train the trainer” approach and support cascade training. Wherever possible, training shall be multi-disciplinary and should encourage medical and non-medical staff to work together on health care waste issues. Although training and skills demonstration shall primarily be on the job, there may be other channels that could be used effectively such as management meetings and Continuing Professional Development (CPD) meetings for doctors. The Contractor shall further ensure that health care waste management training is integrated into the orientation programmes for students placed at the Facility, with a mechanism also in place to cater for night staff and shift workers.

Monitoring of training activities is essential and should also include the identification of further training needs.
G.12 Training materials
The Contractor shall support the training through the use of appropriate visual aids during training to reinforce the main teaching information. The training materials shall be picture based and in more than one language as appropriate. Technical language is however to be avoided. Although the training materials shall predominantly consist of printed materials, audiovisual materials may be accepted if well motivated. All training materials shall be pre-tested by the Contractor during the design phase and approved by the GOK/MoH before printing, with all materials carrying the GOK/MoH logo.

English will be the language used for all training materials as well as for the presentation of training sessions. English and Kiswahili will be the language used for the development of awareness materials for display at Facilities.

G.13 Awareness activities and other support materials
The Contractor shall include awareness activities as part of the Training Programme. Awareness activities shall be used to highlight the importance of health care waste management, to reinforce key messages and to provide incentives. An inter-ward competition could for instance be an effective tool to promote better segregation.

It is expected that one awareness activity per hospital and community health centre and two regional awareness activities for clinics and other regional staff be organised per year.

G.14 Background of trainers
The available capacity of the Contractor and the proposed trainers is essential in the award of this Contract. The Contractor shall demonstrate the following:

- Experience in the design of training programmes;
- Delivery of a five year training programme;
- Experience in the design and production of training materials;
- Capacity to ensure ongoing monitoring and regular reporting to the Department;
- Experience of performance evaluation.

The Contractor’s Trainers shall have the following background:

- Strong informal training experience;
- Training background in community development / health promotion / environmental health / occupational health;
- A good understanding of the health facility environment;
- Ability to work in English and Kiswahili

The CV’s of the proposed trainers shall be included in the Tender.

The Contractor shall only introduce new trainers to undertake the Training Programme, after written approval of such trainer has been granted by the Department.

G.15 Evaluation
The Department will evaluate the effectiveness of training. The Contractor shall cooperate with any evaluator, external or internal, that the Department may appoint to undertake the required evaluation. The Contractor shall make any training programmes and training materials available, as may be required by the evaluator. The Contractor shall further allow for the evaluator or any other persons nominated by the Department, to participate in the training sessions.

As part of the evaluation process, the Contractor shall also compile an evaluation sheet that must be completed by all participants in the various training sessions.
For the purpose of evaluation and monitoring, the Contractor shall submit a report on the training for each Training Cycle completed. The report shall be submitted to the Department's Representative, together with the relevant invoice for the Training Cycle.

The report shall as a minimum contain the following:

- Time sheets and attendance list for all training sessions;
- Evaluation sheets from all training sessions;
- Programme for the Training Cycle with details of venues, dates and participants;
- Any deviations from the Training Programme, with reasons for the deviation;
- Lessons learnt and recommendations for amendments to the Training Programme during future Training Cycles.

G.17 Specifications for the Consultancy Support
The Contractor’s shall provide a Consultancy Support that shall comply with the present Project Specification.

The Consultancy Support shall specifically address technical issues related to the health care waste management system. It is essential for the person nominated to render the consultancy support to be familiar with occupational health and safety legislation, infection control principles and the cradle to grave management of all health care waste streams. Although the consultancy service will primarily be aimed at the Waste Officer in the Facilities, it will also be for support to senior management in Facilities in the Region, Occupational Health and Safety Committees and other Regional representatives. The consultant would further be expected to support and advise on the Training Programme.

G.18 Two Phased Consultancy Support to the Health Care Waste System
Phase 1 of the consultancy support programme will be intensive to ensure the successful Rollout of the new Waste Management System, whereas Phase 2 will provide a sustained presence to ensure the maintenance of HCW management standards. It is expected for the Contractor to provide 15 person-days of consultancy support to each Hospital and cluster of clinics during the Rollout. The consultancy during Rollout is specified in Section 13.5.

Phase 2 of the Consultancy Support will commence at the Rollout Completion Date and will continue to the end of the Contract Period. The objective of Phase 2 will be to provide the Facilities with support in problem solving on HCW Management related matters.

The Contractor shall provide support to the Facilities either by phone or alternatively on location, depending on the nature of the problem.

G.19 Background of consultants
Consultants shall have a background in occupational health and safety, environmental health or infection control. They may also have a nursing or medical background. Consultants shall further be familiar with working in health facilities and should preferable have public sector experience.

The CV’s of the proposed consultants shall be included in the Tender.

The Contractor shall only introduce new consultants to undertake the Training Programme after written approval of such consultant was granted by the Department.
Annexure H – Disposable HCW Containers

H.1 Specification for Disposable Containers

H1.1: Sharps Containers

Note:

- These types of sharps containers will only be used during Phase 3, at which time these more sophisticated containers will be applied to segregate needles from syringes in a safe manner, thereby allowing significant savings in container consumption. Until Phase 3, the 5-litre UNICEF safety boxes will be used.
- The ranges of containers will ultimately be limited to what is readily available for Kenya, thereby keeping the costs down.

Due to the different rates at which infected sharps are generated as well as the particular requirements for different applications of Sharps Containers, there is a need for a range of Sharps Containers to be made available to the HCFs, leaving it up to the respective HCFs to make a decision on the type of container that would best meet their particular needs.

The risk of physical injuries and infection from sharp objects used in hospitals and clinics is high, resulting in a need for Sharps Containers to meet certain minimum standards in terms of user friendliness, robustness and also the effort required for people to gain access to, or come into contact with sharps previously disposed off.

