



MINISTRY OF HEALTH

**HEALTH CARE WASTE
MANAGEMENT PLAN
2016–2021**

ACKNOWLEDGEMENT

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FOREWORD

Strategic planning for health care waste management (HCWM) covers not only the technical aspects related to waste management such as waste handling, storage, transportation, treatment, and disposal, but also capacity-building and awareness creation. It is prudent to note that success in waste management can occur when the staff members working in the health sector dedicate themselves to surmounting the challenges they experience in the areas mentioned.

To confront these challenges, this national HCWM PLAN 2016 – 2021 has been developed to provide viable technical and management options as well as a roadmap for the domestication of the National HCWM Strategic Plan 2015 -2020 in Kenya for the next five years.

This initiative of the Ministry of Health (MOH), together with its development partners—notably the World Bank, the World Health Organization (WHO), the US Centers for Disease Control and Prevention (CDC), the National Environment Management Authority (NEMA), and other partners such as the United Nations Development Programme/Global Environment Fund (UNDP/GEF), Government of Belgium and Japanese International Cooperation Agency (JICA) —has renewed the focus on HCWM in Kenya.

This is in a bid to domesticate the 2012 environment policy as well as ensure conformity to the new constitutional dispensation which provides for each person's entitlement to a clean and healthy environment. This National HCWM plan brings out a deliberate strategy aimed at strengthening the management of HCW within both hospitals and community settings in order to improve and safeguard public health and realize a sustainable safe environment.

The immediate benefit of implementing this plan is to prevent, reduce and mitigate the likely risks of transmission of infections likely to be acquired from unsound HCWM, such as HIV/AIDS, hepatitis B, and other health care-associated infections (HAIs) as well as safe guard the environment for sustainable development. The plan provides feasible options of applying the best available technologies (BAT) and best environmental practises (BEP) in HCWM.

The Ministry, therefore, encourages the use of appropriate, safe, and cost-effective methods and techniques to segregate, contain, transport, treat, and dispose of HCW.

In this regard, therefore, I wish to call upon all the stakeholders to join hands with the Ministry of Health in ensuring consistent support for the successful implementation of this strategic plan.

Finally, the Ministry is grateful to its staff and the World Bank through the Kenya Health Sector Support Project (KHSSP) and Transforming Health Systems for Universal Care (THS-UC) programme for their contributions either technically or financially toward the development of this plan.

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EXECUTIVE SUMMARY

The National Health Care Waste Management Strategic Plan is intended for use by health managers and programme officers across the health sector (including those in the private health sector) and partners as a guide in planning, implementing, and monitoring the activities of HCWM in health facilities and communities in Kenya.

This plan describes the situation of HCWM on the basis of a desk review conducted to collate the findings of three rapid assessments on HCWM during the 2008 to 2012 plan period. The assessments were carried out by the MOH, the World Bank Health Sector Support project, the United States Agency for International Development (USAID) (on environmental compliance in HCWM in Kenya), and PATH (on HCWM financing in 2013).

The devolution of health services to counties can give a renewed impetus from the MOH and other stakeholders providing the desired opportunity of addressing the issues of HCWM up to the lowest level of health care service delivery. A holistic approach has been recommended to include clear delineation of responsibilities, occupational health and safety programmes, waste minimization and segregation, protocols on HCW disposal, and documentation of best practices/innovations. This document will provide viable options to address the challenges encountered in planning for HCWM in Kenya.

The recommendations proposed are as a result of discussions and consultations with the various stakeholders and representatives from counties across the country under the leadership of the National Working Group on Health Care Waste Management covered under the following thematic areas:

- Legal and regulatory framework to provide guidance to health care managers on minimum operation requirements.
- Standardized guidelines on HCWM practices in all health care facilities in all the counties.
- Financing for implementation of HCWM plan of action both at the National and County Governments in order to prevent, minimize and mitigate if not eliminate infection transmission through improper waste management practices.
- Capacity-building of health care workforce in order to bring about the envisaged HCWM uniformity in the health sector to desired policy standards; both for the National and County Governments.
- Operational research on pollution reduction through the development and adoption of environmentally friendly technologies that are appropriate for Kenya.

It is also the endeavor of the MOH in counties to develop county specific plans and a monitoring and evaluation (M & E) tool that shall guide the implementation and actualization of the sector action plan.

It is envisaged that the implementation of this plan over the next five years will result in improvement and sustainability of HCWM in health care facilities, prevent and reduce risks and mitigate hazards associated with poor HCWM in humans and the environment. The counties and national government will develop HCWM plans as appropriate to ensure the challenges of HCW in the context of global changes in technology and practice are addressed.

ACRONYMS

| | |
|-----------|---|
| AIDS | Acquired Immunodeficiency Syndrome |
| ARV | Antiretroviral |
| AMREF | African Medical Research Foundation |
| BAT | Best Available Technologies |
| BEP | Best environmental Practice |
| ARV | Antiretroviral |
| AMREF | African Medical Research Foundation |
| BAT | Best Available Technologies |
| BEP | Best environmental Practice |
| CBO | Community Based Organization |
| CDC | Centres for Disease Control and Prevention |
| CHAK | Christian Health Association of Kenya |
| CHMT | County Health Management Team |
| CME | Continuing medical Education |
| CPD | Continuous Professional development |
| DHIS | District Health Information System |
| DEH | Division of Environmental Health |
| DPH | Director Public Health |
| EIA | Environment Impact Assessment |
| EMCA | Environment Management and Coordination Act of 1999 |
| FBO | Faith-Based Organization |
| FHI 360 | Family Health International |
| GEF | Global Environment Fund |
| GIS | Global Implementation Services |
| GOK | Government of Kenya |
| GoB | Government of Belgium |
| HAI | Healthcare Associated Infection |
| HAV | Hepatitis A Virus |
| HBC | home-based care |
| HBV | hepatitis B virus |
| HCF | Health Care Facility |
| HCW | Health Care Waste |
| HCWM | Health care waste management |
| HCV | Hepatitis C virus |
| HIV | Human Immunodeficiency Virus |
| HMIS | Health Management Information Systems |
| HMT | Health Management Team. |
| HRIO | Health Records Information Officers |
| IEC | Information, Education, and Communication |
| IPC | Infection Prevention and Control |
| IPCC | Infection Prevention and Control Coordinator |
| IPCO | Infection Prevention and Control Officer |
| JICA | Japanese International Cooperation Agency |
| KAIS | Kenya AIDS indicator Survey |
| KEMSA | Kenya medical supplies Authority |
| KHSSP III | Kenya Health Sector Strategic Plan III 2012–2018 |
| KHSSP | Kenya Health Sector Support Project |
| KMTC | Kenya Medical Training College |
| KMDB | Kenya Medical and Dentist Board |
| KQM | Kenya Quality Model |
| M & E | Monitoring and Evaluation |
| MENR | Ministry of Environment and Natural Resources |

| | |
|-------|--|
| MOH | Ministry of Health |
| NEMA | National Environment Management Authority |
| NGO | Non-governmental organization |
| OPD | Out-Patient Department |
| PATH | Project for Appropriate Technology in Health |
| PHC | primary health care |
| PHO | Public Health Officer |
| PPE | Personal Protective Equipment |
| PPP | Public-Private Partnerships |
| PVC | Polyvinyl Chloride |
| SDGs | Sustainable Development Goals |
| SOP | Standard Operating Procedure |
| TB | Tuberculosis |
| TOR | Terms of Reference |
| TWG | Technical Working Group |
| USA | United States of America |
| UN | United Nations |
| USAID | United States Agency for International Development |
| UNDP | United Nations Development Programme |
| WB | World Bank |
| WDU | Waste Disposal Units |
| WHO | World Health Organisation |
| WMO | Waste Management Officer |

1 INTRODUCTION

1.1 Healthcare Waste Overview

Waste from healthcare settings ranges from general waste such as paper and food remains, to infectious waste such as syringes and needles to highly infectious waste such as anatomical body parts to special waste such as mercury from broken thermometers and body imaging films. The term health-care waste includes all the waste generated within health-care facilities, research centres and laboratories related to medical procedures (WHO, 2014). In addition, it includes the same types of waste originating from minor and scattered sources, including waste produced in the course of health care undertaken in the home (e.g. home dialysis, self-administration of insulin, recuperative care). Detailed classification has been provided by WHO (2014) as described below:

| Waste category | Descriptions and examples |
|---|--|
| <i>Hazardous health-care waste</i> | |
| Sharps waste | Used or unused sharps (e.g. hypodermic, intravenous or other needles; auto-disable syringes; syringes with attached needles; infusion sets; scalpels; pipettes; knives; blades; broken glass) |
| Infectious waste | Waste suspected to contain pathogens and that poses a risk of disease transmission (see section 2.1.2) (e.g. waste contaminated with blood and other body fluids; laboratory cultures and microbiological stocks; waste including excreta and other materials that have been in contact with patients infected with highly infectious diseases in isolation wards) |
| Pathological waste | Human tissues, organs or fluids; body parts; fetuses; unused blood products |
| Pharmaceutical waste, cytotoxic waste | Pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals Cytotoxic waste containing substances with genotoxic properties (e.g. waste containing cytostatic drugs – often used in cancer therapy; genotoxic chemicals) |

| | |
|--|--|
| Chemical waste | Waste containing chemical substances (e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents; waste with high content of heavy metals, e.g. batteries; broken thermometers and blood-pressure gauges) |
| Radioactive waste | Waste containing radioactive substances (e.g. 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) |
| Non-hazardous or general health-care waste | Waste that does not pose any particular biological, chemical, radioactive or physical hazard |

According to WHO, around 80% of HCW is nonhazardous and 15% is infectious. The remaining 5% is made up of sharps (1%), toxic chemicals, pharmaceuticals (3%), genotoxic, and radioactive waste (1%) (WHO, 2007). These traditional estimates are not consistent for many developing countries. For instance, 25% of HCW produced in Pakistan is hazardous, 26.5% in Nigeria, and 2%–10% in other sub-Saharan Africa countries. In Kenya, due to poor segregation practices, it is common to find that up to 50% of waste in some facilities is infectious. (HCWSP, 2015-2020).

Increasing population and technology advancement have facilitated expanded growth of health care and research institutions and resulted in increasing amounts of waste, which in turn, lead to opportunities and challenges in the management of HCW and general waste across the globe.

1.2 Background

Due to the complexity and risks associated with health care waste handling, storage, collection, transportation, treatment and disposal, there are four internationally accepted principles that guide systems development and maintenance in order to safeguard public health (WHO, 2014). These are the precautionary, duty of care, proximity and polluter pay principles.

Developing countries have extremely limited options for safe waste disposal. This complicates waste management, since mixing sharps and other infectious waste with non-infectious waste increases the amount of waste that is considered infectious. This type of waste requires special handling

for safe treatment and disposal. The government of Kenya in taking cognizance of the risks of mismanagement of health care waste or use of inadequate or harmful treatment technologies, has set forth a framework of activities aimed at jump starting better HCWM practices in Kenya.

HCWM has been given priority in order to reduce and attempt to eliminate adverse environmental effects of HCW on human health. Kenya has been grappling with the problem of poor and ineffective management of HCW from HCFs in the country. While the rest of the waste is handled on an ad hoc basis by both the counties and the private sector, HCW poses a serious challenge in both public and private sector since no serious sustainable planning arrangements have so far been put in place.

1.3 Organization of Health Services in Kenya

Kenya is among the sub-Saharan countries experiencing high urban population growth rate of 4.3% while rural growth rate stands at 2.1% giving population size of 45.5 million people. The country occupies an area of 591,958 km² with a total of 47 counties (UN data, 2015).

Due to poor health care waste segregation practices, it is common to find that up to 50% of waste in some facilities is infectious. Infectious waste can also include non-sharps (e.g., materials that have been in contact with blood, its derivatives, or other body fluids including bandages, swabs, or items soaked with blood).

Toxic chemicals such as mercury from broken thermometers and formaldehyde from health care facilities can contaminate the soil, air and groundwater hence causing health problems to communities.

Kenya has created an extensive network of health care facilities ranging from the National hospitals to community levels providing integrated curative care, preventive and promotive health care, rehabilitative care, and supportive activities to almost 90% of the population. At the National and County Referral Hospitals, where specialized health services are rendered, production of highly infectious and special wastes is usually at higher level. Other health services ranging from Sub County hospitals, Faith Based Organizations (FBOs), Non-Governmental Organizations (NGOs) and Private Institutions also play a major role in the sustainability of the Kenya health sector. All these produce huge quantities of waste.

Kenya like other developing countries faces the problem of HCWM. While generally less than 10% of HCW is considered infectious, many health facilities have poorly developed waste-segregation practices, leading to up to 50% of waste being categorized as infectious. The main reason for this is

the increased generation of diverse types of healthcare waste due to the multiplication and expansion of healthcare facilities as a result of population growth, ongoing immunizations and treatment of various conditions including emerging and re-emerging communicable and non communicable diseases. The different types of health care wastes generated from these health care services poses potential health risks to the health workforce, the environment and community at large.

Health care settings produce infectious waste that may lead to Hospital Acquired Infections (HAIs) and HIV/AIDS among health care workers, waste handlers, and patients. HAIs have been a major contributor to morbidity and mortality burden in the developing world. In Kenya, the actual burden of HAIs has not been accurately quantified, but it is projected to account for about 10% to 25% of hospital admissions in government health facilities, 2.5% of HIV infections in health care workers, 32% of hepatitis B cases, and 40% of hepatitis C cases (WHO 2010). In addition, it is important to note that viral haemorrhagic fevers (e.g., Ebola) and multi drug resistant TB pose a great threat to the health workforce and the general public.

1.4 Classification of Health Facilities in Kenya

Table 1.1. Number of Health Facilities in Kenya

| | |
|--|---|
| Total number of health facilities | 306 hospitals and 191 nursing homes—public hospitals and sub-district hospitals—158, FBO/ NGO—74 and private—74 |
| Number of tertiary referral hospitals | 9 |
| Number of secondary referral hospitals | 44 |
| Number of primary hospitals | 554 |
| Number of health centres | 1064 |
| Dispensaries | 3676 |

Source: KSSP III 2013 -2018

1.4.1 Community level services

The Kenya Essential Package for Health (KEPH) is designed as an integrated collection of cost-effective interventions that address common diseases, injuries and risk factors, including diagnostic and health care services, to satisfy the demand for prevention and treatment of these conditions. The strategy for the delivery of level one health care services intends

to make the KEPH a reality through empowering Kenyan households and communities to take charge of improving their own health.

This is the foundation of the service delivery system, with both demand creation (health promotion services), and specified supply services that are most effectively delivered at the community. In the KEPH, all non facility based health and related services are classified as community services and include integrated outreaches for hard to access communities due to factors such as geographical and cultural barriers. Under the Community Health Strategy, on average for every 5,000 population, a community unit is established. Community health Volunteers delivery health care services under the supervision of a health extension worker to a specific number of households assigned to them. These services include outreach services where risk health care waste is generated.

The community strategic envisages building the capacity of households not only to demand services from health providers, but to know and progressively realize their rights to equitable, good quality health care. It is the responsibility of the MOH to ensure that Kenyan Communities have the capacity and motivation to take up essential roles in health care delivery.

Through Civil Society Organizations (CSOs), these community based groups offer not-for-profit health services. They often consist of local initiatives such as women groups that respond to felt needs, e.g. building a small maternity or dispensary. Their source of income most often comes from local contributions among those interested in supporting the community initiative. The quality of services provided by these organizations attracts many people thus translating into service provision to an important segment of the Kenya population.

