



REPUBLIC OF LIBERIA

UPDATED MEDICAL WASTE MANAGEMENT PLAN
FOR
WEST AFRICA REGIONAL DISEASE SURVEILLANCE
SYSTEMS ENHANCEMENT (REDISSE) PROJECT

April, 2016

ACRONYMS

BOD – Biological Oxygen Demand BPHS – Basic Package of Health Services

COD – Chemical Oxygen Demand

DEOH – Division of Environmental and Occupational Health DHS – Demographic Health Survey

ECAT – Expanded Costing Analysis Tool

EIA – Environmental Impact Assessment EMUS – Emergency Monrovia Urban

Sanitation EPA – Environmental Protection Agency

EPHS – Essential Package of Health Services EPI – Expanded Programme on

Immunization GDP – Gross Domestic Product

HCF's – Health Care Facilities

HCI's – Health Care Institutions

HCW – Health Care Waste

HCWM – Health Care Waste Management

HCWMC – Health Care Waste Management Committee HCWMP – Health Care Waste Management Plan

HMIS – Health Management Information System

HSRP – Health System Reconstruction Project

HWI – Health Waste Inspectors

HWO – Health Waste Officer

IPRS – Interim Poverty Reproduction Strategy

LHS – Liberia Hydrological Service

MCC – Monrovia City Corporation

MDG – Millennium Development Goals

MLME – Ministry of Lands, Mines and Energy MMR – Maternal Mortality Rate

MOHSW – Ministry of Health and Social Welfare MPW – Ministry of Public Works

MSF - Medicine San Frontier

MWMP - Medical Waste management Plan NHP - National Health Policy

NTD's - Neglected Tropical Diseases

PEP - Post Exposure Prophylaxis

POP's - Persistent Organic Pollutants

RBHS - Rebuilding Basic Health Services

SF - Social Franchising

TNIMA - Tubman National Institute of Medical Arts

WDU's - Waste Disposal Units

WHO - World Health Organization

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EXECUTIVE SUMMARY

Against the newly emerging infectious diseases annually, the WEST AFRICA REGIONAL DISEASE SURVEILLANCE SYSTEMS ENHANCEMENT PROJECT (REDISSE) will be implemented as an interdependent series of projects (SOP) that will eventually engage and support all 15 ECOWAS member countries.

This is the first project in the series, REDISSE-SOP1 which targets both extremely vulnerable countries (Guinea, Sierra Leone and Liberia) and countries which have more effective surveillance systems and serve as hosts for important regional assets (Nigeria and Senegal). Phase 2 (REDISSE-SOP2) is expected to be delivered in the second quarter of Fiscal Year 17 (FY17). The estimated project financing for REDISSE-SOP2 is US\$102 million. Together, REDISSE SOP 1&2 constitute a block of equatorial, coastal countries with shared borders and similar epidemiologic profiles which extends from Senegal in the west to Nigeria in the east. The series of projects will be implemented in the context of the African Integrated disease surveillance and Response Strategy, international standards and guidelines of World Health Organization (WHO), World Organization for Animal Health (OIE), and Food and Agriculture Organization of the United Nations (FAO), fostering a One Health Approach. It will support the countries to establish a coordinated approach to detecting and swiftly responding to regional public health threats. Cooperation among West African countries to prevent and control potential cross-border diseases is a regional public good.

Of infectious diseases in humans, the majority has its origin in animals (“zoonotic” diseases), with more than 70% of emerging zoonotic infectious diseases coming from wildlife. Recent outbreaks such as Ebola Viral Disease (EVD), H7N9 avian influenza, Middle East Respiratory Syndrome (MERS-CoV), Marburg virus, Nipah virus infection, bovine spongiform encephalopathy and HIV/AIDS showcase the catastrophic health and economic effects of emerging zoonotic diseases. Thus Animal health is seen as a priority by the two regional economic communities in West Africa. ECOWAS and WAEMU have set a target of harmonizing national animal health systems.

There have been efforts from different directions at ensuring that the health challenges posed by these emerging situations are tackled. However, coordination of resources and activities offered by the various partner organizations is seen to remain a significant challenge for national governments. Therefore, coordination mechanisms at both national and regional levels that engage both the human and animal health sectors need to be developed to maximize the impacts of the increasing support and foster sustainability of the anticipated outcomes. The World Bank's convening power will be highly instrumental in forging a coalition of national, regional, and global technical and financial institutions to support the disease surveillance and epidemic preparedness agenda in West Africa.

The World Bank has strategically engaged with a core group of development partners including those implementing the Global Health Security Agenda (GHSA) in the development of the REDISSE project. The REDISSE project itself will provide resources to regional institutions and national governments to establish the needed coordinating mechanisms

The REDISSE project's development objective (PDO) is to strengthen national and regional cross-sectoral capacity for collaborative disease surveillance and epidemic preparedness in West Africa. It will address systemic weaknesses within the animal and human health systems that hinder effective disease surveillance and response.

The REDISSE Project components are five and include the followings with their sub-components:

Component 1: Surveillance and Information Systems. *Total costs including contingencies US\$62.32 million equivalent of which US\$50 IDA Credit and US\$12.32 million MDTF*

- *Sub-Component 1.1 Support coordinated community-level surveillance systems and processes across the animal and human health sectors (US\$27 million).*
- *Sub-Component 1.2 Develop capacity for interoperable surveillance and reporting systems (\$20 million)*
- *Sub-Component 1.3 Establish an early warning system for infectious disease trends prediction (US\$14 million)*

Component 2: Strengthening Laboratory Capacity (US\$58 million)

- *Sub-Component 2.1 Review, upgrade and network laboratory facilities (US\$28 million)*
- *Sub-Component 2.2 Improve data management and specimen management (US\$12 million)*
- *Sub-Component 2.3 Enhance regional reference laboratory networking functions (US\$18 million)*

Component 3: Preparedness and Emergency Response (US\$34 million)

- *Sub-Component 3.1 Enhance cross-sectoral coordination and collaboration for preparedness and response (US\$16 million)*
- *Sub-Component 3.2 Strengthen Capacity for emergency response (US\$18 million)*
- *Sub-Component 3.3 US\$0 Component for emergency response.*

Component 4: Human resource management for effective disease surveillance and epidemic preparedness (US\$47 million).

- *Sub-Component 4.1 Health Workforce mapping, planning and recruitment (US\$25 million)*
- *Sub-Component 4.2 Enhance Health Workforce training, motivation and retention (US\$22 million)*

Component 5: Institutional Capacity Building, Project Management, Coordination and Advocacy (US\$41 million)

- *Sub-component 5.1 Project coordination, fiduciary management, monitoring and evaluation, data generation, and knowledge management (US\$30 million)*
- *Sub-component 5.2 Institutional support, capacity building, advocacy, and communication (US\$11 million)*

Since the proposed REDISSE project will support Strengthening of Laboratory Capacity (Component 2) which would involve rehabilitation of old structures or new construction of laboratories and laboratory investigations, veterinary border inspection posts and quarantine stations, the World Bank Operational Policy (OP) 4.01: Environmental Assessment and Pest management (OP/BP 4.09) have thus been triggered with respectively and categorized as B project. Thus three safeguards instruments have been prepared which include: This updated Medical waste Management Plan; and two other standalone but complimentary documents, viz: Integrated Pest Management Plan; and Environment and Social Management Framework.

The ESMF provides guidance for addressing potential environmental and social impacts that may result from civil works and the IPMP provides a comprehensive integrated management plan for pests and related, associated or induced activities in the eventual project locations.

To deal with the relevant environmental issues, especially the potential adverse impacts that would result from medical emergencies and epidemic outbreaks such as hazardous wastes from the labs, pathogens and sharps, it has become necessary to prepare this Medical Waste Management (MWP) to ensure that appropriate and responsive medical waste management is entrenched to the system.

REDISSE will be implemented in five counties: Guinea, Liberia, Nigeria, Senegal and Sierra Leone. This **Updated Medical Waste Management Plan covers the REDISSE activities that shall take place in Liberia.**

Liberia, founded in 1847, is the oldest republic in Africa. However, many years of inequitable distribution of resources resulted in a civil conflict that lasted from 1989 to 2003. The conflict devastated all forms of infrastructure, including the health system, and caused an economic collapse from which Liberia is yet to recover from. This situation was further worsened with the onset of the Ebola Virus disease which posed very great challenge to the entire health and waste management system and generally, the current status of healthcare waste management requires much to be deserved. The situations reveals that there are inadequate containers for the collection of waste, inadequate identification of waste, poor disinfection, inadequate storage before incineration, inadequate disposal of the ash etc.

This led to the update of the Waste Management Plan of the Health Sector Reconstruction and Development Project (HSRDP) to include mitigation of healthcare waste management protocols for the EVD outbreak. This has further been reviewed to include the REDISSE project.

A number of activities have been outlined in the Plan to consolidate the existing MWM (HCWM) Plan and ensure best possible platform for waste collection, treatment, transport and disposal. Without appropriate structures and equipment no HCWM related interventions are possible within the HCI. Hence solutions suggested in terms of equipment are:

- providing HCI with buckets (1/Health Center; 10/Hospital), trolleys (1/Center; 4/Hospital), sharps containers, protective clothing, storage equipment and sharps destroyers;
- rehabilitating existing HCWM structures;
- Provide each county with one autoclave for sterilization;
- An incinerator;
- Provide each municipality with a “Montfort” type incinerator;
- Provide HCI with cesspits (1/Health Center;10/Hospital);
- Provide HCI with sharps destroyers (1/Health Center;10/ Hospital)

Investment on citizen’s training is a mandatory condition for development. Beyond the regular functioning of the regular teaching system (basic school, secondary school and university), there is a need for professional training, namely training for the personnel who are directly involved in the HCWM processes. The current training program at the Tubman National Institute of Medical Arts (TNIMA) at the John F. Kenney Medical Center will be strengthened to produce Environmental Health Technicians that are trained in Health Care waste management. The training plan will include several courses with several formats: On a central level a Training of Trainers course (HCWM trainers) will be carried out. On a county level the following courses will take place:

- Training course on organization and HCWM within HCI;
- Training course for maintenance and collection / cleaning personnel;
- Training courses for health care professionals;
- Training courses on landfills and incinerator operators.

Projects can only be implemented if people are aware of their importance. General population (including a special attention to youth) and particularly involved agents should be strongly sensitized, so that a HCWM program can be successfully implemented. For that purpose, it is required that the message is assimilated by the population. As mentioned, there are three target groups with

different communication related requirements: health care personnel, youth and general population.

Regarding the entire project, an external evaluation will be performed in three distinct moments: at the beginning of the project, during mid-term of project implementation and at the end of the project. The execution of this plan can only be truly efficient with continuous and proactive cooperation of some entities and agents who are directly involved with health care waste management issues. Synergies created by the foreseen team-work will boost optimism to address this important problem in Liberia.

The main entities involved are the Central Government, the Ministry of Health and Social Welfare, EPA, the Ministry of Education, the Ministry of Public Works, Local Governments, Public and Private Health Establishments, NGOs, Community Based Organizations, Religious Organizations, the Media, and several Development Partners (WB, UNICEF, WHO, AfDB, bilateral cooperation, training institutions etc.

The quantification of presented needs correspond to a minimum platform for the improvement of the Health Care Waste Management System. The goal of this minimum platform is to conciliate suitable solutions, in order to guarantee health care waste disposal, with controlled environmental impact, and reasonable investments.

In the implementation of the Health Care Waste Management Plan there will be the opportunity to install waste treatment and disposal facilities which are more “environmentally friendly”. Also, it will be possible to perform these improvements within a larger number of HCIs. The control of all the health care waste in Liberia will have to be attained in a progressive way.

The table below shows an indicative budget breakdown of the cost for implementing the HCWMP.

	Activities	Cost US\$
1	Infrastructure and Equipment Plan (basic equipment for good housekeeping, interim storage and areas for carrying out the maintenance of the waste equipment	220,000.
	A centralized waste treatment facility for hazardous healthcare waste in Montserrado / Monrovia region	250,000.00
2	Training plan	
	National HCW Training Program	72,500.00
	Training for Inspection & supervision System	100,000.00
	Behavior change & public awareness plan	870,000.00
3	Monitoring and Evaluation	80.0000.00
4	Documentation and Information	25,000.00
5	Incidentals	10,000.00
	Total	1,547,500.00

Indicative Budget of MWM Plan Implementation

1.0 INTRODUCTION

1.1 Project Background

Over the last four decades, the world has witnessed one to three newly emerging infectious diseases annually. Of infectious diseases in humans, the majority has its origin in animals (“zoonotic” diseases), with more than 70% of emerging zoonotic infectious diseases coming from wildlife. Recent outbreaks such as Ebola Viral Disease (EVD), H7N9 avian influenza, Middle East Respiratory Syndrome (MERS-CoV), Marburg virus, Nipah virus infection, bovine spongiform encephalopathy and HIV/AIDS showcase the catastrophic health and economic effects of emerging zoonotic diseases. The West Africa region is both a hotspot for emerging infectious diseases (EIDS) and a region where the burden of zoonotic diseases is particularly high. In this region, emerging and re-emerging diseases at the human-animal-ecosystems interface are occurring with increased frequency. As evidenced by the recent Ebola epidemics in Guinea, Sierra Leone, and Liberia, and the re-occurrence and spread in of Highly Pathogenic Avian Influenza (HPAI) (H5N1), highly contagious diseases can easily cross borders in the region through the movements of persons, animals and goods.

The impacts of infectious disease outbreaks can be devastating to the fragile social and economic situation of countries. Overall, the estimated loss in Gross Domestic Product (GDP) for the 15 countries in the ECOWAS region was approximately US\$1.8 billion in 2014, and was expected to rise to US\$3.4 billion in 2015 and US\$4.7 billion in 2016. These add to the ongoing burden of neglected and endemic human and animal diseases, including zoonoses.

Against this background, it has become necessary to implement the WEST AFRICA REGIONAL DISEASE SURVEILLANCE SYSTEMS ENHANCEMENT PROJECT (REDISSE) which is an interdependent series of projects (SOP) that will eventually engage and support all 15 ECOWAS member countries. This is the first project in the series, REDISSE-SOP1 which targets both extremely vulnerable countries (Guinea, Sierra Leone and Liberia) and countries which have more effective surveillance systems and serve as hosts for important regional assets (Nigeria and Senegal). Phase 2 (REDISSE-SOP2) is expected to be delivered in the second quarter of Fiscal Year 17 (FY17). The estimated project financing for REDISSE-SOP2 is US\$102 million. FY17 delivery of this project will allow additional time for consultations, assessments and planning needed to ensure country readiness. REDISSE-SOP2 countries will include: Cote d’Ivoire, Guinea Bissau, Ghana, Togo, Benin and possibly The Gambia. Together, REDISSE SOP 1&2 constitute a block of equatorial, coastal countries with shared borders and similar epidemiologic profiles which extends from Senegal in the west to Nigeria in the east. The series of projects will be implemented in the context of the African Integrated disease surveillance and Response Strategy, international standards and guidelines of World Health Organization (WHO), World Organization for Animal Health (OIE), and Food and Agriculture Organization of the United Nations (FAO), fostering a One Health Approach.

It will support the countries to establish a coordinated approach to detecting and swiftly responding to regional public health threats. Cooperation among West African countries to prevent and control potential cross-border diseases is a regional public good.

The regional benefits and positive externalities of effective disease surveillance and response are substantial. The West African Health Organization (WAHO) and the Regional Animal Health Center (RAHC) (Centre Régional de Santé Animale-CRSA, based in Bamako), both of which are affiliated with ECOWAS, will be responsible for the regional coordination, as well as implementation of specific regional activities and day-to-day oversight of the Project. Collective action and cross-border collaboration are emphasized throughout the Project: (i) the Project will support countries' efforts to harmonize policies and procedures;

(ii) countries will be empowered to engage in joint planning, implementation and evaluation of program activities across borders at regional national and district levels, and; (iii) the Project will promote resource sharing of high cost specialized assets such as reference laboratories and training center and pooled procurement of difficult to access commodities.

1.2 Sectoral and institutional Context:

Like in other developing countries, the performance of health systems in many countries in West Africa is weak. They suffer from chronic insufficient financial and human resources, limited institutional capacity and infrastructure, weak health information systems, prevailing inequity and discrimination in availability of services, absence of community participation, lack of transparency and accountability, and a need for management capacity building. Public sector spending on health is generally low. Only Liberia exceeded the Abuja target of 15% of Gross Government Expenditure (GGE) allocated to health. Out of pocket spending on health was high ranging from a low of 21% in Liberia to a high of 76% of total health expenditure in Sierra Leone. Guinea, Liberia and Sierra Leone have low density and inequitable distribution of health services and health workers as a result of low production, low motivation, inadequate training, lack of quality supplies and the loss of health workers, particularly physicians and nurses to emigration (a.k.a. brain drain). This was further aggravated during the EVD outbreak, which took a high toll on the lives of health workers.

Country led self-assessment on disease surveillance, preparedness and response capacity in Guinea, Liberia, Nigeria, Senegal and Sierra Leone as well as the lessons learnt from the EVD outbreak revealed some key weaknesses of health systems in terms of infectious disease surveillance, epidemic preparedness and response. These include: (i) a fit for purpose health workforce for disease surveillance, preparedness and response is lacking at each level of the health pyramid; (ii) community level surveillance and response structures either do not exist or need significant improvement; (iii) there is limited availability of laboratory infrastructure in place for timely and quality diagnosis of

epidemic-prone diseases; (iv) lack of interoperability of different information systems hampers analysis and utilization of information for decision making and actions for disease mitigation measures; (v) infection prevention and control standards, infrastructure and practices are generally inadequate; (vi) management of the supply chain system is weak and inefficient; and (vii) there are significant gaps in regional level surge capacity for outbreak response, stockpiling of essential goods, information sharing and collaboration. Similar findings were also documented by the Global Health Security Agenda baseline assessments in a number of countries including Liberia, and Sierra Leone.

After the EVD outbreaks, health system recovery and strengthening plans were developed for at least the next five years in Guinea, Liberia and Sierra Leone. Building up a resilient health system to effectively respond to health emergencies has universally been identified as one of the strategic pillars in the plans. At the national level, broad-based health system strengthening committees or similar structures have been established to lead and coordinate the efforts for strengthening the national health system in the three countries. With the help from USAID, a plan for health system strengthening was also developed in Senegal. In all five countries REDISSE will build on and complement the ongoing health system strengthening initiatives of the national governments that are supported by the Bank and other development partners.

Animal Health:

The animal health sector in the ECOWAS region is characterized by a high incidence and prevalence of infectious diseases, communicable diseases, both zoonotic and non-zoonotic, impacting veterinary and public health, trade, rural development and livelihoods. Among the most serious infectious diseases, contagious bovine pleuropneumonia (CBPP), foot and mouth disease (FMD), African Swine Fever (ASF), Rift Valley Fever (RVF), Peste des Petits Ruminants (PPR), African Animal Trypanosomiasis (AAT), highly pathogenic avian influenza (HPAI), and rabies are highlighted by ECOWAS and the GF-TADs for Africa. A recent summary of evaluations of Veterinary Services by the World Organization for Animal Health (OIE) in ECOWAS countries highlighted the services' lack of budgetary resources and mismatch between the human resources required and those actually available for preventing and controlling animal diseases. In terms of the strategic action required to sustain animal health, all of the countries identified the need to improve the coverage of their surveillance programs as well as the control of high-priority animal diseases. Lack of preparedness, insufficient human, physical and financial resources, and the lack of cross-sector collaboration were again emphasized by the FAO and OIE as causes for failure to address promptly and efficiently the resurgence of highly pathogenic avian influenza in the region.

Improvement of animal health requires increased and sustained investments in national Veterinary Services to meet international standards of quality defined by the OIE. Any country failing to prevent, detect, inform, react and control sanitary issues, such as

infectious diseases or antimicrobial resistance places other countries at risk, hence the importance of regional approaches. All countries in the region have engaged in the OIE Performance of Veterinary Services (PVS) Pathway, a program which provides independent qualitative (PVS evaluation) and quantitative (PVS Gap Analysis) evaluations of Veterinary Services, identifying their strengths and weaknesses, prioritizing interventions and costing activities needed to address deficiencies. Some countries have also received support to review their veterinary legislation.

Insufficient government funding and limited interest from donors to support Veterinary Services have not allowed significant progress to date in addressing systemic issues. Some important programs are worth noting though in the animal health sector, such as the EPT2 program, financed by USAID and implemented in many of the ECOWAS countries, through FAO and other implementing agencies; FAO support to HPAI infected countries; and, AU-IBAR support through the Vet-Gov program. In the last 15 years, two main regional and global programs significantly contributed to strengthening national Veterinary Services, namely the PACE program and the World Bank financed Avian Influenza Global Program which were implemented in many countries of the region. The lessons and best practices derived from these two programs are reflected in this project. The RESEPI and RESOLAB networks were also supported and facilitated by FAO under different projects and handed over in 2012 to ECOWAS.

Animal health is seen as a priority by the two regional economic communities in West Africa. ECOWAS and WAEMU have set a target of harmonizing national animal health systems. WAEMU, which covers 8 countries in the region, has moved forward on a number of fronts in particular on the harmonization of regulations on veterinary medicinal products, but progress has been slow due to administrative, human, organizational and financial constraints. In 2012, ECOWAS member countries declared the Regional Animal Health Center (RAHC) – an informal platform originally set up in 2006 by OIE, FAO and AU-IBAR as the ECOWAS specialized technical center for animal health. An operational plan for RAHC was developed in August 2014. However, delays in staff recruitment and establishment of a dedicated operational budget have kept the institution from implementing this plan and rolling-out activities in accordance with its mandate. The RAHC is currently supported through a limited number of initiatives with specific objectives, including to further develop the One Health agenda in the region, and to develop Integrated Regional Coordination Mechanisms for the Control of TADs and Zoonoses (IRCM). The WB-financed Regional Sahel Pastoral Support project (PRAPS), which supports the improvement of animal health in 6 West African Sahel countries, also specifically aims at contributing to the operationalization of the RAHC.

Tackling multispectral issues efficiently requires working across sectors and disciplines. Yet, very few countries have adopted coordinated approaches, along the lines of the “One Health” concept.

The response to the HPAI crisis since 2005 contributed to enhancing cooperation between the human and veterinary health sectors in many countries in the region, but in the absence of a dedicated program incentivizing such a joint approach, silos remain established. Nonetheless, important lessons have been learned and experience gained, and successful regional programs for the control of selected priority diseases, both within and outside the region, have demonstrated the efficiency of a regionally coordinated approach to diseases surveillance and response.

The Development Partner landscape in the sub-region is complex, particularly in the three countries most affected by the 2014-2015 EVD epidemic. The Ebola outbreak triggered a significant international response that brought many partners together to address the crisis and support the post-Ebola agenda of health systems recovery and strengthening. It also highlighted the need to focus attention on building the capacity for disease surveillance and response in the sub-region for both human and zoonotic diseases. The development partners engaged on these issues in the sub-region include major donor organizations including development banks, multilateral and bilateral donors and private foundations; UN systems agencies; technical agencies such as the US and China Center for Disease Control and Prevention; academic and research institutions and large numbers of international and local non-governmental organizations. As noted in Annex 2, in this type of environment, duplication of effort, inefficient use of resources and failure to address resource, policy and programmatic gaps is a substantial risk. It is expected that there will continue to be an influx of funds and other forms of support to the region, in particular, to the three EVD affected countries (Guinea, Sierra Leone, and Liberia) in the next three to five years. As a result, coordination of resources and activities offered by the various partner organizations will remain a significant challenge for national governments. Therefore, coordination mechanisms at both national and regional levels that engage both the human and animal health sectors need to be developed to maximize the impacts of the increasing support and foster sustainability of the anticipated outcomes. The World Bank's convening power will be highly instrumental in forging a coalition of national, regional, and global technical and financial institutions to support the disease surveillance and epidemic preparedness agenda in West Africa.

The World Bank is well placed to mobilize substantial financing for this multi-sector initiative and to convene premier technical and financial partners engaged in the field of disease surveillance and epidemic preparedness. The World Bank has strategically engaged with a core group of development partners including those implementing the Global Health Security Agenda (GHSA) in the development of the REDISSE project. The REDISSE project itself will provide resources to regional institutions and national governments to establish the needed coordinating mechanisms

1.3 REDISSE Project Development Objective (PDO) and Components

The project's development objective (PDO) is to strengthen national and regional cross-sectoral capacity for collaborative disease surveillance and epidemic preparedness in West

Africa. It will address systemic weaknesses within the animal and human health systems that hinder effective disease surveillance and response.

The REDISSE Project has five components as follows:

Component 1: Surveillance and Information Systems. *Total costs including contingencies US\$62.32 million equivalent of which US\$50 IDA Credit and US\$12.32 million MDTF*

This component will support the enhancement of national surveillance and reporting systems and their interoperability at the different tiers of the health systems.

It will support national and regional efforts in the surveillance of priority diseases (including emerging, re-emerging and endemic diseases) and the timely reporting of human public health and animal health emergencies in line with the IHR (2005) and the OIE Terrestrial Animal Health code. Component 1 comprises of three sub-components:

Sub-Component 1.1 Support coordinated community-level surveillance systems and processes across the animal and human health sectors (US\$27 million).

This sub-component will involve the strengthening of community-level surveillance structures and processes in countries where gaps exist for detecting events in communities (human and animal). This will entail improving community-level surveillance capacity for active, passive and rumor surveillance including in cross-border areas, and the development and implementation of a plan to ensure adequate territorial coverage for surveillance from the community to the central level.

Sub-Component 1.2 Develop capacity for interoperable surveillance and reporting systems (\$20 million)

Sub-component 1.2 will support: (i) assessment of existing human and animal health surveillance systems and networks for prioritization of interventions within and across key sectors; (ii) review and update of national and regional disease priorities, and review and development of harmonized guidelines, protocols and tools to enhance surveillance and reporting processes; (iii) development of common methodologies and protocols for efficient flow and utilization of surveillance data (applicable to both public and private actors involved in disease surveillance); (iv) development of the required information communication and technology (ICT) infrastructure to facilitate cross-sectoral interoperability of surveillance and reporting systems at the national and regional level; and (v) establishing the necessary linkage of surveillance and reporting systems to national incidence management systems.