The following requirements are to be met in the supply of Sharps Containers:

H1.1.1 Range of Sharps Containers required:

1. The following generic types of Sharps Containers must, as a minimum form part of the supply made available for ordering by the Facilities:
   
   (a) Type A: 1-4 litre sharps container;
   (b) Type B: 4-8 litre sharps container;
   (c) Type C: 8-15 litre sharps container;
   (d) Type D: 15-25 litre sharps container;
   (e) Type E: Tall slim sharps container with a minimum height of 600 mm and capacity of between 5 litre and 10 litre for long sharps.

2. A minimum of one Sharps Container of type B or type C must be of the horizontal loading type.

H1.1.2 Material to be used in manufacturing of Sharps Containers and mounting Brackets:

1. Sharps Containers must be manufactured from polypropylene (PP) or alternatively polyethylene (PE);
2. The material shall be puncture resistant as prescribed in the South African (SANS) Code 10248 or similar approved;
3. Ink colours and dies must be free of heavy metals;
4. Sharps Container Brackets for wall or nursing trolley mounting of containers are to be manufactured from mild steel and stainless steel respectively as indicated;
5. Sharps Container Brackets are to be powder coated or galvanised when manufactured from mild steel. No coating is required for stainless steel Brackets.
H1.1.3 Sharps Container design requirements:
1. Sharps Containers shall be rigid, puncture resistant, leak resistant, tamper proof and clearly marked as described below;
2. The required colour coding for Sharps Containers is yellow in accordance with the South African SANS Code 10248 or similar approved;
3. Parts of the Sharps Container shall be fully or partially transparent to allow for assessment of level of filling or contents. Alternatively, it shall be possible to assess the degree of filling or contents through the aperture/opening;
4. Sharps Containers shall be designed to allow for disposal of needle and syringe as one unit;
5. Sharps Containers shall include apertures for the safe removal of sharps/needles from syringes/tubing etc. including "butterfly" type needles on tubes, using a one handed technique;
6. Sharps Containers shall be designed to avoid overfilling and protruding sharps;
7. Sharps Containers shall in their dimensions facilitate best possible usage of the available volume, i.e., rectangular plan cross section for parallel packed placing of syringes and other sharps are preferred to circular or oval plan cross sections;
8. Sharps Containers shall allow for nesting in the unassembled state for effective transport and storage of empty containers;
9. Sharps Containers shall be stackable in the assembled state and preferable in modular fashion for the different sizes of containers to allow for effective storage and transport of full containers;
10. The outer dimensions of the Sharps Containers shall be compatible with the inner dimensions of the Reusable Containers to ensure effective modular storage and easy release of Sharps Containers from reusable containers;
11. Sharps Containers shall allow for easy and safe assembling (e.g. fitting the lid part onto the container part of the Sharps Containers);
12. The (a) lid and (b) opening closure of a Sharps Container shall ensure that the lid and opening closure cannot be released after installation and sealing respectively through the introduction of a non-reversible sealing design;
13. Types D and E Sharps Containers shall be equipped with a foldaway handle for safe handling and transport of containers;
14. The mechanical stability of the empty as well as full Sharps Containers, when standing and whilst being moved or transported, shall be ensured for all Sharps Containers, with the exception of the Type E containers for which this requirement will only apply when standing in a static state;
15. Sharps Containers shall be designed to reduce the risk of spillage of contents in the event of tipping or dropping of Sharps Containers, preferable by an automatic obstruction of the aperture when not in the upright position.

H1.1.4 Sharp container markings:
1. A label shall be so located on the Sharps Containers as to be clearly visible when stacked with other packaging;
2. Sharps Containers shall include suitable warning signage, the international biohazards symbol and relevant UN codes as recommended by the World Health Organisation (WHO, 1996), together with the text "Infectious Sharps for Destruction" or similar text clearly readable and identifiable with a font set suitable for the type and size of the container;
3. Lettering on the label shall contrast with the background of the label, be of one size, style and layout that will result in the marking that is clearly readable;
4. The background of the label shall be of the colour that contrasts with the surface area immediately surrounding the label;
5. All text shall as a minimum be in the English language and preferably in one or more of the other official Kenyan languages;
6. Sharps Containers shall be equipped with a maximum filling line that protects against overfilling. The placement of the max fill line shall as a minimum be 35-mm below the level of the aperture of the container;

7. The sizes of hazard labelling shall be as specified in the South African SANS Code 10248 or similar approved:

<table>
<thead>
<tr>
<th>Net volume of containers (litre)</th>
<th>Minimum Label Size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>15 x 15</td>
</tr>
<tr>
<td>&gt; 0.5 but ≤ 5</td>
<td>20 x 20</td>
</tr>
<tr>
<td>&gt; 5 but ≤ 20</td>
<td>30 x 30</td>
</tr>
</tbody>
</table>
| > 20                            | 100 x 100                

**H1.1.5 Sharps Container mounting Brackets:**

*Note: The Sharps Container mounting Bracket designs as illustrated in Annexure B are typical of those used during the pilot studies. Although Tenderers are invited to propose any alternative design, the aforesaid are indicative of the type of Brackets that will be required.*

1. Sharp containers Type B, C and E should be compatible with wall mounting Brackets as presented in Annexure B, with Type B also being compatible with Brackets that can effectively be hanged or clipped onto nursing trolleys to ensure safe positioning of containers during use.

2. Brackets must as a minimum comply with the following specifications:
   (a) Brackets must be strong and robust and have a serviceable life of at least 5-years under normal working conditions. Any Brackets that are not fully functional for the aforesaid service life are to be replaced by the contractor at any time during the contract period without any additional compensation;
   (b) Brackets shall be grey or off-white coloured and shall be powder coated;
   (c) Brackets shall be smooth at all surfaces and free from cutting splinters, welding residues etc. that may cause abrasions to the hand or similar;
   (d) Brackets shall be easy to clean with no exposed areas being unreachable during usual cleaning operations.

**H1.1.6 Quality control requirements:**

1. Sharps Containers shall be able to pass a drop test in accordance with United Nations Recommendations on the Transport of Dangerous Goods, Chapter 6 with particular reference to paragraphs 6.1.5.3 to 6.1.5.6. The Contractor shall verify this by submitting to the Department’s Representative a report on the said drop test, carried out by an independent institution like a University.