1.4.2 Primary care services

This is the first physical level of the health care system. Primary care provides the bulk of health care services and forms the first level contact with the community. Primary care service units are either health centres, or dispensaries (mobile clinics in areas where population density is very low, and/or mobile). The health sector aspires to upgrade all dispensaries into full primary care units ensuring every facility is able to at least carry out a normal skilled delivery.

- **A level II facility** should exist for every 10,000 persons on average, translating to an average of 30 dispensary OPD visits per day for any services, if everyone in the catchment area is to visit a health facility at least once a year for any form of services (curative, preventive, or health promotion services). Such dispensary units are physical facilities, but in areas where populations are mobile and sparse – such

as in arid or Semi-Arid areas, mobile facilities would replace dispensaries as much as is rationally possible.

- **A level III facility** should exist for every 30,000 persons, allowing for at least 4 skilled deliveries per day – a workload that is fair on the system and staff.

1.4.3 Primary referral services

The primary referral hospitals (**level IV health facilities**), services complement the primary care level facilities to allow for a more comprehensive package close to the communities at the county level. These facilities provide both referral and out patient services in addition to the requisite technical support and responsibility to the health care facilities at the periphery.

1.4.4 Secondary referral services

Secondary / second level hospitals (**level V health facilities**) provide a more comprehensive set of services, together with internship services for medical staff, research and serve as training centers for paramedical staff.

1.4.5 Tertiary referral services

The tertiary level hospitals (level VI health facilities) are facilities whose services are highly specialized and complete the set of care available to persons in Kenya. Services available at this level include training for specialists, biomedical research, and serve as internship / apprenticeship center's for specialists.

1.4.6 Private health facilities

Kenya's strategy of pluralism in health care provision has facilitated the growth of diverse non-governmental health sector which is well developed. An elaborate network of non-governmental or private health providers (for and not for profit) supplements the public health systems. The private sector health services are mainly concentrated in the urban areas essentially providing curative services.

1.4.7 Faith based and community based organizations

FBOs are coordinated by religious groups which run health services. In particular, the experiences of FBOs and NGOs in working with communities are an asset for the implementation of health programmes at the household level.

1.4.8 Home based healthcare services

Home Based Care (HBC) health services in Kenya have been practiced through the Primary Health Care/Community Based Health Care (PHC/CBHC) since the Alma-Ata Declaration of 1978. In this approach, the County Health Management Team (CHMT) will advocate for support by religious, government and political leaders, other influential people, and NGOs and CBOs for resource mobilization and allocation for level one services at community level. Social mobilization through sensitizing and motivating social partners to work together in raising awareness and pooling resources, targeted interested organizations, individuals and health related sectors, along with CBOs, NGOs, professional associations and the private sector. A clear organizational structure with well defined roles and responsibilities of all sectors at all levels is necessary to ensure the success of level one services.

1.5 Rationale for HCWM Plan

The Basel Convention rests the responsibility for waste management to the polluter and in this case, the health facility. The National Health Policy 2012 – 2030 has laid emphasis on healthcare waste management to accelerate prevention and minimization of communicable diseases and epidemics including HIV/AIDs, Tuberculosis, Hepatitis B and C, as well as other viral haemorrhagic fevers among others. This policy is in line with the Public Health Act Cap 242 laws of Kenya which also addresses environmental health, water and sanitation including healthcare waste management.

The precautionary principle states that if the outcome of a potential risk is suspected to be serious, but may not be accurately known, it should be assumed that this risk is significant. This obligates HCW generators to operate a good standard of waste collection and disposal, as well as to provide personal protection for their staff.

In this regard, the MOH Kenya has made progress towards implementation of HCWM. The following are the achievements by the Ministry in Healthcare Waste Management:

- The National Health Care Waste Management Strategic Plan 2015 - 2020.
- National Guidelines for Safe Management of Health Care Waste 2011.
- Implementation of programmes for injection safety and HCWM.

Other attempts made include putting in place various legislative and regulatory mechanisms for the purpose of strengthening enforcement and compliance on waste generation and handling.

However, amidst these many efforts and gains, many components of HCWM such as training and advocacy, M & E, waste treatment equipment, standard operating procedures (SOPs), harmonized waste disposal protocols, Environmental Impact Assessment (E.I.A) of projects, operational research and provision of commodities still need to be strengthened at all levels of health care service delivery. This notwithstanding, dissemination of policy documents and sensitization of communities on their rights in HCWM is more critical for the success of holistic sound management of healthcare waste.

HCWM is an integral part of hospital hygiene and infection prevention and control. Improper management of HCW risk can have direct or indirect negative impacts on patients, health work force, local communities and on the environment. Inappropriate handling of infected materials constitutes a risk to health care staff. Infectious healthcare waste contributes to the risk of nosocomial infections, injuries and pollution of the environment putting the health workforce and the community at risk. Some of these risks include HIV/AIDS, TB, Hepatitis B & C and viral haemorrhagic fever from patients. In addition, other workers involved in waste handling as well as families and street children who scavenge on dumpsites are also at risk. The environment is also polluted by indiscriminate disposal of health care waste. This is contrary to the fundamental principle of Cradle for Grave responsibility which stipulates that, parties that generate and handle waste is morally responsible for their waste from the point of generation until its final disposal.

Thus, proper HCWM practices should be strictly followed as part of comprehensive and systemic approach to hospital hygiene and infection prevention and control. It is important to mention that for most health care facilities (HCFs), however, lack of resources tends to affect negatively the way HCW is managed. Furthermore, the situation differs significantly from the public sector to the private sector. Consequently there must be a program focussing on the improvement of the existing HCWM practices within the medical and health care delivery institutions.

It is also important to come up with appropriate treatment and disposal technologies through development of an integrated sector HCWM plan. The plan must be appropriately budgeted with clear institutional arrangements for its execution both at National and County Governments.

The plan's vision, mission statement and goal should be directly in tandem with the strategic plan on HCWM, which are:

Vision

A safe and healthy environment devoid of HCW-related risks, infections, hazards, and environmental pollution.

Mission

To promote high standards of HCWM in order to reduce the risk of exposure to infections, hazards, environmental pollution and improve the safety of patients, clients, HCW, and the general public.

Goal

To strengthen HCWM systems in Kenya through the protection of patients, health workforce, the public and the environment from the hazards associated with health care risk waste.

The HCWM plan 2016 - 2021 is compatible with health sector development priorities which are supported by World Bank among other development partners. The plan provides direction of reinforcing the capacity of the Ministry in its central policy support role and strengthening county health institutions health facility specific HCWM services focusing on best available technologies (BAT) and best environmental practices (BEP).

The plan when properly implemented will be a major input in ensuring the delivery of quality health services which will eventually contribute to the achievement of the Sustainable Development Goals (SDGs) number 3 and 12.

All efforts to improve health sector performance, irrespective of which approved provider runs it, are ultimately geared towards improving peoples' health and safeguarding the environment. Stakeholders in the health sector are many ranging from other government ministries to private sector institutions as well as non-governmental organizations. Professional bodies such as councils and associations are also critical in the regulation of quality health care delivery.

Harmonization of health systems especially on HWM is an asset if it is enforced in all health facilities. Efforts by government institutions and development partners notably WHO, World Bank, UNDP among others has been so far commendable. This partnership has provided the required financial and technical support to HCWM activities that have been implemented in the last 7 years in this country since the development of the first HCWM plan 2008 – 2012. This is an area which for a long time had been neglected

yet very critical in prevention and control of communicable and non-communicable diseases, Prevention and control of clinical hazardous wastes risks and the implementation of mitigation measures to reduce impact of harm to human and the environment.

2 Policy and Legal Framework

2.1 Introduction

Kenya has comprehensive national laws, policies, and regulations relating to environment and particularly waste management. The provisions made for Environmental Management and Coordination regulations (Waste Management Regulations) 2006 apply to biomedical waste management. Furthermore, the National Injection Safety and Medical Waste Management Policy 2007, and Infection Prevention and Control (IPC) Policy and Guidelines 2011 were among the first policy documents giving policy direction to the health sector to manage waste. Other than the constitution, there are also a number of legal statutes with provisions on waste management, including:

- The Public Health Act Cap 242.
- The Occupational Safety and Health Act 2007.
- The Environment Management and Coordination Act, 1999.
- The Food, Drugs and Chemicals Act, Cap 254.
- Relevant professional Acts.
- Other relevant Acts and international instruments, which govern the rights of the community, patients, and health care workers to ensure a safe and sustainable environment.

2.2 International Agreements

Kenya is a signatory to many agreements and conventions on environmental management. These include support for the provisions of Agenda h21 amongst other declarations and statements of principle, such as the Rio Declaration in 1992 on Environment and Development. Kenya is also party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 1992, the Minamata Convention on Mercury, and the Stockholm Convention for Persistent Organic Pollutants (POP's) 1972.

2.3 Kenya Constitution 2010

The promulgation of the Kenya Constitution 2010 marked an important chapter in Kenya's environmental policy development. Hailed as a green

constitution, it contains elaborate provisions with considerable implications for sustainable development. These range from environmental principles and implications of multilateral environmental agreements (MEAs) to the right to a clean, healthy environment (article 42), and the highest attainable standard of health (article 43 (i)) enshrined in the expanded Bill of Rights, chapter four. It also embodies a host of social and economic rights of an environmental character, such as the right to water, food, and shelter, among others. Article 70: (1) If a person alleges that a right to clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed, or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter. This therefore gives the government the mandate to ensure that the rights of the Kenyan people are protected and upheld.

2.4 Existing Policies on Health Care Waste Management

2.4.1 Sessional Paper No. 6 of 1999 on Environment and Development

In 1999, the Government of Kenya produced the Sessional Paper No. 6 on Environment and Development. The goal of the policy was to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development. The policy paper identified areas requiring action, which included the development of a comprehensive waste management policy, guidelines, and standards.

2.4.2 Related policies

The environment policy of 2012, among other comprehensive legal instruments, gives a broad statement on a number of key areas that have an impact on human health. In the policy, issues of health are captured in chapters five and six. Chapter five is concerned with the issues of environmental stewardship, which include climate change, disasters, the sustainability of human settlements, **waste management including management of hazardous wastes and radioactive wastes**, energy, gender, HIV/AIDS, and youth.

The Environment Management and Coordination Act of 1999 (EMCA) is an Act of parliament that provides for the establishment of an appropriate legal and institutional framework for the management of the environment. The Act allows the minister in charge of environment to announce standards,

regulations, and guidelines for the proper management, conservation, and protection of the environment.

The Environmental Management and Coordination (Waste Management) Regulations 2006 is the government's legal instrument that deals with waste management in Kenya. These waste management regulations apply to biomedical waste by virtue of their composition, which includes several of the substances listed as hazardous waste.

There is a need to put in place appropriate interventions to protect human health as well as create opportunities for employment and wealth creation in the subsector.

The interventions could be in the form of developing a comprehensive waste management strategy or amending the current waste regulations of 2006 to expand the scope of biomedical wastes.

2.5 Linkage with the Kenya Health Policy 2012 to 2030

The Constitution of Kenya 2010 through the expanded Bill of Rights has mandated the government to provide equitable, affordable, and quality health care of the highest standard to all its citizens. This is to be achieved through the implementation of appropriate policies and programmes within the health sector.

The Kenya Health Policy 2012 to 2030, developed in line with the Constitution of Kenya 2010 and the Kenya Vision 2030, highlights six policy objectives that are health-sector priorities, including:

- Eliminating communicable diseases.
- Reducing the burden of non-communicable diseases.
- Reducing the burden of injuries from violence and accidents.
- Providing essential health services.
- Reducing the health risk exposures.
- Strengthening health sector collaboration with other sectors.

These objectives are highly relevant to waste management. As highlighted in the National Health Policy and the KHSSP III, strengthening collaboration with health-related sectors in waste management will be vital. It is therefore crucial that collaboration with sectors like environment, urbanization, and

population, land, and housing is emphasized at all levels of implementation of this strategic plan.

To achieve these objectives, the MOH has adopted the WHO's health systems approach as the core principle in guiding strategic investments into the health sector.

The six policy objectives and the health systems building blocks jointly form the policy framework within which one can view the national health system in Kenya. The national "policy intent" of providing equitable, affordable, and quality health care of the highest standard to all its citizens is thus anchored in this strategic plan.

WHO's definition of quality of care emphasizes, among other elements, the safety of both service seekers and service providers within the health service delivery settings. The profiling of and desire to eliminate communicable conditions in the national health policy and the emphasis on safer health care delivery settings within the Kenyan health system thus build a strong rationale and justification for a waste management strategy in the health sector and the general populace in the country.

2.6 Injection Safety and Medical Waste Management Policy 2007

The mission statement of this policy is to ensure the safety of health workers, patients, and the community and to maintain a safe environment through the promotion of safe injection practices and proper management of related medical waste. This is the first document of the Ministry that is explicit on the need to address HCWM problems. The policy objectives spell out the need to advocate for support and implementation of proper management of medical waste, among others.

Some of the guiding principles for the implementation of the policy include:

- Establishing organizational structures at all levels for the implementation of injection safety and related medical waste.
- Addressing the need for environmental protection through appropriate waste-disposal methods.
- Minimizing risks to patients, health workers, communities, and the environment through application of safe injection devices and sharps waste-disposal methods.
- Advocating for the strengthening of necessary human-resource capacity through training and sensitization for safe waste disposal.

One of the policy's key strategies is the need for appropriate financial mobilization and allocation of the components of injection safety and medical waste management for effective policy implementation. The provision of sustained supplies and equipment for waste management through a strengthened logistics system addresses the need for commensurate investment in waste-handling requirements. Another unique strategy recommended by the policy is the advocacy of best waste-management practices through behaviour change communication as a key element in the strategy.

2.7 National IPC Policy

In recognizing the need to redesign and strengthen existing systems and implement evidence-based methods to tackle infectious diseases in health care settings and tackle the gradual development of drug-resistant infections, the MOH in 2010 developed the National Infection Prevention Policy. The policy was set with the purpose of preventing and managing HAIs by:

- Setting national standards for minimizing hazards that are associated with biological agents in health care settings.
- Providing guidance to health administrators, health care workers, and all stakeholders to observe these standards.

The policy was to be operationalized through the development of mid-term and short-term IPC implementation plans and the development of IPC guidelines for health care settings. This strategic plan is thus a key step in the implementation process of the national IPC policy in health care settings in Kenya.

2.8 Kenya Health Sector Strategic Plan III (KHSSP III), 2012–2018

This strategic plan is aimed at feeding into the KHSSP III (2012 to 2018) relevant strategic objectives. A key priority objective in the KHSSP III aligned to this strategic plan is priority objective five: *to minimize exposure to health risk factors*. Activities within the objective, which relates to HCWM, include *strengthening mechanisms for screening and management of conditions arising from health risk factors at all levels and increase collaboration with research-based organizations and institutions*.

Proper management of waste will also play a big role in working toward achieving the Ministry's priority objective one, which is *to eliminate communicable diseases*. As it is evidently known, a number of environmental factors, including poor waste disposal and poor sanitation, influence the

spread of communicable diseases that may lead to epidemics. Proper management of HCW is very prudent to control and prevent the spread of a number of communicable diseases, including the disease vectors that may easily breed in poorly managed heaps of waste.