Sub-Component 1.3 Establish an early warning system for infectious disease trends prediction (US\$14 million)

This sub-component will involve the establishment of an early warning system including the use of Geographic Information System (GIS) techniques to study infectious disease patterns and make predictions on evolution of disease outbreaks, including zoonoses and identify potential high risk areas for disease outbreaks in the region. Activities under this will support the monitoring of trends that occur in infectious diseases such as antimicrobial resistance (AMR) and insecticide resistance, and the impact of climate change on infectious disease outbreaks in the region.

Component 2: Strengthening Laboratory Capacity (US\$58 million)

The objective of this component is to establish networks of efficient, high quality, accessible public health, veterinary and private laboratories for the diagnosis of infectious human and animal diseases, and to establish a regional networking platform to improve collaboration for laboratory investigation. This component is divided into three sub-components.

Sub-Component 2.1 Review, upgrade and network laboratory facilities (US\$28 million)

This sub component will include: (i) assessment of existing human and animal health laboratory facilities and networks for prioritization of interventions; (ii) increasing laboratories services, and biosafety and biosecurity; (iii) support for improved supply chain management including the establishment of efficient inventory tracking and management systems; (iv) technical support for integrated laboratory information systems and the interoperability with disease surveillance and reporting systems; and (v) support to the strengthening of quality assurance systems for diagnostic services.

Sub-Component 2.2 Improve data management and specimen management (US\$12 million)

This sub-component will support strengthening specimen management including: (i) streamlining the laboratory specimen referral process, including use of strengthened sub-national laboratories for diagnosis rather relying on a central laboratory; where possible and (ii) improving efficiency of specimen transport and disposal systems including through the use of private sector partnerships, and the use of accredited private laboratory networks for case confirmation.

In addition, measures to improve data management will include: (i) strengthening the competencies of laboratory personnel to analyze and use laboratory surveillance data; (ii) strengthening laboratory data management systems to 'report up' and 'report down' more effectively; (iii) achieving interoperability between data management systems, where possible.

Sub-Component 2.3 Enhance regional reference laboratory networking functions (US\$18 million)

This sub-component will provide support to improving quality assurance, notably (i) development of common standards, quality assurance systems, procedures and

protocols; (ii) introduction of peer review mechanisms; (iii) application of the WHO/AFRO five-step accreditation process and technical assistance to support accreditation of laboratories; and (iv) support inter-laboratory external quality assessments among the participating countries and recruitment of experts to provide mentorship to laboratories. It will (i) strengthen existing and possibly identify new regional reference laboratories for specific diseases or diagnostic techniques, (ii) strengthen regional networking and information sharing between countries; and (iii) harmonize laboratory quality assurance policies across countries in the region, based on international standards

Component 3: Preparedness and Emergency Response (US\$34 million)

This component will support national and regional efforts to enhance infectious disease outbreak preparedness and response capacity. It will be made up of two sub-components:

Sub-Component 3.1 Enhance cross-sectoral coordination and collaboration for preparedness and response (US\$16 million)

This sub-component will support (i) partnership building activities (including the private sector) for outbreak preparedness and disaster risk management; (ii) improvement and harmonization of policies, legislations, and operating procedures that includes representation from other relevant sectors including environment, customs/immigration, education, law enforcement; and (iii) explore the establishment of national and regional financing mechanisms to ensure swift mobilization of resources for animal health and public health emergencies.

Sub-Component 3.2 Strengthen Capacity for emergency response (US\$18 million)

This sub-component will support the strengthening of emergency operations centers (EOC) and surge capacity at the national and regional levels. Activities under this sub-component will support (i) the establishment and management of a database of multidisciplinary rapid response teams (MRRTs) that will be available for rapid deployment; (ii) the development and management of stockpiling mechanisms (virtual and physical) to ensure availability of supplies to countries during an emergency response; and (iii) the swift mobilization and deployment of resources in response to major infectious disease outbreaks.

Sub-Component 3.3 US\$0 Component for emergency response.

When a major outbreak affects the livelihoods of project beneficiaries, governments may request the World Bank to reallocate project funds to support mitigation, response and recovery. Detailed operational guidelines acceptable to the World Bank for implementing the REDISSE US\$0 component for emergency response activity will be prepared at the national level during the first year of the project's implementation. All expenditures under this activity will be in accordance with paragraph 12 of World Bank OP 10.00 (Investment

Project Financing) and will be appraised, reviewed, and found to be acceptable to the World Bank before any disbursement is made. Disbursements will be made against an approved list of goods, works, and services required to support crisis mitigation, response and recovery. Triggers and implementation details of the \$0 component will be clearly outlined in the Project Implementation Manual (PIM) acceptable to the World Bank.

Component 4: Human resource management for effective disease surveillance and epidemic preparedness (US\$47 million).

This component will include two sub-components:

Sub-Component 4.1 Health Workforce mapping, planning and recruitment (US\$25 million)

This sub-component includes: (i) assessments of current workforce in terms of quantity, geographical distribution and capacity (including private actors); (ii) strengthening capacity for human resource management for disease surveillance and response; (iii) supporting the capacity of governments to recruit health workers and create an incentive environment which encourages skilled individuals to work for the public sector; and (iv) using private actors to deliver public sector activities through delegation of power (e.g. sanitary mandates for veterinarians).

Sub-Component 4.2 Enhance Health Workforce training, motivation and retention (US\$22 million)

This sub-component includes training to develop human resource capacity in surveillance, preparedness and response. Cognizant of the importance of community involvement in disease surveillance, a key lesson from the Ebola crisis, the project places emphasis on training at the community level, rather than focusing solely on higher level cadres.

The project will analyze and seek to address the incentive environment within which healthcare workers operate. Armed with an improved understanding of this environment, the project will seek to implement activities which create incentives which not only draw those with relevant skills to the public sector, but also improve staff motivation and retention.

Component 5: Institutional Capacity Building, Project Management, Coordination and Advocacy (US\$41 million)

This component will include two sub-components:

Sub-component 5.1 Project coordination, fiduciary management, monitoring and evaluation, data generation, and knowledge management (US\$30 million)

Under this sub-component, REDISSE will (i) strengthen the capacities of national and regional institutions to efficiently perform core project management functions including

operational planning, financial management, procurement arrangements, and environmental and social safeguards policies in accordance with WB guidelines and procedures; (ii) enhance M&E systems including routine health management and information systems (HMIS) and other data sources, including bi-annual Joint External Evaluations (JEE) of IHR (2005) and the PVS pathway; (iii) manage operational research program and economic analysis of disease outbreaks and epidemics in the ECOWAS region implemented by national and regional institutions; (iv) promote the design of impact evaluation studies to measure impact of project interventions; and (v) coordinate the roles of existing national and regional institutions to better support the planned project activities. Both the R-PCU and the individual N-PCUs will work closely with national environmental and social agencies to ensure due consideration of their respective legislations.

REDISSE will also finance the generation of data on animal and human health activities in the ECOWAS countries, which is critical to guide and calibrate investments.

Sub-component 5.2 Institutional support, capacity building, advocacy, and communication (US\$11 million)

This sub-component will help assess and build capacities at national and regional level.

It will provide technical and investment support to enhance provision of services by WAHO and other cross-cutting regional institutions or organizations relevant to animal and human health sector development. To this end, the project will support: (i) the conduct of capacity gap analysis (including staffing, skills, equipment, systems, and other variables); (ii) identify potential synergies and cross-fertilization possibilities among various operations pertaining to disease surveillance and response, using a progressive pathway for OH operationalization at country level, supported by regional institutions; and (iii) establishment or upgrading of national public health institutions. REDISSE will also assist in supporting greater engagement and coordination of the five countries in regional decision- and policy-making processes in ECOWAS, as well as among regional public and non-public organizations.

REDISSE will support advocacy and communication for sustained One Health approach. This will include: (i) generation and dissemination of lessons learned at the national and regional levels through One Health (OH) national and regional platforms respectively; and (ii) raising awareness on strategic issues at the decision and policy levels of countries, and regional economic communities to increase and sustain allocation of resources for disease surveillance, preparedness and response.

Project location:

REDISSE will be implemented in five counties: Guinea, Liberia, Nigeria, Senegal and Sierra Leone. This **Updated Medical Waste Management Plan covers the REDISSE activities that shall take place in Liberia.**

1.4 Rationale for Preparation of Relevant Safeguard Documents:

Essentially, the REDDISSE project will include some rehabilitation/construction of buildings and laboratory investigational activities. These have been considered to have negative impacts on the environment and possibly humans. To this end, the Bank has agreed that REDISSE project which is a category B project, triggers two World Bank safeguards policies, namely: Environmental Assessment (OP/BP 4.01) and Pest management (OP/BP 4.09) respectively. Thus three safeguards instruments have been prepared which includes: This updated Medical waste Management Plan; and two other standalone but complimentary documents, viz: Integrated Pest Management Plan; and Environment and Social Management Framework.

The ESMF provides guidance for addressing potential environmental and social impacts that may result from civil works and the IPMP provides a comprehensive integrated management plan for pests/animal disease control and related, associated or induced activities in the eventual project locations.

1.5 Purpose of the Health Care Waste Management Plan (HCWMP):

The Proposed REDISSE project constitute a project that would most certainly yield health care waste, such as sharps (needles, scalpels, blades, etc.), non-sharps (blood and other body fluids, infected or not, chemicals, pharmaceutical products), and medical equipment. These Health care waste constitutes an important factor concerning environmental degradation, a factor of significant health risk threatening peoples' quality of life. Especially due to mismanagement, the risk of infection could be high among healthcare professionals, cleaning and sweeping personnel, maintenance personnel, patients and visitors, as well as the community as a whole.

Thus, managing correctly this specific kind of waste represent an important concern for governments and deserve a special attention by institutions and the population in every country. The definition and implementation of a suitable Health Care Waste Management Plan as represented by this updated plan is an important step leading to increased quality of life, health related costs reduction and new recycling opportunities. A proper Health Care Waste Management Plan should consider topics like policies and laws/regulations definition, human resources, allocation of financial resources and training and awareness raising programs, for people involved in the Health Care Waste

subject (health care personnel, cleaning personnel, etc.) and also for general population, regarding infectious diseases (like HIV/AIDS), EVD and other transmittable diseases (like tuberculosis) or endemic diseases (like malaria).

1.7. Methodology for Preparing this Medical Management Plan:

In recognition of the looming timelines and to avoid re-inventing the wheel, the approach adopted for preparing the relevant instruments including this MWP was review the existing safeguards instruments, with adjustments as needed, to suit the REDISSE program:

Thus this revised Updated Liberia Medical Waste Management Plan is based on the updated version of March 2015 which had based its update on June 2009 one. The following documents formed an integral and important part of the updated MWP:

- The Draft Policy: National Healthcare Waste Management Policy, 2009;
- The Draft Guideline: Safe Management of Healthcare Waste in Liberia;
- Task Report A1: Legal Analysis of the HCW situation in Liberia;
- Task Report A2: Healthcare Waste Baseline study;
- Task Report A3: Assessment of the Healthcare waste management situation in Liberia;
- Task Report B1: Determination of the medical waste treatment technology in Liberia;
- Task Report B2: Determination of the medical waste disposal sites;
- Task Report B3: Financing possibilities for medical waste;
- Task Report B4: Estimated equipment and materials required to implement MWMP;
- Task Report C1: Development of a HCW Training Program;
- Task Report C2: Liberia Healthcare Waste Management Behavior Change;
- Communication and Public Awareness Strategy.



2.0 COUNTRY BASELINE INFORMATION

2.1.1 Location, Size and Characteristics

Liberia is situated on the southwest corner of the West Coast of Africa. It lies between the longitudes of 7°30' and 11°30' west and latitudes 4°18' and 8°30' north. It covers a surface area of about 111,370 km² (about 43,506 square miles). The dry land extent is 96,160 km² or 37,570 sq. miles. Liberia is bordered on the west by Sierra Leone, on the north by Guinea, on the east by Côte d'Ivoire and on the south by the Atlantic Ocean. The perimeter is 1,585 km (990 miles), excluding the Atlantic Ocean. The border with Guinea is 563 km (352 miles), Côte d'Ivoire 716 km (446 miles), and Sierra Leone 306 km (191 miles).

There are four topographical regions at different altitudes, each with distinct physical features. Along the sea coast is the coastal plain of 350 miles (560 km), an almost unbroken sand strip, which starts from the lowest elevation up to 30 meters above sea level. Next to the coastal plain is the belt of inundated plateau followed by the belt of high lands and rolling hills in the north and northwest. The lowest point is the Atlantic Ocean at zero meters and highest elevation is the northern highlands, which includes Mount Wutivi (1380 meters), the highest point in Liberia.

2.1.2 Demography

The last population census of Liberia was conducted in 1984. Since then, the Ministry of Planning & Economic Affairs has updated its population projections. Its 2006 population estimate is 3.2 million, with a growth rate of 2.1%. Population density is 84 per square mile. Population distribution is very uneven, with four counties hosting 70% of the total population. The South-East is very sparsely settled. The age-group 0- 18 years accounts for about 54% of the population. Nearly 15% are under 5 years of age while approximately 3% of the population is over the age of 65. Average life expectancy at birth is estimated by WHO (2006) at 42 years, with 44 years for women and 39 years for men. The current fertility rate is estimated to be 6.8 (DHS, 1999). Three out of every four women age 20-24 years have had a child. The use of modern family planning methods among women is 11.3%. The average household size is 5.1.

2.1.3 Mortality and Morbidity

The infant mortality rate is currently estimated to be 157/1,000 live births – well above the Sub-Saharan Africa average of 102/1000 live births and the world average of 54. The under-five/child mortality rate is also high, at 235/1,000 live births. Liberia ranks above the Sub-Saharan Africa average of 171/1,000 live births and the world average of 99/1,000. In 2005, the maternal mortality ratio was estimated by UNFPA at 580/100,000 live births. The crude mortality rate was recently estimated in rural areas at the alarming level of 1.1 deaths per 10,000 persons per day (CFSNS, 2006). Malaria, acute respiratory infections, diarrhea, tuberculosis, sexually transmitted diseases (STDs), worms, skin diseases, malnutrition, and anemia are the most common causes of ill health. Malaria accounts for over 40% of OPD attendance and up to 18% per cent of inpatient deaths. Diarrheal diseases in Liberia are the second leading cause of morbidity and mortality. HIV prevalence rate estimates vary widely, but the Interim Poverty Reduction Strategy (IPRS) suggests a figure of 5.2%. All agree, however, that HIV/AIDS is a problem of mounting severity. Existing data are inadequate to draw firm conclusions about internal variations in HIV prevalence. It appears that Monrovia and the south-eastern region have higher HIV prevalence rates than the rest of the country.

2.1.4 Mortality and Morbidity

Approximately 27% of children under-five years are underweight. In addition, an estimated 7% are wasted, while 39% are stunted (CFSNS, 2006). These values are remarkably similar to those registered by the National Nutrition Survey of 2000. In the same year, iron deficiency anemia was 87% in children 6-35 months, 58% in non-pregnant women 14-49 years, and 62% in pregnant women aged 14-49 years. Vitamin A deficiency affects 52.9% of children 6-35 months and 12% of pregnant women. Only 35% of children below 6 months of age are exclusively breast fed (UNICEF). Zinc supplementation for children has not yet been introduced.

2.1.5 Water and Sanitation

Access to safe water declined from 58% of households in 1997 to 24% in 2005, due to the destruction of piped water facilities in urban settings (UNDP, 2006). Nationwide; -26% of households have access to sanitation but significant rural/urban disparities exist- with sanitation available to 49% of urban residents and only 7% of rural residents (UNICEF, 2006). However, the problem of poor sanitation is particularly acute in cities. The collapse of waste disposal and sewage services and an increase in population have led to extremely poor sanitary conditions in urban areas - especially in Monrovia - generating serious environmental and health problems.

2.1.6 Access to Health Care

Liberia's health services have been severely disrupted by conflict. Health workers fled to camps for internally-displaced people (IDPs), to secure areas or to neighboring countries. Health facilities were looted and vandalized and medical supplies became unavailable. Government funding stopped and health services collapsed (UNDP,2006). Following the end of the war, the revitalization of the health services has begun, but the health situation is still poor. The dearth of accurate data on health service access and utilization makes most considerations in this respect only tentative. Available estimates are grossly divergent, suggesting that overall they are unreliable. The Interim Poverty Reduction Strategy (IPRS, 2006) reports that 41% of the population has access to health services. Most data suggest low service consumption and gross imbalances across Liberia. The last EPI survey carried out in 2004 found that less than one third of children received a 37 DPT-3 shot. EPI reporting has since shown improvements with DPT-3 at 87% and Measles at 94% (WHO immunization monitoring 2005).

2.1.7 Health Care Delivery and Resources

Health care delivery is fragmented and uneven, heavily dependent on donor-funded vertical programs and international NGOs. Disease prevention, and control programs exist for malaria, leprosy, tuberculosis, STDs/HIV/AIDS, and onchocerciasis. Humanitarian relief agencies concentrated their interventions in the most war-affected areas and where refugees and IDPs were resettling. Many health care providers including Community Health Workers are funded by emergency programs, which are being withdrawn as the country stabilizes. The gap created by the reduction in funding for emergency assistance, before development aid starts flowing, has the potential to disrupt health care provision, as witnessed in other post-conflict settings. In 1990 there were 30 Hospitals, 50 Health Centers and 330 Clinics functional. In 2006, 18 hospitals, 50 health centers and close to 286 health clinics were considered to be functional (RAR, 2006). Many of these facilities struggle to attain acceptable performance levels, and are in need of robust infrastructural interventions to become truly functional and respecting referral functions. The hospital component

of the health sector is under-sized. Its technical capacity is grossly inadequate. Large investments are already under way to restore the functionality of some hospitals.

2.2 Health Needs and Challenges

Enabling the health sector to play a full and effective role implies addressing immediate as well as long-term challenges in a holistic and balanced way. The health needs of a distressed and impoverished population must be alleviated by urgent measures, while starting to invest in the areas that will make the future growth of the health sector possible. The post war needs include:-

- Assurance of quality equitable antenatal care and safety in obstetric practices
- Assurance of child health
- Addressing nutrition issues
- Dealing with the current burden of disease addressing the high fertility rate
- Meeting demand for access to quality health services Development of a social welfare policy and strategy.
- Meeting population requirements to access safe water and sanitation. The immediate challenge is expanding access to basic health care of acceptable quality, through immediate interventions such as:
- Ensuring the availability of funds at county level to support the continuous delivery of basic services;
- Improving the availability of essential medicines and other critical health commodities;
- Rehabilitating health facilities in under-served areas;
- Upgrading the skills of health workers and redeploying them to areas where they are most needed;
- Boosting management capacity at all levels to support the delivery of services. The step in this direction is improving the information base and evaluation capacity;
- Improving availability of safe water and sanitary facilities.

3.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

“ The Republic shall, consistent with the principles of individual freedom and social justice enshrined in this Constitution, manage the national economy and the natural resources of Liberia in such manner as shall ensure the maximum feasible participation of Liberian citizens under conditions of equality as to advance the general welfare of the Liberian people and the economic development of Liberia.1”

This article forms a constitutional basis for the setup of an active environmental policy (including healthcare waste policy) and to develop national development plans that are environmentally sustainable - including plans for the future management of healthcare waste. The legal analysis of the Healthcare Waste situation in Liberia carried out during

this project showed that no specific policies or regulations explicitly for healthcare waste exist. To exacerbate this shortfall, Liberia also currently lacks resource capacity to empower regulatory bodies to effectively monitor and ensure compliance where environment-related permit requirements do exist. Although several requirements exist for carrying out environmental impact assessments for proposed projects, these requirements are rarely enforced.

In order to develop appropriate and tailored environmental acts for Liberia, public participation is crucial. This principle is enshrined in Liberia's National

Environmental Policy which not only encourages community participation, but sets out general objectives on how to achieve it. Given the significance of public participation, it is important that the Government of Liberia move toward drafting a public awareness campaign concerning waste management. Section 8.2 of this report provides further details on waste management and training for institutions and agencies. In summary, the key legal recommendation from this assessment relates to the existing Environment Protection and Management Law of Liberia. In its current form, this law does not adequately clarify which projects are legally obliged to carry out an environment impact study. By default, this theoretically means all projects are subject, however current practices show that few impact studies are being implemented. It is recommended that the law be further refined to provide clear criteria for determining which projects require environmental assessments. Once a permit is actually provided following a successful impact assessment study, it is also recommended that the current permit validity period of 12 months be extended to at least a multi-year period, which would ease administrative burden.

Specific questions in regard to the legal situation in Liberia considering health care waste are answered in detail in the –Task Report A1: Legal Analysis of the HCW situation in Liberia which can be found in the annex.

3.1 Assessment of the Policy, Regulatory (Legal) and Administrative Framework on Healthcare waste management

For the environmental side, two main acts exist:

An act creating the Environmental Protection Agency which empowers the agency with the principal authority in Liberia for the management of the environment and to coordinate, monitor, supervise, and consult with relevant stake-holders on all activities in the protection of the environment and sustainable use of natural resources;

An act adopting the Environmental Protection and Management Law' with sections on air quality standards and solid waste management as well as a draft legislation on ='Persistent Organic Pollutants', and Waste Management'

For the Health side, Article 20 of the Liberia Constitution (6 January 1986) says a. No person shall be deprived of life...|| Article 7 of the Liberia Constitution (6 January 1986) states: —The Republic shall, consistent with the principles of individual freedom and social justice enshrined in this Constitution, manage the national economy and the natural resources ... as to advance the general welfare of the Liberian people.|| The relevant law is the public health law from 1975. In Part III, environmental sanitation is covered. §21.1 specifies that improper management of waste can result in nuisance which is prohibited in accordance with §21.2. Chapter 24 regulates liquid waste (water pollution control). Between 2005 and 2007, within an initiative of the Ministry of Health and Social Welfare (MoH&SW) in cooperation with UNICEF and WHO, the National Policy on Healthcare Waste Management (Draft) was developed. However, this document was never implemented. The policy was also supported by set of documents which elaborate basics of the healthcare waste management in specific areas:

- National Policy on Injection and Healthcare Waste Management. Draft. MoH&SW, September 2005; Immunization Safety Policy and Plan of Action 2006 - 2010. Expanded Program On Immunization and
- Liberia Policy Guidelines for Safety Measures and Management of Waste In Blood Transfusion Program, prepared by Dr Michel Toukam, December 2006.
- The above documents on healthcare waste were not distributed to the stakeholders, and not implemented. No other official documents on healthcare waste management have been issued by MoH&SW, Ministry of Environment (MoE), or EPA. Liberia is further signatory of several international conventions and agreements, of relevance for healthcare waste management are:
 - Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, 1989
 - Convention on Persistent Organic Pollutants (POPS), Stockholm, 2001
 - Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, 2003 (not yet ratified)

The technical guidelines on the management of healthcare waste issued by the Basel Convention have so far not been implemented in Liberia. Within the Stockholm Convention on Persistent Organic Pollutants (POPs), Liberia is receiving support to develop a National Implementation Plan (NIP). EPA is currently pre-paring legislation on POPs. Liberia is further a member of several United Nations Organizations (e.g. the WHO, UNEP, etc.) but so far has not began implementing the recommendations provided by these organizations. Looking at the administrative framework the following key public institutions can be identified which have a legal mandate to be involved in healthcare waste management:

- i. The Environmental and Occupational Health Division of the MoH&SW has the mandate to assess —the environmental health of the population. This mandates it to

conduct sanitary inspections to evaluate compliance with regard to the Public Health Law.

- ii. The Municipalities have been granted, by the Public Health Law of 1975 (still valid), the responsibility of ensuring clean and sanitary environmental conditions in the territory under their respective jurisdictions. This also includes waste management and healthcare waste. They are thus responsible for sanitation activities including the cleaning, collection and disposal of healthcare waste.
- iii. The Environmental Protection Agency (EPA) is primarily in charge of setting up (developing and publishing) national guidelines for solid waste management in Liberia, environmental quality standards (and related penalties and fines), and ensuring compliance for pollution control. It should also provide guidelines for the preparation of environmental impact assessments (EIAs), audits/inspections and environmental licenses/permits for healthcare waste treatment plants.
- iv. The Ministry of Public Works (MPW) is in principle responsible for the installation of the entire infrastructure required for waste management delivery services, including waste collection and transfer stations, and the construction of engineered landfill sites.
- v. The Ministry of Lands, Mines and Energy (MLME) hosts the Liberian Hydrological Service (LHS) whose responsibility is to evaluate urban sanitation projects, such as to provide guidance for the geotechnical investigation of engineered landfill sites for the disposal of nonhazardous waste generated from Healthcare facilities.

3.2 Identification of permit requirements

Permit requirements concerning operations within the healthcare sector are set by all three environment protection acts: the National Environmental Policy (NEP), Environment Protection & Management (EP&M) Law, and the Act Creating the Environmental Protection Agency.

The NEP and the EPA Act recognize in general that any project or activity that may have impact on human health and the environment shall be subjected to a review, an audit, assessment, or environmental impact assessment (EIA) before being granted a permit. According to Part III (Section 6 to 33), and Annex I of the Environment Protection & Management Law, a permit is required for:

- construction of a public health facility (Annex I, 22),
- hazardous and municipal solid waste generation, collection, storage, transport, treatment and disposal, including incineration plants, and landfills (Section 64; Annex I, 18 a and b),
- Construction of a water supply, well digging, and sewage treatment (Annex I, 19, 22, and 18 c).

A project developer shall submit an application for an environmental impact assessment license (permit) prior to the commencement of all projects and activities to the County

Environmental Officer of the Environment Protection Agency. A project brief shall be also submitted to the Agency and the relevant Line Ministry. Following the submission of the application for an environmental impact assessment permit, the applicant shall publish a notice of intent, which shall state in concise or prescribed manner information that may be necessary to allow stakeholder or interested party to identify its interest in the proposed project or activity. The Agency, in consultation with the Line Ministry, shall evaluate the project brief to determine the potential environmental impact of the proposed project or activity and shall make the following determination:

- If a project may have a significant impact on the environment, the Agency shall require the proponent of applicant to prepare an environmental review in accordance with section 13 of EP&M Law;
- If the project or activity will have or is likely to have a significant impact on the environment and the project brief discloses no sufficient mitigation measures, the Agency shall require the proponent or application to prepare an environmental impact study in accordance with section 14 of the EP&M Law;
- If the project or activity will not have, or is unlikely to have a significant impact on the environment or that the project discloses sufficient mitigating measures, the Agency may issue.
 - i. A finding of no significant impact, a "FONSI", and a notice published and placed on the notice board of the registry of the Agency at its head office and the office of the County Environmental Committee for the information of the public;
 - ii. A certificate of approval; unless the Agency determines that the scope, size and/or sensitivity or the project warrants public consultation prior to the issuance of the certificate of approval.