**H1.2: Specican Containers**

*Note:*

① These types of specican containers will be used during Phases 1 and 2 as reusable containers, with it only being used as disposable containers from Phase 3 onwards.

② The range of containers would ultimately be limited to what is readily available for Kenya, thereby keeping the costs down.

Different applications and rates of Waste generation, will require that a range of Specican Containers be made available to the Facilities, leaving it up to the Facilities to make a decision on the type of container that would meet their particular needs best.

The risk of physical infection from blood and Pathological Waste generated in hospitals and clinics is high, resulting in a need for Specican Containers to meet certain minimum standards in terms of user friendliness,
robustness and also the effort required for people to gain access to, or come into contact with infectious Waste previously disposed off.

The following requirements are to be met in the supply of Specican Containers:

**H1.2.1 Range of Specican Containers required:**

1. The following generic types of Specican Containers must, as a minimum form part of the supply made available for ordering by the health care institutions:
   
   (a) Type F: 8-15 litre Specican Container;
   (b) Type G: 15-25 litre Specican Container;
   (c) Type H: 40-70 litre sealable isolation ward container suitable for all waste from isolation wards as well as certain amputations. Type H containers must have an opening of at least 800 cm$^2$ and no side of the aperture may be less than 250 mm should the opening be rectangular/polygonal;
   (d) Type I: 80-100 litre, 650 mm tall, 350 x 400 mm diameter that is suitable for limbs.

**H1.2.2 Material for manufacturing of Specican Containers and mounting Brackets:**

1. Specican Containers must be manufactured from high-density polyethylene (HDPE), thus being able to withstand temperatures as low as $-5\,^\circ\mathrm{C}$ for cold storage of pathological waste;
2. The material shall be puncture resistant in accordance with the South African SANS Code 10248 or similar approved;
3. Printing colours and dies must be free of heavy metals;
4. All Specican Container Brackets for wall mounting of containers are to be manufactured from mild steel and stainless steel respectively as indicated in Schedule of Rates and Quantities;
5. Specican Container Brackets are to be powder coated or galvanised when manufactured from mild steel. No coating is required for stainless steel Brackets.

**H1.2.3 Specican Container design requirements:**

Types D and E Specican Containers shall be equipped with a foldaway handle for safe handling and transport of containers;

1. Specican Containers shall be rigid, leak resistant, puncture resistant, tamper proof and clearly marked as described below;
2. Specican Containers shall be designed to reduce the risk of spillage and ensure that any moisture or liquid is safely contained;
3. Specican Containers with lids shall be designed so that it has a two-staged closure, with the first stage preventing the emission of odours, but still allowing the Specican Container to be opened. Once the lid is however firmly closed by means of a non-reversible sealing design in the second stage, it should not be possible to be reopened;
4. Specican Containers must allow for the use of a seal that could also be used for identification, whilst providing evidence of tampering/opening;
5. The required colour coding for Specican Containers is red, with red lids when used for pathological waste;
6. Parts of the Specican Container shall be fully or partially transparent to allow for assessment of level of filling or contents, provided that this will not in any way impact on the strength or the leak resistance of the container.
7. The Specican Containers Type F and G shall in their dimensions facilitate best possible usage of the available volume, i.e., rectangular plan cross section are preferred to circular or oval plan cross sections;
8. Specican Containers shall allow for nesting in the unassembled state for effective transport and storage of empty containers;
9. Specican Containers shall be stackable in the assembled state and preferable in modular fashion for the different sizes of containers to allow for effective storage and transport of full containers;
10. The outer dimensions of the Specican Containers shall be compatible with the inner dimensions of the Reusable Containers to ensure effective modular storage and easy release of Specican Containers from Reusable Containers;
11. Specican Containers shall allow for easy and safe assembling (e.g. fitting the lid part onto the container part of the Specican Containers);
12. Types F, G, H and I Specican Containers shall be equipped with a handle for safe lifting and transport of containers;
13. The empty as well as full mechanical stability of the Specican Containers, when standing and while being moved or transported shall be ensured;
14. Specican Containers shall be designed to reduce the risk of spillage of contents in the event of tipping or dropping.

**H1.2.4 Specican Container markings:**

1. A label shall be located on the Specican Containers as to be clearly visible when stacked with other packaging
2. Specican Containers shall include suitable warning signage, the international biohazards symbol as detailed in the South African SANS Code 10248 or similar approved, together with the text “Biohazardous Waste for Destruction” or similar text in clear readable letters;
3. Lettering on the label shall contrast with the background of the label, be of one size, style and layout that will result in the marking that is clearly readable;
4. The background of the label shall be of the colour that contrasts with the surface area immediately surrounding the label;
5. All text shall as a minimum be in the English language and preferably in one or more of the other official Kenyan languages;
6. The sizes of hazard labelling shall be as specified in the South African SANS Code 10248 or similar approved:

<table>
<thead>
<tr>
<th>Net volume of containers (litre)</th>
<th>Minimum Label Size (mm)</th>
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<tbody>
<tr>
<td>□ 0.5</td>
<td>15 x 15</td>
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<tr>
<td>&gt; 0.5 but □ 5</td>
<td>20 x 20</td>
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<td>&gt; 5 but □ 20</td>
<td>30 x 30</td>
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<tr>
<td>&gt; 20</td>
<td>100 x 100</td>
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**H1.2.5 Specican Container mounting Brackets:**

*Note: The Specican Container mounting Bracket designs as illustrated in Annexure B of this report are typical of those used during the pilot studies. Although Tenderers are invited to propose any alternative design, the aforesaid are indicative of the type of Brackets that will be required.*

1. Specican Container Type F should be compatible with wall mounting Brackets to ensure safe positioning of containers during use.
2. Brackets must as a minimum comply with the following specifications:
(a) Brackets must be strong and robust and have a serviceable life of at least 5-years under normal working conditions. Any Brackets that are not fully functional for the aforesaid service life are to be replaced by the contractor at any time during the contract period without any additional compensation;

(b) Brackets shall be grey or off-white coloured and shall be powder coated, or similar smooth and easy to clean surface that is durable;

(c) Brackets shall be smooth at all surfaces and free from cutting splinters, welding residues etc. that may cause abrasions to the hand or similar;

(d) Brackets shall be easy to clean with no exposed areas being unreachable during usual cleaning operations;

(e) Wall plates for all Disposable Container brackets and baskets shall be of uniform design with a standard screw pattern that would allow for the interchange of brackets or baskets without the need for any modification to the drilled holes or wall plugs.