In providing the essential commodities necessary to effectively manage waste, the Ministry will also be achieving its policy priority objective number four: *providing essential health services*. This will be achieved if the strategic plan comes up with strategies to ensure sustained provision of supplies and equipment for waste management through strengthened logistics system and committed commensurate investment in waste-handling requirements.

Objective six in the KHSSP III, strengthening collaboration with health-related sectors, is crucial in management of waste. It aims to achieve this by adopting a “Health in all Policies” approach, which ensures the health sector interacts with and influences design implementation and monitoring processes in all health-related sector actions. Sectors like environment, urbanization and population, and land and housing affect the choice of methods for treatment or disposal of waste, which if not carefully selected affects the health of the people, human settlement, and the overall environment integrity. As highlighted in the linkage between this strategic plan and the National Health Policy above, strengthening collaboration with health-related sectors in waste management will therefore be crucial.

To achieve these relevant objectives, the Ministry has adopted the WHO’s health system approach as the core principle in guiding strategic investments into the health sector.

2.9 Other applicable Acts

- The Kenya National Guidelines on Safe Disposal of Pharmaceutical Waste provides a schedule on how unwanted pharmaceutical waste should be disposed. The document also makes reference to
- The Radiation Protection Act, Cap 243, provides for directions on radioactive waste management.
- The Medical Practitioners and Dentist Board Act, which regulates the licensing of private health care establishments within the country has addressed dental units as generators of dental health care waste.

3 SITUATION ANALYSIS OF HCWM IN KENYA

3.1 Introduction

Recent reviews and assessments made by MOH and partners suggest that the risk of health care waste management challenges in Kenya continue to pose a threat to the health workforce, patients and communities.

HCW contains toxic and hazardous substances that pose a threat to human, animal and the environment. WHO report (2000), estimate that injections with contaminated syringes caused 21 million hepatitis B virus (HBV) infections (32% of all new infections), two million hepatitis C virus (HCV) infections (40% of all new infections) and 260,000 HIV infections (5% of all new infections) globally. It is estimated that more than two million health-care workers are exposed to percutaneous injuries with infected sharps every year (Prüss-Üstünet al., 2005).

Three situation analyses carried out by the Ministry of Health with implementing partners (MOH-PATH, 2010, USAID-2011 & MOH/KHSSP-2013) indicated that, scavengers on waste disposal sites are at significant risk from used sharps. However, the risk of sharps injury among patients and the public is much lower with the introduction of retractable needles and safety boxes for the disposal of used sharps.

3.2 The Kenyan Situation

HCWM assessments were carried out by the MOH, World Health Organization, the World Bank Health Sector Support project, USAID (on environmental compliance in HCWM in Kenya), and PATH (on HCWM financing in 2013). In February 2013, a baseline survey report on HCWM for the World Bank-funded Health Sector Support project assessed five individual target facilities.

The performance of all the facilities combined for each of the thematic areas was as follows:

- Policies and procedures - 5.6%;
- Management and oversight - 16.2%;
- Logistics and budget - 20%;
- raining and occupational health - 20%; and
- Treatment and infrastructure - 9.4%.

The overall average score for the level of HCWM performance was 14.24%. Based on a predetermined scoring criteria where a score of poor (0% to 49%); fair (50% to 74%) and good (above 75%), all the facilities scored poorly in all the thematic areas. The overall score for all the thematic areas combined was 14.24%.

An assessment of HCWM in 24 non-government health care facilities in Nairobi (Ngari W.N., University of Nairobi, 2011) found that no facility had an HCWM plan, and only 12.5% had a waste management team headed by a waste management officer.

At the level of Community based health care service, one of the challenges faced is the management of clinical or health care waste. Home-based caregivers in Kenya face a challenge of lack of any clear policies for clinical waste management; adequate capacity on the safe handling of clinical waste resulting to unhygienic waste handling and disposal by home-based caregivers, including burning and burying the healthcare wastes posing risk of harming humans and the environment. The absence of pre-treatment methods of home-based health care waste; inadequate transportation facilities to ferry the waste to health facilities and then to appropriate disposal sites; stigma and discrimination associated with the physical removal of clinical waste from homes or clinics; poor storage of the healthcare waste at clinics complicates the potential for safe management of home-based care waste. The community household systems are faced with the challenge of coping with growing demand for home care, in the face of chronic diseases, deepening poverty and dwindling resources.

Waste segregation was found to be inadequate, as no facility had a general waste category, hence all the wastes produced within these facilities are considered hazardous and have to be treated prior to disposal. Waste storage facilities were not adequate and were poorly secured. Waste was also transported manually in 88% of the health care facilities, putting the waste handlers at risk of injuries and infections.

The only treatment method found to be in use within the facilities was incineration, and only 54% of health facilities were found to have functioning incinerators. The installed incinerators are the De Montfort type, and there are no measures for emission control in place, and can therefore be a source of air pollution, putting the community at risk of diseases like upper respiratory tract infection. Private collectors are used by two-thirds of the facilities to dispose their wastes, while the rest dispose of them within their premises by means of secured or open pit.

Kenya like many developing countries experience the problem of getting sufficient medical waste handling supplies and even worse is the disposal of medical waste itself. Poor investment in waste management infrastructure and lack of risk awareness among medical personnel and sanitary staff exposes them to greater risk of nosocomial infections.

The study also found that knowledge of the health workers on HCWM was inadequate; however, their attitude was found to be positive. Three-quarters of the health workers re-cap used needles, they have low immunization rates against tetanus and HBV, and the rate of needle-stick injuries was low. About 88% of healthcare facilities provided personal protective equipment (PPE) for their waste handlers, and the waste handlers had high levels of compliance in the usage of the PPE. Immunization status and needle-stick injuries among the waste handlers were also low.

3.3 HCW Production and Containment

The standard practice in most hospitals in Kenya is that health care waste is separated into three main categories as follows:

- Infectious or hazardous health.
- General waste or non-infectious waste
- Sharps in puncture proof safety boxes.

3.3.1 HCW Production

Appropriate handling, treatment, and disposal of waste by type can help to reduce costs and in the same breath serve as safeguard in the protection of public health and the environment. Critical here is the observance of health care waste production with the following being key result areas:

- **Waste Generation.** Most health facilities generate varying quantities of waste ranging from one health facility to the other in accordance with their patient workload and treatment offered in the health care facilities. However, very few facilities measure the amount of waste generated.
- **Waste Minimization;** Waste minimization is a strategy for sound management of health care waste although most health facilities in

Kenya still have difficulties in practicing waste minimization or showing any efforts geared towards waste minimization.

- **Waste receptacles:** The containment of waste **from points of generation** is critical towards the achievement of sound management of health care waste. Previous assessments in Kenya have revealed that sharps waste was generally well contained at 95% in both government facilities and faith based hospitals. For non-sharps waste, the 10 liter and 30 liter bins are the commonest bins provided in most clinical areas while use of bins without liners is common.

3.3.2 Health Care Waste Handling

Health-care waste management options may themselves lead to risks in human health and environment and no perfect readily achievable solution exists in the management of health-care waste. Waste, whether generated at smaller rural clinics or larger facilities, can be managed where adequate well-operated infrastructures exist. In order to achieve sound implementation of waste management, most healthcare institutions have adopted the following steps as a strategy for success;

- **Waste Segregation Practices:** Segregation of waste by type is observed in some facilities in the country which have embraced segregation practices using color -coded bins. Segregation of HCW is done according to the following categories; infectious or clinical waste (hazardous waste), Non-infectious or general waste, highly infectious waste, and sharps waste. In few hospitals, glass waste is placed in its own category. Use of colour codes for waste containers was low in the assessed facilities. The following colour codes for HCW are provided in the Ministry of Health, National Guidelines for HCW and are legislated by NEMA:
 - Yellow for infectious and sharps waste;
 - Black for non-infectious.

The Guidelines borrow from WHO recommendations to use red colored bins to contain pathological and/or highly infectious waste. Careful segregation of waste into different categories helps to minimize the quantities of hazardous waste.

Poor segregation and poor choice of technology for treatment and disposal of waste are two problems identified that are due in part to inadequate management practices or simply because of absence of adequate provision of waste receptacles.

- **Packaging of Healthcare waste:** The packaging involved putting waste colour-coded waste bags, with most waste being kept at waste holding storage areas without being sealed. The practice in Kenya is that most waste is loaded onto waste transportation facilities without being tied or covered.
- **Labeling:** Labeling of waste bags is a recommended practice to ensure each waste category is easily identified, and waste loads can be traced back to their point of generation. The current practice in most health facilities in Kenya is that labeling is rarely done.

3.3.3 Waste Transportation and Storage

- **Waste Transportation:** It is common practice in Kenya that most hospitals continue to use wheelbarrows for the transportation of waste within the health care facilities and within its compounds, while only a few of the facilities were using trolleys. The use of wheelbarrows should be discouraged since it leads to spillage of waste. It is noticeable that more than half of the hospitals have noticeable waste spillage within health facility compounds posing a risk to human health and the environment. The recommended practice for waste transportation within hospitals should be dedicated trolleys with separate ones for infectious waste to be drawn on paved surfaces to waste treatment sites.
- **Waste Storage:** Generally, about 47% of hospitals in Kenya have refuse storage areas/rooms. In some of these hospitals, disused rooms, some with leaking roofs are used to store waste. Of the waste storage areas provided, 61% of health facilities had waste storage facilities that were fenced or had restricted entry. The frequency of collection of waste in most hospitals is done once daily and in few cases it is done twice or thrice per day. Few hospitals had identified some areas with high waste generation for two or three collections daily.

3.3.4 Waste Treatment and Disposal

- **Treatment of Healthcare Waste.** Most dispensaries lack placenta pits and septic tanks for the safe disposal of maternity health care wastes. Most hospitals in Kenya currently treat their waste onsite. Among 15% of hospitals have approved waste treatment equipment. Incineration in levels four and five health facilities is the commonest method of waste treatment at 62% using functional incinerators. The rest were either dysfunctional or undergoing repair. Most of the

wastes taken from hospitals for treatment off-site were glass waste and domestic waste or non-infectious waste. Open burning, open dumping is still practiced along with incineration. Most healthcare facilities practicing onsite or off-site treatment of their waste have been established not to keep records of the waste they treat on-site or contract for off-site disposal. Other waste treatment facilities available in Kenyan hospitals include; compost pits for non-hazardous biodegradable waste, and shredders are found in few hospitals, which are mainly high level private hospitals namely Agha Khan, Nairobi and Mater Hospitals. Most of the hospitals in Kenya have no alternative waste treatment option apart from incineration.

- **Final Waste Disposal.** Most hospitals in Kenya have improved the maintenance of their compounds around the final waste disposal areas based on 2008-2012 HCWM plan. However, less than half of the health facilities did not maintain cleanliness around their waste disposal areas. Previous studies show that 64% of the health facilities had done good siting of their waste disposal areas while about 12% of the facilities had tried to site the disposal area or facility fairly well. Small proportion of 24% of the health facilities however did not do good siting of their waste disposal areas. Good siting of waste disposal sites or facilities entails locating them where they do not cause pollution or injury to the occupants of adjacent dwellings. Most rural hospitals were doing onsite disposal of waste in pits or open dump sites which in some cases were fenced off. Most hospitals dumped their anatomical waste in placenta pits. Some healthcare facilities use contracted companies to dispose maternity waste off-site.

3.3.5 Occupational Health & Safety

- **Personal Protective Equipment:** Awareness of the danger of disease transmission from infectious waste among health workers in most health facilities raised demand for provision of personal protective equipment (PPEs) to waste handlers. Use of gumboots for protection of waste handlers feet, and possession of heavy duty gloves for hand protection is common. The provision of respirators or face masks, overalls, helmets, and plastic goggles for eyes protection was poor on an overall average of 37%. The use of the PPEs is what has not been internalized among expected users. In most waste treatment sites where waste operators had possession of respirators or goggles, most of those found handling waste did not have them on but wore them on noticing visitors.

3.1.1 Capacity building

- **Training plans on HCWM:** Best practices in Health Care Waste Management require that all healthcare staff receive induction and repeated training on health care waste management. **From the study 61% of all technical** staff had received training on the management of healthcare waste, while 65% of waste operators had been trained. The deployed member of staff for waste **management duties was expressed** as adequate in 57% of assessed health care facilities. However, most staff members deployed to handle waste were engaged in doing other chores apart from waste management.
- **Development of Waste Management Plans:** From previous assessments, only 16.7% of healthcare facilities had health care waste management plans. A good waste management plan is a good basis for implementing waste management plans that has allocation of roles, responsibilities and resources. A well-thought-out plan describes the actions to be implemented by authorities, health-care personnel and waste management workers. At the national level, a plan is critical for government to define its intentions to make improvements, and the resources required across the country for successful implementation of environmental safe guards.

Under the fundamental principle of duty of care that any person or organization generating or handling HCW is morally responsible to take care of the waste while under their responsibility; all persons associated with financing and supporting health-care activities should provide for the costs of managing health-care waste. This is the duty of care. Manufactures also share a responsibility to take waste management into account in the development and sale of their products and services. Ministry of health and County governments are expected to develop their health care waste management plans and allocate resources for their operationalization in accordance with the relevant strategic objectives.

3.3.6 Finance and Resources

Most health managers do not know the costs involved in managing health care waste in their hospitals. In most cases, the difficulty of separating cost of managing waste is not well understood and defined since the costs are currently lumped up with other operational costs. Obtaining resources to purchase bins, bin-liners, funds for personnel deployment and maintenance of treatment equipment has been difficult to obtain most facilities.

4 STRATEGIC APPROACH TO PLAN IMPLEMENTATION

4.1 Introduction

The National Health Care Waste Management Strategic Plan (2015 – 2020) launched in August 2015 is the reference strategic document used in identifying scheduled priority areas for implementation of this plan while appreciating the World Bank guidelines for inclusion of environmental safeguards in the implementation of her funded projects to mitigate against adverse effects to human health and the environment. This plan gives an array of activities to implement at the national level wholly based on the HCWM strategic plan. Counties and other stakeholders, while developing their own operational plans on waste management are encouraged to develop theirs, based on this sector plan and in line with the strategic priority areas identified in the strategic plan 2015 – 2020. The strategic priorities are:

- Review and revise policies, guidelines, and standards.
- Improve infrastructure, commodities, and equipment supply.
- Increase capacity building, training, and awareness.
- Ensure adequate resources to increase efficiency.
- Promote best practices in HCWM systems.
- Strengthen M & E and operational research.

In addition to these strategic priorities, the following areas will also be considered under this HCWM sector plan: Community health care services, HCWM in emergency situations, water pollution, Environmental Sanitation and hygiene at primary health care level.

4.2 Strategic Priority 1: Develop, Review and Revise HCWM Policies, Guidelines and Standards

This strategic focus covers developing, review, and revising HCWM policies, guidelines and standards to strengthen management of health care waste at the national and county levels.

4.2.1 Objective 1: Strengthen policy and regulatory structures and mechanisms for HCWM

The management of health care waste in Kenya remains a sensitive issue since highly infectious waste continues to be generated and sometimes disposed off poorly and indiscriminately thus causing a lot of acrimony in the society. The aim of legislative provisions on biomedical waste is to guide health professionals in serving the public in a safe working environment and also protect the community from adverse effects of poor disposal practices. The outputs given above underscore the fulfillment of gaps identified in the process of strengthening policy and regulatory structures in order to streamline and provide a better framework to the management of wastes in the country.