3.3 Needed public participation or involvement

Article 7 of chapter II of the New Liberian Constitution of 1986 provides for full public participation of all citizens in the protection and management of the environment and consultations with, and the involvement of, a cross-section of stakeholders. Public participation is defined by the Act Adopting the Environment Protection and Management Law of the Republic of Liberia as:

[...] in keeping with the peoples' right to know the potential impacts of decisions being made, the information relating to the right of any person to receive effective notice with relevant information and to review and comment on major decisions with such comments being taken into consideration at the decision making stage; and involves open, ongoing two-way communication, both formal and informal between decision makers and stakeholders – those interested in or affected by the Decisions.

All environmental protection acts ensure that the public have the right to be informed and participate in decision making processes concerning management and protection of the

environment. The acts also encourage state institutions and administrations to conduct appropriate educational activities for environmental awareness-raising and capacity building of the community. The NEP sets general objectives and tasks, rights and procedures for public participation in decision making. The involvement of the citizenry in environmental management and utilization of natural resources is considered as crucial.

People's participation shall be developed and supported by building the capacity of individuals, groups, and communities. It is fundamental that an enabling atmosphere be created to allow for public education on environmental matters, scope for public participation in decision making processes, and active involvement of NGOs, CBOs, PVO's and youth clubs.

The NEP is encouraging individual and community participation in improving the environment. Participation of the people in resource management and environmental protection is intended not only to enlist their support, but to also influence change in their behavior and attitudes. The processes to be followed for public participation is defined by the Environment Protection and Management Law (EP&M Law), and the EPA Act.

The EP&M Law underscores in Section 4 (Principles of Environmental Management and Objectives) Part e, the principle of public participation. This shall include encouraging and ensuring maximum participation by the people of Liberia in the management and decision making processes of the environment and natural resources; Section 10 of the EP&M Law declares that the Environmental Impact Assessment process is an responsibility of the Environmental Protection Agency and in Section 11 (Scoping process) requests from the project proponent or applicant to conduct public consultations which includes to ensure public participation early in the EIA process.

Section 33 of the EP&M Law obliges the Agency to make available to the publically documents submitted to the Agency under Part III of this Law and shall duly consider all public comments. To enable public participation, Section 10 explains the access to environmental information and declares that there shall be freedom of access to environmental information

3.4 Time demands needed for obtaining permits and necessary environmental impact requirements

Precise time demands for obtaining permits are not defined in any environmental law. It is only stated that procedures should be done—in a timely manner. In accordance with the Administrative Procedure Act, a right to review exists. In an interview with the Executive Director of the EPA it was stated that the EPA considers 30 days as a timely manner. In case of a negative, or outcome, a petition against the agency can be filed. A person who has exhausted all administrative remedies available for obtaining permit within the agency and who is aggrieved by a final determination in contested matter is entitled to

judicial review under the chapter. As it is not otherwise expressly provided by law, proceedings for review shall be instituted by filing a petition requesting in the Circuit Court with 30 days after the final determination of the agency or, if a rehearing is requested, within 30 days after the determination thereon. Within 30 days after the service of the petition, or within further time allowed by the court, the agency shall transmit to the reviewing court the original or a certified copy of the entire record of the proceedings. The review shall be conducted by the court without a jury and shall be confined to the record. The court may affirm the decision of the agency or remand the case for further proceedings. The court may reverse or modify the decision if substantial rights of the appellant have been prejudiced. The minimum typical time for obtaining a permit is therefore 30 days, the maximum typical in case of a needed petition would be 120 days. Depending on the magnitude of a project impact on the environment, Environment Protection & Management Law defines in Sections 13 and 14 two types of documents and range of information which is required to obtain a permit by a healthcare facility. If a project may have a significant impact on the environment, the Agency shall require the proponent of applicant to prepare an environmental review.

- 1) It shall be prepared in accordance with the Terms of Reference developed by the applicant or project proponent based on the results of the scoping activities and in consultation with the Agency and Line Ministry;
- 2) The environmental impact study shall focus on the concerns outlined in the Terms of Reference developed under subsection (1) and provide the research results/technical data necessary to, at the least:
 - Identify the nature and magnitude of the anticipated impacts of the project;
 - Predict the extent/scale/location of the impacts;
 - Identify the timing, the stage at which the anticipated impact is likely to occur and the duration of the impact;
 - Predict the reversibility/irreversibility of anticipated impacts

If the project or activity will have or is likely to have a significant impact on the environment and the project brief discloses no sufficient mitigation measures, the Agency shall require the proponent or application to prepare an environmental impact study. It shall contain:

- A detailed description of the proposed project or activity and of activities it is likely to generate;
- A description of the potentially affected environment including specific information necessary for identifying and assessing the environmental effects of the proposed project or activities;

- A description of the technology, method and processes that shall be used in the implementation of the project or activities and the main alternatives and
 - reasons for declining to use those alternatives;
- Reasons for preferring the proposal location and rejecting alternative sites;
- Environmental impact of the proposed activity or project including its direct, indirect, cumulative, short-term and long-term effects on both the natural and built environments and on public health and safety;
- An identification and description of measures proposed for avoiding, minimizing, mitigating and monitoring the anticipated adverse effects of the project or activity on the environment;
- An indication of whether the environment of any other state or area beyond the limits of national jurisdiction is likely to be affected and the mitigating measures to be undertaken;
- A brief description of how the information provided for in this section has been generated;
- An identification of gaps in knowledge and uncertainties which were encountered in completing the required information;
- The social, economic, cultural and public health effects the project is likely to have on people and society;
- The ecological and atmospheric impacts anticipated;
- The stage at which irreversible and irretrievable impacts are likely to occur if the project is implemented in the manner proposed by the developer; and
- Such other matters that the Agency may require.

The environmental impact statement shall be accompanied by:

- a) A report containing a non-technical summary of the main findings of the study; and
- b) Ten copies to be disseminated to affected County and District environmental committees in the affected areas.

3.5 National Policy and National Guideline development

In accordance with the proposed changes indicated in the Inception Report, a National Policy, and National Guidelines on Healthcare waste have been drafted for Liberia (herein referred to as Task A4) as it was decided by the stakeholders that this would bolster the

sustainability of the project - nearly all stakeholders interviewed referred to the lack of a robust and implementable policy as a root cause to the myriad healthcare waste management issues.

3.6 The Draft Policy: National Healthcare Waste Management Policy

The policy document was derived from analyzing the current context within Liberia, and to then complement, rather than replace existing legislation. It sets out a broad framework within which the guidelines will provide more specific pragmatic solutions. Its goal is to minimize negative effects of management of Healthcare waste on human health and the environment. The policy also aims at sustainable use of resources, and relative reduction of costs associated with Healthcare waste management. The guiding principles listed in the policy underscore the significance of sustainability and adaptability within the Liberian context. The principles are based largely upon empowering Healthcare workers to create an enabling environment where workplace accidents are minimized, as well as environmental hazards. In line with the World Health Organization, the ‘polluter pays’ principles also included; this makes provision for all producers of waste to be legally and financially responsible for the safe and environmentally sound disposal of the waste they produce. To eliminate unsafe practices and improper handling of Healthcare waste, it is imperative that Healthcare workers, and more broadly the general public, are aware of the issues and their role in managing waste. This project already has public awareness and education campaign component, so the policy accordingly includes this element. Key to good governance is public participation, with policy provisions for heightening awareness for the healthcare workers and the general public. Healthcare workers (both medical and janitorial/maintenance) are at the highest risk of contracting nosocomial (hospital-borne) diseases. The policy therefore sets out objectives to minimize potential risks and mitigate against accidents should they occur. Personal and environmental harm will naturally decrease as waste is managed correctly. To ensure safe management, the policy makes reference to a number of relevant international conventions. Within the Healthcare facilities, the key objective is to ensure waste is segregated at point of generation, and deposited, handled, treated and disposed of properly. A monitoring and evaluation (M&E) framework is proposed to monitor progress, and to act as a mechanism to be able to institute future improvement where necessary. Although implemented by private and public Healthcare institutions, the EPA will also play a key monitoring role. To clearly delineate institutional responsibilities, the policy sets out a framework indicating which line ministries will have authority relating to Healthcare waste. The MOH&SW is placed in the prime position, as it is responsible for providing Healthcare services. The EPA and Ministry of Education will also have responsibilities. The MOH&SW will serve as the leading body, in coordination with the appropriate sister Ministries and Agencies, and shall be responsible for the implementation of the Liberia National Healthcare Waste Management Policy.

3.7 The Draft Guideline: Safe Management of Healthcare Waste in Liberia

The effective management of Healthcare waste is of vital importance to the Healthcare sector and the people in Liberia, who need to be assured that such wastes are managed and disposed of properly. The guidelines have been developed to support Healthcare facilities to implement the National Health Policy and the National Health Plan as well as the National Policy on Healthcare Waste Management, and as such aims to be part of the Basic Package of Health Services (BPHS). Whilst the guidance set out in this guideline document should help those responsible for the management of Healthcare waste, it does not remove their obligations to comply with other legislation and good practice. The guidelines will serve as a tool for the long term implementation of sustainable Healthcare waste management solutions in Liberia. Nevertheless it provides also a guide for the national government, for the local authorities and international donors how to implement a sustainable system under consideration of the existing Healthcare system in rural and urban areas of Liberia.

3.8 Waste Management Plan goals and objectives

The overall objective of the update reported is to conduct a comprehensive medical care waste assessment of the Liberian situation; and develop a national medical waste management strategy and plan, including both physical investments and training activities.

The main activities are the assessment of the existing policies and waste management practices, the determination of appropriate technology and sites, the training and public awareness and the preparation and presentations of the reports.

The problems of healthcare waste management in Liberia are well-known to stakeholders and the project is supported and welcomed by all relevant institutions and organizations. This project focuses on the assessment on practical problems and to achieve sustainability for ongoing updating of knowledge and skills in the future. The project is coordinated with other ongoing projects and donor organizations, especially with the WHO and UNICEF, the RBHS project of USAID, the World Bank household waste management support project targeting the MCC (Monrovia City Council) and other projects.

3.9 Report outputs and results

The main outputs and results to be delivered by the updated plan are:

- A detailed Assessment Report on the legal situation is available and recommendations are formulated
- A base line study on the actual healthcare waste situation is available
- A short report on the healthcare waste management situation and is available

- A short report on appropriate medical waste treatment technology for Liberia including a decision making process flow is produced
- A short report on the evaluation of sample disposal sites with clear recommendations for future disposal sites is available
- A short report on the financial situation in regard to the financing possibilities including possibilities for private participation is drafted
- A report on the review of the existing public awareness raising system and practices is developed
- A training plan for the carrying out of HCW training exists

4.0 BASELINE DATA ON HEALTHCARE WASTE GENERATION

This project aimed to identify healthcare waste generators, assess their waste generation rates, and provide a comprehensive description of the current status of healthcare waste management in Liberia.

4.1 Identification of all Healthcare facilities in the country

The assessment showed that there was a dearth of available, quality, centralized data related to Healthcare facilities in Liberia. The Health Management Information System (HMIS) section within the MoH&SW can provide some data, but it has not been established for long enough to it enable to maintain sophisticated centralized databases, uploaded with verified information. The various County Health Officer's also have access to limited ad-hoc data which is not stored in any easily accessible format. The MoH&SW Health Services department can provide County Health Plans, which contain valuable data, but not to the level of providing bed numbers or bed occupancy rates.

As international non-government organizations (NGOs) are widespread in Liberia, they are naturally a source of data regarding the hospitals they support. The Clinton Foundation for example, was able to provide the closest thing to a comprehensive list of Healthcare facilities in Liberia which includes data such as numbers of beds.

This assessment used all the above sources of information to compile one document. The data was cross-checked against other sources to confirm its veracity, and then extrapolated to cover areas of the country where no accurate data exists. In summary, the final document identifies all tertiary and secondary hospitals nationwide and provides bed count data, and then focuses on Montserrat County with Healthcare facility data. The assessment showed:

Total No. of healthcare facility: 509

- Clinics: 426
- Healthcare centers 53
- County Hospitals 29

- Tertiary Hospitals (1) JFK, under re-construction

334 of the 509 facilities are operated by the Government, often with support by NGOs or NGOs. The remaining 172 are privately operated or are by the churches or other organization operated facilities. In total, the healthcare facilities operated 3324 beds in October 2009. (See Task Report A2 Healthcare waste baseline report in the annex)

4.2 Assessment of healthcare waste generation rates

This report aims at identifying healthcare waste generators and assessing their waste generation rates. For this the Ministry of Health & Social Welfare selected the following number and types of Healthcare facilities for further analysis.

- one tertiary hospital;
- seven county hospitals;
- five major health centers; and
- three private hospitals.

To assess Healthcare waste generation rates, the following Healthcare facilities were targeted:

Table 1 List of Assessed Health Care Facilities

Type of facility	Name of facility
Tertiary Hospital	JFK Hospital, Monrovia
CountyHospital1	Redemption Hospital, Montserrado
CountyHospital2	CH Rennie Hospital, Margibi
CountyHospital3	Phebe Hospital, Bong
CountyHospital4	Government Hospital, Bomi
CountyHospital5	JJ Dossen Hospital, Maryland
CountyHospital6	Martha Tubman Memorial Hospital, GrandGedeh
CountyHospital7	Liberia Government Hospital, Buhanan, Grand Bassa
HealthcareCentre1	Saclapea CHC, Nimba
HealthcareCentre2	SinjeHC, GrandCapeMount
HealthcareCentre3	Salala HC, Bong
HealthcareCentre4	Barnersville HC, Montserrado
PrivateHospital1	ELWA Hospital, Montserrado
PrivateHospital2	St.Joseph's Catholic Hospital, Montserrado
PrivateHospital3	SD Cooper Hospital, Montserrado

All the above Healthcare facilities were inspected and interviewed for essential information on their institutional structure, services provided, and the waste management system they maintain. Training was provided to staff of the healthcare facilities in how to collect the needed data. The veracity of some of the data collected from this survey appears questionable, given the reported amount of waste generated compared to the bed capacity, and bed occupancy rate. For that reason data reported from three hospitals have been excluded from the analysis.

It should be noted that in most cases even the basic data about the facilities differ from that obtained during site visits and interviews. Nine hospitals reported different number of beds than during the first phase of the assessment. The most extreme examples are:

- JFK Medical Center reported 122 beds more than previously assessed, which is 75% increase within two months. Albeit it has been verified that the number is correct;
- Liberia Government Hospital, Bomi, JJ Dossen Memorial Hospital, Martha Tubman Hospital reported very low occupancy rate during the whole assessment period when compared to data provided earlier.

The amounts of total non-hazardous and hazardous waste were estimated for each individual healthcare facility. The estimations are based on the total number of beds and reported occupancy rate. The minimum and maximum generation of waste were calculated covering slack and peak situations.

Table 2 Average Waste Generation Rates for Non-hazardous and hazardous Wastes Produced by Assessed Healthcare Facilities

Healthcare facility	Average generation kg/bed/day	Minimum generation kg/bed/day	Maximum generation kg/bed/day	Bed occupancy rate (%)
JFK Medical Center	0.30	0.23	0.39	n.r. (100)
Redemption Hospital	1.50	1.27	1.80	n.r. (100)
CH Rennie Hospital	0.40	0.21	0.62	n.r. (75)
Phebe Hospital	0.82	0.47	1.29	51
Liberia Government Hospital, Bomi	1.07	0.30	2.25	18
JJ Dossen Memorial Hospital	3.94	0.43	25.60	9
Martha Tubman Memorial Hospital	1.24	0.51	1.84	18
Liberia Government Hospital, Buchanan	0.74	0.32	1.14	47
Saclepea Comprehensive Health Center	0.89	0.79	1.06	97
Sinje Health Center	1.13	0.48	2.90	24
Salala Clinic	0.52	0.22	1.00	n.r. (100)
Barnesville Health Center	1.02	0.14	2.62	n.r. (100)
ELWA Hospital	2.44	1.01	3.93	67
St. Joseph Catholic Hospital	4.90	3.33	6.17	60
SD Cooper Hospital	0.62	0.37	0.87	n.r. (60)

Due to incorrectly reported quantities of waste, compared to services provided and the number of patient's data, three hospitals were excluded from further evaluation: JJ Dossen Memorial Hospital, ELWA Hospital and St. Joseph Catholic Hospital. Such

elevated quantity of waste is hardly produced by hospitals in Northern hemisphere, which utilize more medical procedures and use more single-use equipment than currently is practiced in Liberia. Therefore, data from 12 facilities were used for analysis instead of 15 facilities that had been earmarked for the survey. Results obtained from the 12 facilities are similar to those published in an UNDP -GEF survey. According to the GEF, daily HCW generation rate in African countries ranges from 0.17 to 2.78 kg/bed. It is recommended by WHO to consider the following composition of HCW for calculation of normalized waste generation rates:

- 80% general health-care waste, which may be dealt with by the normal domestic and urban waste management system;
- 15% infectious and pathological waste; 0 1% sharps waste;
- 3% chemical or pharmaceutical waste;
- Less than 1% special waste, such as radioactive or cytostatic waste, pressurized containers or broken thermometers and used batteries.

Based on the above rationale, normalized HCW generation rates were estimated for the 12 Healthcare facilities. The estimations take into account bed occupancy rates. The results are presented in the table below

Table 3 Normalised Average Waste Generation Rate for Non-hazardous and hazardous Produced by Assessed Healthcare Facilities

Healthcare facility	General Waste - 80% (kg/bed/day)	Infectious Waste - 15% (kg/bed/day)	Sharps Waste - 1% (kg/bed/day)	Chemical Waste - 3% (kg/bed/day)	Special Hazardous Waste - 1% (kg/bed/day)	Total Waste (kg/bed/day)
JFK Medical Center	0.240	0.045	0.003	0.009	0.003	0.300
Redemption Hospital	1.200	0.225	0.015	0.045	0.015	1.500
CH Rennie Hospital	0.320	0.060	0.004	0.012	0.004	0.400
Phebe Hospital	0.656	0.123	0.008	0.025	0.008	0.820
Liberia Government Hospital, Bomi	0.880	0.165	0.011	0.033	0.011	1.100
JJ Dossen Memorial Hospital	Not calculated	Not calculated	Not calculated	Not calculated	Not calculated	3.940
Martha Tubman Memorial Hospital	0.992	0.186	0.012	0.037	0.012	1.240
Liberia Government Hospital, Buchanan	0.592	0.111	0.007	0.022	0.007	0.740
Saclepea Comprehensive Health Center	0.712	0.134	0.009	0.027	0.009	0.890

Healthcare facility	General Waste - 80% (kg/bed/day)	Infectious Waste - 15% (kg/bed/day)	Sharps Waste - 1% (kg/bed/day)	Chemical Waste - 3% (kg/bed/day)	Special Hazardous Waste - 1% (kg/bed/day)	Total Waste (kg/bed/day)
Sinje Health Center	0.904	0.170	0.011	0.034	0.011	1.130
Salala Clinic	0.416	0.078	0.005	0.016	0.005	0.520
Barnesville Health Center	0.816	0.153	0.010	0.031	0.010	1.020
ELWA Hospital	Not calculated	Not calculated	Not calculated	Not calculated	Not calculated	2.440
St. Joseph Catholic Hospital	Not calculated	Not calculated	Not calculated	Not calculated	Not calculated	4.900
SD Cooper Hospital	0.496	0.093	0.006	0.019	0.006	0.620
Average	0.685	0.129	0.009	0.026	0.009	0.857

It could be found out from the above estimation that the infectious (including sharps waste) generation rate per bed per day for the twelve researched hospitals is between 0.04 and 0.237 kg/bed/day, and in average 0.137 kg/bed/day. A correlation between the amount of waste generated, the type and/or size of Healthcare facility could not be found. The reason for this is improper waste classification and segregation system in all assessed establishments.

Due to dynamic reconstruction and improvement of the Healthcare system in Liberia it is expected that the waste generation rate will increase in near future. Taking into account data from research carried in other similar countries, it is projected that infectious waste generation rate may grow by 15% each year.

It is also expected that implementation of a Healthcare Waste Management Plan in Liberia will lead to improvement of waste classification and segregation practices by the Healthcare sector. Therefore, better management will further influence the system by reducing infectious waste generation rate by about 8% per year, so that the total increase will be 7% per year.

4.4 Health Care Waste Collection:

General and hazardous waste (including contaminated health care waste) pre-collection and collection are usually performed through the use of plastic buckets (with or without a bag inside), cardboard boxes or, in some cases, aluminum buckets (with or without a cover).

Without distinction, all collection equipment receives food, medicines, used compresses, sore bottles, syringes, needles, etc. Frequently, collect equipment is placed in the wards.

However, in certain cases, nurses use treatment trolleys containing waste buckets (made of plastic, aluminum or cardboard), in order to receive waste generated within health care treatments, like cotton, compresses, syringes, needles, etc.

Nevertheless, poor hygiene practices are frequent and notorious within HCI. Sometimes, solid and liquid waste can be found on the floor.

Without exception, liquid waste is sent through restrooms and laboratories' sinks.

4.5 Cleaning Teams

In Liberia cleaning is performed by HCI internal cleaning teams. These cleaning are done by employees, who, within HCI, are in charge of cleaning and waste pre-collection, collection and (frequently) storage.

Health care waste is removed and transported by the referred employees, using in some cases wheeled containers/recipients. However, since lack of pre-collect and collect bags is usual, buckets containing waste are transported and unfilled into containers; afterwards, they are washed or cleaned with wet wiper.

4.6 Health Care Waste Segregation

Waste segregation practices depend on the specific HCI services, but usually when performed segregation regards only needles, other sharps and, in some cases, placentas. Indeed, within most of the health care establishments, health care waste is not segregated.

As an exception, needles are chosen and stored in sore bottles, plastic bottles or recovered juice packs. Full bottles are later placed in the storage containers together with the remaining waste; however it is frequent to find needles and other sharps in garbage buckets.

In some HCI, mainly within the capital, segregation is also performed in the delivery rooms. Childbirth derivatives (liquid derivatives and placentas) are placed in plastic bags, which are later tied, directed for temporary storage location (usually restrooms) and later on buried.

Generally, dirty clothes are sent separately to the laundries. Frequently patients bring their own bed-clothes. In such cases the familiar ones usually wash clothes at home.

4.7 Temporary Storage

Most of the waste collected in the different health care services is not stored separately. Needles are the exception. They are at first placed in plastic or sore bottles or juice packs and afterwards placed together with the other waste. Remaining waste is placed into

garbage buckets or containers, located in non-specific rooms or in the HCI yards. Thus, storage is practiced in restrooms, near washbasins, corridors or in HCI yards.

4.8 Waste Transportation within HCI

In the majority of HCI, waste transportation is performed by the cleaning staff. Waste is carried in bags or buckets, with or without a wheeled support. Waste is carried to disposal locations, without any kind of protection, at any time of the day, even during the rush-hour.

Waste evacuation is constant, even in those periods when county HCIs are crowded (of bigger affluence) neither personnel nor waste are properly protected. Indeed, generally no protective clothing issued. Sometimes, dirty clothes are carried through wheeled support.

4.9 Storage within the HCI

In most of the visited HCI waste is placed, not bagged, in public containers outside or in dumps site at the back of HCI, places that are easily accessible to people and animals and also exposed to climatic conditions.

It must be enhanced that, due to high poverty levels, it is frequent to find people seeking for reusable materials in those places. In certain HCI, waste is placed in a closed storage room, exterior to the main building.

4.10 Recovery / Reuse

Materials used during surgeries (clamps, shears, etc.) are sterilized by autoclave or hot oven and reused. Glassware used in laboratories is also used after being washed or disinfected.

4.11 Waste segregation and disposal locations

Waste segregated at the source, particularly needles, is usually reintroduced into common waste circuit at collection or temporary storage levels which are not labeled or color coded. Therefore, general waste and contaminated healthcare waste have the same final destination. This is particularly dangerous for medical and cleaning personnel, within HCI, and for waste collecting personnel working in municipal services. Dirty clothes are taken to HCIs' laundries or washed by patients' families at home.

Generalized infrastructures degradation and equipment lack within these laundries must be enhanced. Often, clothes are washed in tanks. Once reintroduced in the health care circuit, these clothes can caused different kinds of contamination to health care staff and patients.

4.12 Liquid Waste

Liquid waste (blood, urine, etc.) is eliminated in restrooms and laboratory sinks, sent to sewers or to garbage bins with clinical analyses' pipes.

4.13 Perception of health care waste related risks

At Managing/Administration level there is a misalignment between perception and reality regarding health care waste related risks. This could be justified by the long war period in the country.

At HCI level, health care personnel mostly have a notion of the risks, but lack of equipment and infrastructures is common. Facilities degradation, lead to a reduced sensitivity towards this issue. Awareness level on Health Care Waste related risks is very low among cleaning personnel and general population

4.14. Brief SWOT Analysis

An institutional process of analysis commonly used is SWOT method. Four (4) main vectors compose this method:

- 1) **“STRENGTHS”**- aspects which will allow establishing and consolidating the HCWM Plan.
- 2) **“WEAKNESSES”**- weaknesses related with the HCWM plan; should be eliminated or to reduce.
- 3) **“OPPORTUNITIES”**- these are external positive influences on HCWM; should be used and developed.
- 4) **“THREATS”** - should be deeply known in order to prevent their possible negative effects on the HCWM plan.