**H1.2.6 Quality control requirements:**

1. Specican Containers shall be able to pass a drop test in accordance with United Nations Recommendations on the Transport of Dangerous Goods, Chapter 6 with particular reference to paragraphs 6.1.5.3 to 6.1.5.6. The Contractor shall verify this by submitting to the Department’s Representative a report from the said drop test, carried out by an independent institution like a University.
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<td>Container Type.</td>
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<td>No heavy metals</td>
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<tr>
<td>Sharps Container</td>
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<td>Sharps Container</td>
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<td>No heavy metals</td>
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<td>Tall Sharps Container</td>
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<td>No heavy metals</td>
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<td>No heavy metals</td>
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<tr>
<td>Limb Specian.</td>
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<td>No heavy metals</td>
<td>Red</td>
<td>No heavy metals</td>
</tr>
</tbody>
</table>

**Capacity (litre)**
- 1-4
- 4-8
- 8-15
- 15-25
- 5-10 litre. 600 mm tall.
- 8-15
- 15-25
- 40-70
- 80–100 litre. Approx. 650 mm tall, 350 x 400 mm in plan.

**Minimum volume increase (litre)**
- 3
- 4
- 7
- 7
- 15

**Material allowed for container**
- Polypropylene or polyethylene
- Polypropylene or polyethylene
- Polypropylene or polyethylene
- Polypropylene or polyethylene
- High density polyethylene
- High density polyethylene
- High density polyethylene
- High density polyethylene
- High density polyethylene

**Handle required.**
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes

**Allowable material for handle.**
- Polypropylene or polyethylene
- Polypropylene or polyethylene
- Polypropylene or polyethylene
- Polypropylene or polyethylene
- High density polyethylene
- High density polyethylene
- High density polyethylene
- High density polyethylene
- High density polyethylene

**Wall Bracket required.**
- Yes
- Yes
- Yes
- -
- Yes
- -
- -
- -
- -

**Nursing trolley Bracket req.**
- Yes
- Yes
- -
- -
- -
- -
- -
- -
- -

**Wall/trolley Bracket material.**
- Mild / stainless Steel
- Mild / stainless Steel
- -
- -
- Mild / stainless Steel
- -
- -
- -
- -

**Wall Bracket coating.**
- Powder coated / galvanis e
- Powder coated / galvanis e
- -
- -
- Powder coated / galvanis e
- -
- -
- -
- -

**Container colour.**
- Yellow
- Yellow
- Yellow
- Yellow
- Yellow
- Red
- Red
- Red
- Red

**Constituents not allowed in dye.**
- No heavy metals
- No heavy metals
- No heavy metals
- No heavy metals
- No heavy metals
- No heavy metals
- No heavy metals
- No heavy metals
- No heavy metals
**H1.3: Liners**

**Note:**
- These types of plastic liners will be used as from Phase 1 onwards.

The range of liners would ultimately be limited to what is readily available for Kenya, thereby keeping the costs down.

Due to the different rates at which Waste is generated as well as the particular requirements for different liner applications, there is a need for a range of liners as well as Baskets and Freestanding Racks to be made available to Facilities, leaving it up to the Facilities to make a decision on the type of liners, Baskets and Freestanding Racks that would best meet their particular needs. It is further required that liners, Baskets and Freestanding Racks for both HCRW as well as HCGW be made available under this contract, although the Contractor would not under this contract have exclusive right for the supply of HCGW liners as well as Baskets and Freestanding Racks.

All plastic liners shall be packed and delivered in batches of 20 to allow for easy handling and internal distribution within Facilities.

The risk of infection and pollution caused by spillage is high, resulting in a need for liners to meet certain minimum standards in terms of user friendliness during handling and sealing as well as in terms of robustness.

The following requirements are to be met in the supply of plastic liners:

**H1.3.1 Range of liners required:**

1. Waste Liners (Red):
   a) Type J1: 12-litres @ 40 micron thickness;
   b) Type K1: 30-litres @ 60 micron thickness;
   c) Type L1: 85-litres @ 80 micron thickness.

2. HCGW Liners (Black):
   a) Type K2: 30-litre @ 60 micron thickness;
   b) Type L2: 85-litre @ 40 micron thickness.

**H1.3.2 Material to be used in manufacturing of liners:**

1. Liners are to be manufactured from Polyethylene (PE);
2. Liners shall not contain in excess of 15% recycled PE to ensure that strength and resistance to tearing is acceptable;
3. Dies must not contain heavy metals;
4. All Plastic Liner Baskets and Freestanding Racks are to be manufactured from mild steel and stainless steel respectively as indicated in Schedule of Rates and Quantities;
5. Plastic Liner Baskets and Freestanding Racks are to be powder coated or galvanised when manufactured from mild steel. No coating is required for stainless steel Baskets or Freestanding Racks.

The following type of ties for plastic liners shall be supplied:

- Standard Pure natural rubber bands, size 34 (3.0-mm x 100-mm) or size 35 (3.0-mm x 115-mm).

**H1.3.3 Plastic liner design requirements:**
1. Liners for HCRW must be red;
2. Liners for HCGW must be black;
3. Liners may be semi transparent;
4. All seams for liners of a thickness 40 micron must be single welded, whereas all liners with a thickness of more than 40 microns shall be double welded;
5. All liners are to be supplied with appropriate ties, with the number of ties exceeding the number of liners by 5%.