4.2.1.1 Disseminating strategic plan and other strategic documents on HCWM.

The Ministry together with partners at the national level will strive to disseminate the strategic plan among other key strategic documents in order to facilitate a clear framework for management of health and other hazardous waste.

4.2.1.2 Developing and Reviewing Legal and Regulatory Framework at National and County levels.

- **Develop and review existing national regulations, policies, and guidelines** to identify existing rules that should guide practice. Additionally, support development of prototype County Waste Management Bill.
- **Review and update the National Guidelines for HCWM** so that they can be used to guide the renewed focus on health care waste management. There is also need to develop standards of practice for managing healthcare waste. In this context, a code of hygiene for all working in the health sector should be developed and implemented especially at primary health care level.

4.2.1.3 Standardizing HCWM Practices

- **Regulate Standards:** The Kenya Quality Model (KQM) which was developed by the Ministry of Health strives to regulate standards in service delivery to Kenyans through quality assurance strategies. One among the strategies for service quality is to mainstream staff motivation, staff competence and provision of required resources to allow for quality work. With this in mind, it is obvious that the kind of service delivery envisaged by the Ministry to Kenyans can only be

achieved widely through standardization of processes. The limiting factor in proper management of waste include; inadequate training and supplies, IEC materials for community capacity and lack of standards and guidelines. The provision of standards and guidelines as a remedy should be accompanied with allocation of required resources by both National and County Governments to all health facilities in order to achieve success in standardizing HCWM practices and to encourage innovation.

- **Establish and Develop National HCWM Standard Practices in HCFs:** Through this plan, the Ministry is to develop and establish standard operating procedures for HCWM in the country. It is for this reason that Waste Management Teams from hospitals are recommended to first and foremost define acceptable procedures of health care waste management and requirements for HCW disposal technologies that should be embraced by the HCF. By using a code of practice it is possible to describe the roles and responsibilities of each staff group member. This decision should form the baseline document against which the waste management system of the facility can be monitored. If health work force is not aware of their roles and responsibilities, it becomes very difficult for a supervisor to manage staff effectively in HCWM. It is advisable for institutions to develop standard operating procedures consistent with the national standards of practice and with the facility operations. The standards so adopted should endeavor to harmonize operations of waste management across the health sector and be able to reinforce good practices.

4.2.1.4 Expected Outputs (Objective No1)

- Disseminated strategic plan on HCWM.
- Developed HCWM Policy
- National HCWM guidelines reviewed.
- Updated legal frameworks for the implementation of HCWM at national and county levels.
- Standardized/harmonized HCWM practices

4.2.2 Objective 2: Strengthen the Governance and Institutional Capacities for HCWM Activities across National and County Levels

Due to the weakness in institutional capacities identified, the Director Public Health (DPH) office through the Unit responsible for Waste Management Coordination is urged to strengthen and resource the office responsible for the implementation of this five years plan and the Annual Operational Plans on National HCWM. The secretariat for driving health care waste management issues at the Ministry should be drawn from the relevant Unit housed at the office of DPH. The office should coordinate the operations of the national steering committee on HCWM, which is popularly known as the National Technical Working Group on Health Care Waste Management. At the national level, there is need to designate a Public Health Officer to be the National Waste Management Coordinator (NWMC). This officer based at the Unit responsible for Waste Management is charged with the coordination of activities of waste management at the national level. His / her duties among others to be identified shall include;

- To run the secretariat/TWG on HCWM at the Ministry of Health.
- To coordinate in liaison with the head of the Unit activities of the National Steering Committee on Health Care Waste management.
- To convene meetings in liaison with the DPH for donors and other stakeholders.
- To coordinate the preparation of annual plans on the component of HCWM and compile a national budget.
- To implement model pilot Programmes and best practices nationally through selected Health Management Teams (CHMTs).
- To coordinate monitoring and evaluation activities of health care waste management.
- To identify areas for operational research in waste management practices and treatment technologies.
- Consolidate gaps identified by specific counties and mobilize for resource to support counties
- Implement any other priority areas in the strategic plan which has not been mentioned above

This will strengthen and enhance coordination and implementation of HCWM across the national level and counties.

4.2.2.1 Strengthen the National Health Care Waste Management Coordination

- **Designate a County Waste Management Officer:** A Waste Management Officer (WMO) or a PHO in Charge of County Waste Management should be designated in all counties across the country. Map out and document all HCWM facilities in the county indicating gaps.

The WMO will be responsible for the day-to-day operation and monitoring of the waste management system. It is therefore essential that he or she has direct access to all members of staff. He or she should be directly responsible to the County Public Health officer. He or she is responsible for the county hospitals waste management officers stationed in health facilities and work in close liaison with other heads of preventive and promotive health services at the county, notable is the sanitation officer, food quality and control officers.

At service level, the WMO based at the facilities should:

- Ensure waste is segregated at source by health workers
- Control internal collection of waste containers and their transport to the central waste storage facility of the hospital on a daily basis;
- Liaise with the Supplies Department to ensure that an appropriate range of coded bags and containers for health-care waste, protective clothing, and collection trolleys are available at all times;
- Ensure that support staff immediately replace used bags and containers with the correct new bags or containers;
- Directly supervise supportive staff assigned to collect and transport health-care waste;
- Be responsible for installing and maintaining waste treatment and storage facilities and handling equipment to comply with the specifications in the NEMA standards;
- Be responsible for coordinating maintenance and repair of waste treatment facilities;
- Develop maintenance standards for HCWM equipment. It is normal that most equipment require preventive maintenance

to avoid it grinding to a halt. Facilities such as incinerators require regular preventive maintenance and scheduled maintenance for effective performance all the year round. Likewise, equipment such as trolleys, trolley bins, wheelbarrows, waste vans /tractors will require maintenance. It is incumbent upon institutions to ensure they set aside funds as a matter of routine for maintenance purposes, while also providing alternative facilities or options for use at the time of breakdowns or repairs;

- Develop HCWM plans of the facility in liaison with the Waste Management Team;
 - Ensure that written emergency procedures are available; Mitigation measures spelt out and displayed.
 - Maintain documentation of all reported cases of harm and complains and redress mechanisms both by health workforce and community.
 - Monitor all HCW management operations to comply with set standards and guidelines.
 - Be responsible for the staff involved in waste treatment, ensuring that: (i) staff receive training in the principles of health care waste management, and (ii) they are aware of their responsibilities under the hospital waste management plan.
- **Staff Training and Information:** For staff training and information, the WMO at the facility through the county WMO should:
 - Ensure health workforce understands potential risks and mitigation measures to prevent, control and stop negative impacts from HCW they generate.
 - Liaise with the Matron (or Senior Nursing Officer) and the Hospital Manager to ensure that the nursing staff and clinicians are aware of their own responsibilities for segregation and storage of waste and also understand the responsibilities of supportive staff in handling and transporting sealed waste bags and containers;
 - Liaise with Departmental Heads to ensure that all doctors and other qualified clinical staff are aware of their own responsibilities regarding segregation and storage of waste.

- Ensure that supportive staffs understand waste segregation and that they handle waste bags and containers that have been sealed in the correct manner.
- **Matron and Hospital Manager:** The Matron (or Senior Nursing Officer) and the Hospital Manager are responsible for training nursing staff, clinical officers, supportive staff on anticipated risks in management of HCW, mitigation measures in case of harm, correct procedures for segregation, storage, transport, and disposal of waste. They should therefore:
 - liaise with the WMO and the advisers (Infection Prevention and Control Officer, Pharmacist in Charge and Radiation Officer) to maintain the established standards;
 - participate in staff introduction to, and continuous training in, the handling and disposal of health-care waste;
 - Liaise with Department Heads to ensure coordination of training activities, and help in address other waste management issues specific to particular departments, etc.
- **Departmental Heads:** Departmental Heads are responsible for the segregation, storage, and removal of waste generated in their departments. They should ensure that all doctors, nurses, and clinical and non-clinical professional staff in their departments are aware of the segregation and storage procedures and that all personnel comply with the established standards, so that they;
 - continuously liaise with the WMO to monitor working practices for failures or mistakes;
 - ensure that key staff members in their departments are given training in waste segregation and disposal procedures;
 - Encourage medical and nursing staff to be vigilant so as to ensure that supportive staff follow correct procedures at all times.
- **Pharmacist in Charge:** The Pharmacist in Charge is responsible for the sound management of pharmaceutical stores and for pharmaceutical waste minimization. His or her duties are to:
 - liaise with Department Heads, the WMO, the Matron, and the Hospital Manager, giving advice, in accordance with the national policy and guidelines, on the appropriate procedures for pharmaceutical waste disposal;

- coordinate continuous monitoring of procedures for the disposal of pharmaceutical waste;
- Ensure that personnel involved in pharmaceutical waste handling and disposal receive adequate training.
- Ensure that any expired pharmaceutical products in health facility are disposal according to protocol.

The Pharmacist in Charge also has the special responsibility of ensuring the safe management of genotoxic waste.

- **Radiation Officer:** The duties and responsibilities of the Radiation Officer are the same as those of the Pharmaceutical Officer but relate to radioactive waste.
 - All radioactive materials should be handled safely to prevent harm to people and environment.
 - Mitigation measures of risks spelt out and displayed
- **Supply Officer:** The Supply Officer should liaise with the WMO to ensure a continuous supply of the items required for waste management (plastic bags and containers of the right quality, spare parts for on-site health-care waste treatment equipment, purchase of waste transport trolleys, etc.). These items should be ordered in good time to ensure that they are always available, but accumulation of excessive stores should be avoided. The Supply Officer should also investigate the possibility of purchasing environmentally friendly products through liaison with technical officers in the IPCC.
- **Infection Prevention and Control Officer/Coordinator (IPCO):** The IPCO should liaise with the WMO on a continuous basis and provide advice concerning the control of infection and the standards of the waste disposal system. His or her duties are to:
 - Identify training requirements according to staff grade and duties.
 - Organize and supervise staff training courses on safe waste management;
 - Liaise with the Department Heads, the Matron, and the Hospital Administrator to coordinate the training.
 - Proper documentation of any harm suffered

The Infection Prevention and Control Officer has an overall responsibility for chemical disinfection, sound management of chemical stores, and chemical waste minimization. Incidents resulting in injury, “near misses”, or failures in the handling, separation, storage, transport, or disposal system, should be reported to the IPCO so that he or she will plan for preventive measures against recurrences.

- **Health and Safety Practices for Health Workers:** Health care waste management policies or plans should include provision for continuous monitoring of workers’ health and safety through the observation of essential occupational health and safety measures. The IPCC should ensure that;
 - Personal protection equipment is supplied.
 - Workers are properly trained on the aspects of their job concerning waste management, and informed on how to avoid infection transmission.
 - An effective occupational health programme that includes immunization, post-exposure prophylaxis treatment, and medical surveillance is established.
 - There is also need for handlers of patients at home to be trained on how to manage medical waste generated at home.

4.2.2.2 Expected Outputs (Objective No 2)

- Strengthened HCWM national and county coordination structures to continuously monitor, coordinate, and evaluate HCWM implementation
- Strengthening partnerships between various stakeholders involved in HCWM, enhancing leadership skills for HCWM at all levels of the waste-management systems and
- Development and dissemination of tools to assist HCWM planning and management will be expected to be implemented during the implementation period.

4.3 Strategic Priority 2: Improve Infrastructure, Commodities, and Equipment Supply for Safe Treatment and Disposal of Waste

This strategic focus covers improvement, standardization and enhancing access to new technologies for infrastructure, commodities and equipment supply in HCWM system at all levels.

In terms of improvement, the expected output will be to improve HCWM equipment, supplies, and commodities, provision of technical guidance on implementation of the HCWM system. Additionally, partnerships between various levels of health care facilities for waste pooling will be established and enhanced will be enhanced during the plan implementation period. It will also be important to revise future health facility plans to incorporate HCWM infrastructure in initial designs. In following up to ensure that this strategic focus is implemented to the latter for an increased number of facilities with effective HCWM systems.

4.3.1 Objective 1: Improve Infrastructure for HCWM System

4.3.1.1 Internal Transport

Health care waste within a hospital or other facility should be transported by means of wheeled trolleys, trolley bins or containers, or carts that are not used for any other purpose and meet the following specifications:

- Easy to load and unload.
- Leak-proof with cover.
- Dedicated to waste removal and colour-coded to maintain segregation of hazardous from non-hazardous waste.
- No sharps edges that could damage waste bags or containers during loading and unloading.
- Easy to clean with smooth bends.
- Vessels should be cleaned and disinfected daily with an appropriate disinfectant.
- Ensure periodic disinfection and cleaning of trolleys and wheeled containers
- Easy to access most places and negotiate bends in hospital buildings

4.3.1.2 Determinants of Waste Treatment Method

Globally, incineration used to be the method of choice for most hazardous health care waste and is still widely used. However, waste management options chosen for use should be efficient, safe and environmentally friendly to protect people from voluntary and accidental exposure to waste when collecting, handling, storing, transporting, treating or disposing of waste.

Important activities include identification of available centralized waste management and disposal resources. The final choice of treatment system should be made carefully, on the basis of various factors, many of which depend on local conditions.

Table 4.1: Factors to consider in choice of health care waste treatment technology

- Disinfection efficiency;
- Health and environmental considerations;
- Occupational health and safety considerations;
- Quantity of wastes for treatment and disposal/ capacity of the system;
- Types of waste for treatment and disposal;
- Infrastructure requirements;
- Training requirements for operation of the method;
- Operation and maintenance considerations;
- Available space;
- Location and surroundings of the treatment site and disposal facility;
- Investment and operating costs;
- Public acceptability;
- Regulatory requirements.

The choice of sustainable management and disposal options for waste should be done according to:

- Affordability
- Environmental-friendliness
- Efficiency or operation cost.
- Prevention of the re-use of disposable medical equipment (e.g. syringes)
- Worker safety

Figure 4.1: Synopsis of the HCW Stream.

| Step | Location | Healthcare | Key points |
|------|----------------------------------|--------------------------------|--|
| 0 | | Waste minimization | Purchasing policy stock management recycling of certain types of waste. |
| 1 | In medical | Generation | |
| 2 | unit | Segregation at source | One of the most important steps to reduce risks and amount of hazardous waste |
| 3 | In health facility | Collection + on-site transport | Protective equipment; sealed containers; specific easy to wash trolleys |
| 4 | Outside of health facility | On-site storage | Lockable easy to clean storage room: limited storage time of 24-28hours. |
| 5 | | On-site treatment/disposal | Adequate storage room, limited time of max 48 hours |
| 6 | | Off-site transport | Appropriate vehicle and consignment note; HCF is informed about final destination |
| 7 | | Off-site treatment/disposal | Appropriate vehicle and consignment note to ensure delivery to disposal site. |

4.3.1.3 Treatment Options Available for HCW

Effective treatment of infectious HCW can be considered to be the most important objective of health care waste management, which eliminates the risk of infection.

In this context the range of HCW treatment options can be grouped as burn and non-burn technologies.

i. Burning Technologies

a. Incineration

This process is usually selected to treat waste that cannot be recycled, re-used, or disposed of in a landfill site. Incineration is the dominant technology for health care waste treatment in Kenya. Steam sterilization, microwaving and other non-incineration health care waste treatment technologies are however rapidly becoming the dominant treatment technologies in the first world countries, primarily due to stricter emission standards that are set for incinerators.