4.14.1 Vector A - Strengths

- Awareness of the need to change;
- Predisposition of hospital heads/directors in order to create (and to participate in) teams that can assure an integrated HCWM;
- Strong interdependence between HCWM and General Waste Management;
- Predisposition for the development of cooperation agreements with other national and international entities;
- Increasing awareness regarding the necessity of staff participation in order to achieve the HCWM expected results;
- Increasing sensitivity in terms of professional development of personnel (agents who are related with the HCWM sector);
- Concern, among governmental entities, regarding to organization and implementation of a HCWM Plan;

- Enough assimilation and adaptation personnel capabilities, regarding the use of more appropriated technologies;
- Gradual implementation of HCWM related training courses within health care establishments, related with hygiene and public sanity;
- Availability of health care professionals and other staff for the HCWM sector at reasonable costs;
- Provision of some suitable incinerators;
- Awareness of the need to improve all the transport related logistic, as well as waste processing;

4.14.2 Vector B - Weaknesses

- Existing gaps in environmental policies;
- Existing gaps in waste management policies;
- Existing gaps at the level of environmental related legislation; o Consequently, there are gaps in terms of HCWM legislation;
- Existing gaps in terms of Health Care Waste (related) statistics;
- Insufficient training plans regarding personnel responsible for HCWM and also for waste handlers;
- Low sensitization in terms of hygiene and waste treatment among entities, responsible people, staff and patients;
- In terms of searching for solutions within the HCWM sector, low level of motivation of the leaders was noticed. This low level of motivation is caused mainly by structures 'degradation and financial difficulties;
- Health Care Establishments' budgets are generally reduced. For that reason, funds are primarily directed to other areas. Health care waste related investments and inherent expenditures remain in a second level of importance;
- Needs of HCWM related equipment, namely equipment related with waste separation, transport, storage and disposal;
- The majority of visited health care establishments do not possess adequate equipment for collecting sharps and (other) contaminated waste;
- Frequently, health care establishments do not possess adequate structures, neither for practicing medicine, in general terms, nor to waste management, in particular;
- Deficiencies regarding both general and hazardous waste collection (performed by companies exterior to HCI);
- Landfills are insufficient; there are two diverse situations depending on the counties.
- Non-existence of dynamic companies in the HCWM sector, namely at county level;
- Absence of long-term strategic plans; o Deficient management systems;
- Reduced information on generated waste quantification, evolution trends, and respective use;
- Deficient definition of organizational structures;

- Non-existence of specialized services promoting prevention of labor related risks, and occupational security and hygiene;
- Scarcity of national public aids and international supports for personnel training and sensitizing general population;
- Low technological level, specially at county level, where it is notorious and insufficient degree of modernization;
- Lack of adequate structures;
- Low use of the installed available capacity; o Deficient processes' organization;
- Scarce waste treatment;
- Low development in terms of support activities;
- Low level of cooperation between HCI and other entities related with waste management;
- Difficulty in developing consistent investment projects.

4.14.3 Vector C - Opportunities

Liberian Economy is clearly developing;

- Government is investing in several kinds of infrastructure;
- There are great investments in the public health sector;
- There is more private investment on the health care sector;
- International public opinion is favorable to Liberian economical options;
- Participation of the country in international development platforms;
- Support by international financial institutions as the International Monetary Fund and the World Bank;
- Interest of national and international private investors;
- Existence in Liberia of a considerable amount of projects in different kinds of activities;
- Existence in Liberia of a high number of non-governmental organizations working within the health care sector;
- Commitment of the most representative Liberian institutions in order to participate in this project;
- Increasing capability of relationship and establishment of partnerships with the private sector;
- Social and political stability.

4.14.4 Vector D - Threats

- Significant delays in terms of investments on infrastructures namely in health and accessibility infrastructures; o Social and labor instability;
- Delay in education development;
- Scarcity of highly skilled technicians within the health care sector;

- Difficulty of implementing the project in the most remote municipalities due to lack of communications;
- Change of international opinion towards the Liberian development process;
- Qualified technicians abandon the country;

4.15 Crossed analysis

Potentialities (internal potential/strengths to preserve, crossed with external opportunities):

- Responsible entities are conscious on the HCWM issue allied with Governmental international institutions' commitment in order to invest in infrastructures and in healthcare system;
- Human resources with assimilation capability regarding to new technologies and new fields of knowledge, supported by NGO's existing in Liberia and financed by international institutions, favor the execution of the HCWM Plan in Liberia;
- The existence of some incinerating facilities and (in some cases) the availability of structures (with rehabilitation needs, though) allied to current investment increase phase (by both the government and financing international entities). These aspects allow the existence of a positive frame, in terms of technological conditions, on a short-term.
- Constraints (internal weaknesses to be reduced/eliminated, crossed with external chances that can be wasted):
- Existing gaps in terms of legal aspects and also in terms of HCWM can compromise the results of investments in infrastructures (either by the Government or by financing international entities);
- The vast country's dimension and difficulties regarding road transport are a constraint in terms of investment by national and international private investors, in this sector;
- Reduced cooperation among health care establishments is not adjusted to international institutions standards, namely the World Bank financing models.

Vulnerabilities (internal forces crossed with external threats):

- Consciousness on the necessity of change and structural global interventions within the HCWM. This consciousness exists among responsible entities and employees. However, it could possibly not be enough to face some project implementation related difficulties. These difficulties are related to aspects like remoteness of some HCI and to scarcity of properly trained/qualified professionals;
- Although within the HCI some predisposition exists for the development of cooperation agreements, and in spite of the governmental concern regarding to HCWM, a deficient preparation or implementation of a plan within this sector

could lead to change in terms of international public opinion in regard to in the development processing Liberia.

Problems (external threats crossed with internal weaknesses):

- A change of international public opinion regarding the development process of Liberia in conjunction with the current state of infrastructure and lack of equipment constitutes serious problem in terms of intervention within this sector;
- Another important problem is the conjunction of lack of suitable legislation, with the non-existence of HCWM Plans, and qualified technicians scarcity;
- Deficient sensitization and awareness (on the HCWM subject) of health care personnel and general population in conjunction with delays in both human and material/structural investments. This conjugation makes difficult the attainment of solutions on a short and medium term.

4.16 Organization and Management

Necessity of an adequate management at all levels, including integrated management plans, namely:

- Health Care Waste strategic management at central, county and onsite (within the county HCIs) levels;
- Organization and management of the whole process related with collect, storage and disposal practices as well as inherent activities;
- Transport related logistics organization and management;
- Incinerating facilities and landfills' organization and management;

Necessity to find joint solutions for common problems;

- Creation of synergies between (the) county HCIs and entities managing incinerators and landfills.

4.17 Human Resources

Necessity to sensitize and train health care personnel so that they become more qualified and in order to promote permanent motivation at all levels.

4.18 Policies, Legislation and Regulation

- Definition of environmental policies including the HCWM subject;
- Elaboration of adequate environmental legislation in compliance with international environmental rules;
- Elaboration of specific regulations with regard to health care waste.

4.19 Sensitization and Training

- Any intervention in terms of HCWM requires the involvement of all implicated agents; for this reason, sensitizing all of them is crucial and urgent;
- Developing broad sensitization programs, directed to agents intervening within the healthcare system and general population. These programs should be performed in order to raise awareness on the necessity of hygiene and health care waste treatment. Sensitization must be performed both on health care waste and hygiene topics, for it is very difficult to alert all the involved agents - entities, heads and managers, other personnel and patients - for HCWM issue, in degraded health care establishments, with a deficient hygienic situation;
- It is to enhance the possible complexity of the sensitization and training aspects, for these items are related with mentalities' change, which is usually a very slow process;

4.20 Financing And Investment Questions

- Health care establishments must have budgets to assure the performance of HCW Activities;
- Investment plans in terms of health care infrastructures are required in order to promote hygiene and to improve health care waste treatment within HCI;
- Developing programs for the attainment of national and international public aids for organizing and managing, sensitizing and training and infrastructure construction and rehabilitation.

It is also expected that implementation of a Healthcare Waste Management Plan in Liberia will lead to improvement of waste classification and segregation practices by the Healthcare sector. Therefore, better management will further influence the system by reducing infectious waste generation rate by about 8% per year, so that the total increase will be 7% per year:

For the development of waste management plans and proposal for procurement of necessary equipment it is recommended to adopt infectious waste generation at 0.2 kg/bed/day. It shall be also assumed that minimum infectious waste generation rate for per facility is no less than 1 kg per day - this concerns first of all those Healthcare units which do not have beds, like Clinics and some Health Centers. After the HCWM Plan implementation waste generation should further stabilize as it has in other countries. Based on the above infectious waste generation rates, following extrapolation can be made for the entire country.

5.0 ASSESSMENT OF HEALTHCARE WASTE MANAGEMENT

Within the project a detailed assessment of the medical waste management in Liberia was carried out. The assessment covered the following tasks:

- Analyses of applied medical waste management including Healthcare waste guidelines, segregation, collection, transportation, storage and disposal systems
- Assessment of Healthcare waste management knowledge, awareness and behaviours at various levels
- Identification of financing needs, potential sources of funding, key actors, and necessary budgetary allocation for waste management
- Assessment of the existing recycling systems for healthcare waste within the Healthcare facilities, along the transportation routes, and at the final disposal sites.

The assessment included the inspection of the current waste management practices in 16 different healthcare facilities, and the interviewing of more than 300 healthcare workers by using standardized questionnaires. The assessment included further the analysis of the legal and financial situation of health care waste management in the facilities and the evaluation of the general waste recycling situation.

5.1 Main findings of the HCW management assessment

In the following only the main findings are described. Further and detailed information can be found in the –Task Report A3: Assessment of the Healthcare waste management situation in Liberia, provided in the annex. The analyzing of the applied medical waste management included the examination of existing Healthcare waste guidelines, and current practices of segregation, collection, transportation, and storage and disposal systems. The assessment found indicated major shortcomings along the entire disposal chain, and that large-scale changes will be needed to improve the situation. Major shortcomings are:

- No systematic planning of the medical waste system
- Unclear organization, no human resource planning
- Unclear responsibilities, unclear or missing instructions
- Not or very weak existing segregation system
- Missing minor, major and fixed waste logistic equipment
- Risky waste logistic practices
- Not existing monitoring & record keeping systems
- Missing instruction for critical and emergency situations
- High risk working environment with several accidents
- Financial planning (budgeting) is not carried out

For the assessment of the Healthcare waste management knowledge, awareness and behaviour, a Rapid On-Site Assessment (ROSA) tool was used. This provided an in-depth assessment of the awareness and existing capacity of healthcare waste management

(HCWM) practices among the healthcare personnel. A training strategy was formulated on the basis of the findings.

The assessment showed further that a formal, vocational training system for healthcare waste management does not currently exist in Liberia. There is ascertain awareness of the problems created by healthcare waste among health care facility staff and managers, but it needs to be improved. There is a clear correlation between the low knowledge of Healthcare staff and the current inadequate management of Healthcare waste. One of the potential risks created by healthcare waste is occupational infections among healthcare staff by blood borne pathogens. A rough situation analysis on sharps accidents was carried out during the assessment process. The results showed extremely high accident rates - on average 4 times higher than the international standards. Urgent actions to improve this critical situation are required and it is recommended to base awareness raising activities for healthcare waste on the problem of occupational accidents (a campaign to upgrade healthcare waste management and occupational safety aspects).

Based on WHO recommendations, the identification of financing needs, potential sources of funding, key actors, and the necessary budgetary allocation for waste management was carried out. The financing need is estimated to be about 1 million US\$ per year. Strategies for how to include financing in future NHP will be formulated in the National Waste Management Plan. The assessment of the existing recycling system for healthcare waste inside the Health care facilities; along the transportation routes and at the final disposal sites was carried out. The results showed that only a limited recycling system exist in Liberia, however that a risk due to the practice of reusing of waste exist. It is noteworthy that all health facilities in Liberia operate within substantial budgetary constraints. All of the Healthcare facilities visited during this assessment lacked adequate physical infrastructure, medical equipment and trained (and paid) staff. Against this backdrop, it is understandable that the limited resources available are not generally directed toward waste management. This scenario is not unique to Liberia. It is evident that as Liberia's population (and waste output) grows, the inherent public health risks associated with poor H CWM will increase accordingly, adding a greater financial burden to Liberian society.

5.2 Recommendations for improvements based on the findings

The assessment showed that waste management systems in the broader sense do not exist in most parts of Liberia and are only partly introduced in the greater area Monrovia. In the healthcare sector, most hospitals are trying to do their best and put certain system in place to minimize risk created by healthcare waste. These systems are however not uniform due to the lack of guidelines and policies. Based on the assessment the following recommendations are formulated which will, in part, contribute to the strategy development. Recommendations for legal aspects and for training and awareness-raising will be provided in the specific documents which will be later provided.

5.3 National healthcare waste stream treatment strategy

Currently, no uniform system and strategy for the treatment and disposal of healthcare waste has been developed or agreed upon. The setup of a national strategy is recommended and should be included in the national healthcare waste plan. The strategy should be included in the national guidelines. A sample strategy is displayed in the following figure:

5.4 Sample national healthcare waste treatment strategy

Based on the findings of the assessment developed strategies should provide two different strategies:

- i. Strategy for areas without municipal waste disposal service (rural areas)
- ii. Strategy for areas with municipal waste disposal service (urban areas).

The strategy should include and provide recommendations for management of all main waste streams:

1. Non-hazardous or general healthcare waste,
2. Infectious waste
3. Highly infectious waste,
4. Sharps,
5. Pathological waste,
6. Pharmaceutical waste,
7. Cytotoxic or genotoxic waste,
8. Chemical waste,
9. Waste with high content of heavy metals

5.5 Improvement of the internal logistic system

The assessment showed that there are weak points along the entire internal waste disposal logistics chain. ROSA further showed that an appropriate waste logistics unknown to most of the healthcare workers. The carrying out of demonstration project to demonstrate safe logistic system is recommended. A sample safe logistic system is displayed in the following:

5.6 Sample internal healthcare waste logistic system

Potential systems should be based on recommendations provided in the forthcoming guidelines. For the demonstration of improved internal logistic systems fixed, major and minor physical assesses for healthcare waste must be available. As these are today not available it is recommended to procure them at least for a number of demonstration hospitals.

5.7 External logistics, waste disposal and treatment

The assessment showed that external logistic services and centralized waste management only exists in Monrovia – and also there only partly and only for non-hazardous waste. To create a sustainable disposal system for non-hazardous, but also for hazardous waste, the strengthening of these systems is recommended. Within the Project: –Emergency Monrovia Urban Sanitation Project (EMUS)||support will be provided to the MCC in the field of solid domestic waste, however no support will be provided for the management and treatment of healthcare waste and for other hazardous waste coming from the healthcare sector (e.g. solvents, heavy metals, photo chemicals, etc.). It is therefore recommended to carry out demonstration project to demonstrate how a central operated disposal system for hazardous healthcare waste can function.

5.7 Sample external healthcare waste logistic system

The NHP is currently aiming to decentralize its decision-making processes, most notably to the county level. It is therefore recommended to carry out the demonstration project on county and not only at national level.

5.8 Improvement of occupational health and safety

One of the main and urgent to be tackled weak points of the Liberian healthcare waste system is the nonexistent system on occupational health and safety. Based on the example of needle stick accidents the principles of improved safety systems should be demonstrated including:

- Vaccination of healthcare staff against at least HBV and Tetanus
- Carrying out of risk assessments on needle stick accidents and implementing of counter measures
- Development of post exposure systems including accident reporting and PEP (Post Exposure Prophylaxis)

Further basic methods to reduce the risk of occupational exposure should be introduced, such as usage of PPE (Personal Protection Equipment).

5.9 Recycling and Reuse of Healthcare Waste

As currently no market for to be recycled products exist, it is not recommended to put too much emphasis on recycling but to strengthen especially the reuse of materials. Considering the planned increase of to be offered services in the field of diagnostic (X-ray, laboratories) it should be considered whether sample systems for the reusing of solvents (ethylene, alcohols, etc.), aldehydes (formalin, etc.) or photo-chemicals (fixing bath) should be demonstrated.

5.10 Determination of treatment technology

Different kinds of methods for the treatment, destruction, or disposal of HCW are available today.

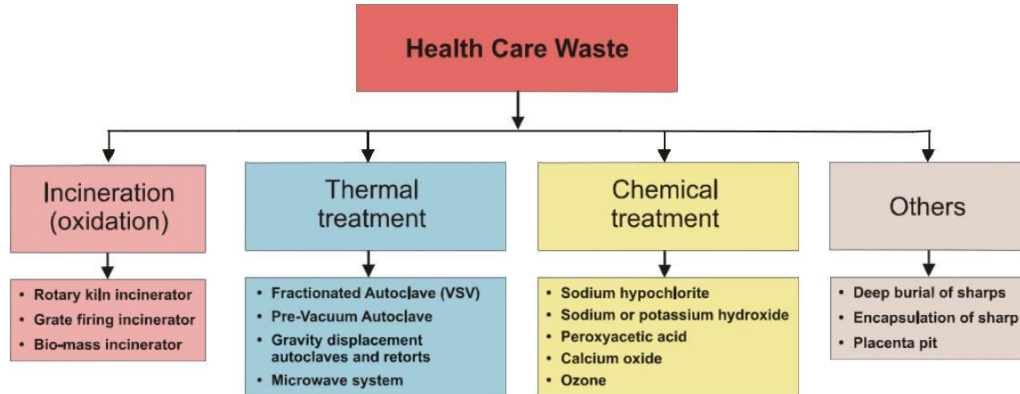


Figure8: Overview of possible health care waste treatment strategies for Liberia

In the past, incineration was world-wide the most common used treatment method for healthcare waste. Due to upcoming concerns of the environmental impacts from emissions (fluegas, bottom ash, contaminated fly ash and waste water from the flue gas treatment), and due to the relatively high investment and operational cost, companies and research institute started to develop alternative treatment systems in the late 70's in Europe and later in the US and other countries.

After nearly three decades of development and operation of these systems, today these are well proven and a wide range of different treatment systems are available. In general, alternative treatment systems can be classified in steam based, dry heat based, chemical based and irradiation based systems.

More detailed information can be found in the Task Report B1: Determination of the medical waste treatment technology in Liberia

5.11 Assessment of alternative treatment systems

An assessment of alternative technologies for waste treatment and destruction was completed during this project with due consideration given based on there source and infrastructure constraints present in Liberia. The assessment confirmed a lack of adequate treatment and disposal systems within Liberia, most notably for infectious waste and sharps. The controlled disposal of waste on a secured landfill site, for example, is not currently viable given the inadequate waste segregation at source currently practiced at Healthcare facilities.

There are a number of different systems for the decontamination of infectious waste available these days, the two most common treatment methods being incineration

(oxidation) and steam treatment (thermal decontamination). While incineration has certain advantages such as the possibility to treat a wider waste spectrum, economical analysis showed strong disadvantages, especially in regard to operational costs and maintenance. Field observations showed that more advanced incinerators are not in operation due to budgetary constraints for operational and maintenance costs. Subsequently, the use of incinerators is not recommended.

Cost analysis for a sample treatment system with a capacity of 100kg/h showed that the capital investment costs for a steam treatment system would be less than for an incinerator system with integrated flue gas treatment system. Also the operational cost of an advanced steam treatment system (fractionated autoclave) will be about 3 times lower than an incinerator system. As some hospitals already operate autoclaves to sterilize medical equipment, there already exists a basic knowledge of the operation and maintenance of this type of system.

More complex steam treatment systems which require pre-shredding such as microwave systems or gravity flow autoclaves with integrated shredder are not currently in operation in Liberia. Given the increased costs in set up and maintenance, these systems are not recommended for Liberia at this stage. Microwave systems are also not recommended due to the higher investment costs compared with other thermal decontamination systems such as autoclaves.

5.12 Status of existing waste treatment systems

Healthcare facilities in Liberia use various types of bio-mass incinerators for hazardous healthcare waste treatment. County Health Plans report 136 installations. However, no exact information has been compiled on their type, wear, and quality of the performance. Also there is no information from Bomi, Grand Cape Mount, Nimba because the reporting forms they used do not contain an incinerator database entry. Data for Bomi was possible to obtain from a quarterly report.

County	WDU	Healthcare Facilities(C/HC/H)	CHP Report
Bomi	6	21	2007. Template does not include "Incinerator". Data as reported for 3rd quarter of 2008
Bong	16	33	2007-2008

Gbarpolu	3	17	2007-2008
Grand Bassa	11	31	2007-2008
Grand Cape Mount		32	2007. Template does not include

County	WDU	Healthcare Facilities(C/HC/H)	CHP Report
			"Incinerator"
Grand Gedeh	1	15	2007-2008
Grand Kru	4	13	2007-2008
Lofa	51	52	2007-2008
Margibi	8	31	2007-2008
Maryland	17	23	2007-2008
Montserrado	11	110	2007-2008
Nimba		49	2007. Template does not include "Incinerator"
Rivercess	6	15	2007-2008
RiverGee	2	15	2007-2008
Sinoe	0	18	2007-2008
Total	136	475	

Tab. 5: Number of WDU reported in County Health Plans, 2007-2008

Available data and filed investigation show that most of these facilities are out dated and may face maintenance problems. Some older units are being replaced by the De Mont fort WDU mode 12006 and 2007, delivered by UNICEF. Fifteen new De Mont fort units have been installed as of November 2009.

County	WDU Gen1, 2006 mode 1	WDU Gen2, 2007 model	Total	Suggested sites
Bomi	1	2	3	Tubmanburg, Klay, Mecca
Bong	1	3	4	Phebe, Gbarnga, Salala,

				Kokoya
Gbarpolu	1	1	2	Bopolu, Belle
GrandBassa	1	2	3	Buchanan, Districts#2,#3,
GrandCape Mount	1	2	3	Sinje, Dambala, Gola-Konneh
GrandGedeh	1	2	3	Zwedru, Konnobo, Pennoken
GrandKru	1	1	2	Barclayville, Benwen
Lofa	1	3	4	Voinjama, Foya, Kolahun, Zorzor
Margibi	1	3	4	Gibi, Kakata, M'Kaba, Firestone
Maryland	1	1	2	Harper, Karloken, Glofaken
Montserratado	1	3	4	Bensonville, Todee, St.Paul, Carreysburg, Medical College, ELWA Hospital
Nimba	1	3	4	Sanniquellie, Ganta, Tappita, Bahn
Rivercess	1	1	2	Cesto City, Boegezay
RiverGee	1	2	3	Fishtown, Kilepo, RiverGbe
Sinoe	1	2	3	Greenville, Pynestown, Jedepo
Total	17	30	47	

Tab.6: UNICEFWDU distribution list (September-November,2009)

Information was verified for the following sites:

- Bomi: Operating unit in Tubmanburg.
- Bong: Nounitin Salala(smallclinic).In Phe be installed but not yet operating.
- Grand Bassa: In Buchan an installed buth as no money to buy wood.
- Grand Cape Mount: Delivered to Sin jebut not installed.
- GrandGedeh: Installedin MTM Hospital, Zwedru but not used. Old incineratoris used instead.
- Margibi: Installed in CHRenie Hospital, Kakata but was a waiting approval from EPA.

- Maryland: JJ Dossen Hospital, Harper used only for EPI campaign.
- Montserrat: Operating units in J.F.K. Hospital (selfdesign), ELWA Hospital (poor design), SD Cooper Hospital, St. Joseph's Catholic Hospital (poor practice, low temperature). Redemption Hospital has 1 small and 1 standard burner but both face maintenance problems.
- Nimba: Operating De Montfort unit in Saclapea.

The control of the quality of the installed incinerators, temperature test were carried out in four facilities. The test showed that none of the facilities reached the recommended temperature of 800°C for bio-mass incinerator. Most of the tested incinerators only reached a temperature of 500-600°C.

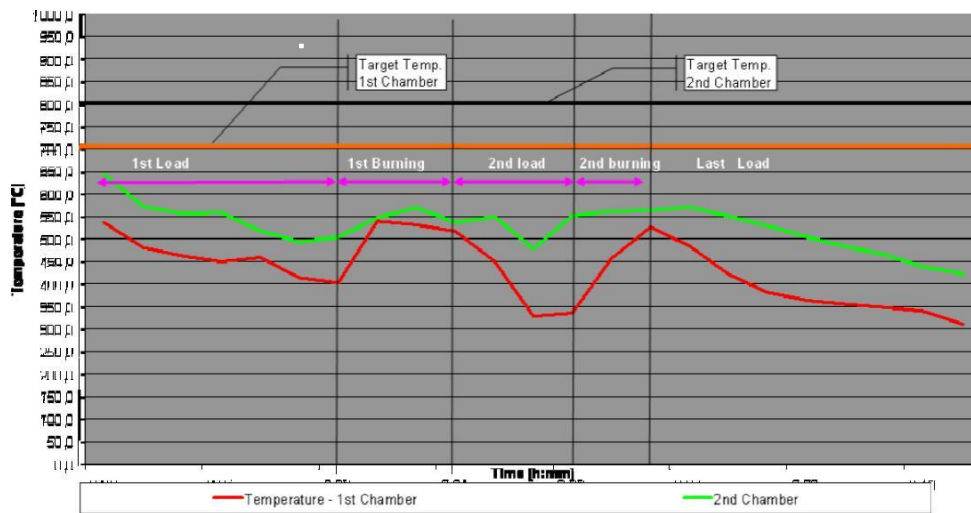


Figure9: Temperature-Time Diagram of an Incinerator in Liberia

Based on pilot studies, World Health Organization estimated that a De Montfort unit (Mk8a) may burn 6 kg of waste per hour. This allows for the disposal of up to twelve 5 litre inward safety boxes. Maximum expected capacity of a unit is 14.4 tons per year (8 hours/day x 300 days/year). Thus taking into account only newer units being installed in Liberia, their combined capacity should allow treatment of approximately 676 tons of Healthcare waste per year.

It is 1.7 times more than the estimated quantity of infectious waste produced in Liberia. However, in reality quantity of waste treated in new WDUs will be much lower. This is because no organized transportation system for Healthcare waste exists, health facilities do not yet share installation capacity and they use bio-mass burners for their own waste only.

Waste treatment costs depend on a local price of wood: 1-2 kg of wood per 1kg of waste burnt is required. Other combustible agro-waste like coconut shells can be used instead. Kerosene is needed in small volume to fire the content at the beginning of the process.

The bio-mass burners are only a temporary solution, scheduled for operation no longer than 5 years, *if well maintained*. After this period they should be replaced with more advanced waste treatment technologies.

5.13 Methodology for decision making

The logic behind the decision making process flow to select the most suitable choice of environmentally sound treatment and final disposal of Healthcare waste is based largely on Liberia's current legislation. According to Part III (Section 6), and Annex I of the Environment Protection & Management Law (EP&M Law), an Environmental Impact Assessment, permit, and audit are required for:

- Hazardous waste incineration, collection, transportation, landfilling including non-hazardous waste (Section 64; Annex I, 18 a and b),
- Decisions of policies and programs and legislative acts on environment and development as well as technical assistance (Section 64; Annex I, 25).

Although the legislation does not specify other waste treatment methods like infectious waste decontamination (i.e. autoclaving, microwaving, etc.), EIA process will be required for them nevertheless as they involve waste transportation and final disposal of the treatment process residues (landfilling).

In addition, it is recommended that the MOH&SW consider the following key points to determine appropriate treatment and disposal:

1. suitable policies and guidelines on Healthcare waste management should be drafted and adopted,
2. available technical documents on waste treatment methods and technologies should be considered,
3. precise information on waste treatment needs to be obtained from counties (CHT)
4. international guidelines and technical recommendations developed by the Basel Convention, Stockholm Convention, and World Health Organization should be adhered to,
5. financial resources (project financial security/sustainability) should be made available; and
6. Available technical and human resources should be required.