**H1.3.4 Plastic liner markings:**
No markings/printing will be required on any of the liners.
Annexure I - Liner mounting Baskets and Freestanding Racks

Note:  The plastic liner mounting Basket and Freestanding Rack designs as illustrated in this Annexure are typical of those used during the pilot studies. Although Tenderers are invited to propose any alternative design, the aforesaid are indicative of the type of Baskets and Freestanding Racks that will be required.

1. Liners Type K1 and K2 should be compatible with wall mounting Baskets as well as Freestanding Racks, whilst liners type K1 should also be compatible with Baskets that can be hanged or clipped onto nursing trolleys to ensure safe positioning of liners during use.

2. Baskets and Freestanding Racks must as a minimum comply with the following specifications:

   (a) Baskets and Freestanding Racks must be strong and robust and have a serviceable life of at least 5-years under normal working conditions. Any Baskets and Freestanding Racks that are not fully functional for the aforesaid service life are to be replaced by the contractor at any time during the contract period without any additional compensation;
   (b) Brackets shall be grey or off-white coloured and shall be powder coated;
   (c) Baskets and Freestanding Racks shall be smooth at all surfaces and free from cutting splinters, welding residues etc. that may cause abrasions to the hand or similar;
   (d) Baskets and Freestanding Racks shall be easy to clean with no exposed areas being unreachable during usual cleaning operations;
   (e) Freestanding Rack of stainless steel shall be equipped with 4 wheels, one of which must have a break. The overall height of the stainless steel Freestanding Racks shall not exceed 800 mm, which is to include the height of the wheels.
   (f) Facilities should have the choice between mild steel Freestanding Racks without wheels, or alternatively mild steel Freestanding Racks equipped with 4 wheels, of which one is to have a brake. The overall height of the Freestanding Racks shall in all instances not exceed the overall dimensions indicated;
   (g) Due to the slow rate at which liners are filled in some of the smaller Facilities, tenderers are during the design of baskets and freestanding racks to consider the possibility of providing some form of a closure mechanism that would reduce the emission of odours, provided that this would not increase the risk of contamination of baskets and racks to the extent that it would require frequent disinfection of fixed items. Where baskets and racks are offered that include some form of a closing mechanism at prices exceeding that of the open baskets or racks, such items are to be submitted as an alternative tender.
   (h) Wall plates for all Disposable Container brackets and baskets shall be of uniform design with a standard screw pattern that would allow for the interchange of brackets or baskets without the need for any modification to the drilled holes or wall plugs.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Container type</td>
<td>J1</td>
<td>K1</td>
<td>L1</td>
<td>K2</td>
<td>L2</td>
</tr>
<tr>
<td>Capacity (litre)</td>
<td>12</td>
<td>30</td>
<td>85</td>
<td>30</td>
<td>85</td>
</tr>
<tr>
<td>Dimensions: Width x length</td>
<td>500 x 540</td>
<td>560 x 660</td>
<td>750 x 950</td>
<td>560 x 660</td>
<td>750 x 950</td>
</tr>
<tr>
<td>Liner thickness (μm)</td>
<td>40</td>
<td>60</td>
<td>80</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Material allowed for liner.</td>
<td>Polypropylene or polyethylene</td>
<td>Polypropylene or polyethylene</td>
<td>Polypropylene or polyethylene</td>
<td>Polypropylene or polyethylene</td>
<td>Polypropylene or polyethylene</td>
</tr>
<tr>
<td>Min / max % recyclable material.</td>
<td>0/10</td>
<td>0/10</td>
<td>0/10</td>
<td>0/10</td>
<td>0/10</td>
</tr>
<tr>
<td>Wall Basket required.</td>
<td>-</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>Nursing trolley Basket required</td>
<td>-</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Freestanding Rack required (This type not applicable for Kenya)</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Wall/trolley Basket or Freestanding Rack material. (This type not applicable for Kenya)</td>
<td>-</td>
<td>Mild / stainless steel</td>
<td>-</td>
<td>Mild / stainless steel</td>
<td>-</td>
</tr>
<tr>
<td>Wall/trolley Basket or Freestanding Rack coating. (This type not applicable for Kenya)</td>
<td>-</td>
<td>Powder coated / galvanised.</td>
<td>-</td>
<td>Powder coated / galvanised.</td>
<td>-</td>
</tr>
<tr>
<td>Liner colour.</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Black</td>
<td>Black</td>
</tr>
<tr>
<td>Constituents not allowed in dye.</td>
<td>No heavy metals</td>
<td>No heavy metals</td>
<td>No heavy metals</td>
<td>No heavy metals</td>
<td>No heavy metals</td>
</tr>
</tbody>
</table>
I.1 Specification for HCW Brackets and Baskets

I 1.1 Wall-Mounted Bracket for 32 Litre Bin

All dimensions in millimetres

1. Dimension tolerances + -3 mm, except otherwise indicated
2. Bend radii (wire & flat bar): 15 mm < r < 5mm

I 1.2 Sharps Container Bracket for Nursing Trolley
Annexure J – Specification for Reusable HCW Containers.

J.1 Specifications for Reusable Containers.
Although Tenderers are allowed to submit indicative samples and are not required to submit actual prototypes of the Reusable Containers at the time of Tender, such samples will be used for verification of features and quality standards until such time that actual prototypes are submitted for approval after award of Contracts to successful Tenderers.

J 2.1: Reusable Containers for Hospitals and Clinics.
Due to the vastly different rates at which Waste is generated in Hospitals and Clinics respectively, as well as the limitations that exists on internal movement and storage of large wheelie bins at clinics, it is intended that two different sizes of wheelie bins be used for the respective applications.

The risk of physical injuries by and spillage from Waste containers used in hospitals and clinics are high, resulting in a need for reusable wheelie bins to meet certain minimum standards in terms of quality, robustness and user friendliness.