The combustion of organic compounds produces mainly gaseous emissions, including steam, carbon dioxide, nitrogen oxide, and certain toxic substances (e.g. metals, halogenic acids), all particulate matter, plus solid residues in the form of ashes. If the conditions of the combustion are not properly controlled, toxic carbon monoxide will also be produced. It is therefore advisable that the waste that is meant for incineration should contain moisture of less than 30% with a combustible content of at least 60%.

Assessment of Waste Parameters to be incinerated

Specific waste parameters should be assessed at the planning stage to determine the most suitable type and size of incinerator:

- Current extent of waste production and type of health care waste;
- Estimated future waste production;
- All the physical parameters that determine the suitability of waste for incineration, such as low heating value and low moisture content.

Waste Types Not To Be Incinerated

- Pressurized gas containers.
- Large amounts of reactive chemical waste.
- Silver salts and photographic or radiographic waste.
- Halogenated plastics such as polyvinyl chloride (PVC) materials.

- Waste with high mercury or cadmium content, such as broken thermometers, used batteries, and lead-lined wooden panels.
- Sealed ampoules or ampoules containing heavy metals.

Type of Incinerators

Incinerators range from extremely sophisticated, high-temperature operating plants to very basic combustion units that operate at much lower temperatures. All types of incinerators if operated properly eliminate pathogens from waste and reduce the waste to ashes. However certain types of health care waste, e.g. pharmaceutical or chemical waste, require higher temperatures for complete destruction. Higher operating temperatures and cleaning of exhaust gases limit the atmospheric pollution and odours produced by the incineration process.

Incineration equipment should be carefully chosen on the basis of the available resources and the local situation, and the risk benefits of pathogen elimination before waste disposal against the potential risk of air or ground water pollution caused by inadequate destruction of certain wastes. Three basic kinds of incineration technologies are of interest for treating health care waste;

- Double-chamber pyrolytic incinerators, which may be specially designed to burn infectious health care waste;
- Single chamber furnaces with static grate, which should be used only if pyrolytic incinerators are not affordable.
- Rotary kilns operating at high temperature, capable of causing decomposition of genotoxic substances and heat resistant chemicals.

Pyrolytic Incinerators

The most reliable and commonly used treatment process for health care waste is pyrolytic incineration, also called air incineration or double chamber incineration. The pyrolytic incinerators comprises of a pyrolytic chamber and a post combustion chamber and functions as follows: In the pyrolytic chamber, the waste is thermally decomposed through an oxygen-deficient, medium-temperature combustion process (800-900°C), producing solid ashes and gases. The pyrolytic chamber includes a fuel burner used to start the process. The waste is loaded in suitable bags or containers.

The gases produced in this way are burned at high temperatures (900-1200°C) by a fuel burner in the post-combustion chamber, using an excess of air to minimize smoke and odours.

Larger pyrolytic incinerators (capacity 1-8 tonnes/day) are usually designed to function on a continuous basis.

b. Other Thermal Technologies

- **Rotary Kilns** are generally used in lime and cement industries and can be used in the treatment of chemical hazardous waste. Rotary kilns are versatile and also capable of handling slurries, bulk solids and sludge. The unit treatment cost for the operation and maintenance of smaller rotary kiln plants are however expensive and therefore not frequently used in the treatment of infectious health care waste only.

One such incinerator has been installed by Environment Combustion Limited Company at Kitengela for handling mainly industrial waste and sometimes health care waste. In some countries, rotary kilns are used to treat certain types of hazardous /chemical waste as well as health care waste. Separation at source of especially chemicals, pharmaceuticals etc. is not critical where a rotary kiln is used, although radioactive HCW is still to be separated from the remainder of the HCW stream.

- **Fluidized 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 fluidizes a bed of sand and the rapid motion allows heat exchange to occur between the hot bed and the hazardous waste thus providing effective combustion efficiencies. To date, this technology has not been used for the treatment of HCW in Africa. Rotating fluidized bed incinerators are used in Japan.
- **Plasma Arc Technology**, achieves extremely high temperatures of between 2000°C and up to 8,000°C, thus resulting in effective destruction of hazardous waste. It is evident that all waste streams, except for radioactive waste, can be treated using this technology. The cost of treatment however, is very high, thus making this technology inappropriate for cost effective treatment of infectious HCW.

Environmental, Health and Safety Impact of Incineration

Incineration, undertaken at high temperatures, has proven to be not only a very effective way of sterilizing infectious HCW but also for significant volume reduction of waste and no special tests to determine the efficiency of the sterilization process is normally required. However, the technical standards of incinerators in Kenya as well as the standard of operation have been poor. If the long term objective of HCWM in Kenya is to meet the European Union or North American air emission standards, then 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.

Incineration is internationally still a very common technology for HCW treatment. It can meet the strict environmental requirements, provided the incinerators are well operated and have good emissions control equipment. However, in parts of the world where no or limited mass incineration of domestic or commercial waste is done, steam sterilization, microwave treatment and other non-burn technologies are fast becoming the more cost effective infectious HCW treatment technology due to increasing costs of fuel, gas, cleaning and imposed government (NEMA) fees for incinerator operation. Such increased costs, together with negative perception of incineration in many parts of the world have led to the development of a range of sterilization / disinfection technologies for the treatment of infectious HCW.

ii. Non-Incineration Treatment Options

a. Chemical Disinfection

Chemical disinfection is generally done by adding bleach or other disinfectants to syringes or other types of infectious wastes. It is uncertain whether or how harmful the syringes still are after such treatment, but in case no more satisfying option is available, such disinfection certainly reduces the risk of infection in case of accidental needle stick before transportation for further treatment. Disinfection of infectious HCW can serve as a pre-treatment step and may be required prior to employing subsequent treatment technologies, e.g. size reduction by shredding.

b. Shredding

Shredders cut sharps into small pieces. This technology requires a worker skilled in the operation and maintenance of sometimes heavy-duty, rotating equipment. Simple shredders can be made from a manually operated grain mill. Due to the presence of workers during operation, only disinfected needles and syringes should be processed. Shredding can help facilitate plastic

and needle recycling technologies in developing countries when large quantities of used needles and syringes are available, implying that a centralized system involving collection and transportation from various settings can be considered.

c. Microbial Inactivation Using Sterilization Technologies

Some of the non-incineration technologies recently introduced on the African continent include Autoclaving, Micro waving, Electro-thermal Deactivation

d. Microwave Irradiation

Most microorganisms are destroyed by the action of microwave of a frequency of about 2450 MHz and a wavelength of 12.24 cm. The water contained within the wastes is rapidly heated by the microwaves and the infectious components are destroyed by heat conduction.

In a microwave treatment unit, a loading device transfers the waste into a shredder, where it is reduced to small pieces. The waste is then humidified, transferred to the irradiation chamber, which is equipped with a series of microwave generators, and irradiated for about 20 minutes. After irradiation, the waste is compacted inside a container and enters the municipal waste stream.

The efficiency of microwave disinfection should be routinely measured through bacteriological and virological tests. In the USA, a routine bacteriological test using *Bacillus subtilis* is recommended to demonstrate a 99.99% reduction of viable spores.

The process is not suitable for the treatment of pathological, chemical or radioactive infectious HCW. Large quantities of metal in the infectious HCW stream can reduce the effectiveness of microwaves penetrating the infectious HCW. Air emissions from shredder and treatment plant are usually treated to remove moisture and volatile organic carbon compounds. Shredding and compaction of the final product significantly reduces the volume of the final waste residue, but no mass reduction occurs. The microwave process is widely used in several countries and is becoming increasingly popular. However, relatively high costs coupled with potential operation and maintenance problems mean that it is not yet recommended for use in developing countries. Similar processes using other wavelengths or electron beams are also being developed.

e. Autoclaving / Steam Sterilization

Steam sterilization of HCW has been practiced world wide for some decades, firstly as a simple sterilization process and later by inclusion of volume reduction/ shredding prior to or after treatment. In a modern autoclave, shredded/ unshredded infectious HCW is placed inside an autoclave, where, after evacuation of air, steam is introduced under pressure from a boiler. 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 sterilization 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 HCW treatment in countries where advanced flue cleaning is required.

The process is however not suitable for treatment of all categories of infectious HCW (e.g. pathological and pharmaceutical infectious HCW). Special measures are further to be introduced for the disposal of treated infectious HCW as unshredded residues should under no circumstances be accessible to waste recyclers due to the presence of sharps as well as the remaining risk of infection.

Shredding and compaction reduces the volume of the final HCW residue with the mass of the residue being about 80% to 90% of the original, as some drying occurs subsequent to sterilization.

4.3.1.4 Final Disposal Methods

i. Land filling in Municipal disposal sites

The two basic forms of land disposal in developing countries include controlled and uncontrolled. A variety of controlled land disposal options range from small pits to a modern sanitary landfill. Land disposal for untreated waste is not recommended and should only be used as a last resort option. When this solution has been used, it is important that HCW is disposed of in a sanitary landfill and rapidly covered.

Waste may be land filled in municipal disposal sites if it cannot be treated before disposal. However, HCW should not be deposited or scattered on the surface of open dumps. If land filling is planned, the following minimal requirements should be met;

- Measures established by a municipal authority for the rational and organized depositing of municipal waste should be used to dispose off health care wastes;
- Engineering work instigated by the municipal authority should be prepared to retain waste more effectively;

ii. **Encapsulation**

Encapsulation (or solidification) refers to the containment of a small number of hazardous or dangerous items or materials in a mass of inert material. The purpose of the treatment is to isolate the dangerous items from humans and the environment by encapsulating them in an impervious mass. Encapsulation involves filling containers with waste, adding an immobilizing material, and sealing the containers. The process uses either cubic boxes made of high-density polythene or metallic drums, which are three-quarters filled with sharps and chemical or pharmaceutical residues. The containers or boxes are then filled up with a medium such as plastic foam, bituminous sand, cement mortar, or clay material.

The main advantage of the process is that it is very effective in reducing the risk of scavengers gaining access to the hazardous HCW. Encapsulation of used sharps is generally not practiced and can definitely not provide a long term solution. Encapsulation of sharps or unwanted vaccines could however be envisaged in temporary settings such as camps, or mass campaign, provided that raw materials such as cement for encapsulation are available.

4.3.1.5 Other types of wastes and their management options

i. **Liquid Waste Management**

There are a number of areas of concern directly or indirectly related to poor management of healthcare waste. Incineration and crude/open burning, for example, releases bottom ash that may contain carcinogenic residues into water bodies through exfiltration/infiltration of liquid waste from health facilities. Furans and dioxins released into the atmosphere through incineration and or crude/open burning of healthcare waste are known to be carcinogenic and end up into water bodies through precipitation. Thus provision of quality services including sound management of HCW at all levels of service delivery goes along way into safeguarding the health of the patient, health workers and public against adverse effects emanating from such services. There is therefore need to soundly put systems in place to ensure proper management of liquid waste by provision of approved on-site pre-treatment facilities such as bio-digesters, protected placenta and ash pits, connection to approved off-site sewerage systems and ensuring compliance to appropriate planning designs and innovations.

ii. **Community Health Outreach Waste Management**

Community outreach services are services provided away from health facilities and include home-base care, mobile clinics, medical camps and temporary refugee camp clinics. Outreach services are one of the possibilities to enhance access to health workers and to improve access to quality

healthcare at country level. Better mobilization of urban health workers to serve remote or underserved areas is a strategy to improve access to health to the population in remote and rural areas. The health services provided in such scenario generate healthcare waste such as infectious category of waste whose risk factors and possible infections have been explained earlier. There is therefore great concern which should be given to healthcare waste management, and may include provision of adequate personal protective equipment to health workers, adequate and appropriate waste segregations bins and bin-liners, approved transport facilities to approved treatment and disposal facilities, periodic training and orientation of health workers on IPC/HCWM, health worker safety through provision of post-exposure prophylaxis and immunization against hepatitis B and strategic provision and placement of information education materials. HCW generated from community health care services should be transported and disposed off in a health facility which has a HCW treatment facility.

iii. **Outbreaks & Emergency Services Waste Management**

Outbreaks and/or emergency services may be at facility level or away in mobile clinics, medical camps or ambulatory. Waste generated from such outbreaks or emergency services require to be considered highly infectious. The waste generated from such scenario could be both or either liquid or solid and posing danger to the health of the patient, health workforce and the environment in terms of pollution. There is therefore need to put mechanisms and systems in place to provide for adequate and appropriate supplies and training to cater for these services so as to safeguard the general health of the public and environment from adverse conditions that may arise out of provision for such services. This will include adequate and appropriate bins and bin-liners, PPEs, scheduled training and induction of new staff on safe handling, collection and transportation of infectious/highly infectious waste while ensuring safety of the health force through provision of post-exposure prophylaxis and immunization against hepatitis B and strategic placement of information education materials.

iv. **Sanitation & Indoor pollution Waste Management**

Patients and their visiting families, and health workers in healthcare settings are exposed to risk of infections arising from provision of health services.

Nosocomial infections is one of them and arise from poor hygiene practices among patients, relatives and health workers. In order to mitigate against the existence of environmental conditions favoring the existence of poor hygiene related infections, there need for adequate training of health workers, adequate provision of sanitary facilities such as wash hand basins and

disinfectants, bath rooms and toilets/water closets and patient-friendly signage to direct patients timely and conveniently. Poor patient flows can also precipitate cross-infections, hence there is need to ensure proper and approved designs of facilities are in place, while ensuring proper preventive maintenance of buildings and all other installations to ensure adequate ventilation and lighting whose inadequacy may lead to disease conditions such as TB and injuries

v. **Water Pollution and Management**

Water safety for patient care is an integral component of quality services in health care facilities. However, there is a great challenge in the provision of safe water in rural health facilities in Kenya as water is often sourced through transportation in containers from unprotected and/or untreated sources, or from inadequate and unsecured roof catchment tanks. Such water is likely to be polluted with disease-causing micro-organisms such as vibrio cholera, typhi bacillus, among others, due to unhygienic handling, transportation and storage. Waste water from unsecured drains and leaked drainage pipes can also pollute on-site water sources at such facilities, and therefore poses a danger of transmission of disease-causing micro-organisms arising from procedures of patient care. This calls for adequate provision of approved systems and infrastructure whether from on-site or off-site to eliminate or minimize such pollution (WHO & UNICEF, 2015). Also Counties and individuals health facilities are obligated to provide adequate and portable water for patient care from reliable sources such as treated water from public supplies, protected springs, protected wells, boreholes and roof catchment.

4.3.1.6 Expected Outputs

- Improved HCWM equipment, supplies, and commodities.
- Technical teams to provide guidance on implementation of the HCWM strategy at different levels formed.
- Partnerships established between various levels of health care facilities for waste pooling.
- Revised future health facility plans to incorporate HCWM infrastructure in initial designs.
- Increased number of facilities with effective HCWM systems.

4.3.2 Objective 2: Standardize commodities and equipment for HCWM at all levels

Specifications and standardization for HCWM equipment and supplies will be developed during the period of this and where possible updated then disseminated. It will also be important to strengthen capacity at all levels to quantify HCWM commodity needs and develop annual procurement plans.

The standards should address need for uniform practice in waste containment, storage, transportation, treatment and disposal. Peculiarities in the category of health facilities and their levels of operation should be addressed as well. The health care facility waste management practices play a critical role in the overall waste management system. Some of the key procedures that require to be complied by the waste management team should include; waste minimization, waste segregation, labeling waste receptacles or containers, waste containment collection, internal transport, internal storage, special storage areas and waste treatment as discussed in the recommendations below:

4.3.2.1 Minimization of waste generation/production

Waste minimization usually benefits the waste producer in terms of costs for; the purchase of goods, waste treatment, and disposal of hazardous waste. It is important to investigate options for waste minimization / reduction, recycling, and disseminate information to health care facilities explaining feasible options. The procurement department and the relevant heads of departments should be involved in making these important decisions on the choice of health products or equipment for use. At the national level, consultations with KEMSA should explore all options in applicable areas.