Once a waste treatment method is selected, the MOH&SW are obliged to submit an Environmental Impact Assessment application to the EPA.

Besides the application, the Environment Protection & Management Law requires also to submit to EPA notice of intent (Section 7) and a project brief (Section 8). A project brief has to include:

- a) The nature of the project in accordance with the categories specified in the Annex I of the EP&M Law;
- b) The location of the project and the county under whose jurisdiction it is situated and reasons for proposing the project in the area;
- c) The activities that shall be undertaken during and after the development of the project;
- d) The design of the project;
- e) The materials to be used in the project, including during construction;
- f) The possible product or by-products anticipated and their environmental consequences including the potential mitigation methods and measures;
- g) The number of people the project shall employ;
- h) The projected area of land, air and water that may be affected;
- i) Findings of the scoping activities; and
- j) Any other pertinent evidence and analysis which the Agency may require for decision-making.

The Agency shall evaluate the project brief to determine the potential environmental impact of the proposed project and shall make the following determination:

- a) If a project may have a significant impact on the environment, the Agency shall require the proponent or applicant to prepare an environmental review in accordance with section 13 of EP&M Law;
- b) If the project or activity will have or is likely to have a significant impact on the environment and the project brief discloses no sufficient mitigation measures, the Agency shall require the proponent or applicant to prepare an environmental impact study in accordance with section 14 of EP&M Law;
- c) If the project or activity will not have, or is unlikely to have a significant impact on the environment or that the project discloses sufficient mitigating measures, the Agency may issue:

- i. A finding of no significant impact, a "FONSI", and a notice published and placed on the notice board of the registry of the Agency at its head office for the information of the public;
- ii. A certificate of approval; unless the Agency determines that the scope, size and/or sensitivity or the project warrants public consultation prior to the issuance of the certificate of approval.

If the environmental review or environmental impact study is required—shall be always for waste incineration— the applicant shall conduct public consultations.

The same administrative procedure shall be carried for specific technology/equipment and its location. It is due to EPA has to evaluate given local conditions. However, in such case the applicant will be usually a Healthcare facility applying for decision through the County Environmental Officer.

A license (permit) for operating a hazardous waste installation, including waste storage, transport, and disposal is also required by Section 64 of the EP&M Law.

5.14 Recommended flow chart

Based on the regulatory requirements the following flow charts can be drawn:

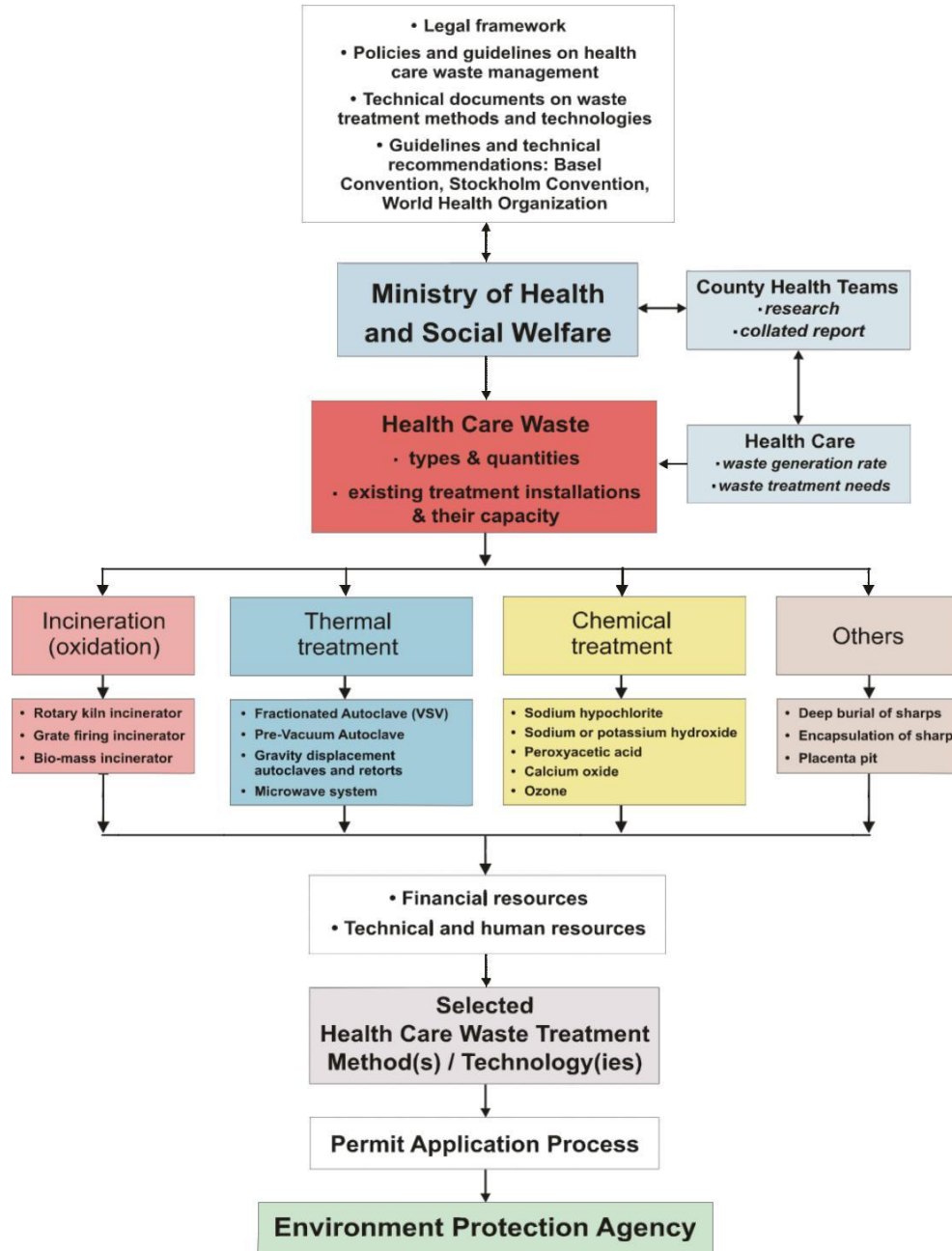


Figure 10: Process flow-chart-decision making, selection of Healthcare waste treatment method or technology

Assessment of Medical Supplies and Medical Waste Management

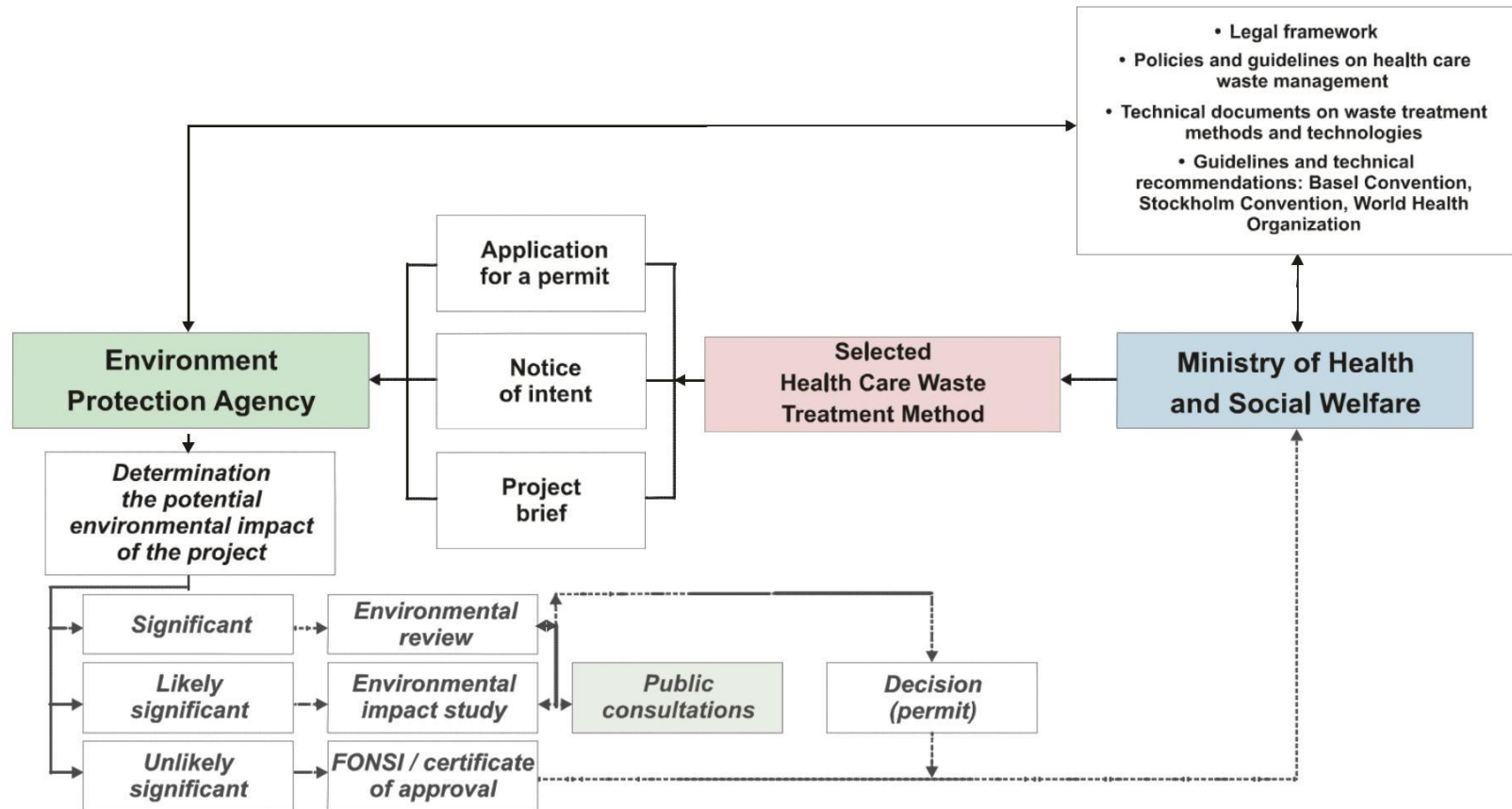


Figure 11: Process flow-chart-decision making, permit application process for the selected Healthcare waste treatment method or technology

General Recommendations and Strategies

The most common alternative for the safe decontamination of infectious Healthcare waste is to day steam treatment technology. Based on experience, other treatment systems based on waste combustion, chemicals, dry heat or irradiation are less trustable and cause unnecessary environmental pollution. Therefore these treatment methods are not recommended by certain institutions as the UNEP or the German Robert Koch Institute. In the official list for decontamination systems in Germany it is stated: —Only thermal processed are suitable for the disinfection of waste conforming to the definition in Section 10 of the Federal Epidemic Control Act (infectious waste). Processes should be given preference in which the medium is saturated steam and in which air is evacuated mechanically.

As the treatment cost will be about 3 times higher when using an incinerator instead of an autoclave system and as the operation cost are almost 3 time higher, the usage of incineration systems for Liberia is not recommended. Instead steam based treatment systems should be used. As the investment cost for microwave system are 2 times higher than for an autoclave, autoclave systems should be preferred.

For the future treatment of infectious waste by alternative systems, the setup of autoclave systems with a fractionated process cycle (pulsing of steam shots) is recommended. This type of steam-based treatment system does not require pre-shredding the waste is relatively easy to operate and maintain and has comparably low operational costs, while still decontaminating waste safely.

6.0 Determination of disposal sites

The disposal of healthcare waste is a well-known problem in Liberia. Existing disposal practices are sporadic due to the lack of clear policies or guidelines, and disposal infrastructure is either non-existent or poorly functioning. Due to the absence of central operated, engineered municipally landfills, hospitals are forced to find temporary solution. Often this is resulting in the digging of simple pits and dumping the mixed waste in an uncontrolled and unsafe way.

The assessment of the applied disposal method in the Liberian healthcare sector showed that only uncontrolled pits for the depositing of waste in to or on to land and surface impoundment methods for waste disposal exist. Both methods showed weak points in application. The Task Report —B2: Determination of the medical waste disposal sites|| includes description of two existing waste depositing sites (waste pits) and two surface impoundment methods (placenta pits) as well as a description of the only official waste dumping site in Liberia.

Considering the current situation it cannot be expected that with in the next years a nationwide system of engineered sanitary land fills will be setup. It must be expected that it might even take several years until simple dump sites will be available in the different cities and villages. Proposed solutions can be delineated between on-site and off-site:

On-site



Figure12: Typical Dump Site in a country hospital

- Properly designed and constructed placental pits, and on a more temporary basis, a sharps and waste burial pits. The latter will minimize, if not eliminate the potential for ground water contamination, and the spread of disease.

Off-site



Figure13: Only official Solid Waste Disposal Site, Whein Town

- Development of controlled land fill sites at larger towns (county capitals). MoH&SW should particularly support those locations where healthcare facilities are more numerous.

- Implementation of separate waste collection and disposal system in healthcare facilities in Montserrat County. Non-hazardous waste then disposed of at the Wherein Town landfill.

6.1 Status of on-site waste disposal facilities

Except Monrovia, Healthcare facilities in Liberia have no access to organized external services for waste disposal. Therefore all waste is managed on-site with some sort of burn or bury process.

- solid and infectious waste, often including sharp items are collected together, buried, open burn to rarely treated in WDU;
- sharps are burned in case of facilities having no WDU disposed of in a waste pit;
- pathological waste is disposed of in placenta a pit or buried in ground;
- expired pharmaceuticals a restored but small quantities are also burnt or disposed of to waste pit or latrine;

Chemical waste is disposed of down a drain.

Due to lack of hydro-geological studies and documentation, and law enforcement, foremost of the inspected pits their locations have been chosen based on available space only but not distance to water table. The burial pits are in most cases not designed and maintained according to recommended standards (please see report B2).

JFK Hospital, Monrovia

There is neither placenta nor waste burial pit. Pathological waste, including placentas, is collected by private contractor Stryker Funeral Services, who manage this waste according to the renown internal policies. It was unclear what Stryker did with body parts. All solid general waste is collected by local contractor NC Senators. Medical waste is incinerated on-site; however field observations noted substantial quantities of general waste in the incinerator placenta in with general waste. Accumulated stockpile of 1328kg of expired pharmaceuticals is stored in a TIR container.

Redemption Hospital, Montserrado

The placenta pit is divided into 3 sections of which one is filled. There is no burial pit. MSF pick up then on-medical waste once per week.

CHR ennie Hospital, Margibi

Solid waste is disposed of in a burning pit, which is 90% filled. The size of the pit is about 3x 4 meters and 2 meters deep. A placenta pit is about 4 meters deep, not filled. Open septic tanks for liquid waste exists. There is a health care waste management shelter constructed but not furnished and not in use

Phebe Hospital, Bong

General waste is burned and buried in an open pit with in the hospital grounds (please see report B2). Pathological waste is disposed of in a placenta pit, mostly filled. A new incinerator son-site but had yetto be used.

Government Hospital, Tubmanburg, Bomi

The collected waste mixture is burnt and disposed of in a pit. Organic waste (mainly placentas) is disposed of in the placenta pit. There is a health care waste management shelter constructed but not furnished and not in use

JJ Dossen Hospital, Maryland

All waste generated from the hospital grounds is burned in the open pits. Placent as and body parts are disposed of in a pit. There is a health care waste management shelter constructed but not furnished and not in use

Martha Tubman Memorial Hospital, Grand Gedeh

There is a placenta pit, organic kitchen waste pit and an ash pit. In addition, there is an old covered pit with open entry pipe currently being used for syringe disposal. It is unknown what this pit was originally intended for.

Liberia Government Hospital, Buhanan, Grand Bassa

Pathological waste is dispose do fin a placenta pit. There is no burial pitbuta stockpileofmixed waste scheduled for burning in DeMont fort incinerator.

Saclapea HC, Nimba

There are well designed and maintained burial, and placenta pit (please see report B2).Solid organic waste mixed with packaging waste is buried in a pit which is almost filled. The size of the pit is 2x2 meters and 1.5 meters deep. In accordance with the MSF manual waste is covered with palm leaves, and occasionally with soil.

6.3 General HCW disposal Strategies

The disposal of hazardous Healthcare waste, especially untreated waste on dump sites is today not recommended any more. Several objections exist, objections out of cultural or religious reasons or objections based on a perceived risk about the release of pathogens to air and water or on the risk of access by scavengers. The removal of the remaining Healthcare waste, after recycling or treatment of the original Healthcare waste, will require access to land for disposal. Allowing waste to accumulate at hospitals or elsewhere leads to a far higher risk of transmission of infection than controlled disposal at specially prepared sites or well operated municipal landfills, even if the place is not designed according to modern standards (engineered, sanitary landfill).

Indiscriminate dumping of waste is unsafe. Instead, an acceptable land disposal method, either on-site or off-site, should satisfy four general principles:

- Permanent control – The disposal location should be under some form of permanent control such as protected by a fence, secure cover or staff
- Controlled waste emplacement–Wastes should be deposited in a controlled way at a disposal site and not scattered around irresponsibly
- Engineered construction– A disposal site, no matter how small or simple in design, should be constructed in a safe and properly engineered manner
- Hydrogeological isolation – The purpose of disposal is to isolate wastes from people and the environment and to allow chemical and microbiological processes to degrade the wastes and its remaining pathogen content. Therefore, an acceptable disposal option is one that provides, at least, some isolation from the surrounding strata and hydrology

In all cases it is necessary to ensure that disposal facilities are built and maintained according to established regulatory standards. This includes that the construction process should be evaluated and permitted by EPA, and operation of the facility should be monitored by County Environment Officers, in collaboration with Environmental Health Technicians and County Health Officers.

In all situations it should be ensured that waste is correctly classified and separated so infectious waste is not mixed with other types of non-hazardous (solid waste) and hazardous waste (chemicals, pharmaceuticals, etc.).

6.4 Determination for temporary disposal sites

Until there are controlled municipal waste landfills in the counties in Liberia, this option might only be feasible in Monrovia. In addition, if the county towns landfills and transport is available, then a realistic approach to the managed land disposal of Healthcare wastes would be to use this site. The destruction of pathogens by treatment prior to disposal further increases suitability of the residual wastes for landfill. A possible option would be decontamination by steam. If pre-treatment is not possible, it might be on a temporary basis possible for untreated Healthcare wastes to be securely deposited in a controlled landfill.

In that case potentially infectious Healthcare waste and sharps can be buried in trenches approximately 2 m deep, excavated in partially decomposed municipal wastes and preferably covered daily. At a depth of 2 metres, re-excitation by scavengers or animals may not be possible. The burial of potentially infectious and sharps wastes is unlikely to cause additional pollution problems at a controlled landfill. Its engineered design should minimize the possibility of off-site transport of pollutants and the physical-chemical conditions within partially decomposed municipal waste would accelerate biodegradation of the organic components in the Healthcare waste. The following points should be obtained

- Access to site and working are as possible for waste delivery and site vehicles.
- Presence of site personnel capable of effective control of daily operations.
- Division of the site in to manageable phases, appropriately prepared, before landfilling starts.
- Adequate sealing of the base and sides of the site to minimize the movement of wastewater (leachate) off the site.
- Adequate mechanisms for leachate collection, and treatment systems if necessary.
- Organized deposit of wastes in a small area, allowing them to be spread, compacted, and covered daily.
- Surface water collection trenches around site boundaries.
- Construction of a final cover to minimize rain water in filtration when each phase of the land fill is completed.

More detailed and technical Recommendations for the determination of different types of temporary disposal sites are provided in the Task Report –B2: Determination of the medical waste disposal sites. In the report, also recommendations for the upgrading of existing sites can be found.

7.0 MEDICAL WASTE MANAGEMENT PLAN (MWMP), INCLUDING ESTIMATED COSTS AND TIMELINE

7.1 MWMP-Strategic Framework

Vision of the Strategy

The Vision of the Liberian Medical Waste Management Plan strategy is to facilitate the establishment of an:

- Environmentally sustainable,
- Occupationally healthy and safe,
- Financially viable,
- Institutionally feasible
- Technically appropriate
- operationally practical comprehensive and integrated— cradle-to-grave Healthcare Waste Management system.

7.2 Policy Options

As it appears from the above formulation, implementation of an improved HCWM will have to be based on selection between different options and at the same time ensuring

progress as well as due balance between the various elements, requiring political decisions. This section includes proposals for policies that should be adopted in further development of the HCWM in Liberia.

The proposed policies to be applied for the future improvement of HCWM:

Centralized versus decentralized implementation of improved HCWM:

Initially initiatives taken by a central institution (e.g. MoH&SW) are necessary to ensure common standards for HCWM as well as for bringing out environmental guidelines pertaining to HCWM.

- A central institution should co-ordinate all activities pertaining to development of common standards with respect to HCWM.
- Capacities at all levels will be strengthened to enable them to be responsible for implementing HCWM systems in their respective facilities.

Private versus public services:

- Private involvement should be considered for external transport and treatment, with the purpose of rationalizing the functions and to reduce cost, while improving standards.

Regulation:

- There is an urgent need to implement the developed draft policy and guideline on HCWM and the development of other regulation (Standard Operation Procedures) that establishes common standards for waste segregation, transport, treatment and disposal.

Waste collection:

- Simple but efficient waste collection system will be introduced for all Healthcare facilities. Occupational health and safety aspects of persons handling HCW will be given due consideration while implementing HCWM systems.

Treatment:

- Appropriate technology will be utilized to treat the HCW so as to render it harmless to environment and public.

Final disposal:

- Environmental and public health issues will be given due consideration while choosing the final disposal of HCW.

Finance:

- Adopt duty-of-care as well as polluter-pay-principle for the whole life cycle of the Healthcare Waste.

Implementation

1. National Level

- Guidelines and policies should be developed

2. Phase: County and Referral Level

- Establish central/de-central treatment plants and establish transport systems on county level

3. Clinics & other Primary Health Facilities

- Establish treatment and disposal facilities as well as transport systems to central treatment facilities when required.

Time Frame

The implementation of the vision is based on fundamental changes and improvement of the current HCWM system. Therefore this MWMP is aimed at implementing the first steps within a period of not less than 2 to 5 years. After five years the plan has to be revised and upgraded for another five years.

7.3 Framework of the MWMP

The following steps should be taken and are already partly taken to develop a national plan on HCW management:

	Action item	Status
1	Establishing of a Steering committee and Working Group on HCWM "Waste Committee"	Partly done, needs strengthening
2	Reviewing and assessment of legal regulations regarding Healthcare Waste	done
3	Assessment of the current situation	Done
4	Development of a Policy on Healthcare Waste Management	In progress
5	Development of an Implementation/ Action Plan	(in progress)
6	Reviewing, adapting and development of standard procedures and guidelines	In progress for the guideline
7	Approve the HCWM Plan and start of Implementation	
8	Review the HCWM Plan	

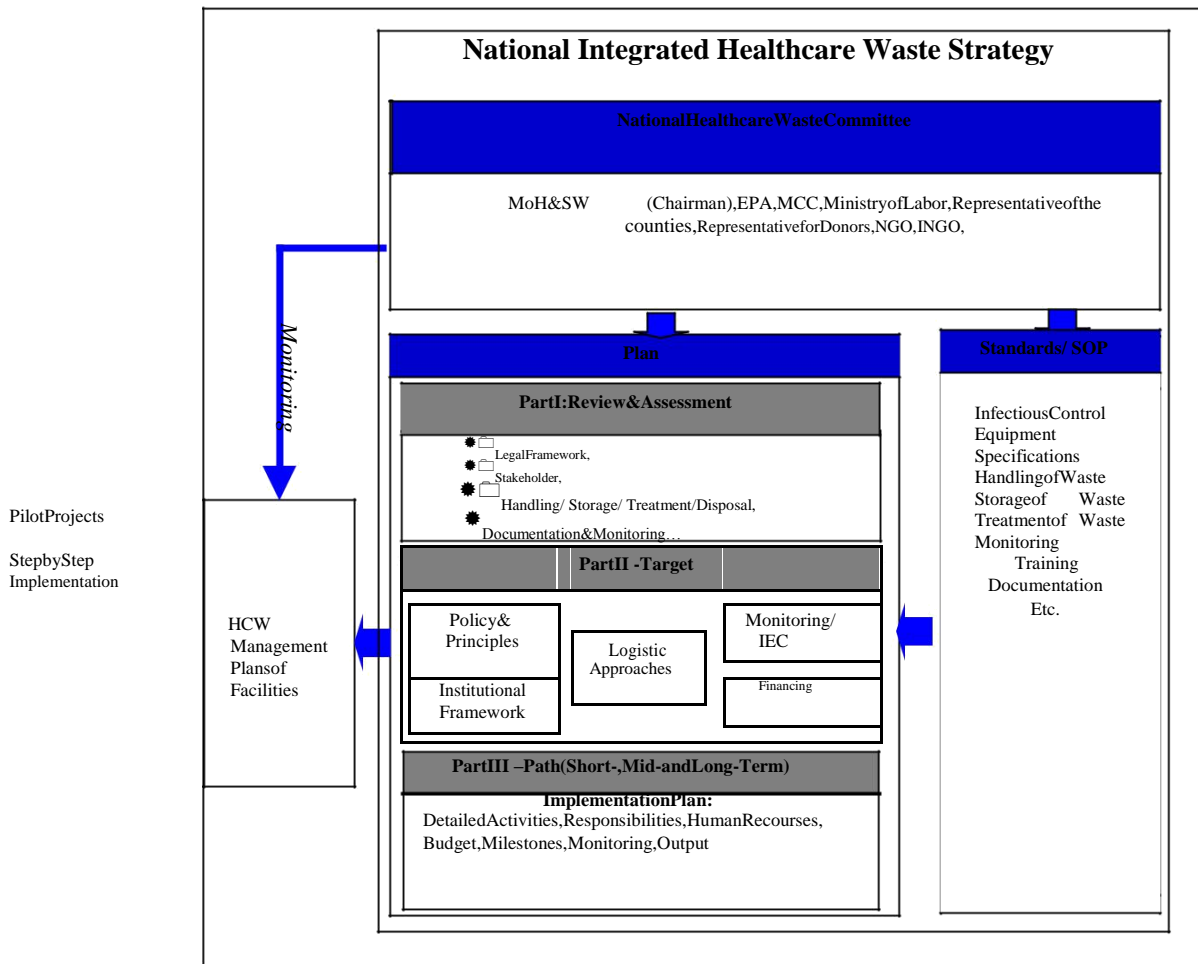


Figure14: Framework of a MWMP

7.5 MWMP- Regulatory Framework

Detailed and clear regulations and guidelines enables the Healthcare waste generator, the transport and treatment entities to work and operates afe and environment friendly on a standardized basis. The following standards and safety operation procedures must be developed and implemented:

Internal Healthcare Waste Management	<ul style="list-style-type: none"> Standards on HCW segregation and HCW streams Standards on HCW collection and internal transportation Standardson HCW interim storage
External Processes of Healthcare Waste Management	<ul style="list-style-type: none"> Treatment of HCW (also applicable for on-site treatment with in Healthcare facilities) Validation Procedures for the treatment of waste Guide line on external transportation of HCW Certification Procedure for external transport entities Guideline on safe Disposal of HCW
Monitoring	<ul style="list-style-type: none"> Monitoring guide line for Environmental Hygiene Management Commission and National Institute for Hygieneand Epidemiology (Collection, Transport, Storage,Treatment, Training, Documentation) Evaluation sheets for internal audits in siderthe Healthcare facilities Template for record keeping for waste amounts
Accidents and spillages response	<ul style="list-style-type: none"> Guide line and procedure how to collect accidents and incidents occurring in Healthcare facilities and related activities like storage transport and treatment Template for incident report form
Capacity Development – Education	<ul style="list-style-type: none"> Concept fort raining and awareness building Curriculum and certification system for training activities
Reporting & Documentation	<ul style="list-style-type: none"> Development of Transport documents (transfer notes...) Report guide line for yearly report of Healthcare facilities Report guideline for yearly report of Environmental

- Report guideline for yearly report of MoH

7.6 MWMP - Logistic approach

For the determination of to be managed amounts of Healthcare Waste, the setup of a Healthcare Waste treatment strategy is needed. To ease the handling, monitoring and treatment of different kind of waste, groups of waste with similar hazard characteristics or the same needs for transport and or treatment are clustered in groups or waste streams.