The following requirements are to be met in the supply of wheelie bin containers:

J 2.1.1 Range of Reusable Containers required:
The following generic types of Reusable Containers must form part of the supply made available for distribution to Facilities:

(a) Type A: 600 to 800-litre wheelie bins, primarily for use in Hospitals (This type of reusable container is not applicable to Kenya);

(b) Type B: 200 to 300-litre wheelie bins, primarily for use in Clinics, as well as for transport of Specican Containers containing pathological waste from hospitals. (These are typically the 240-litre wheelie bins);

(c) Type C: 50 and 100 litre reusable plastic box containers.
Type C1: 100 LITRE ROTO-MOULDED BOXES FOR WCRW

Outside dimensions in millimetres

FRONT

SIDE

BASE

LID

Section “b-b” through lid
Type C2: 50 LITRE ROTO-MOULDED BOX FOR WCRW
Outside dimensions, in millimetres

FRONT

SIDE

BASE

LID

Section “a-a” through lid

Nesting ‘stops’ on diagonal corners
Stiffening rib front & back
Nesting ‘stops’ on diagonal corners

PROPERTY OF GAUTENG PROVINCIAL GOVERNMENT

JC 02-10-08 Roto Moulded Box 50 litre 01.wpg
J 2.1.2 Manufacturing process to be used in manufacturing of Type B Reusable Containers:

(a) Container body: One-piece injection moulding;
(b) Container lid: One-piece injection moulding;
(c) Wheel hubs: Injection moulding;
(d) Hinge pins: Injection moulding;
(e) Tyres: Compressed solid rubber

Note: No moulded parts are to show any foreign substances, shrink holes, cracks or blowholes. There should also not be any obvious colour streaks.

J 2.1.3 Material to be used in manufacturing of Type B Reusable Containers:

(a) Body, lid, wheel hubs and hinge pins: High-density polyethylene (HDPE) - Ultra violet stabilised to withstand an average annual UV radiation level of 160 Kilocalories per cm². Only virgin material is to be used;
(b) Tyres: First grade compressed solid rubber;
(c) Axle: Solid steel galvanised yellow chrome plated;
(d) Colorant: The colorant shall be colourfast to prevent the plastic material colour from altering appreciably in normal use;

J 2.1.4 Type B Reusable Container design requirements:

1. Reusable Containers shall be rigid, puncture resistant, leak resistant, tamper proof;
2. Flat lids shall be affixed to wheelie bin bodies by means of hinged shafts;
3. Lids shall be such as to provide a seal between the body and the lid that will prevent/minimise the release of odours;
4. The empty as well as full mechanical stability of the Reusable Containers, when standing and while being moved or transported shall be ensured;
5. Reusable Container bodies shall be slightly tapered to allow for easy release of its contents when tipped, as well for it to be nested in the unassembled state for effective transport and storage of unassembled containers;
6. Reusable Containers shall allow for easy and safe assembling;
7. Reusable Containers shall be designed to reduce the risk of spillage of its contents in the event of accidental tipping or dropping by providing two sets of 10-mm holes opposite to the hinge side, also securing the bin contents by inserting 2 cable ties. Such holes are not in any way to impact on the structural integrity of the bins and is not to allow the ingress of water or the release of odours from the bin;
8. Suitable and sufficient cable ties are to be provided with each batch of clean and disinfected Reusable Containers delivered to the respective Facilities for sealing of full containers, forming part of the Reusable Container system;
9. Reusable Containers shall in its dimensions facilitate best possible usage of the available volume when stored or transported;
10. Types A and B Reusable Containers shall preferable be modular in plan for the 2 sizes of containers to allow for effective storage and transport of empty and full containers;
11. Type A Reusable Containers shall be equipped with handles on both sides of bin body and Type B Reusable Containers shall be equipped with own full width handle for handling and manoeuvring of containers. Lifting of wheelie bins will only be required by means of hydraulic bin lifting equipment;
12. All Reusable Containers must be compatible with standard combination lifting mechanisms in use in South Africa, with the acceptance lifting mechanism lip reinforced with locking lip, honeycomb reinforcing as well as reinforcing webs;

13. All bar code plates or transponder tags used for the identification of reusable wheelie bins shall be attached by means of a suitable epoxy or similar method that will prevent the accumulation of dirt behind the plates or tags;

14. The colour coding for Reusable Containers should be in accordance with the South African SANS Code 10248 or similar approved, with appropriately coloured attachable tags for easy identification of the various categories of Waste to be collected in the Reusable Containers:

<table>
<thead>
<tr>
<th>Category</th>
<th>Placeholder</th>
<th>Lid Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Infectious Waste</td>
<td>Body - Red</td>
<td>Lid - Red</td>
</tr>
<tr>
<td>Pathological Waste</td>
<td>Body - Red</td>
<td>Lid - Red</td>
</tr>
<tr>
<td>Chemical Waste</td>
<td>Body - Red</td>
<td>Lid - Red</td>
</tr>
</tbody>
</table>

15. All Type A Reusable Containers are to be provided with drainage holes and tight sealing plugs at the base of the bins;

16. Lifting trunnions are to be fitted on either side of the Type A reusable bin body;

17. A yoke for the fitment of the flat lid to be affixed by a hinge pin must be an integral part of the back of the Type A Reusable Container body;

18. All Type A Reusable Containers shall be equipped with a handhold slotted on the front of the lid;

19. Type A Reusable Containers are to be equipped with 4 swivel wheels, with a diameter of minimum 250 mm, fitted to the base of the bin body. Two wheels placed symmetrically over the longest of the two horizontal axes shall be equipped with brakes. The wheels shall be non-marking;

20. A simple foot brake is to be provided on 2 of the swivel wheels;

21. For all Type A Reusable Containers, the swivel wheel connecting areas at the base of the bin must be reinforced with moulded webbing and fins;

22. All wheels and lifting trunnions on Type A Reusable Containers are to be connected by means of steel screws for plastic part assembly. The use of rivets is unacceptable.