Significant reduction of waste generated in hospitals and research facilities may be encouraged by the implementation of certain policies and practices such as;

- Source reduction: measures such as purchasing restrictions to ensure the selection of methods or supplies that are less wasteful or generate less hazardous waste.
- Recyclable products: use of materials that may be safely recycled, either on-site or off site.
- Good management and control practices: apply particularly to the purchase and use of chemicals and pharmaceuticals. i.e. frequent ordering of small quantities of supplies and using old batches of a product first.

4.3.2.2 Segregation of waste

The key to minimization and effective management of health care waste is segregation and identification of the waste. Appropriate handling, treatment, and disposal of waste by type can help to reduce costs and does much to protect public health. Segregation should always be the responsibility of the waste producer and should take place as close as possible to where the waste is generated and should be maintained in storage areas and during transport. Since most Kenyan health staff /workers can be transferred from one place to another, it is advisable that the same system of waste segregation should be in force throughout the country. Health facilities should display the segregation charter at the source of waste generation.

However challenging it may be, waste segregation can succeed in a health care institution when there is commitment by the health care managers and the staff so long as the approach chosen for waste segregation meets local needs. We now need to focus on feasible set of practices that should be followed in Kenyan hospitals as outlined below:

- i. **3-Bin System:** Health care waste can be separated into three main categories as follows;
 - Non infectious or general waste placed into black polythene bags in matching colour of bins. Food waste may be collected separately. General waste or non-infectious waste should join the stream for domestic refuse for disposal to the local authority disposal site.
 - Non-sharp Infectious or hazardous health care waste should be placed in yellow bags in matching colour of bin.
 - Sharps should be placed into preferably yellow puncture-proof safety boxes or yellow plastic containers with a biohazard symbol inscription.
- ii. **Other Waste Bins.** Other categories of waste that require separate bins or receptacles include;

Highly infectious waste placed into **red bags** in **red bins**. Highly infectious waste should, whenever possible be sterilized immediately by autoclaving. It needs to be packaged in bags that are compatible with the proposed treatment process: red bags with a suitable gauge for autoclaving, are recommended.

- Glass waste resulting from used medicine bottles or laboratory specimen bottles may be collected in separate bins or containers.

- Cytotoxic waste, most of which is produced in major hospitals such as Kenyatta National Hospital or Research facilities, should be collected in strong, leak proof containers clearly labeled “cytotoxic wastes” and stored according to established guidelines.
- Small quantities of chemical or pharmaceutical waste may be collected together with infectious waste. Large quantities of obsolete or expired pharmaceuticals from hospital wards or stores should be well packaged and returned to pharmacy to await verification and later disposal.
- Waste with high content of heavy metals (cadmium or mercury) should be collected separately and not incinerated or burned.
- Aerosol containers may be collected with general health care waste once they are completely empty, provided that they are not destined for incineration.
- Low-levels of radioactive infectious waste (swabs, syringes for diagnostic or therapeutic use) may be collected in yellow bags or containers for infectious waste if these are destined for incineration.

iii. **Colour Codes system and Segregation**

- The most appropriate way of identifying the categories of health care waste is by sorting the categories of waste into colour-coded plastic bags or containers. The WHO waste regulations are recommending a colour coding system which is given in the Table below;

Table 4.2: Colour Codes system used in Kenya

| Type of Waste | Colour of container and markings | Type of Container. |
|--|---|---|
| Sharps | Yellow (Marked 'Sharps') | Puncture proof |
| Infectious | Yellow | Strong leak proof plastic bag with biohazard symbol |
| Highly Infectious | Red (Marked Highly Infectious) | Containers capable of being autoclaved |
| Non-Infectious/ non-hazardous (non-clinical) | Black | Plastic Bag or container. |
| Chemical and Pharmaceutical | Brown | Plastic bag or Container |
| Radioactive waste | Yellow with black radioactive symbol | Lead Box |

iv. **Labeling Waste Receptacles or Containers**

For the bins to be used well, it is necessary to ensure clear labeling of bags and containers to differentiate between waste categories. Use of posters

and stickers, or preprinted bins and liners should help the members of staff and patients and their visiting relatives to segregate the waste. This omission was evident during the assessment and could be one of the causes of poor waste segregation in most hospitals. There is need therefore to label waste bins and waste bags so that waste operators in hospitals and company workers managing health care waste can be able to know;

- The precautions necessary for each bag of waste as per its place of origin and waste category.
- Where segregation problems are arising from especially when poorly segregated waste is loaded to the incinerator for combustion.
- The appropriate final disposal method for particular waste.
- The quantities of waste generated from various departments in the hospital.

Labeling can also help to facilitate a waste tracking system where quantities of waste are recorded at a waste transfer station. In poorly segregated waste small explosions and poor burning of the waste can be identified by the incinerator operators. Since labeling of waste can be challenging to implement, it is necessary for a hospital waste management team to make a decision as to which strategy they need to follow in order to ensure a labeling system is put in place. Stickers with prepared printed details can either be used or tags that shall be written at the time of replacing the waste bags could do.

v. **Waste Containment and Collection**

Clinical staff and waste operators should ensure that waste bags are tightly closed when they are about three quarters full. Waste should not be allowed to accumulate at the point of production. A routine programme for their collection should be established as part of the health care waste management plan. Certain recommendations should be followed up by a WMO who will ensure that:

- Waste is collected as frequently as required and transported to the designated site or storage area.
- He or she knows the daily requirements for waste bags and coordinates the supply and collection schedules.

vi. **Internal storage**

A storage location for health care waste should be designated inside the health care establishment. The waste, in bags or containers, should be

stored in a separate area, room, or building of a size appropriate to the quantities of waste produced bearing in mind the frequency of collection and final disposal. Segregation of hazardous waste from general waste should be maintained in storage. There should be planned periodic cleaning and disinfection of temporary storage areas and containers.

Table 4.2 Recommendations for storage facilities for health care waste.

- The storage area should have an impermeable, hard-standing floor with good drainage; it should be easy to clean and disinfect.
- There should be a water supply for cleaning purposes.
- The storage area should afford easy access for staff in charge of handling waste.
- It should be possible to lock the store to prevent access by unauthorized persons.
- Easy access for waste-collection vehicles is essential.
- There should be protection from the sun.
- The storage area should be inaccessible to animals, insects, and birds.
- There should be good lighting and at least passive ventilation.
- The storage area should not be located close to patient areas, or to fresh food stores or food preparation areas.
- A supply of clean equipment, protective clothing, and waste bags or containers should be located conveniently close to the storage areas.

vii. **Special Storage Areas**

- **Cytotoxic waste** should be stored separately from other health care waste in a designated secure location.
- **Radioactive waste** should be stored in containers that prevent dispersion, behind lead shielding. Waste that is stored during radioactive decay should be labeled with the type of radionuclide, the date, and details of required storage conditions.

4.3.2.3 Expected Outputs (for Objective 2)

- Specifications and standards for HCWM equipment and supplies updated and disseminated.
- Strengthened capacity at all levels to quantify HCWM commodity needs and develop annual procurement plans.

4.3.3 Objective 3: Increase Access of Emerging HCWM Technologies

To achieve this objective the National and County levels will be required to link with researchers in identification and fostering of new technologies in HCWM infrastructure system. To this end, introduction of appropriate and effective technologies that reduce impact on the environment will also be enhanced.

4.3.3.1 Expected Outputs (for Objective 3)

- Linkage with researchers to identify new technologies in HCWM infrastructure created and fostered.
- Introduction of appropriate and effective technologies that reduce impact on the environment.

4.4 Strategic Priority 3: Increase Capacity Building, Training, and Awareness for Health Care Personnel and the Community on HCWM

A policy for the management of health care waste cannot be effective unless it is applied carefully, consistently and at all levels of government. It is through training that standardization of waste handling practices and its management can be achieved.

In 2015, the Ministry developed the HCWM Training Guide and the Orientation manuals. These manuals are already in use across the country both in public and private facilities. Through the National HCWMM steering committee with support of partners, notably PATH, CDC, WHO, The World Bank, MWA and PS Kenya, the Ministry has started the roll out of health care workers training through use of the manuals. Plan to upscale the capacity building and training across the country for the next five years is expected to receive support from CDC and its four partners across the country. The partners are University of Maryland, AMREF, GIS and FHI360. The World Bank and WHO are expected to continue with their support in capacity building as well as supporting the policy and legal framework strategic priority area during this plan implementation period.

4.4.1 Cadres to be trained

Training activities should be targeted to the following main categories of health care personnel both from the public sector and the private sector:

- Health facility managers and administrative staff responsible for the implementation of health care waste management plans and regulations.
- Hospital management board members.
- Medical doctors
- Public Health Officers/Technicians.
- Nurses, Clinical Officers, Lab Technicians and Radiographers.
- Cleaners, incinerator/equipment operators and waste handlers.
- Pre-service students from KMTCs and University Public Health, Medical and Nursing Schools.
- Community Health Volunteers

4.4.2 Training Needs

At the National level, a Trainer of Trainers' Course should be carried out to senior Public Health Officers who will in turn train the staff in their areas of jurisdiction. Since training is continuous in all the leading medical training institutions in Kenya, the training needs for health workers undergoing training requires to be catered for through;

- Inclusion of approved waste management practices in the curricula of all health workers.
- The establishment of a HCWM plan that should progressively lead medical institutions and administrative authorities to consider HCWM as a routine issue.
- Review of curricula in the medical schools for doctors and in all the faculties training at Kenya Medical Training Colleges.
- Development of a national training package for staff under continuing medical education, (CME).
- Creation of a participative and practical training of trainers.
- Organized regular welcome training sessions in the health facility for new staff members.

4.4.3 Proposed Training Package for Health Care Waste Management

The content of staff education on infection prevention and health care waste management programme should contain the following:

- Justification for all aspects of health care waste policy;
- Explanation of the role and responsibilities of the health workforce and community in implementing the plan.
- Technical instructions relevant for the target group under some or all of the following headings;
 - Definition of health care waste
 - Importance of proper waste disposal
 - Classification of health care waste
 - Handling health care waste
 - Segregation of health care waste
 - Safety measures when handling health care waste
 - Recording and reporting accidents
 - Health care waste disposal methods
 - Laws relating to waste management.
 - HCW risks to human health and environment and relevant mitigation measures
- Education of health risks associated with bio-medical waste to health workers and members of the public through Information Education and Communication (IEC) materials in all media.
- Education on safe disposal practices and methods to all. The public has a right and responsibility to know how to handle home based care medical waste and condoms waste.
- Monitoring and Evaluation

Table 4.3: Awareness creation plan for health care waste management

| Target Group | Awareness Building strategy |
|-----------------------------|---|
| General Public | <ul style="list-style-type: none"> ▪ Posters, Radio, TV, participatory education theatre and targeted pamphlets. |
| Health workers (all cadres) | <ul style="list-style-type: none"> ▪ Distribute pamphlets and brochures on HCWM ▪ Distribute the acceptable code of practice for HCWM in the institution, and use relevant video clips. Workshops could also be used. |
| Scavengers | <ul style="list-style-type: none"> ▪ Public education awareness meeting for all at the dumpsite and use of participatory awareness theatre. |

4.4.4 Follow up and Refresher Courses

Follow-up/refresher courses should be undertaken to provide refresher training as well as orientation for both old and new employees with new responsibilities. The employees will also be updated on knowledge in line with policy changes. Follow up training is necessary for trainers in order to indicate how much has been retained by course participants and the likely need for future refresher courses.

The training should be organized by the Public Health Department in through the CME coordinator of health institutions. This committee should be in the forefront of ensuring that training needs assessment for staff members is conducted regularly through monitoring of staff performance in their areas of duty. The performance indicators set out by the CME/CPD should match with the Waste Management Team's set standards.

4.4.5 Expected Outputs (Priority 3)

- HCWM integrated to MOH community strategy for health service delivery.
- HCWM job aids, information, education, and communication (IEC) materials, and media advertisements developed.
- Improved awareness on HCWM in Kenya.
- HCWM awareness-creation plan developed.
- Cost of non-compliance to regulations - EIA/EA and EMCA 1999 costed.
- Budgeting for HCWM at county budgets.

4.5 Strategic Priority 4: Enhancing adequate Funding and Resources to increase Efficiency of HCWM

Each health care facility according to “polluter pays” principle should be financially liable for the safe management of any waste it generates. The costs of waste containment, collection, appropriate packaging, and on-site handling and treatment are internal to the establishment and paid as labour and supplies costs. The costs of off-site transport, treatment, and final disposal are external and should be paid to the contractors who provide the service. Most health facilities have not adequately given HCWM the serious profile it deserves in terms of direct funding towards waste management activities.

On this basis, health facilities are therefore required to regularly dedicate funds in hospital budgets for health care waste management. Since most health managers were not clear on how much funds were being used in the management of health care waste, it is needful to;

- Determine the costs associated with all action items in the plan. Plans should be drawn and costs itemized in a logical framework analysis. Some of the items to plan for include; installation of infrastructure, provision of waste containment and transportation equipment.
- Link up with key agencies that are supporting HCWM activities in Kenya and other development partners willing to support the sector Plan. It is logical for the National Ministry of Health and the County Department of Health to bring together all its development partners interested in supporting HCWM activities so that their areas of support can be defined and roles assigned in order to achieve synchrony and avoid duplication of activities.
- Determine the funding available in the HCWM Vote head within the GoK, and establish a plan for raising additional funding needed to execute the plans. Resource gaps contained in GoK implementation plan can be filled in with funds from development partners. However, it is advisable that the implementation of such a process should be incremental rather than a snapshot.
- Develop multi-year budgets to accomplish the activities in the National Action Plan. The construction of a multi-year budget should be done carefully with a logical sequence of events rolling out incrementally. The sequencing of events should be weighed carefully to avoid implementation hiccups.

4.5.1 Expected Outputs (Priority 4)

- HCWM budget integrated into the annual operational plan budget in the county and facility levels.
- County stakeholders' forum for HCWM created in all the counties.
- Budget code and line for HCWM created in the county level and national level.
- Consistent and adequate funding for HCWM activities.
- Kenya HCWM resource-mapping report.
- Framework for partner support in HCWM to include public-private partnerships (PPPs).

4.6 Strategic Priority 5: Promotion of Best Practices in HCWM Systems

Implementation of best available technologies (BAT) and best environment practices (BEP) is critical to facilitate sound environment management of health care waste in the country. This in turn is hugely expected to contribute to minimization of exposures to health risk thus enhancing promotion of public health and well-being of people and entire ecosystem.

The deliverables will be in the areas of demonstration of non-combustion pre-treatment equipment, which must be technically and economically feasible in selected number of HCFs. Upgrading of existing incinerators to comply with best available practices will also be modeled. The strategy to promote best practices will require some pre-conditions, which will need to be carefully verified. Non-combustion pre-treatment equipment, which are steam autoclaves, waste microwaves and highly efficient energy recovery combustion incineration will be installed in medium-size facilities.