Five main HCW streams which should be considered and include the particular sub - groups:

Waste stream I:

Non-risk Waste: Household waste and waste for recycling

Definition according to the Liberia regulation: Non-risk, general waste comparable to household waste or waste from markets

Waste stream II:

Bio-hazardous Waste: Infectious waste and sharp items

Definition according to the Liberian regulation: Infectious waste and sharp waste

Waste stream III:

Chemical waste (including pharmaceutical waste, cytotoxic waste)

- Definition according to the Liberia regulation: Pharmaceutical waste, Genotoxic waste, Chemical waste, Waste with high contents of heavy metals, Waste from pressurized containers

Waste stream IV:

Pathological waste and body parts

Definition according to the Liberia regulation: Pathological waste

Waste stream V:

Radio active waste

Definition according to the Liberia regulation: Radio active waste

7.7 Segregation and collection

The here presented MWMP covers all sources generating Healthcare Waste in Liberia, including small and large hospitals, polyclinics, health posts and nursing homes, whether public or private. Following types of Healthcare facilities are focused in particular:

- General national hospitals,
- Special national hospitals,
- Referral hospitals,
- County hospitals,
- Health canthers,
- Clinics

The MWMP includes all kinds of Healthcare Waste, which have been divided in to different categories such as domestic or municipal type Healthcare waste and hazardous Healthcare Waste, except wastewater generated in Healthcare facilities.

The detailed waste classes for segregation of Waste in the Healthcare Facilities should comply with the draft Guideline: —Safe Management of Healthcare Waste in Liberia published in Nov. 2009. The waste classification system used in this document is based on the recommendations of the World Health Organization (WHO).

In accordance to the regulation at least a three bin system for collection should be implemented: General Waste, Infectious Waste, and Sharp Waste. In facilities with additional waste kinds the system should be extended. Note:

Low radioactive waste and chemical waste shall NEVER be collected together with the infectious waste stream, in order to prevent the risk of explosions during transport, storage and treatment and the risk of radiation.

7.8 Storage

A storage location for Healthcare waste should be designated inside the Healthcare establishment or research facility. 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 and the frequency of collection. Details about safe storage are out lined in the draft Guideline: —Safe Management of Healthcare Waste in Liberia published in Nov. 2009.

Storage Facilities should be labeled in accordance hazardous level of the stored waste. In general there are four different kinds of waste storage areas which should be built and equipped in accordance to their amount and risk level:

1. Non-hazardous or general waste.
2. Hazardous Waste:
 - a. Infectious and sharp waste,
 - b. Chemical and hazardous pharmaceutical waste,
 - c. Radioactive waste.

If new HCW management systems are developed and if new infrastructure is planned, it is recommended to build a —waste yardll. A —wasteyardll is the place where all the relevant waste management activities are bundled. To concentrate certain tasks, the setup of multi-functional buildings (waste storage area) is recommended.

7.9 Transport

Hazardous and non-hazardous waste should always be transported separately. In general there are three different transport systems:

1. Transport of general waste. The waste transportation trolleys for general waste should be neutral (or painted black) and only be used for household waste and labelled where appropriate.
2. Infectious waste can be transported together with sharp waste (depending on the final treatment / disposal). Infectious waste should not be transported together with other hazardous waste in order to prevent spreading of infectious agents. The trolleys should be coloured in the appropriate colour code for infectious waste (yellow) and should be labelled with the —Infectious Sign and the words: —Danger, Infectious Waste.
3. Other hazardous waste.

On-site transportation should take place during low activities times on the hospital compound. Specific routes should be planed to prevent exposure to staff and patients and to minimize the passage of loaded carts through patient care and other clean areas. Prevent the transport on public ways – use separate floors, stairways or elevators as far as possible. Regular transport routes and collection times should be fixed and reliable. Transport staff should wear adequate personal protective equipment like gloves, closed shoes and an overalls and masks where appropriate.

Off-site or external transport is the transport of Healthcare waste on public streets outside of the compound of the Healthcare facility. As here are the general public may be affected in case of an accident, special requirements and restrictions should be considered to prevent accidents to other people and vehicles. Restrictions will depend upon the risk level of the transported waste and the amount.

Transporting of hazardous waste should comply with national regulations and with international agreements if wastes are shipped abroad for treatment (Basel Convention). In case there are no such national regulations, responsible authorities may refer to Recommendations on the transport of dangerous goods, published by the United Nations. This regulation is available in English, French, Spanish, Russian, Arabic and Chinese (UN Recommendations on the Transport of Dangerous Goods, 15th edition, 2007: <http://www.unece.org/>).

Details about transporting of Healthcare waste are outlined in the draft Guideline: —Safe Management of Healthcare Waste in Liberia published in Nov. 2009.

Treatment

Resources that will ensure a national network of disposal facilities for Healthcare Waste should be identified. The concentration of healthcare facilities and the accessibility of the disposal facilities are relevant. Equipment involved in acceptable treatment options and technical specifications for the processes should be included also in a national or county level policy.

Three options for treatment organization are to be differentiated:

- On-site treatment in each facility (recommended for rural areas),
- Regional or cooperative Healthcare Waste treatment, Supplemented by individual facilities for outlying hospitals.
- Treatment in existing industrial or municipal treatment facilities, where these exist.

Regional circumstances, such as the number, position, type and size of HCF's, the quality of the road system and existing technical and financial resources have to be considered. Different kinds of methods for the treatment, destruction, or disposal of HCW are available today.

According to the carried out assessment, the two main treatment technologies to be applied are incineration (oxidation of the waste) or decontamination by using steam treatment (thermal treatment). Decontamination of waste by thermal treatment methods is only permitted for infectious and sharp waste.

“Other methods” like listed before are mainly used for recycling or reuse processes of waste. Encapsulation should only be used if no proper treatment method is feasible.

Emissions from incineration especially from Healthcare waste including high amounts of halogenated plastics and chemicals, including heavy metals such as mercury, lead, cadmium, arsenic, chromium, copper, and zinc as well as persistent organic pollutants (POPs) such as dioxins and furans. Due to upcoming concerns of the environmental impacts from emissions by incineration (flue gas, bottom ash, contaminated fly ash and waste water

from the flue gas treatment), and due to the relatively high investment and operational cost, the introduction of alternative treatment methods should be followed where feasible.

Health Care Waste Management During Health Emergencies (Ebola Virus Disease-EVD) General consideration

One of the major tasks faced by the Ministry of Health Incident Management System during the Ebola Virus Disease (EVD) emergency is minimizing contamination/infection rates among healthcare workers particularly during handling waste generated from the treatment activities of patients with suspected, probable and confirmed Ebola as well as personnel handling human remains of victims of the EVD.

Special attention is placed on waste generated from Ebola Treatment facilities including Ebola Treatment Units and Community Care Centers (CCCs) as well as in households of EVD victims who are undergoing homebased treatment. These wastes should be separated into the following categories:

- 1) Waste Stream II:
- 2) Waste Stream III

The box below provides additional guidance on handling waste during health emergency

Guidance

The approach to solid waste management is to reduce the risks and costs associated with handling and transportation by on-site disposal and burning. The area designated for solid waste management should have controlled access to prevent entry by animals, untrained personnel or children.

All solid waste produced from the Ebola Treatment Units is potentially contaminated and must be securely collected, transported and disposed using different methods. No material or waste should leave patients room or isolation/Care Centres and Units without spraying with or submersing in 0.5% chlorine solution. All Ebola treatment Units should have a separate waste management and disposal facility for both suspected cases and non-suspected cases.

Biological waste material such as placenta and biopsy samples are to be contained in sealed, leak-proof cadaver bags (or double bags to ensure that there is no leakage as per WHO recommendation) and either buried or burned. If burned, complete burning must be assured.

PERSONAL PROTECTIVE EQUIPMENT

Proper use of PPE (personal protective equipment) is extremely important when dealing with an Ebola outbreak.

PPE includes:

- Correctly sized gloves (non-sterile examination gloves) when entering the patient care area.¹ Consider changing gloves if heavily soiled with blood or any body fluids while providing care to the same patient (perform careful hand hygiene immediately after removal). Always change gloves and perform hand hygiene immediately after removal, when moving from one patient to another while caring for patients in the same room. Consider double gloving when the quality of gloves appears to be poor (e.g., if holes and tears form rapidly during use).
- A disposable, impermeable gown to cover clothing and exposed skin.
- A medical mask and eye protection (eye visor, goggles or face shield) to prevent splashes to the nose, mouth and eyes.
- Closed, puncture and fluid resistant shoes (e.g. rubber boots) to avoid contamination with blood or other body fluids or accidents with misplaced, contaminated sharp objects. If boots are not available, overshoes should be used but these must be removed while still wearing gloves and with caution to avoid hand contamination.²

Some important guidelines to consider when using PPE are the following:

- When undertaking any strenuous activity (e.g. carrying a patient) or tasks in which contact with blood and body fluids is anticipated (e.g., the patient has symptoms like diarrhoea, bleeding or vomiting and/or the environment could be contaminated with blood or body fluids), in addition to the above-mentioned PPE also use double gloving, and wear a waterproof apron over the gown if for any reasons your gown is non impermeable, and disposable overshoes and leg coverings, if boots are not available.
- Avoid aerosol-generating procedures if possible. Wear a respirator (FFP2 or EN certified equivalent or US NIOSH-certified N95), if any procedures that stimulate coughing or promote the generation of aerosols (e.g., aerosolized or nebulized medication administration, diagnostic sputum induction, bronchoscopy, airway suctioning, endotracheal intubation, positive pressure ventilation via face mask) are planned to be performed.³
- Before exiting the isolation room/area, carefully remove and dispose of PPE (including boots) into waste containers and perform hand hygiene.
- When removing PPE, be careful to avoid any contact between the soiled items (e.g. gloves, gowns) and any area of the face (i.e. eyes, nose or mouth) or non-intact skin.
- Do not recycle any single-use disposable PPE. However, if the decontamination of goggles and visors is necessary, it is essential that these items should be cleaned with water (\pm detergent) to remove any organic matter and then immersed fully in a 0.5% chlorine solution or a solution containing 5000 ppm (parts per million) available free chlorine for a

minimum of 30 minutes (preferably overnight) for decontamination. After decontamination, they should be thoroughly rinsed with water (to remove irritating hypochlorite residues and salt deposits) before re-use. The wipes used for the initial cleaning should be treated as infectious waste; the disinfectant can be safely poured down a sink or drain.⁴

Healthcare, 3rd ed. Malden, Mass: Blackwell Pub.; 2004.

GENERAL ENVIRONMENTAL CLEANING AND MANAGEMENT OF LINEN

1WHO (World Health Organization). 2009. Hand Hygiene Posters. Geneva, available from:

http://www.who.int/gpsc/5may/tools/workplace_reminders/en/

2 WHO (World Health Organization). September 2014. Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, with Ebola Focus Available at http://apps.who.int/iris/bitstream/10665/130596/1/WHO_HIS_SDS_2014.4_eng.pdf?ua=1&ua=1&ua=1.

3CDC (Centers for Disease Control and Prevention) Infection Prevention and Control Recommendations for Hospitalized Patients with Known or Suspected Ebola Hemorrhagic Fever in U.S. Hospitals. Atlanta, GA; Available from: <http://www.cdc.gov/vhf/ebola/hcp/infection-prevention-and-controlrecommendations.Html>.

4 Hoffman PN, Bradley C, Ayliffe GAJ, Health Protection Agency (Great Britain). Disinfection in page66

Personal Protective Equipment Required

- Wear heavy duty/rubber gloves, impermeable gown and closed shoes (e.g. boots) when cleaning the environment and handling infectious waste.
- In addition, wear facial protection (mask and goggle or face shield) and overshoes if boots are unavailable, when undertaking cleaning activities with increased risk of splashes or in which contact with blood and body fluids is anticipated (e.g., cleaning surfaces heavily soiled with vomit or blood or cleaning areas closer than 1 meter/3 feet from a patient with symptoms like diarrhoea, bleeding or vomiting, etc.).

Cleaning Process

- Environmental surfaces or objects contaminated with blood, other body fluids, secretions or excretions should be cleaned and disinfected as soon as possible using standard hospital detergents/disinfectants (e.g. a 0.5% chlorine solution or a solution containing 5 000 ppm available free chlorine).⁵ Application of disinfectants should be preceded by cleaning to prevent inactivation of disinfectants by organic matter.
- If locally prepared, prepare cleaning and disinfectant solutions every day. Change cleaning solutions and refresh equipment frequently while being used during the day, as they will quickly become contaminated (follow your hospital protocols if available).
- Clean floors and horizontal work surfaces at least once a day with clean water and detergent. Cleaning with a moistened cloth helps to avoid contaminating the air and other surfaces with air-borne particles. Allow surfaces to dry naturally before using them again.
- Dry sweeping with a broom should never be done. Rags holding dust should not be shaken out and surfaces should not be cleaned with dry rags.
- Cleaning should always be carried out from “clean” areas to “dirty” areas, in order to avoid contaminant transfer.
- Do not spray (i.e. fog) occupied or unoccupied clinical areas with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit.⁶

Management of Linen

- Linen that has been used on patients can be heavily contaminated with body fluids (e.g. blood, vomit) and splashes may result during handling. When handling soiled linen from patients, use gloves, impermeable gown, closed shoes (e.g., boots) and facial protection (mask and goggle or face shield).
- Soiled linen should be placed in clearly-labelled, leak-proof bags or buckets at the site of use and the container surfaces should be disinfected (using an effective disinfectant) before removal from the isolation room/area. If there is any solid excrement such as faeces or vomit, scrape off carefully using a flat firm object and flush it down the toilet or in the sluice before linen is placed in its container. If the linen is transported out of the patient room/area for this procedure it should be put in a separate container – it should never be carried against the body.
- Linen should be then transported directly to the laundry area in its container and laundered promptly with water and detergent.
- For low-temperature laundering, wash linen with detergent and water, rinse and then soak in 0.05% chlorine

solution (a solution containing 500 ppm available free chlorine) for approximately 30 minutes. Linen should then be dried according to routine standards and procedures.

□ Washing contaminated linen by hand should be discouraged. However, if washing machines are not available or power is not ensured, take the soiled linen out of the container and empty it into a large drum container of hot water and soap. Soak the linen in this drum and make sure it is totally covered with water. Use a stick to

5 WHO best practices for injections and related procedures toolkit. World Health Organization, Geneva, 2010; Available from: http://www.who.int/injection_safety/toolbox/9789241599252/en/

6 WHO (World Health Organization). September 2014. Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, wpitahgeE6b7ola Focus. Available at http://apps.who.int/iris/bitstream/10665/130596/1/WHO_HIS_SDS_2014.4_eng.pdf?ua=1&ua=1&ua=1.

stir; then throw out the water and refill the drum with clean water and add chlorine 0,1% (a solution containing 1 000 ppm available free chlorine) and allow to soak for 10–15 minutes. Remove the linen and then rinse in clean water. Remove excess water and spread out to dry. Avoid as much splashing as possible.

- If safe cleaning and disinfection of heavily soiled linen is not possible or reliable, it may be prudent to burn the linen to avoid any unnecessary risks to individuals handling these items.⁷

INJECTION SAFETY AND MANAGEMENT OF SHARPS

- Each patient should have exclusively dedicated injection and parenteral medication equipment which should be disposed of at the point of care. Syringes, needles or similar equipment should never be reused.
- Limit the use of needles and other sharp objects as much as possible.
- Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care.⁸
- If the use of sharp objects cannot be avoided, ensure the following precautions are observed⁹:
 - Never replace the cap on a used needle.
 - Never direct the point of a used needle towards any part of the body.
 - Do not remove used needles from disposable syringes by hand, and do not bend, break or otherwise manipulate used needles by hand.
 - Dispose of all sharps (including syringes, needles, scalpel blades, cannulas and other sharp objects) in appropriate, puncture-resistant/leak-proof sealed disposable containers designed for sharp medical waste collection before incineration.
 - Ensure that puncture-resistant containers for sharps objects are placed as close as possible to the immediate area where the objects are being used ('point of use') to limit the distance between use and disposal, and ensure the containers remain upright at all times. If the sharps container is far, never carry sharps in your hand but place them all in a kidney dish or similar to carry to the sharps container.
 - Ensure that the puncture-resistant containers are securely sealed with a lid and replaced when 3/4 full.
 - Ensure the containers are placed in an area that is not easily accessible by visitors, particularly children (e.g. containers should not be placed on floors, or on the lower shelves of trolleys in areas where children might gain access).

In Liberia there are local manufacturers of WHO-approved drum incinerators that are suitable for this purpose.

It is essential to ensure that total incineration has taken place. Caution is also required when handling flammable material and when wearing gloves due to the risk of burn injuries if gloves are ignited. Sharps not fully burnt should be buried in designated waste pits and covered with a layer of soil 10 –15 cm deep.

All used disposable Personal Protective Equipment (PPE), non-sharps and other infectious medical waste need to be collected in leak-proof hazard waste bags and placed in covered waste bins. Bins should never be carried against the body (e.g. on the shoulder). Pouring 0.5% chlorine solution on top of the waste bags prior to being securely sealed as pre-treatment disinfection is recommended. The procedure can create back-splash, so care should be taken to protect the eyes. Pre-treated contaminated medical waste can be transported for incineration.

Although incineration may be used during outbreaks of infections such as ebola, pits may also be used for final disposal.

to a depth of 1-1.5 m (or about 3-5 feet). After each waste load, the waste should be covered with a layer of soil
10 -15 cm deep.

7 Ibid.

8 Hoffman PN, Bradley C, Ayliffe GAJ, Health Protection Agency (Great Britain). Disinfection in healthcare. 3rd ed. Malden, Mass: Blackwell Pub.; 2004.

9 WHO (World Health Organization) How to safely collect blood samples from persons suspected to be infected with highly infectious blood-borne pathogens (e.g. Ebola).

- ❑ An incinerator may be used for short periods during an outbreak to destroy solid waste. However, it is essential to ensure that total incineration has taken place. Caution is also required when handling flammable material and when wearing gloves due to the risk of burn injuries if gloves are ignited.
- ❑ Placenta and anatomical samples should be buried in a separate pit.
- ❑ The area designated for the final treatment and disposal of waste should have controlled access to prevent entry by animals, untrained personnel or children.
- ❑ Waste, such as faeces, urine and vomit, and liquid waste from washing, can be disposed of in the sanitary sewer or pit latrine.¹⁰
- ❑ All other waste generated in the Centres (i.e. gloves, masks, surgical gowns) should be collected and contained in waste bags and cover bins.

When designing solid waste management pits for an Ebola Treatment Unit, it is important to consider the type of waste generated, wind direction, distance to Centre/Unit, type of geology and topography, distance to water source, availability and suitability of site and number of patient, staff and waste management technicians required.

INCINERATION AND LIQUID WASTE AREAS

Direct, unprotected contact during disposal of infectious waste can result in accidental transmission of EVD. For this reason, all contaminated waste produced in the care of the EVD patient must be disposed of safely. All non-reusable items should be destroyed so they cannot be used again. The place for siting incinerators should be well demarcated (50-70 m² estimates). Incinerators should have capacity to burn waste 1000kg in one time. All waste from an isolation room should be treated with caution and the appropriate Personal Protective Equipment (PPE) must be worn during handling and disposal. All waste generated during the cleaning and decontamination of reusable equipment that comes into contact with an ebola infected patient should be treated as infectious waste.

Liquid waste, including patient excreta and from washing, can be disposed of in an isolated latrine or toilet set aside for EVD cases. No further treatment is necessary.

An incinerator may be used for short periods during an outbreak to destroy solid waste. However, it is essential to ensure that total incineration has taken place. As previously stated above, caution is also required when handling flammable material and when wearing gloves due to the risk of burn injuries if gloves are ignited.¹¹ A safe and inexpensive disposal system can be made by using an incinerator or a pit for burning.

- ❑ Select Staff to supervise waste disposal and burning
- ❑ Training and Supervise Staff to Carry out Waste Disposal
- ❑ Select Site for Burning EVD Contaminated Waste

¹⁰ WHO (World Health Organization). September 2014. Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, with Ebola Focus. Available at http://apps.who.int/iris/bitstream/10665/130596/1/WHO_HIS_SDS_2014.4_eng.pdf?augae=691&ua=1&ua=1.

¹¹ Ibid.

- Use Incinerator to burn EVD Contaminated Waste
- Take Steps to ensure Security of Burning Site

Table: 1 Incinerator distribution plan

No.	Name of Ebola Treatment Facility	Number of Incinerators
1	Samuel K. Doe ETUs	4 Units
2.	Ministry of Defense ETU	2 Units
3.	Redemption Hospital	1 Units
4.	Island ETU	2 Units
5.	ELWA ETU	1 Units

Non-Patient Care Activities (For Suspected or Confirmed Patients with Haemorrhagic Fever)

Diagnostic Laboratory Activities

- For procedures to safely collect blood or other samples from persons suspected or confirmed to be infected, follow the instructions provided by WHO.¹²
- All laboratory sample processing must take place under a safety cabinet or at least a fume cabinet with exhaust ventilation. Do not carry out any procedure on the open bench.
- Activities such as micro-pipetting and centrifugation can mechanically generate fine aerosols that might pose a risk of transmission of infection through inhalation as well as the risk of direct exposure.
- Laboratory personnel handling potential hemorrhagic fever (HF) clinical specimens should wear closed shoes with overshoes or boots, gloves, a disposable, impermeable gown, eye protection or face shields, and particulate respirators (e.g., FFP2, or EN certified equivalent, or US NIOSH-certified N95), or powered air purifying respirators (PAPR) when aliquot ting, performing centrifugation or undertaking any other procedure that may generate aerosols.
- When removing PPE, avoid any contact between the soiled items (e.g. gloves, gowns) and any area of the face (i.e. eyes, nose or mouth).
- Do not hang up the apron or gown for reuse. Discard immediately.
- Perform hand hygiene immediately after the removal of PPE used during specimen handling and after any contact with potentially contaminated surfaces even when PPE is worn.
- Place specimens in clearly-labelled, non-glass, leak-proof containers and deliver directly to designated specimen handling areas.
- Disinfect all external surfaces of specimen containers thoroughly (using an effective disinfectant) prior to transport.

Ebola Virus Disease (EVD) Body Management Consideration

12 Hoffman PN, Bradley C, Ayliffe GAJ, Health Protection Agency (Great Britain). Disinfection inpage71 healthcare. 3rd ed. Malden, Mass: Blackwell Pub.; 2004.

Improperly handling Ebola Virus Disease (EVD) victims corpses at any point of the process can lead to more human or long term environmental hazards. The activity of disposing of human remains resulting from the Ebola Virus Disease (EVD) Epidemic is crucial and consists of two major procedures:

- How the bodies (EVD victims remains) are handled from the point of death/pick up
- How the corpse/body are disposed of at the point of burial

Handling of EVD corpses:

The handling of EVD corpses shall follow strict protocols developed by the Incident Management System (IMS) within the Ministry of Health and Social Welfare. Personnel involved with burial activities will have to undergo thorough training in line with existing protocols. The use of Personal protective equipment (PPE) must be strictly adhered to by such personnel. Table 1, shows minimum PPE requirements for burial teams.

POST-MORTEM EXAMINATIONS

- The coordinator and/or the infection prevention and control staff should be consulted for any decision making on post-mortem examinations.
- Post-mortem examination of HF patient remains should be limited to essential evaluations only and should be performed by trained personnel.
- Personnel examining remains should wear eye protection, mask, double gloves, disposable, impermeable gowns, and closed shoes or boots.
- In addition, personnel performing autopsies of known or suspected HF patients should wear a particulate respirator (e.g., FFP2, or EN certified equivalent, or US NIOSH-certified N95) or a PAPR.
- When removing PPE, avoid any contact between soiled gloves or equipment and the face (i.e. eyes, nose or mouth).
- Hand hygiene should be performed immediately following the removal of PPE.
- Place specimens in clearly-labelled, non-glass, leak-proof containers and deliver directly to designated specimen handling areas.
- All external surfaces of specimen containers should be thoroughly disinfected (using an effective disinfectant) prior to transport.
- Tissue or body fluids for disposal should be carefully placed in clearly marked, sealed containers for incineration.¹³

Site Selection for Burial of EVD Victims

13WHO (World Health Organization). September 2014. Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, wpitahgeE7b2ola Focus. Available at http://apps.who.int/iris/bitstream/10665/130596/1/WHO_HIS_SDS_2014.4_eng.pdf?ua=1&ua=1&ua=1.