**J 2.1.5 Reusable Container markings:**

1. A label shall be so located on the Reusable Containers as to be clearly visible when stored with other wheelie bins;

2. The Department’s name is to be hot-foiled in black on the front face of bin body, approximately 50-mm in height;

3. Serial numbers are to be hot-foiled in black on the side of body, not less than 8-mm in height. Incorporated in the number is the month and year of manufacture, which is visible when the containers are nested;

4. Reusable Containers shall include suitable hot-foiled warning signage, the international biohazards symbol and relevant UN codes as recommended by the World Health Organisation. The following text shall be provided in clear readable letters for the various Waste categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Infectious Waste</td>
<td>&quot;Infectious Health Risk Care Waste for Destruction&quot; or similar approved text;</td>
</tr>
<tr>
<td>Pathological Waste</td>
<td>&quot;Infectious Pathological Waste for Destruction&quot; or similar approved text;</td>
</tr>
<tr>
<td>Chemical Waste</td>
<td>&quot;Chemical Health Care Risk Waste for Destruction&quot; or similar approved text;</td>
</tr>
</tbody>
</table>

5. Lettering on the label shall be in red to contrast with the background colour, be of one size, style and layout that will result in the marking that is clearly readable;

6. The background of the label shall be of the colour that contrasts with the surface area immediately surrounding the label;

7. All text shall as a minimum be in the English language and preferably in one or more of the other official Kenyan languages;
J 2.1.6 Quality control requirements:

1. Reusable containers are to meet the requirements of the South African SANS Code 1494/1989 or similar approved. Copies of certification of containers will be required.
Annexure K – Specification for Reusable Container Hygiene

K.1 Cleansing, Disinfection and Inspection of Reusable Containers

The cleaning and disinfection of the Reusable Containers shall be done in accordance with the Regulations and the following requirements:

1. Written operating procedures must be established by any person responsible for disinfecting Reusable Containers, which procedures shall include approved testing methodologies for relevant biological and other indicators relating to the adequate disinfection of Reusable Containers for each unit, as well as all pertinent operating parameters;

2. Adequate disinfection of Reusable Containers must be monitored by any person responsible for disinfecting Reusable Containers, based on swab tests or similar sampling procedures for relevant biological indicators, which tests or sampling must be conducted by a competent person. Such samples must be processed by an accredited laboratory for the following biological indicators: (a) Bacterial cultures; and (b) Fungal cultures;

3. The minimum frequency of testing to be conducted in terms of Clause (2) above, must be in accordance with the following:
   (a) Initial testing prior to commencement of operations: Daily sample swab tests of disinfected Reusable Containers for 5 (five) working days;
   (b) Testing during usual operation: Weekly sample swab tests of disinfected Reusable Containers before dispatch to Facilities; and monthly sample swab tests of Reusable Containers after delivery to a Facility;
   (c) After 4 (four) consecutive months of achieving reasonably adequate levels of disinfection for Reusable Containers, the test frequency as required by (a) and (b) above, may be reduced to 50 (fifty) %; Provided that should any one sample fail to achieve a reasonably adequate level of disinfection, the frequency levels required by (a) and (b) above must be adhered to.

4. Any person responsible for disinfecting Reusable Containers must ensure that a report is compiled quarterly by a competent person, regarding the level of disinfection achieved based on the results of the tests conducted in terms of Clause (2) above, which report shall include details of all procedures used.

5. The number of swab samples taken shall be reasonable compared to the number of Reusable Containers being disinfected per day at the disinfecting facility and shall be determined by a competent person.

6. The specific area of the Reusable Container to be used for sampling, as well as the location for intercepting Reusable Containers for sampling once delivered to a Facility, shall be determined by a competent person.

7. The reports required in terms of Clause (3) above must be retained for a period of 3 (three) years.

8. A 3.5% Sodium hypochlorite solution or similar approved is recommended as a solution for disinfection of Reusable Containers, as only scanty growth of bacillus species was detected in 50% of the samples taken during the Pilot Studies. The bacillus species isolated falls into the Group 1 category that is unlikely to cause human disease. Special attention is however also to be given to the risk of odour generation and where feasible, the addition of a deodorising agent to the disinfection solution may be beneficial.

Notwithstanding the aforesaid recommendations, it will ultimately remain the Contractor’s responsibility to ensure that the requirements for deactivation of micro organisms are achieved.
9. Based on experience from the Pilot Studies where it was found that contamination of the reusable containers occurred during the handling and transport thereof, it is recommended that this aspect be addressed by protecting reusable containers from contamination by providing disposable wrapping (similar to "Glad Wrap") around the handles, provided that the containers are not touched in any area other than that before the wrapping is removed and round collection is done within the Facilities.

Contamination of disinfected reusable containers could alternatively be prevented by fitting a disposable plastic cover over the containers after disinfection, once again only to be removed at the start of any collection round. To optimise the use of such disposable covers, it may be designed in such a way that it could be used as bin liners when removed from the reusable containers, should that be a viable option.

Notwithstanding the aforesaid, the Contractor will ultimately remain responsible to prevent contamination of containers after disinfection.
## Annexure L List of Workshop Participants