It is expected that, the county and facility staff will at least be partially knowledgeable about best HCWM practices. This is because the proper operation of non-combustion pre-treatment facility at hospital level will require an effective implementation of segregation procedures to ensure that the proper waste stream is fed to the equipment. A proper waste manifest system will also be enforced to ensure that waste treated - either from the same facility or from other facilities - is properly tracked. A careful technical and economical feasibility analysis for the upgrade of a double chamber, up-to-date incinerator will be carried out.

In ensuring that best practices are replicated and sustained across the country by counties, the Ministry will develop a toolkit on how to implement best practices and techniques. This practical toolkit is expected to be properly disseminated to relevant stakeholders to carry out an evaluation to pick out lessons learnt and best practices and innovations especially for levels III,II and community based facilities.

4.6.1 Expected Outputs (Priority 5)

The Output expected to be delivered under this strategic result area relate to the practical implementation of HCWM best practices in selected facilities during the five years implementation of this plan and they include the following:

- Strengthening and implementing HCWM guidelines, standards, and SOPs to incorporate best practices in HCWM
- Improving management support and oversight of HCWM in line with the best practice focus
- Establishing and supporting model HCWM facilities/systems at different levels of health care delivery that demonstrate best practices and replicate practice to other health facilities.

5 NATIONAL PLAN OF ACTION

5.1 Introduction

This plan is based on the results of the situation analysis presented in chapter three and subsequent recommendations arrived at in chapter Four. This chapter gives the detailed short and long term actions, coordination and supervision structures, indicators for achievement and the cost implications. The plan also provides recommendations for the implementation of each component.

5.2 Strategy for the Implementation of Plan

In the planned strategy, all health care facilities in Kenya that generate HCW should set up comprehensive waste management systems based on the most appropriate means of achieving human and environmentally safe management of health care waste. The implementation of this plan is proposed to run for 5 years beginning from 2016 to 2021. The resources needed for successful implementation of this plan of action are both human and financial. The systems should start with basic measures that are improved gradually. The most important step is to begin with commitment of Health System Managers at all levels to address Kenya's waste management challenges.

The implementation of this plan is based on the six strategic priority areas contained in the HCWM strategic plan 2015 -2020. This plan is therefore based on the need to operationalize the strategic plan. It is to provide the counties with direction and model while formulating their own operational plan on HCWM. Among the priority areas identified for implementation include review and update of the legal and regulatory framework where the need to develop the HCWM policy, review the national guidelines on HCWM and communication strategy were identified. In order to standardize the HCWM, the Ministry will develop HCWM SOPs in order to standardize HCWM practices while assigning responsibility to key actors in the sector. The operationalization of the laws governing HCWM also needs to be harmonized among stakeholders and lead agencies.

The Public Health Act, Cap 242 Laws of Kenya has been recommended for review on the laws regulating the issuance of license to HCFs so that they may meet minimum waste treatment management standards as a pre-condition to issuance of license. The need to engage other regulatory bodies on enforcement of all the laws touching on HCWM were also recommended including supporting counties in formulation of waste management law.

For meaningful progress to be achieved in Kenya on HCWM matters, it is important, implementation of this plan across the board in public facilities and in the private sector HCFs is resourced and enhanced. It is of utmost importance that the Ministry implements the updated HCWM plan in close collaboration with all stakeholders who include; the counties, national health program and referral facilities, development partners, NGOs, FBOs and CBOs. Good waste segregation and hygiene practices require constant follow up. Staff can be reminded in various ways, such as training on recruitment, posters and signs, hygiene inspections, staff newsletters and information literature. An integrated effort is necessary to set up safe and environmentally sound HCWM practices which focus on mainstreaming climate change in all approaches to be used while utilizing the best available technologies (BAT). Focus is now turned on to minimizing waste, standardizing waste management practices and need to identify alternative innovative technologies that are environmentally sound safe and people friendly.

This plan therefore endeavors to tackle the HCWM challenges in Kenya that comprise the following components as addressed in the recommendations of Chapter Three:

- Legal and Regulatory (Including institutional framework)
- Commodity supply and infrastructure development
- capacity building, training and awareness creation on HCWM
- Resource mobilization to increase efficiency.
- Promotion of best practices in HCWM systems.
- Strengthen monitoring and evaluation and operational research.

5.3 Strengthening and Setting up Health Care Waste Management Systems

In the WHO core principles for achieving safe and sustainable management of HCW, it recommends that countries should identify and progressively allocate sufficient funds to the management of HCW. This is in view of the fact that funding of HCWM shall translate into measurable outcomes, such as reductions in needle stick injuries, lower disease burdens, economic savings and safe environment etc. Further, countries are urged to view waste management expenses as a new category of overhead costs built into programmes, just as administrative costs are seen as normal costs of doing business.

Currently in Kenya, the Ministry of Health does not have clearly defined framework for financing healthcare waste management activities at all levels. The current scenario is that financial resources are allocated as a block fund together with other activities hence it is difficult to quantify exactly how much goes specifically to waste management. In some large facilities however, funds are allocated for incinerator operation, purchase of the necessary supplies such as bins, bin liners and protective clothing.

In order to implement this plan therefore, it is necessary for policy makers and those in decision making positions at the two levels of government to appreciate the need for financial allocation to the management of HCW based on plans which have been developed, budgeted and discussed and further approved by a recognized body in specific health institutions.

The areas that will need financial allocation include;

- Capacity building HCW- potential risks to health workforce and community.
 - mitigation measures to prevent, minimize possible negative impacts on people and environment.
 - management of HCW
- Investment on waste handling facilities, e.g. waste storage areas or refuse transfer stations, incinerators and fencing off the waste handling-disposal site.
- Fuel for operating on-site incinerator.
- Purchase of equipment such as;
 - trolleys, trolley bins,
 - waste bins,
 - weighing scales for weighing waste generated on daily basis in the hospitals,
 - Workers' personal protective gear (helmets, plastic goggles, respirators, heavy duty gloves, gumboots, overall and aprons).
- Funds for maintenance of HCWM equipment such as:
 - Repairing incinerators, and replacing them as they become obsolete.
 - Repairing and replacing trolleys and trolley bins,

- Performing regular maintenance for the building structures and fences that surround waste management storage and treatment areas.
- Waste operation tools such as;
 - shovels,
 - steel rods for poking the fire,
 - brooms,
 - Waste-ash-buckets for use at the refuse storage areas, incinerator and final waste disposal area.
- Purchase of consumable materials required for daily implementation of good segregation practices which include;
 - Safety boxes for sharps,
 - Bin-liners of different colors and sizes for different waste generation areas.
 - Stickers for labeling waste.
- Funds for contractual services for out sourced waste from the facility and cleansing services.
- Meeting transportation cost within the facility or to the waste treatment Site.
- Minor repairs to improve on ventilation and lighting so as to minimize and control nosocomial infections and injuries.
- Install running water facilities so as to control and minimize infection prevention

5.4 Strengthening Monitoring and Evaluation

Monitoring is the process of regularly reviewing achievements towards the goal. In order to carry out monitoring and evaluation activities, critical issues are; the goals, objectives, targets, inputs, outputs and indicators must be clearly defined.

An effective monitoring and evaluation system needs monitoring structures with appropriate staff, a good information network system, and appropriate

reporting formats/ registers and procedures. The HCW expected to be delivered at the various levels of services provision provide the bench marks of expected outputs.

Fundamentally, monitoring should be established from the beginning as part of the planned activities. Monitoring involves comparing what is actually happening with what was planned. On the other hand, evaluation asks whether we succeeded or failed to meet stated goals, whether we used resources appropriately, and whether our actions will have long-term results.

The aspects to be monitored and evaluated on health care waste management should be identified based on the injection safety and medical waste management policy guidelines and then National Environment Management Authority (NEMA) standards.

Every project or programme no matter how small needs a monitoring and evaluation strategy tailored to its nature, which should be put in place at the design stage. Process monitoring should be done as a routine of gathering information on key aspects of the implementation process of the action plan of HCWM. This process shall provide the understanding of how activities are progressing.

Monitoring should provide information for incremental planning and for regular feedback about the progress of the project to stakeholders, implementers and the health facilities benefiting from the Action Plan.

On the other hand process evaluation is the periodic assessment of the value of what a project or programme has achieved in relation to planned activities and overall objectives and can help in providing solutions that can then be implemented. Process evaluations for the waste management should be conducted at strategic intervals in planned five of the project life cycle. Process monitoring and evaluation therefore are often seen as the most important type of monitoring and evaluation activity for project managers, as it helps to identify successful aspects that can be continued or expanded as well as deficiencies that can be reworked and the means of addressing them. The M & E framework encompassing all required tools for HCWM in Kenya should therefore be developed and disseminated to all counties and Health records Information Offices (HRIOs).

In this context therefore, it is important for the National Steering Committee for HCWM to;

- Develop monitoring and evaluation plan and tools that can be integrated into existing M & E systems.
- Determine indicators of achievement.

- Develop a tool for auditing.
- Develop an oversight plan in a devolved system of governance.
-
- Develop a simple reporting format on what to monitor in order to create a feedback process.
- Determine and execute a plan for follow-up assessment to measure improvements against earlier assessments. Stakeholder participation in the analysis and interpretation of findings from process evaluation, including the formulation of conclusions and linkages with future plans, is critical to ensure that results become accepted and used.

When the entire required framework will be in place, it will be critical to ensure that all the indicators be integrated into the National Health Management Information System (HMIS). This therefore requires that the Unit responsible for HCWM both at the National and County levels coordinates closely with HMIS.

5.5 Operational Research

Operational research is applying analytical methods to researches and surveys in health care waste and other wastes in order to inform decision makers in HCWM. This is very critical as it helps inform policy and practice in HCWM. It is therefore recommended that the National Steering Committee on HCWM identifies operational research gaps and encourages research and training institutions to prioritize. Critical also will be to mobilize resources both from public and [private stakeholders for purposive researches and surveys of key areas across the waste management stream.

Research areas will include;

- Air emissions from incinerators to surrounding people and environment
- Effect of bottom ash from incineration to the surrounding environment
- Non burn technologies effectiveness,
- Rapid assessment on gaps in HCWM at counties

5.6 HCWM Indicators

| Indicators | Base line | Target | | | | | Cumulative |
|---|-----------|--------|----|----|----|----|------------|
| | | Y1 | Y2 | Y3 | Y4 | Y5 | |
| 1) Proportion (%) of facilities with annual HCWM implementation plans | | | | | | | |
| 2) Proportion (%) of facilities with waste segregation colour-coded bins & bin-liners | | | | | | | |
| 3) Number of waste handlers[1] reporting needle stick injuries | | | | | | | |
| 4) Proportion(%) of health facilities with trained[2] health workers on HCWM | | | | | | | |
| 5) Proportion (%) of facilities with adequate[3] PPEs for waste handlers/incinerator operators. | | | | | | | |
| 6) Proportion (%) of facilities with adequate[4] sharps safety boxes | | | | | | | |
| 7) Proportion(%) of facilities with approved waste treatment equipment[5] | | | | | | | |
| 8) Average number OPD injections[6] per 100 OPD attendance | | | | | | | |
| 9) Proportion(%)of health budget allocated for HCWM | | | | | | | |
| 10) Proportion(%) of facilities with functional[7]HCWM/ IPC committees | | | | | | | |

Note:

[1] Waste handling covers point of generation to point of disposal.

[2] Minimum training package includes 10 TOTs/county, 2-day training for Facility managers, 8-hour training for Healthcare workers, waste handlers, and 2-day training incinerator operators.

[3] Adequate PPE means a complete set of water proof apron, overall, rubber gloves, heavy duty gum boots for waste handler and additional helmet, respirator, goggles, heavy duty gloves for incinerator operator.

[4] Adequate sharps safety boxes-refers to availability of stocks lasting for three months with no stock-outs.

[5] A functional diesel fired incinerator, autoclave and shredder, De Montfort mark 9.

[6] Information available in DHIS

[7] Functional HCWM/IPC committee that meets at least quarterly and minutes are available, action points acted upon.

6 PLANNING MATRIX

Generic (Based on the six strategic priorities as per the Healthcare waste management strategic plan 2015-2020)

| MOH HCWM PLAN 2016 - 2021 IMPLEMENTATION MATRIX | | | | | | | | | | |
|---|---|--------------|------------|----|----|----|----|--------------|--------------|--|
| Objective | Activity | Responsible | Time Frame | | | | | Budget (Ksh) | Source | Verifiable Indicators |
| | | | Y1 | Y2 | Y3 | Y4 | Y5 | | | |
| Result area 7.1: Review policies, guidelines and standards on HCWM | | | | | | | | | | |
| Strengthen policy & regulatory structures & Mechanisms for HCWM | 1: Develop HCWM policy | DEH | X | X | | | | 5.3 M | Gok/Partners | policy in place, |
| | 2: Review HCWM guidelines | DEH | X | X | | | | 5.2 M | Gok/Partners | guidelines in plc |
| | 3: Develop PPP guidelines on HCWM | DEH | X | X | X | X | | 10 M | Gok/Partners | reports, printed |
| | 4: Develop M & E guidelines on HCWM | | | X | | | | 3.5M | Gok/Partners | Guidelines in place |
| | 4: Review of HCWM communication Strategy | DEH | X | | | | | 5M | Gok/Partners | Strategy & tools in place |
| | 5: Develop e-waste disposal strategy | MOH/MENR | X | | | | | 5M | Gok/Partners | Strategy in place |
| | 6: Develop procedures & guidelines for assessment & implementation of hazardous waste management in health facilities | MOH/MENR | X | | | | | 23.5M | Gok/Partners | Procedure & guidelines in place |
| | 7: Specifications/standards for incinerators, shredders, autoclaves, microwaves & macerators developed & disseminated | MOH/MENR | | | X | X | | 1.5M | Gok/Partners | |
| | 8: Review HCWM training curricula for in-service and pre-service | MOH | X | X | X | | | 4.8M | Gok/Partners | Specifications/standards in place, curriculum in place |
| | 9: Develop guidelines on energy recovery & efficiency on burn & non-burn technologies | MOH/MENR | | X | X | | | 7.5M | Gok/Partners | Guidelines in place |
| Strengthen governance of | 9: Disseminate HCWM policies, guidelines & standards | MOH/Counties | X | X | X | X | X | 3.5M | Gok/Partners | Reports |
| | 1: Strengthening & formation of coordination structures at national level & county level respectively | DEH/Counties | X | | | | | 10M | Gok/Partners | Reports |