The following procedures should be followed in selecting sites for EVD victims. Where suitable, such sites should undergo environmental and social impact assessment. However, due to the emergency, the following should be considered when selecting site for burial of EVD victims:

- Ideally an area of at least 1500m³ per ten thousand population
- Burial site should be determined through consultation with the affected community and local authorities and relevant stakeholders
- Soil conditions, water level and available space must be considered in the selection of burial sites
- Burial sites must be located in dry highland terrains
- Plot of land should be no less than fifty (50) meters from the surface water bodies
- Land identification should be two hundred fifty (250) meters to any type of wetland
- Water table at burial sites should be at least four (4) meters below the surface
- Depth of the grave should be at least two (2) meters below the surface
- The burial site should be located not less than five hundred (500) meters from the habitable areas.
- The use of the cemetery should be carefully managed. Where there are different religious groups within the affected population it may be necessary to provide separate burial areas.
- Community should be involved in identifying suitable sites taking into consideration water sources, cultural and traditional shrines.

Transportation of EVD Corpse

- Prepare bodies of EVD patients by packaging in requisite body bags in line with existing protocol
- Transport body safely to burial site using protocol below
- Disinfect the vehicle after transporting bodies
- PPE is not required for individuals driving or riding a vehicle to collect human remains, provided that drivers or riders will not be handling a dead body of a suspected or confirmed case of HF

Burial of Human Remains

- The coordinator and/or the infection prevention and control staff should be consulted for any decision making on movement and burial of human remains.
- For this topic, see also the WHO “Interim manual - Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation”.¹⁴ And the Ministry of Health Standard Operating Procedure on Safe Burials for Ebola Victims.
- The handling of human remains should be kept to a minimum. The following recommendations should be adhered to in principle, but may need some adaptation to take account of cultural and religious concerns:
 - Wear PPE (impermeable gown, mask, eye protection and double gloves) and rubber boots or closed puncture or fluid resistant shoes and overshoes to handle the dead body of a suspected or confirmed case of HF. Plug the natural orifices. Place the body in a double bag, wipe over the surface of each body bag with a suitable disinfectant

(e.g., 0.5% chlorine solution) and seal and label with the indication of highly infectious material. Immediately move the body to the mortuary.

- PPE should be put on at the site of collection of human remains, worn during the process of collection and placement in body bags, and should be removed immediately after. Hand hygiene should be performed immediately following the removal of PPE.
- Remains should not be sprayed, washed or embalmed. Any practice of washing the remains in preparation for “clean burials” should be discouraged.
- Only trained personnel should handle remains during the outbreak.
- After wrapping in sealed, leak-proof material, human remains should be placed inside a coffin if possible, and buried promptly.¹⁵

Table 1: Materials for safe disposal of EVD bodies

Item Category	Product Description	Unit
WATSAN	Body Bags (L)	piece
WATSAN	Body Bags (S)	piece
WATSAN	Chlorine Powder	Kg
WATSAN	Plastic Bucket w/ faucet	piece
Disposable PPE	PPE Suit - Hooded Coverall	piece
Disposable PPE	PPE Suit - Coverall (no hood)	piece

14WHO (World Health Organization). 2014. Interim manual - Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation, Geneva, Available from: http://www.who.int/csr/disease/ebola/manual_EVD/en/

15 WHO (World Health Organization). September 2014. Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, wptahgeE7b4ola Focus. Available at http://apps.who.int/iris/bitstream/10665/130596/1/WHO_HIS_SDS_2014.4_eng.pdf?ua=1&ua=1&ua=1.

Table 2: Summary table for implementation of IPC best practices during direct patient care and related activities.

What?	How?	Who is responsible
Create isolation rooms or areas	<input type="checkbox"/> Identify single rooms and prioritise these with known or suspected Ebola Virus.	<input type="checkbox"/> Coordinator or infection prevention and control to identify areas/ rooms for patient placement.
Restrict all non-essential from HF patients care rooms/ areas	<input type="checkbox"/> Ensure that clinical and nonclinical personnel are assigned exclusively to patients care areas and members of staff do not between these areas the outbreak. <input type="checkbox"/> Cohort staff between with suspected and those confirm heamorrhagic (HF) patients. <input type="checkbox"/> Use signage to alert restrictions of staff <input type="checkbox"/> Maintain a log of people entering the room	<input type="checkbox"/> Coordinator and or IPC staff
Limit the number of allowed access to the	<input type="checkbox"/> Use signage and other communications to alert restrictions of visitors. simple messages understandable for the but also be careful to stigmatization.	<input type="checkbox"/> Coordinator and/or IPC <input type="checkbox"/> Involve patient of representatives, if available <input type="checkbox"/> Health workers to adhere to recommendations and the coordinator when they followed.
Ensure that all staff and correctly use and remove recommended personal protective equipment (PPE).	<input type="checkbox"/> Ensure the equipment is always available and at the isolation	<input type="checkbox"/> Coordinator and/or IPC <input type="checkbox"/> Involve patients or representatives if available.

Ensure that all staff and visitors perform hand hygiene according to the above recommendations. These hand hygiene actions should be performed when recommended even if PPE is worn

Limit the use of needles and Provide staff and carers with Health workers to adhere to

other sharp objects as much as possible. If this cannot be avoided see instructions in the text.	instructions on the essential use of needles and sharps through training and reminder posters.	recommendations.
Dispose of needles and other sharp objects safely.	<input type="checkbox"/> Provide staff and carers with instructions on the safe disposal of sharps through training and reminder posters.	<input type="checkbox"/> Health workers to adhere to recommendations and report to the coordinator when they are not followed.
Create system of safe management of waste and linen.	<input type="checkbox"/> Provide staff and visitors/carers with instructions on the safe management and disposal of waste and linen through training and reminder posters.	Health workers to adhere to recommendations and report to coordinator when they are not followed.
Limit the use of phlebotomy and laboratory testing to minimum necessary for essential diagnostic	<input type="checkbox"/> Provide staff with training and visual instructions on the need for essential phlebotomy and	<input type="checkbox"/> Health workers to adhere to recommendations.
Only take a patient out of their room/care area if they are free of virus, or for essential life saving tests.	<input type="checkbox"/> Provide staff with training and visual instructions on the appropriate times to take the patient from	Health workers to adhere to recommendations and report to the coordinator when they are not followed.
Undertake cleaning of the environment and patient care equipment safety following recommendations in the text.	<input type="checkbox"/> Provide staff and visitors/carers with instructions on cleaning through training and reminder posters. <input type="checkbox"/> Ensure the equipment is available to	<input type="checkbox"/> Health workers to adhere to recommendations and report to the coordinator when they are not followed.

Ensure that all staff and visitors perform hand hygiene according to the above recommendations. These hand hygiene actions should be performed when recommended even if PPE is worn entry.

- Provide staff and visitors with instructions on the use and correct removal of PPE through training and reminder posters.
- Provide staff and visitors with instructions on the importance of hand hygiene best practices through training and reminder posters.
- Ensure continuous availability of alcohol-based hand-rub and soap. Water and single-use towels at the isolation room/areas entry and at the point of care.

Source: Adopted from WHO Interim Infection Prevention and control Guidance for Care of Patients with suspected or confirmed Filovirus Haemorrhagic Fever in Health Care Settings with focus on Ebola

MWMP - financing possibilities and cost estimations

Experiences & capacities in financing and management of waste management systems

Experiences in the financial management of waste management system exist only in municipal waste. The collection and management of this waste stream in Liberia is mandated to the city corporations based in each county capital. Given around 40% of Liberia's population live in greater Monrovia, it is the Monrovia City Corporation (MCC) that has the broadest capacity and experience to manage and finance municipal waste (and by default medical waste). MCC runs on a limited budget (\$286k for 2009/10) and relies heavily on external donor support to finance its waste management activities.

Municipalities are very weak in terms of institutional and staff capacity, internal controls, revenue mobilization capacity, ability to engage with their constituencies, and asset management. Five years after the end of the war, most local governments in Liberia continue to deliver few public services. The Government of Liberia has declared its commitment to the principles of decentralization, however, available resources and capacity need to be strengthened considerably.

Furthermore, the combination of lack of effective policy and regulations on waste management, combined with the Government's lack of resource capacity to monitor and enforce compliance has resulted in relatively unregulated municipal waste management.

The World Bank-supported Emergency Monrovia Urban Sanitation Project (EMUS) is the largest initiative to address waste management in Liberia, with budget of \$18.4m as the name suggests, it is an emergency project designed to have quick impact, particularly to response to the massive accumulation of waste throughout the city. It makes no specific provision for medical waste per se.

In practical terms, the EMUS project provides skips in strategic locations throughout the city. Four private solid waste contractors maintain a fleet of trucks which regularly empty the skips depositing the waste at the Whein Town Landfill.

The skips are designed to be used by the general public to deposit routine household waste. However, given the lack of alternatives and relatively low public awareness, businesses and institutions continue to use the skips for commercial waste, as do Healthcare facilities use the skips for medical waste. Field observations during this HCWM assessment witnessed un-segregated medical waste being dumped at Whein Town.

The MCC is responsible to manage the Whein Town landfill, and acknowledges that certain technical features are lacking. The direct results are noxious elements leaching into soils and groundwater - this problem is further exacerbated by non-segregated medical waste being deposited there. To mitigate against further potential environmental damage, the EMUS project is currently examining possible technical solutions. An alternative sanitary landfill site has been identified in Mt. Barclay; however it is unclear when a realistic start date will be to begin the project.

The key Government possibilities relating to solid waste management are linked the final year of the EMUS project when implementation is handed over to the MCC. It is envisaged that by the end of the four year project, the MCC will have sufficient capacity in terms of financial and systems management to manage up to 60% of greater Monrovia's solid waste management. Furthermore, once the World Bank funding is finished, the MCC attract its own funding through the Liberian national budget process.

The Government's capacity to manage medical waste is currently limited to on-site treatment and disposal systems located on health facility grounds. Although many facilities have a combination of either furnaces, incinerators and burial pits, there is negligible budget allocation at each facility to manage these resources. In some instances, new UNICEF De Montfort waste destruction units (incinerators) were installed, however the institution lacked the resources to procure wood needed light them. As such, some incinerators remain unused.

Financial possibilities of the MCC and the MoH&SW

Current financial possibilities for waste can be divided into two major sources: the MCC's budget for solid municipal waste management in Monrovia; and the Health budget within Liberia's national budget for Healthcare facilities.

The current scope for cost recovery for waste management at Healthcare facilities is negligible. It is necessary that Healthcare facilities include within their budgets an allocation for HCWM. In addition each facility would need to perform a waste audit to establish the volumes of waste they produce, and consequently determine the funds required.

Furthermore, this assessment project and resultant policy and guidelines support the polluter pays principle'. This principal implies that all producers of waste are legally and financially responsible for the safe and environmentally sound disposal of the waste they produce. The objective of this principle is to shift the responsibility of dealing with waste from governments to the entities producing it. As the polluters receive no subsidies to help in this process, over time much of that cost is passed along to consumers in the price of the goods involved. As mentioned above, for this principal to be pragmatically implemented, due regard must be given when developing budgets, particularly when government Healthcare facilities in Liberia provide free services.

At this embryonic stage, it is difficult to determine at what level polluters (Healthcare facilities) must pay, and whether this is limited to treatment, disposal or both. It is envisaged that supplies of such things like pharmaceuticals, bags, bins etc would also shoulder some of this cost. Given the current budget profiles within Healthcare facilities, it is highly unlikely any facilities are able to cover costs for anything more than rudimentary/ad-hoc treatment and disposal.

Regarding possible budget, the national budget for the fiscal year FY-08/09 indicated that the amount of US\$298,087,792 was approved. The external assistance to Liberia was estimated at US\$405,076,239 in 2006.

For the Health sector it was approved:

	2007-2008	2007-2008	2008-2009
	Budget	Revised	Budget
MINISTRIES/AGENCIES			
Ministry of Health	10,932,079	12,367,079	15,128,880
J.F.K Medical Center	3,947,064	3,947,064	5,521,736
Phebe Hospital and School of Nursing	261,178	411,178	391,637
Liberia Institute of Biomedical Research	236,921	236,921	364,355
TOTAL HEALTH SECTOR	15,377,242	16,962,242	21,406,608

Additionally US\$1,850,000 were approved for funding 15 county health programs and for volunteer doctors. The total budget for the healthcare sector was US \$23,256,608 = 8% of the entire National Budget.

The cornerstone for the financial planning in the health sector is the National Health Plan 2007-2011 (NHP). The NHP outlines the objectives, strategies and resources to reform the health sector to effectively deliver quality health and social welfare services to the people of Liberia.

The operational and integrated framework for implementing the National Health Plan is based on four key components:

1. Essential Package of Health Services

The Basic Package of Health Services (EPHS) is the cornerstone of the National Health Plan and defines an integrated minimum package of standardized prevention and treatment services.

2. Human Resources for Health

Human Resources for Health will ensure that the right numbers of health workers are in the right place, at the right time, and with the right skills to deliver the EPHS.

3. Infrastructure Development;

Infrastructure Development will increase geographic access to the EPHS, especially for clinics and health centers.

4. Support Systems.

Support Systems are the planning and management functions required to deliver the EPHS. This includes Policy formulation & implementation; Planning & Budgeting; Human Resources Management; etc. and also Facility & Equipment Maintenance; Supervision, Monitoring & Evaluation. Financing of Healthcare waste management is not included in one of the four main sectors but would be under —Support systems.

Financial assumptions and needs assessment

Given this project focuses on bio-hazardous waste (mostly infectious and sharps), the financial assumptions contained here do not relate to general solid waste. It is assumed that this stream of waste will be managed by municipal bodies.

As for solid municipal waste, the future waste quantities of bio-hazardous waste are a function of the present waste quantities and an increase factor dependant on several parameters. Typical to be considered are the increase of population, ageing of the population, increase of hospital services and others. For the waste amount forecast of healthcare waste also other parameters as developments in the LOS (Length of stay in a hospital) are important as due to changes in the hospital practices and the reliance of day clinics.

As experiences from other countries show, the most important factor to be considered for the forecast of bio-hazardous waste amount will be the introduction of improved waste management systems which will lead to a drastic minimization of bio-hazardous waste.

Generally the forecast for the increase of bio-hazardous waste is connected to general waste. An annual increase of 7% for the complete healthcare waste stream can be assumed (given Liberia's relatively low population growth, and economic development). The main element for amount reduction is the improvement of the healthcare waste management system belonging to this strategy. At the moment, the estimated waste generation rate for bio-hazardous waste is about 0.2 kg/bed for inpatients and day and 0.01 kg/outpatient. These figures are due the current poor segregation system at point of generation within the Healthcare facilities. In addition the introduction of a weight based pricing system (payment by kg) will lead to a reduction of the hazardous waste amount

Expanded Costing Analysis Tool (WHO)

The availability of accurate and specific data concerning Healthcare waste costs in Liberia is limited. The national health budget does not break down into detail a specific allocation for Healthcare waste. Similarly, Healthcare facility budgets rarely feature this level of detail. Allocating insufficient financial resources to manage HCW properly has an even greater financial cost in the medium and long term in terms of morbidity and mortality as well as environmental damage that will, in the end, impact negatively on peoples' health.

The calculations in this report for budget needs for medical waste management in Liberia are derived from the World Health Organisation's (WHO) Expanded Costing Analysis Tool (ECAT). The tool acknowledges that developing countries rarely allocate sufficient

budgetary allowances for safe and environmentally sustainable Healthcare waste management. The tool is used to estimate costs related to Healthcare waste management at the Healthcare facility (HCF), central treatment facility or cluster, and national levels.

The ECAT allows one or more treatment approaches:

- 1) Treatment of waste on site at the healthcare facilities (decentralized or on-site treatment);
- 2) Treatment of waste at central facilities or large hospitals to which waste from a cluster of healthcare facilities can send their waste (centralized or cluster treatment); or 3) A combination of the above.

For this exercise, the following assumptions are used:

- small HCFs (without beds),
- medium HCFs (up to 100 beds),
- large HCFs (100 to 499 beds, or "Group A" facilities),
- very large HCFs (500 beds or more, or "Group B" facilities),
- medium-size clusters (treating between 300 to 1000 kg/day),
- large clusters (treating more than 1000 kg/day), or any combination of these.

The ECAT also allows four treatment technology options for on-site treatment. Also note that the ECAT version for low-income countries allows incinerators that do not meet international standards including the guidelines of the

Stockholm Convention.

Option	Description
1	Autoclaves and sharps pits for small and medium HCFs; autoclaves, reusable sharps containers and sharps pits for large HCFs; transport vehicle(s), medium to large autoclaves and shredders for clusters
2	Incinerators and lined ash pits for small, medium and large HCFs; transport vehicle(s), medium to large incinerators and lined ash pits for clusters; only the incinerator for large clusters meets international standards
3	Needle removers, autoclaves and small pits for small and medium HCFs; needle removers, autoclaves, reusable sharps containers and small pits for large HCFs; transport vehicle(s), medium to large autoclaves and shredders for clusters
4	Needle removers, incinerators and lined ash pits for small, medium and large HCFs; transport vehicle(s), medium to large incinerators and lined ash pits for clusters; only the incinerator for large clusters meets international standards

Tab. 7: Treatment technology options – ECAT

The recommendations and figures shown in following figure are based on assumptions and current data available. Particularly, the veracity of waste-specific data varies greatly Liberia. The costs below were calculated using WHO's ECAT tool; see healthcarewaste.org.

Waste specific data is strongly connected with the health system and should be assessed in the preparation phase. To ensure the implementation of a suitable and cost covering treatment system, the data (including cost-related data) should be gathered and if necessary adjusted shortly before the planned implementation! Detailed information about the carried out cost calculations can be found in the Task Report B3: Financing possibilities for medical waste.

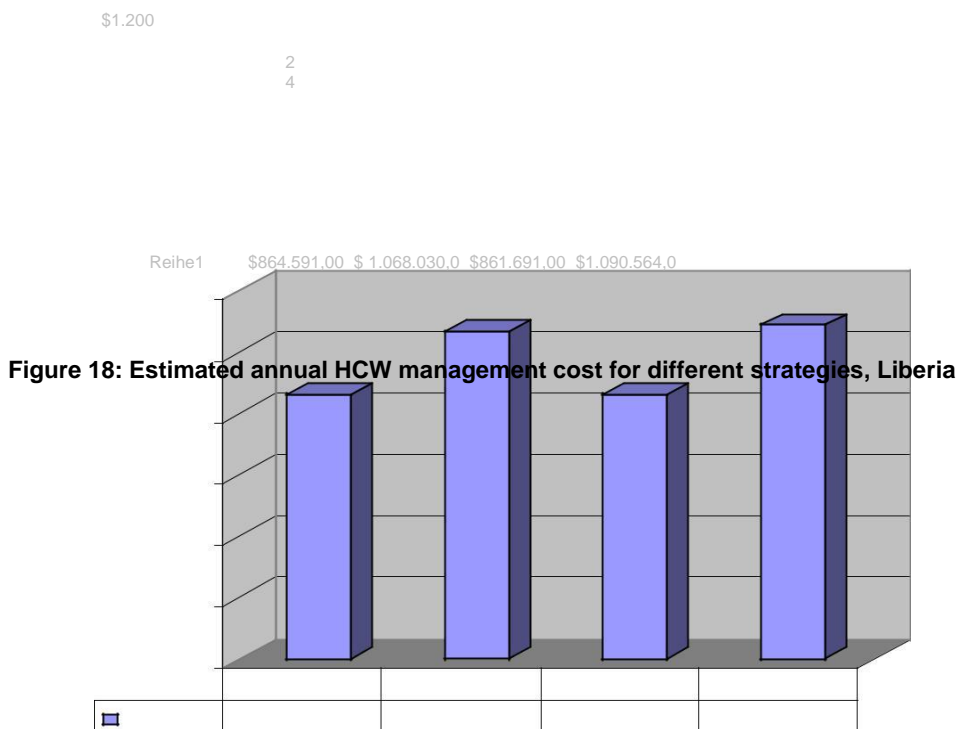


Figure 18: Estimated annual HCW management cost for different strategies, Liberia

The analysis of the results of the ECAT showed that the most cost efficient option would be the usage of steam treatment (autoclave) for treatment in combination with sharp pits (Option 1 and 3). The yearly needed budget (annual capital cost + recurrent cost) would be about US\$ 0.9 Million. Further calculations are necessary after the introduction of a basic HCW system (better database needed).

MWMP - Infrastructure and Equipment Plan

The assessment of the treatment and disposal practices of Healthcare waste in Liberia has confirmed widely held expectations that substantial short comings exist concerning both minor and major equipment. As agreed in the Inception Report, a technical report (B4 – annexed) entitled *estimated equipment and materials required to implement MWMP* was drafted.

The lack of waste management equipment for internal waste logistics (i.e. within the Healthcare facility buildings) is increasing the risk of occupational accidents and might result in nosocomial infections. Within this project, a recommended package of essential goods and materials has been created to improve the situation. The total costs of the

package, which also includes basic equipment for good housekeeping, is estimated to be US\$140,000.

In addition to waste logistics equipment, certain infrastructure improvements for the management of waste are needed, especially interim storage places for different type of waste, storage places for waste equipment and areas for carrying out the maintenance of the waste equipment. The cost for this infrastructure is estimated at US\$80,000

The construction of secured landfills for controlled hazardous waste disposal is currently not viable. At present, the only controlled disposal of non-hazardous waste is taking place in the greater Monrovia region (Montserrado). A potential threat by the unsafe disposal of bio-hazardous waste for the public and especially for the waste haulers and the workers on landfills is evident.

For the recommendation on treatment equipment, solutions must be differentiated for geographical areas with and without public waste collection services. In mainly rural areas without public waste services, the treatment of bio-hazardous waste at the county level (or referral) hospitals by the small scale incinerators shall be supported. These incinerators could be provided by UNICEF.

For the Montserrado/Monrovia region, the set up of a centralized waste treatment facility for hazardous healthcare waste is recommended. The cost for the treatment equipment + the needed logistics equipment is expected to be US\$250,000.

MP – Vocational Training plan

The starting point for any improvements in the HCW sector is the high awareness on to be solved problems and the knowledge how to solve the problem. For the improvement of healthcare waste management (HCWM) processes all relevant national authorities as well as waste generators should be involved in a comprehensive capacity building and training program. At least one person in a healthcare facility should be fully trained to be able to implement a safe management system and to undertake proper measures in case of incidents or crisis.

In the Task Report C1: Development of a national vocational HCW Training Program, the recommended future system is described. The document includes a strategy and framework for an enduring national vocational capacity building system on HCW for the Liberian healthcare sector. In addition it incorporates the training activities carried out in this project into the here presented system. The training issues should become an integral part of all planned activities to put in place the national policy and guideline for HCWM and to ensure sustainability and introduce continuous professional development. The capacity building system on healthcare waste considers the training needs of different types of healthcare facilities located in Liberia and is based on the internationally recommended —Healthcare Waste Officer (HWO)|| & —Healthcare Waste Inspector (HWI)|| principle

The aim of the capacity building system shall be to educate trainees capable of planning, setting up and operating a sufficient management system in their respective hospitals. This shall include the training of colleagues in HCW, the implementation of occupational exposure response system and the monitoring and supervision of all activities related to healthcare waste. In addition HCW inspectors shall be trained in supervising HCW management systems to strengthen the monitoring system.

For the time period 2010-2011 recommendations for to be carried out trainings are formulated. It is recommended to train staff at primary and secondary healthcare facility levels as well as to train staff from the MoH&SW to enable them to act as HCW Inspector. The cost for the training program is estimated to be 100.000 US\$.

No.	Item	Unit	Price	Total Price
Part A: National HCW Training Program				
1	Development Training Materials	1	\$ 10.000,00	\$ 10.000,00
	Int. Trainer cost (incl. Prep)	1	\$ 25.000,00	\$ 25.000,00
2	Cost for Training Materials	200	\$ 15,00	\$ 3.000,00
2	Cost for HWT Trainees	115	\$ 150,00	\$ 17.250,00
2	Cost for HWO Trainees	60	\$ 150,00	\$ 9.000,00
2	Cost for HWI Trainees	25	\$ 150,00	\$ 3.750,00
3	Cost for Training Sessions	6	\$ 750,00	\$ 4.500,00
Total:				\$ 72.500,00
Part B: Capacity building Inspection & Supervision System				
1	Development Monitoring System	1	\$ 20.000,00	\$ 20.000,00
2	Equipment for Monitoring	1	\$ 2.500,00	\$ 2.500,00
3	Fin. Support for Inspection	1	\$ 5.000,00	\$ 5.000,00
Total:				\$ 27.500,00
			Total	\$ 100.000,00

Tab. 8: Cost estimation – national vocational HCW training & monitoring system

MWMP – Behavior change & public awareness plan

Lasting improvement and sustainable healthcare waste management systems will require a change of behaviour and a higher public awareness on the risks by healthcare waste. This will not be reached overnight but will need comprehensive planning and a longer time period for implementation.

Public awareness is also critical given that in developing countries like Liberia, rag pickers and scavengers routinely make their living by seeking items of value in refuse collection sites. As waste segregation in Healthcare facilities is in its infancy in Liberia, the prevalence of hazardous waste in general landfill or ad-hoc dump sites is high. Accurate data concerning infection rates among rag-pickers (and more broadly the general public)

as a result of direct contamination with medical hazardous is not available; however the likelihood for injuries is high.

Regarding the public awareness component, the *Liberia Healthcare Waste Management Behaviour Change Communication and Public Awareness Strategy* is designed to support the MOH&SW in the framework of its existing plans and strategies. The strategic framework is based upon the results of the Healthcare Waste Management Assessment, as well as site visits to urban and rural health facilities at all levels (clinics, health centres and hospitals), and interviews with public and private health workers, medical education advisors, health facility cleaning staff, sanitation workers, public officials, County Health Department staff, landfill workers and community members in areas surrounding garbage dumps and urban slums. It is a first step in the process of working with key stakeholders to develop a comprehensive public awareness/behaviour change communications and training plan to address Healthcare waste management at the institutional and community levels and protect Liberians from medical transmission of disease.