### L.1 List of Participants to the Stakeholders Consultative Workshop for National Health Care Waste Management Plan

<table>
<thead>
<tr>
<th>Participant</th>
<th>Designation</th>
<th>Organization</th>
<th>Contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Dr. P.A. Orege</td>
<td>Director</td>
<td>NACC</td>
<td>Tel: 2715109 Email: <a href="mailto:porege@nacc.or.ke">porege@nacc.or.ke</a></td>
</tr>
<tr>
<td>2 Dr J. W Nyikal</td>
<td>Director of Medical Services</td>
<td>Ministry of Health</td>
<td>Tel: 2717077</td>
</tr>
<tr>
<td>3 Alfred K. Langat</td>
<td>Chief Public Health Officer</td>
<td>Ministry of Health</td>
<td>Tel: 2715677 Email: <a href="mailto:cpho@insightkenya.com">cpho@insightkenya.com</a></td>
</tr>
<tr>
<td>4 Blanche Tumbo</td>
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<td>Tel: 2717077 Email: <a href="mailto:tblanche@hotmail.com">tblanche@hotmail.com</a></td>
</tr>
<tr>
<td>5 John G. Kariuki</td>
<td>Assistant Chief Public Health Officer</td>
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<tr>
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</tr>
<tr>
<td>7 John Kamigwi</td>
<td>Deputy Director</td>
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</tr>
<tr>
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<td>HD Technical Support</td>
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<td>Tel: 2715144 Email: <a href="mailto:dmwaniki@nacc.or.ke">dmwaniki@nacc.or.ke</a></td>
</tr>
<tr>
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</tr>
<tr>
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<td>Head / Stakeholder Coordination</td>
<td>NACC</td>
<td>Tel: 0722-503979 Email: <a href="mailto:mbahati@nacc.or.ke">mbahati@nacc.or.ke</a></td>
</tr>
<tr>
<td>11 Barrack Onduto</td>
<td></td>
<td>NACC</td>
<td>Tel: 0722-611202 Email: <a href="mailto:obarrack@yahoo.com">obarrack@yahoo.com</a></td>
</tr>
<tr>
<td>12 Micah K. Kisoo</td>
<td>Programme Officer</td>
<td>NACC</td>
<td>Tel: 0722-611202 Email: <a href="mailto:obarrack@yahoo.com">obarrack@yahoo.com</a></td>
</tr>
<tr>
<td>13 Caroline Kinoti</td>
<td>Programme Officer</td>
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<td>Tel: 2715109 Email: <a href="mailto:carolkinoti@nacc.or.ke">carolkinoti@nacc.or.ke</a></td>
</tr>
<tr>
<td>14 Evelyn Waweru</td>
<td>PO</td>
<td>NACC</td>
<td>Tel: 215109 Email: <a href="mailto:ciiru@nacc.or.ke">ciiru@nacc.or.ke</a></td>
</tr>
<tr>
<td>15 Dr. Mburu P.G</td>
<td>ADMS/ PMO - Eastern</td>
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<td>Tel: 05631345 Email: 068-31883 / 31081</td>
</tr>
<tr>
<td>16 C. M. Wanganga</td>
<td>Senior Public Health Officer</td>
<td>Ministry of Health - Eastern</td>
<td>Tel: 068-30785</td>
</tr>
<tr>
<td>17 Ananias Njagi Nkonge</td>
<td>Senior Public Health Officer</td>
<td>Moi University - Eldoret</td>
<td>Tel: 053-2031951 Email: <a href="mailto:annnkonge@yahoo.com">annnkonge@yahoo.com</a></td>
</tr>
<tr>
<td>18 James K. Thuo</td>
<td>Provincial Public Health Officer</td>
<td>Ministry of Health (Central Province)</td>
<td>Tel:0722-822819 Email: <a href="mailto:ithuok@yahoo.com">ithuok@yahoo.com</a></td>
</tr>
<tr>
<td>19 Samuel N. Njoroge</td>
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<td>Nairobi Province</td>
<td>Tel: 0722-493264 Email: <a href="mailto:pmenairobi@yahoo.com">pmenairobi@yahoo.com</a></td>
</tr>
<tr>
<td>20 Timothy Olubero</td>
<td>Provincial Public Health Officer</td>
<td>PMO Office - Western</td>
<td>Tel: 05631345 Email: <a href="mailto:pmowestern@africaonline.co.ke">pmowestern@africaonline.co.ke</a></td>
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<tr>
<td>21 George O. Oele</td>
<td>Deputy Provincial Public Health Officer</td>
<td>MOH</td>
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</tr>
<tr>
<td>22 Isaac Rotino</td>
<td>Deputy Provincial Public Health Officer</td>
<td>Ministry of Health</td>
<td>Tel: 051-2213064 or 0733-278326</td>
</tr>
<tr>
<td>23 Sammy B.K Makama</td>
<td>District Public Health Officer</td>
<td>Ministry of Health, Bussia</td>
<td>Tel:05522594/0722-866387 Email: <a href="mailto:healthbusia@vicweb.net">healthbusia@vicweb.net</a></td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td>Title/Position</td>
<td>Organization</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>24</td>
<td>Bonface Othieno</td>
<td>District Public Health Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>25</td>
<td>Ali A. Hussein</td>
<td>Provincial P.H Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>26</td>
<td>Mohamed Bagajo Duba</td>
<td>District Public Health Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>27</td>
<td>Erastus J. Ntwiga</td>
<td>District Public Health Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>28</td>
<td>Peter N. Gathungu</td>
<td>District Public Health Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>29</td>
<td>Henry N. Wanyonyi</td>
<td>District Public Health Officer</td>
<td>Ministry of Health</td>
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<tr>
<td>30</td>
<td>Samuel O. Okuche</td>
<td>District Public Health Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>31</td>
<td>David K. Koech</td>
<td>District Public Health Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>32</td>
<td>Anthony M. Wainaina</td>
<td>Public Health Officer</td>
<td>Kenyatta National Hospital</td>
</tr>
<tr>
<td>33</td>
<td>Jane Villinga Indogo</td>
<td>Occupational Therapist</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>34</td>
<td>Fredrick M. Shiguri</td>
<td>Public Health Officer</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>35</td>
<td>Dorcas M. Kameta</td>
<td>Programme Officer</td>
<td>NASCOP</td>
</tr>
<tr>
<td>36</td>
<td>Dr. Maina Daniel</td>
<td>Centre Manager</td>
<td>Family Planning Ass. of Kenya</td>
</tr>
<tr>
<td>37</td>
<td>Jonathan K. Kertich</td>
<td>Public Health Officer (NACADA)</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>38</td>
<td>Hudson M. Mukanga</td>
<td>Researcher</td>
<td>NEMA</td>
</tr>
<tr>
<td></td>
<td><strong>Academia &amp; CSO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>G. N Kamau</td>
<td>Professor</td>
<td>University of Nairobi</td>
</tr>
<tr>
<td>40</td>
<td>Michael K. Koech</td>
<td>Prof. Environmental Sciences</td>
<td>Kenyatta University</td>
</tr>
<tr>
<td>41</td>
<td>Charles Chemjor</td>
<td>Public Health Officer</td>
<td>Moi Teaching and Refferal Hospital</td>
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<td>Joyce M. Olenja</td>
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<td>University of Nairobi</td>
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