| MOH HCWM PLAN 2016 - 2021 IMPLEMENTATION MATRIX | | | | | | | | | | |
|---|--|--------------|------------|----|----|----|---------------|--------------|--------------|---|
| Objective | Activity | Responsible | Time Frame | | | | | Budget (Ksh) | Source | Verifiable Indicators |
| | | | Y1 | Y2 | Y3 | Y4 | Y5 | | | |
| HCWM at national & County level | 2: Conduct scheduled partnership forum at national & county level | DEH/Counties | X | X | X | X | X | 25M | Gok/Partners | Reports |
| SUB-TOTAL | | | | | | | 109.5M | Gok/Partners | | |
| Result area 7.2: Improve infrastructure, commodities, and equipment supply for HCWM | | | | | | | | | | |
| Improve Infrastructure for HCWM | 1: Set up 15 autoclaves/microwave & shredders pilot sites in 20 Counties/National hospitals | MOH/KEMSA | X | X | X | X | | 300M | Gok/Partners | reports, |
| | 2: Procure 20 PPP pilot contracts for pooled waste transportation/treatment | MOH/Counties | X | X | X | X | | 240M | Gok/Partners | reports, |
| | 3: Identify & rehabilitate/upgrade broken down/functional incinerators | GoK | X | X | X | | | 57.5M | Gok/Partners | functional equipment, reports |
| | 4: Carry out EIA for all new treatment equipment projects | GoK | X | X | X | | | 9M | Gok/Partners | Approved EIA Reports |
| | 5: Demonstrate 40 Waste Disposal Units (WDU) in hard-to-reach/remote areas | DEH | X | X | X | X | | 80M | Gok/Partners | Functional WDU in place |
| | 6: Preventive maintenance of equipment (Autoclaves, microwaves, shredders, macerators, incinerators) | GoK | X | X | X | X | X | 120M | Gok/Partners | Reports |
| | 7: Procure & install energy recovery systems for five pilot sites incinerators | MOH/KEMSA | X | X | | | | 12.5M | Gok/Partners | Functional systems in place, Reports |
| Standardize commodities and PPEs | 1: Quantify, procure & distribute bin/bin liners to all tier 3, 4 & 5 h/facilities | MOH/KEMSA | X | X | | | | 80M | Gok/Partners | Quantification list in place, distribution list & reports |
| | 2: Quantify, procure & distribute PPEs to all h/facilities | MOH/KEMSA | X | X | | | | 20M | Gok/Partners | Quantification list in place, distribution list & reports |
| SUB-TOTAL | | | | | | | 919M | | | |
| Result area 7.3: Increase capacity-building, training and awareness-creation on HCWM | | | | | | | | | | |
| Capacity building, training & awareness creation | 1: Carry out national assessment/mapping of HCWM TOTs in all Counties | MOH | X | | | | | 2.4M | Gok/Partners | Report developed |

| MOH HCWM PLAN 2016 - 2021 IMPLEMENTATION MATRIX | | | | | | | | | | |
|---|--|--------------|------------------|----|----|----|----|----------------|--------------|---------------------------------|
| Objective | Activity | Responsible | Time Frame | | | | | Budget (Ksh) | Source | Verifiable Indicators |
| | | | Y1 | Y2 | Y3 | Y4 | Y5 | | | |
| | 2: Train 10 TOTs in each of 47 counties as back-up to existing teams | DEH | X | X | | | | 40M | Gok/Partners | Training report |
| | 3: Train TOTs for Faith-based organizations supporting health facilities | DEH | X | X | | | | 2.2M | Gok/Partners | Training Report |
| | 4: Train all incinerator/autoclave operators for newly procured equipment | DEH | | X | X | X | X | 2.14M | Gok/Partners | Training report |
| | 5: Support facility-based trainings of health workers on HCWM in all counties | MoH/Counties | x | X | X | X | X | 470M | Gok/Partners | Training report |
| | 6: Train facility managers of HCWM planning | MoH/Counties | | X | X | | | 67.68M | Gok/Partners | Training report |
| | 7: Annual Advocacy/awareness/media campaign forums for HCWM conducted In five counties | MoH/Counties | X | X | X | X | X | 5M | Gok/Partners | Advocacy meetings |
| | | | SUB-TOTAL | | | | | 521.74M | | |
| Result area 7.4: Ensure adequate resources to increase efficiency of HCWM | | | | | | | | | | |
| establish sustainable sources of funding for HCWM | 1: Support integration of HCWM budget AWP into county plans | MOH | X | X | X | X | X | 5M | Gok/Partners | |
| | 2: Set up data-base of all partners supporting HCWM | MOH | x | | X | | x | 0.2M | Gok/Partners | |
| | 3: support external joint resourcing to support HCWM | MOH | | | X | X | X | 0.5M | Gok/Partners | |
| | | | SUB-TOTAL | | | | | 5.7M | | |
| Result area 7.5: Promote best practices in HCWM in health care service delivery points | | | | | | | | | | |
| Best available technologies (BAT) & Best Environmental Practices (BEP) | 1: Carry out annual environmental audits of functional treatment systems | MENR/DEH | X | X | X | X | X | 200M | Gok/Partners | |
| | 2: Support faith-based & Private facilities to link MOH/NEMA approved transportation/treatment systems | MOH | X | X | X | X | X | 47M | Gok/Partners | tracking of waste |
| Continuous capacity-building | 1. Develop a training plan for orientation of new staff, & annual refresher training at facility level | MOH/Counties | X | X | X | X | X | 23.5M | Gok/Partners | Training plan in place, reports |

| MOH HCWM PLAN 2016 - 2021 IMPLEMENTATION MATRIX | | | | | | | | | | |
|---|---|--------------|------------------|----|----|----|----|---------------|--------------|--|
| Objective | Activity | Responsible | Time Frame | | | | | Budget (Ksh) | Source | Verifiable Indicators |
| | | | Y1 | Y2 | Y3 | Y4 | Y5 | | | |
| | 2: Avail supportive job aids to health workers | MOH/Counties | X | X | X | | | 11.8M | Gok/Partners | |
| Management structure & Oversight | 1: Initiate & support structures to ensure facilities comply with EIA/EA as per NEMA requirements | DEH/MENR | | X | X | X | X | 8.6M | Gok/Partners | place, available |
| | 2: Support facilities (HMTs & CHMTs) to develop annual HCWM plans | MOH/Counties | X | X | X | X | X | 8.6M | Gok/Partners | place, procurement |
| | 3: Support facilities/Counties in developing annual procurement plans | MOH/Counties | X | X | X | X | X | 4.3M | Gok/Partners | plans available |
| | 4: Set up & strengthen HCWM committees at County & facilities level | moh/Counties | X | X | X | | | 9.4M | Gok/Partners | Functional HFC |
| Improve health & safety of h/workers | 1: Advocate for vaccinations to all waste handlers & incinerator operations at facilities level | MoH/Counties | X | X | X | X | X | 71M | Gok/Partners | Surveillance reports |
| | 2: Set up medical surveillance systems for all waste handlers & incinerator operators according to OSHA | MOH/Counties | | X | X | X | X | 188M | Gok/Partners | Vaccination reports |
| | | | SUB-TOTAL | | | | | 572.2M | | |
| Result area 7.6: Strengthen other Waste Management Options | | | | | | | | | | |
| Liquid waste management at facility level | 1. Support infrastructure design & re-design for efficient removal & containment | MOH/Counties | X | X | X | X | X | 150M | Gok/Partners | Infrastructure in place |
| | 2. Support activities for management of environmental spills | MOH/Counties | X | X | X | X | X | 50M | Gok/Partners | Spills reports, environmental plans |
| Community outreach Waste Management | Support outreach services including training & induction, commodity & PPEs supplies, containment, collection & transportation & treatment of healthcare waste | Counties | X | X | X | X | X | 100M | Gok/Partners | Commodities & PPE lists, & distribution, user reports, transport reports, treatment logs |
| HCWM management in emergencies & outbreaks | Support HCWM activities including training & induction, commodity & | Counties | X | | X | | X | 30M | Gok/Partners | Commodities & PPE lists, & distribution, user reports, transport reports, treatment log |

| MOH HCWM PLAN 2016 - 2021 IMPLEMENTATION MATRIX | | | | | | | | | | |
|---|---|-------------|------------------|----|----|----|----|--------------|--------------|--|
| Objective | Activity | Responsible | Time Frame | | | | | Budget (Ksh) | Source | Verifiable Indicators |
| | | | Y1 | Y2 | Y3 | Y4 | Y5 | | | |
| | PPEs supplies, containment , collection & transportation & treatment/disposal of healthcare waste | | | | | | | | | |
| Sanitation & Indoor Pollution | Support facilities provide for adequate washing facilities, one-way patient design flows to minimize infections, adequate lighting & ventilation to reduce TB risks, | Counties | X | X | X | X | X | 300M | Gok/Partners | Preventive maintenance reports & checklists, |
| Energy Conservation & recovery | Support health facilities minimize climate change effects by electricity use and reuse by using other energy conservation technologies like solar energy equipment & utilities, bio-fuels, windmills | Counties | X | X | X | X | X | 250M | Gok/Partners | Innovation plans, evidence of functional systems, reduced electricity end-use costs. |
| Water Pollution and Management | Support provision of adequate & portable water supplies for patient use through roof catchment, connection to approved water sources such as public supplies, protected springs, wells & other aquifers | Counties | X | X | X | X | X | 500M | Gok/Partners | Reports, evidence of installations, analysis reports |
| | | | SUB-TOTAL | | | | | 1380M | | |
| Result area 7.7: Strengthen M&E and operational research | | | | | | | | | | |
| M & E Plan | 1: Develop M & E Plan and disseminate to Counties | DEH | X | X | | | | 3.6M | Gok/Partners | M & E plan in place |
| M & E Tools | 1: Develop & adopt M & E tools | DEH | | X | X | | | 2.5M | Gok/Partners | M & E tools in place |
| | 2: Disseminate M & E tools to counties(Tracking tools,facility audits, HCWM checklist | DEH | | X | X | | | 3M | Gok/Partners | training reports, |
| | 3: Training, orientation & induction on M & E tools & reporting | DEH | | X | X | | | 3.6M | Gok/Partners | evidence in DHIS, |
| Integrate HCWM tools | 1: Integrate HCWM indicators into DHIS | MOH | | X | X | | | 1.5M | Gok/Partners | Baseline, mid-term & end term reports. |

| MOH HCWM PLAN 2016 - 2021 IMPLEMENTATION MATRIX | | | | | | | | | | |
|---|---|--------------------|-------------------|-----------|-----------|-----------|-----------|---------------------|---------------|------------------------------|
| Objective | Activity | Responsible | Time Frame | | | | | Budget (Ksh) | Source | Verifiable Indicators |
| | | | Y1 | Y2 | Y3 | Y4 | Y5 | | | |
| Periodic M & E | 1: Conduct national baseline on HCWM, mid-term & end-term review of HCWM PLAN | MOH/Counties | X | | X | | X | 7.5M | Gok/Partners | Dissemination Reports |
| Capacity build on | 1: Enhance collaboration between research institutions & stakeholders | MOH | X | X | X | X | X | 5M | Gok/Partners | evaluation reports, |
| Operational Research | 1: Baseline study on HCWM in Kenya | MOH | X | | | | | 8.5M | Gok/Partners | documented, |
| Operational Research | 2. Initiate & support emissions study on incinerators | MOH/MENR | | X | X | X | | | Gok/Partners | Reports published |
| | 3: Performance evaluation of HCWM systems & equipment | DEH | | | X | X | X | 10.5M | Gok/Partners | Accepted Reports |
| | 4: PPPs in HCWM | MOH | | X | X | X | | 7.5M | Gok/Partners | Accepted Reports |
| | | | SUB-TOTAL | | | | | 53.2M | | |
| GRAND TOTAL FOR ALL COMPONENTS OF ENVIRONMENTAL SAFEGUARDS IS KSH. 4, 038, 140, 000.00 | | | | | | | | | | |

7 GLOSSARY OF TERMS COMMONLY USED IN HCWM

Anatomic waste: consisting of recognizable body parts.

Biomedical and health-care waste: solid or liquid waste arising from health-care (medical) activities such as diagnosis, monitoring, treatment, prevention of disease or alleviation of handicap in humans or animals, including related research, performed under the supervision of a medical practitioner or veterinary surgeon or another person authorized by virtue of his professional qualifications.

Chemical waste: consisting of/or containing chemical substances.

Collection: the act of removing accumulated containerized solid waste from the generating source. In Kenya, collection of solid and liquid waste is either done by county authorities or privately by individuals or companies from residential, commercial, health facility or industrial premises. The arrangements for the service are made directly between the owner or occupier of the premises and the collector.

Colour coding: Designates the use of different colours for the storage of various categories of HCW.

Container: vessel in which waste is placed for handling, transportation, storage and/or eventual disposal. The waste container or receptacle is a component of the waste package.

Cytotoxic waste: drugs possessing a specific destructive action on certain cells.

Decontamination: the process of reducing or eliminating the presence of harmful substances such as infectious agents so as to reduce the likelihood of disease transmission from those substances.

Disinfectant: chemical agent that is able to reduce the viability of micro-organisms.

Disposal: intentional burial, deposit, discharge, dumping, placing or release of any waste material into or on any air, land or water.

Fly ash: the finely divided particles of ash entrained in the flue gases arising from combustion. The particles of ash may contain incompletely burned material. The particles are frequently glassy spheres but may also be crystalline or even fibrous in structure.

Handling: the functions associated with the movement of waste materials.

Hepatitis B: 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

HIV/AIDS: Human Immunodeficiency Virus, a virus transmitted through exposure to blood or blood products or during sexual intercourse. HIV cause the Acquired immunodeficiency Syndrome (AIDS).

Incineration: the controlled burning of solid, liquid or gaseous combustible wastes to produce gases and residues containing little or no combustible material.

Infection control: 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.

Irradiation exposure: to radiation of wavelengths shorter than those of visible light (gamma, x-ray or ultraviolet) for medical purposes, the destruction of bacteria in milk or other foodstuffs or initiation of polymerization of monomers or vulcanization of rubber.

Infectious health-care waste: 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, which have been in contact with blood and its derivatives, tissues, tissue fluids, or wastes from isolation wards.

Minimization of waste: the application of activities such as waste reduction, reuse and recycling to minimize the amount of waste that requires disposal.

Monitoring: periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals and other living things.

Off-site facility: a clinical and related waste treatment, storage or disposal facility that is located away from the generating site.

On-site facility: a clinical and related waste treatment, storage or disposal facility that is located on the generating site.

Open dump: characterized by the uncontrolled and scattered deposit of wastes

Pathogen: A microorganism capable of causing diseases.

Pharmaceutical waste: consisting of/or containing pharmaceuticals. (Includes: pharmaceuticals expired, no longer needed, their containers, items contaminating pharmaceuticals (bottles))

Pressurized containers: consists of containers (full or empty) with pressurized liquid, gas or powdered materials.

Pyrolysis: the decomposition of organic material by heat in the absence of or with limited supply of oxygen.

Radioactive waste: material contaminated with a radioisotope which arises from the medical or research use of radionuclide. It may be in a solid, liquid or gaseous form.

Recycle: A term embracing the recovery and reuse of scrap or waste material for manufacturing or other purposes.

Residual waste: those materials (solid or liquid) which still require disposal after the

completion of a treatment or resource recovery activity (e.g. slag and liquid effluents following a pyrolysis operation and the discards from front-end separation systems.

Safe injection: An injection that does not harm the recipients neither does it expose health worker to risks or results in waste that puts communities at risk.

Safety (sharps) box: A puncture proof/liquid proof container designed to hold used sharps safety during disposal and destruction

Sanitary landfill: 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.

Sanitation: the control of all the factors in the physical environment that exercise or can exercise a deleterious effect on human physical development, health and survival.

Segregation: the systematic separation of waste into designated categories.

Sharps: sharps are a subcategory of infectious health-care waste and include objects that are sharp and can cause injuries.

Sterilization: a process used to reach a state of free of viable micro-organisms. Note that in a sterilization process, the nature of microbiological death or reduction is described by an experimental function. Therefore, the number of micro-organisms that survive a sterilization process can be expressed in terms of probability. While the probability may be reduced to a very low number, it can never be reduced to zero.

Storage: the placement of waste in a suitable location or facility where isolation, environmental and health protection and human control (e.g. monitoring for radioactivity, 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 of radio nuclides from radioactive waste.

Waste management: all the activities - administrative and operational - involved in the handling, treatment, conditioning, storage, transportation and disposal of waste.

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