For the Liberia Healthcare Waste Management Behavior Change Communication and Public Awareness Strategy, the following three main objectives could be identified:

1. To ensure proper Healthcare waste management practices at Healthcare facilities and other delivery points through supportive behavior change strategic Framework: In order to achieve the above three objectives, a basic four- pronged, mutually reinforcing public awareness strategic framework is proposed that include targeted:
 - A. behavior change communications and training focused on improving waste segregation practices at the point of waste generation among key health workers -- nurses, certified midwives, physician assistants, environmental health officers, vaccinators, laboratory technicians, morgue attendants, doctors, students in clinical training and traditional trained midwives and patients and their families. Prevention and management of needle stick injury will also be included;
 - B. behavior change communication and training focused on improving waste collection, storage, transportation, treatment and disposal practices among those whose jobs require them to oversee or handle medical waste (including hospital and clinic cleaning and grounds-keeping staff, public sanitation workers and incinerator operators). Prevention and management of needle stick injury will also be included;
 - C. advocacy and training approaches focused on improving the policy environment for Healthcare waste management and strengthening support for HCWM planning, supervision of HCWM practices and adequate procurement of HCWM equipment and supplies among health facility directors/managers/supervisor, student nurse supervisors,

Officers in Charge, MOH&SW and municipal policy makers and County Health Officers; and

- D. an integrated waste management public awareness approach that leverages other sanitation and solid waste communications and outreach initiatives in urban Liberia – starting in Monrovia where the need is the greatest – focusing primarily on those who are most vulnerable to exposure from Healthcare waste (garbage pickers, unemployed youth engaged in sanitation jobs creation programs, and households in close proximity to garbage dumpsites and landfills).

Public awareness, training and advocacy activities will not be successful if they are not accompanied by the basic equipment to allow proper Healthcare waste management to occur. At every level, there is an inadequate supply of waste bins, personal protective equipment, sharps boxes, waste transportation and waste disposal equipment. With only a few exceptions, there is currently no capacity in Liberia to effectively dispose of infectious waste. Public awareness activities will not be effective unless the equipment and commodities needed to support simple, yet effective, Healthcare waste management practices are in place. Therefore it is recommended to include a public awareness program not in the short-term planning but in the mid-term planning.

The budget below should be considered as a first draft only. When a HCWM public awareness workplan is finalized, it should be carefully budgeted out based on the exact numbers of people to be reached, copies to be printed, people to be trained, etc.. This budget is illustrative only, and includes the following assumptions:

- The budget below accounts only for direct costs associated with the direct costs of formative research, curriculum development, training development, materials development, printing and dissemination. Indirect costs are not included in this budget.
- This budget only includes the costs of public awareness, behaviour change communications, training and advocacy programming. It does not include the costs of procuring HCWM equipment and supplies described above under —Other Supportive Actions. These should be budgeted separately.
- All staff salaries will be covered by agency providing staff (e.g. MOH&SW, MCC, RBHS, World Bank, Gates, private sector partners, etc.)
- Training will be integrated into existing pre- and in-service training programs currently managed by the MOH&SW and other partners. Therefore, it is assumed that HCWM training costs will be covered by agency normally providing training (e.g. MOH&SW, RBHS, etc). Cost of curriculum development, however, is included in the budget below.
- Primary emphasis will be on improving HCWM practices in urban areas.
- Costs estimates below are based on RBHS public awareness campaign costs.

Budget line items	Costs
Print- Posters, leaflets, counselling cards, birthing kit materials, advocacy	\$500,000
Radio- Spots, talk shows, etc.	\$100,000
M&E- formative research, baseline surveys, monitoring,	\$80,000
Master Trainings	\$20,000
Communications	\$20,000
Transportation	\$20,000
External Technical Assistance	\$130,000
TOTAL	\$870,000

MWMP - Monitoring and Evaluation

Monitoring and evaluation of activities within the prescribed HCWM system is important, as it allows the collection of necessary information on the progress and extent of implementation of the suggested management system in the Healthcare institutions in Liberia, both in the public and in the private sector.

Monitoring program and Indicators

It is important to include means to monitor the implementation of the Strategy and to monitor the actual implementation and effectiveness of the strategy in terms of achieving the desired results.

Firstly, a number of milestone and indicators have to be established so that there is a common agreement on how improvements should be determined. Milestones can be the various activities within the Action Plans, and a success criteria can be the timely and successfully implementation of an activity. Indicators can be physical as well as non-physical parameters that can be measured.

Before implementation of actual HCWM systems as part of this program, information on the present practices of HCWM in each HCF will be collected and recorded. A specific format shall be developed to capture all information pertaining to HCWM and shall be circulated along with the HCWM guidelines to all HCF's in Liberia. The HCFs will be required to fill in the form and send the same back to the MoH&SW who will evaluate it and present it to the Healthcare Waste Management Committee (HCWMC). This would provide a clear picture of the quantity of HCW generated in each HCF as well as about the way the HCW is managed.

HCF's will be required to report on HCWM on an annual basis. Such information will be compared with the previously reported data to assess the improvement.

Waste Management Indicators

The development of the healthcare waste management can among others be determined through measuring the following indicators:

- 1) Equipment installation and use (incinerators / autoclaves / shredders...),
- 2) Implementation of Healthcare Waste Management Plans,
- 3) Information on amounts of infectious HCW generated and treated,
- 4) Quantities of waste, divided on various fractions (general waste and hazardous waste)
- 5) Infectious materials
- 6) Consumption of equipment and materials (e.g. waste collection bags).
- 7) Compliance of Liberia legislation,
- 8) Training,
- 9) Documentation and Reporting

The quantity of waste is an important parameter in healthcare waste management. However, it is important that the weight of the various fractions – hazardous waste and non-risk waste – are measured and compared. An improved waste segregation should result in a lower ratio of risk waste in relation to non-risk waste.

However, it is very important to combine this with visual investigation of the non-risk waste to ensure that staff is not so eager to reduce the quantities of risk waste that they drop e.g. infectious materials in the non-risk fraction. Another factor to determine the state of the healthcare waste management system is to measure the number of waste collection equipment distributed at the Healthcare facility and e.g. the number waste collection bags used. However, it is a sensible indicator, because a high use of waste collection bags not necessarily leads to a more efficient waste collection; it may just as well indicate “wasteful” use of waste collection bags. However, in the beginning where the use of waste bags in many HCF’s are absent the total use of waste bags may indicate a more efficient, safer and cleaner collection of the waste.

Occupational Health and Safety Indicators

The following two indicators could be used to determine the impact on the state of the occupational health and safety:

1. Number of needle stick injuries
2. Number of staff trained in proper accident response
3. Number of health care workers vaccinated against Hepatitis B

The number of needle stick injuries indicated how well informed and thorough the staff is handling used needles. It also indicated how well the healthcare facility is supplied with appropriately designed equipment to handle the sharps, e.g. sharps containers. A success criterion is to reduce the needle stick injuries to null.

Another indicator is the number of staff trained in proper accident response, which is an essential step in the whole handling of the waste. However, this is an indirect indicator as the training need not necessarily lead to reduced accidents rates. It might even result in higher rates of reported accidents as staff is following correct proceedings.

Environmental Indicators

One of the overall goals of improved HCWM is to reduce the impact on the environment and at least meet the standards. This can among others be done through measuring the following indicators regularly:

- 1) Temperature and Emission parameters from incinerators (particulate matter/dust, HCl, SO₂, NO_x, Pb, Cd and Hg)
- 2) Parameters for quality of the incineration process (e.g. the organic matter in ashes)
- 3) Selected parameters in the wastewater (BOD, COD, etc.).

Monitoring and Evaluation Procedure

One element of a monitoring programme can be regular audits where independent parties are investigating which milestones have been reached and measured the various indicators. A list of indicators is included in the following section. For each audit the present state - determined by the indicators - is compared with previous states. If that is not the case, measures must be taken to strengthen the activities.

Monitoring and evaluation will be focused on routine tracking of programme implementation parameters. Monitoring over these activities can take on two forms:

1. Monitoring of "Internal" activities
 - a. By the Healthcare institution and
 - b. By environmental health inspectors for the parameters relating to procedures inside of the Healthcare institution
2. Monitoring of "External" activities
 - a. By inspectors for environmental protection, for the parameters relating to procedures outside of the Healthcare institution.

Internal monitoring and control of activities within the healthcare institution itself is the responsibility of the person in charge of HCWM. It should be stressed, however, that all healthcare workers and paramedical staff take part in operational activities, on a daily basis, as part of their regular duties.

In addition to the person in charge, internal monitoring of activities relating to HCWM is within the scope of the responsibility of the nosocomial infection prevention and control committee, as well as the healthcare Waste committee (if one of these has been already formed).Figure19:HCW transportation scheme, Montserrat

8.9.5 MWMP- Documentation and Information

National Action Plan for Healthcare Waste Management

The MoH&SW with its relevant departments is responsible to develop, update and implement a National Action Plan for Healthcare Waste Management (NAP- HCWM) for

short, mid and long term period. The time planning of the action plan should correspond with the national health plan and the 5 year budget plan. The NAP-HCWM should be updated every 5 years.

Report on the National situation of Healthcare Waste Management

The MoH&SW in cooperation with the EPA is responsible to summarise the Healthcare Waste Management Situation in accordance to the Indicators mentioned in Chapter before once a year. The Report should be officially published.

Report on Healthcare Waste Situation in the Counties

The Healthcare Waste Management Committee (HCWMC) is responsible to bundle all information received from the Healthcare waste facilities and submit a report to the MoH&SW every year.

Report on generated and treated waste

According to the National Guideline on HCWM, Healthcare facilities must investigate the waste generation rate and components of waste to estimate the total volume of the wastes generated as well as analyzed and report the result to the responsible HCWMC.

Healthcare Waste Management Plan of larger Healthcare Facility

In addition secondary and tertiary level healthcare facilities are responsible for the Development of a plan and budget for short, medium and long term healthcare waste management. The report should be sent to the responsible Healthcare Waste Management Committee.

Tab. 9: Cost estimation - Behaviour change & public awareness program

8.7 MWMP-Vocational Training plan

The starting point for any improvements in the HCW sector is the high awareness on to be solved problems and the knowledge how to solve the problem. For the improvement of healthcare waste management (HCWM) processes all relevant national authorities as well as waste generators should be involved in a comprehensive capacity building and training program. At least one person in a healthcare facility should be fully trained to be able to implement a safe management system and to undertake proper measures in case of incidents or crisis.

In the Task Report C1: Development of a national vocational HCW Training Program, there commended future system is described. The document includes a strategy and framework for an enduring national vocational capacity building system on HCW for the Liberian healthcare sector. In addition it incorporate the training activities carried out in this project in to the here presented system. The training issues should become an integral part of all planned activities to put in place the national policy and guideline for HCWM and to ensure sustainability and introduce continuous professional development. The

capacity building system on healthcare waste considers the training needs of different types of healthcare facilities located in Liberia and based on the internationally recommended —Healthcare Waste Officer (HWO) &— Healthcare Waste Inspector (HWI) principle. The aim of the capacity building system shall be to educate trainees capable of planning, setting up and operating a sufficient management system in their respective hospitals. This shall include the training of colleagues in HCW, the implementation of occupational exposure response system and the monitoring and supervision of all activities related to healthcare waste. In addition, HCW inspectors shall be trained in supervising HCW management systems to strengthen the monitoring system. For the time period 2010-2011, recommendations for to be carried out trainings are formulated. It is recommended to train staff at primary and secondary healthcare facility levels as well as to train staff from the MoH&SW to enable them to act as HCW Inspector. The cost for the training program is estimated to be 100,000 US\$.

No.	Item	Unit	Price	Total Price
Part A: National HCW Training Program				
1	Development Training Materials	1	\$ 10,000.00	\$ 10,000.00
	Int. Trainerost (incl. Prep)	1	\$ 25,000.00	\$ 25,000.00
2	Cost for Training Materials	200	\$ 15.00	\$ 3,000.00
2	Cost for HWT Trainees	115	\$ 150.00	\$ 17,250.00

2	Cost for HWO Trainees	60	\$ 150.00	\$ 9,000.00
2	Cost for HWI Trainees	25	\$ 150.00	\$ 3,750.00
3	Cost for Training Sessions	6	\$ 750.00	\$ 4,500.00
Total:				\$ 72,500.00

1	Development Monitoring System	1	\$ 20,000.00	\$ 20,000.00
2	Equipment for Monitoring	1	\$ 2,500.00	\$ 2,500.00
3	Fin. Support for Inspection	1	\$ 5,000.00	\$ 5,000.00
Total:				\$ 27,500.00
			Total	\$100,000.00

Tab.8: Cost estimation—national vocational HCW training & monitoring system

8.8 MWMP—Behavior change & public awareness plan

Lasting improvement and sustainable healthcare waste management systems will require a change of behavior and a higher public awareness on the risks by healthcare waste. This will not be reached overnight but will need comprehensive planning and a longer time period for implementation.

Public awareness is also critical given that in developing countries like Liberia, rag pickers and scavengers routinely make their living by seeking items of value in refuse collection sites. As waste segregation in Healthcare facilities is in its infancy in Liberia, the

prevalence of hazardous waste in general land fill or ad-hoc dump sites is high. Accurate data concerning infection rates among rag-pickers (and more broadly the general public) as a result of direct contamination with medical hazardous is not available; however the likelihood for injuries is high.

Regarding the public awareness component, the *Liberia Healthcare Waste Management Behaviour Change Communication and Public Awareness Strategy* is designed to support the MOH&SW in the framework of its existing plans and strategies. The strategic framework is based upon the results of the Healthcare Waste Management Assessment, as well as site visits to urban and rural health facilities at all levels (clinics, health centres and hospitals), and interviews with public and private health workers, medical education advisors, health facility cleaning staff, sanitation workers, public officials, County Health Department staff, landfill workers and community members in areas surrounding garbage dumps and urban slums. It is a first step in the process of working with key stakeholders to develop a comprehensive public awareness/behavior change communications and training plan to address Healthcare waste management at the institutional and community levels and protect Liberians from medical transmission of disease.

For the Liberia Healthcare Waste Management Behavior Change Communication and Public Awareness Strategy, the following three main objectives could be identified:

1. To ensure proper Healthcare waste management practice at Healthcare facilities and other delivery points through supportive behavior change Communication and training in order to reduce Healthcare waste as close to the point of waste generation as possible.
2. To build a supportive policy and working environment for evidence-based good waste management practices.
3. To build public awareness of ways to prevent disease transmission through Healthcare waste among those at greatest risk of exposure in the community, as part of a broader integrated sanitation campaign.

Strategic Framework: In order to achieve the above three objectives, a basic four pronged, mutually reinforcing public awareness strategic framework is proposed that include targeted:

- A. behavior change communications and training focused on improving waste segregation practices at the point of waste generation among key health workers--nurses, certified midwives, physician assistants, environmental health officers, vaccinators, laboratory technicians, morgue attendants, doctors, students in clinical training and traditional trained midwives and patients and their families. Prevention and management of needle stick injury will also be included;
- B. behavior change communication and training focused on improving waste collection, storage, transportation, treatment and disposal practices among those

whose jobs require them to oversee or handle medical waste (including hospital and clinic cleaning and grounds-keeping staff, public sanitation workers and incinerator operators). Prevention and management of needle stick injury will also be included;

- C. advocacy and training approaches focused on improving the policy environment for Healthcare waste management and strengthening support for HCWM planning, supervision of HCWM practices and adequate procurement of HCWM equipment and supplies among health facility directors/managers/supervisor, student nurse supervisors, Officers in Charge, MOH&SW and municipal policy makers and County Health Officers; and
- D. an integrated waste management public awareness approach that leverages other sanitation and solid waste communications and outreach initiatives in urban Liberia – starting in Monrovia where the need is the greatest – focusing primarily on those who are most vulnerable to exposure from Healthcare waste (garbage pickers, unemployed youth engaged in sanitation Jobs creation programs, and house holds in close proximity to garbage dump sites and land fills).

Public awareness, training and advocacy activities will not be successful if they are not accompanied by the basic equipment to allow proper Healthcare waste management to occur. At every level, there is an inadequate supply of waste bins, personal protective equipment, sharps boxes, waste transportation and waste disposal equipment. With only a few exceptions, there is currently no capacity in Liberia to effectively dispose of infectious waste. Public awareness activities will not be effective unless the equipment and commodities needed to support simple, yet effective, Healthcare waste management practices are in place. Therefore it is recommended to include a public awareness program not in the short-term planning but in the mid-term planning.

The budget below should be considered as a first draft only. When a HCWM public awareness work plan is finalized, it should be carefully budgeted out based on the exact numbers of people to be reached, copies to be printed, people to be trained, etc.. This budget is illustrative only, and includes the following assumptions:

- The budget below accounts only for direct costs associated with the direct costs of formative research, curriculum development, training development, materials development, printing and dissemination. Indirect costs are not included in this budget.
- This budget only includes the costs of public awareness, behavior change communications, training and advocacy programming. It does not include the costs of procuring HCWM equipment and supplies described above under –Other Supportive Actions. || These should be budgeted separately.
- All staff salaries will be covered by agency providing staff (e.g. MOH&SW, MCC, RBHS, WorldBank, Gates, private sector partners, etc.)

- Training will be integrated into existing pre-and in-service training programs currently managed by the MOH&SW and other partners. Therefore, it is assumed that HCWM training costs will be covered by agency normally providing training(e.g. MOH&SW, RBHS, etc). Cost of curriculum development, however, is included in the budget below.
- Primary emphasis will be on improving HCWM practices in urban are as. It is assumed that efforts in rural are as will be less intensive.
- Costs estimates below are based on RBHS public awareness campaign costs

Budget line items	Costs
Print-Posters ,leaflets, counseling cards, birthing kitmaterials, advocacy factsheets, etc.	\$500,000
Radio-Spots, talk shows, etc.	\$100,000
M&E-formative research, baseline surveys, monitoring, evaluation	\$80,000
Master Trainings	\$20,000
Communications	\$20,000
Transportation	\$20,000
External Technical Assistance	\$130,000
TOTAL	\$870,000

Tab.9: Cost estimation–Behaviour change & public awareness program

8.9 MWMP-Monitoring and Evaluation

Monitoring and evaluation of activities with in the prescribed HCWM system is important, a sit allows the collection of necessary information on the progress and extent of implementation of the suggested management system in the Healthcare institutions in Liberia, both in the public and in the private sector.

8.9.1 Monitoring program and Indicators

It is important to include means to monitor the implementation of the Strategy and to monitor the actual implementation and effectiveness of the strategy in terms of achieving the desired results.

Firstly, a number of milestone and indicators have to be established so that there is a common agreement on how improvements should be determined. Milestones can be the various activities within the Action Plans, and a success criteria can be the timely and successfully implementation of an activity. Indicators can be physical as well as non-physical parameters that can be measured.

Before implementation of actual HCWM systems as part of this program, information on the present practices of HCWM in each HCF will be collected and recorded. A specific format shall be developed to capture all information pertaining to HCWM and shall be circulated along with the HCWM guidelines to allHCF' sinLiberia.TheHCFswillberequiredtofillintheformandsendthe same back to the MoH&SW who will evaluate it and present it to the Healthcare Waste Management

Committee (HCWMC). This would provide a clear picture of the quantity of HCW generated in each HCF as well as about the way the HCW is managed.

HCF's will be required to report on HCWM on an annual basis. Such information will be compared with the previously reported data to assess the improvement.

8.9.2 Waste Management Indicators

The development of the healthcare waste management can among others be determined through measuring the following indicators:

1. Equipment installation and use (incinerators/autoclaves/Shredders...),
2. Implementation of Healthcare Waste Management Plans,
3. Information on amounts of infectious HCW generated and treated,
4. Quantities of waste, divided on various fractions (general waste and hazardous waste)
5. Infectious materials
6. Consumption of equipment and materials (e.g. waste collection bags).
7. Compliance of Liberia legislation,
8. Training,
9. Documentation and Reporting

The quantity of waste is an important parameter in healthcare waste management. However, it is important that the weight of the various fractions—hazardous waste and non-risk waste— are measured and compared. An improved waste segregation should result in a lower ratio of risk waste in relation to non-risk waste.

However, it is very important to combine this with visual investigation of the non- risk waste to ensure that staff is not so eager to reduce the quantities of risk waste that they drop e.g. infectious materials in the non-risk fraction. Another factor to determine the state of the healthcare waste management system is to measure the number of waste collection equipment distributed at the Healthcare facility and e.g. thenumber waste collection bags used. However, it is a sensible indicator, because a high use of waste collection bags not necessarily leads to a more efficient waste collection; it may just as well indicate —wastefully use of waste collection bags. However, in the beginning where the use of waste bags in many HCF's are absent the total use of waste bags may indicate a more efficient, safer and cleaner collection of the waste.

8.9.3 Occupational Health and Safety Indicators

The following two indicators could be used to determine the impact on the state of the occupational health and safety:

1. Number of needle stick injuries
2. Number of staff trained in proper accident response

The number of needle stick injuries indicated how well informed and thorough the staff is handling used needles. It also indicated how well the healthcare facility is supplied with appropriately designed equipment to handle the sharps, e.g. sharps containers. As success criterion is to reduce the needle stick injuries to null.

Another indicator is the number of staff trained in proper accident response, which is an essential step in the whole handling of the waste. However, this is an indirect indicator as the training need not necessarily lead to reduced accidents rates. It might even result in higher rates of reported accidents as staff is following correct proceedings.

8.9.4 Environmental Indicators

One of the overall goal of improved HCWM is to reduce the impact on the environment and at least meet the standards. This can among others be done through measuring the following indicators regularly:

1. Temperature and Emission parameters from incinerators (particulate matter/ dust, HCl, SO₂, NO_x, Pb, Cd and Hg)
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8.9.5 MWMP- Documentation and Information

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The MoH&SW with its relevant departments is responsible to develop, update and implement a National Action Plan for Healthcare Waste Management (NAP-HCWM) for short, mid and long term period. The time planning of the action plan should correspond with the national health plan and the 5 year budget plan. The NAP-HCWM should be updated every 5 years.

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The Healthcare Waste Management Committee (HCWMC) is responsible to bundle all information received from the Healthcare waste facilities and submit a report to the MoH&SW every year.

Report on generated and treated waste

According to the National Guideline on HCWM, Healthcare facilities must investigate the waste generation rate and components of waste to estimate the total volume of the wastes generated as well as analyzed and report the result to the responsible HCWMC.

Healthcare Waste Management Plan of larger Healthcare Facility

In addition secondary and tertiary level healthcare facilities are responsible for the Development of a plan and budget for short, medium and long term healthcare waste management. The report should be sent to the responsible Healthcare Waste Management Committee.

8.10 MWMP-Phased implementation plan

MWMP - Documentation and Information

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According to the National Guideline on HCWM, Healthcare facilities must investigate the waste generation rate and components of waste to estimate the total volume of the wastes generated as well as analyzed and report the result to the responsible HCWMC.

Healthcare Waste Management Plan of larger Healthcare Facility

In addition secondary and tertiary level healthcare facilities are responsible for the development of a plan and budget for short, medium and long term healthcare waste management. The report should be sent to the responsible Healthcare Waste Management Committee.

MWMP - Phased implementation plan

Although it is desirable to achieve immediate improvement in HCWM across the country, it is more realistic and practical that the national HCWM strategy should include a phased implementation strategy. While general awareness and capacity building should be undertaken at all levels, actual implementation of HCWM systems in the Healthcare facilities should be done in phases.

It is recommended to concentrate first on major healthcare waste generators and regions. Major healthcare waste generators in Liberia are the tertiary level and future referral hospitals. Major healthcare waste generation region is the county Montserrado, including Monrovia. After the first implementation phase, other secondary healthcare facilities such as county level hospitals and other counties should be considered, until in the third phase also minor healthcare waste generators (e.g. clinics, funeral homes, etc.) should be included. The phased improvement program is recommended as follows:

Phase	Period	Target Facilities	Recommended Activities	Time Line
Phase 1	Short-term	A) All Referral Hospitals B) County level Demo Project - Montserrado	<ul style="list-style-type: none">- Implementation of HCW management systems in the future referral hospitals- Demonstration of centralized system for Monrovia / Montserrado County- Carrying out of a demonstration project for one entire county - including all levels of facilities.- Development of the Monitoring &	Until end 2011

			Reporting system, trial - Development of training program & start of the national training program - Immunization campaign HBV for healthcare staff (GAVI support) - Technical support to the NHCWC - Planning & budget for the next phase	
Phase 2	Mid-term	All county hospitals & healthcare centers	- Extending of activities on county level - Public awareness campaign & Continuation of the training program - Preparing of other relevant documents and guidelines - Monitoring & Continues	2012 – 2016
			Improvement... - Planning of next phase (2016-2021)	
Phase 3	Long-term	Including of all clinics and other small sized HCFs	- Extending of activities on county level - Preparing of relevant documents - Monitoring & Continues Improvement... - Development of next action plan (2021-)	2016 – 2021

Tab. 10: MWMP - Phased implementation plan

Short-Term Planning - Implementing the MWMP

The first phase of the implementation of the MWMP shall be from the date of publishing until the end of 2011. During this time period, it is recommended to carry out the following working tasks:

- ▶ **Work Package A** (For the main referral hospitals). Main Targets:
 - Improvement of the internal healthcare waste logistic system in the main hospitals in Liberia including the set up of needed infrastructure
 - Demonstration of the cooperation & integration possibilities of EPI and HCW activities
 - Demonstration of possibilities for a –referral system|| for healthcare waste, combination of supply and disposal chain

- ▶ **Cost estimation: 220.000 US\$**



Figure 20: Location of target hospitals, package A

► **Work Package B** (On county level). Main Targets:

- Demo project for a comprehensive, county wide solution from clinics to tertiary hospital
- Pilot project for the first time introduction of Autoclaves in Liberia
- Demonstration of the advantages of the centralization of waste treatment services in Monrovia
- Covers about 1510 Beds (nearly 50% of all hospital beds in Liberia)

► **Cost estimation: 250.000 US\$**

► **Work Package C:** Capacity building for HCW Management. Targets:

- Development and introduction of a national vocational training system for HCW
- Development and introduction of a monitoring & supervision system
- Development and introduction of a reporting system
- Support for & Evaluation of demonstration projects

► **Cost estimation: 100.000 US\$**

The financial assessment showed that within the current national health budget no financial resources are allocated for healthcare waste management. To maintain he set up internal healthcare waste system in the referral hospitals, the recurrent cost must be covered. Also broken minor equipment will have to be replaced. Additionally staff will have to be retrained and supervision and monitoring will have to be carried out. The yearly cost to keep the installed system running is estimated to be 100.000 US\$ per year.

It is recommended that the operation of the central treatment plant shall be outsourced to a private service company. The annual cost for the operation of the central treatment plant

by a private operator are assumed to be US\$75,000 (Based on 150 t/a healthcare waste, 10% win). Additionally the collection of the healthcare waste containers will have to be financed (6 days per week). The cost for this service is assumed to be US \$45,000. In total 120.000 US dollars will be needed year to keep the central treatment plant running.

Considering that package A and B will be implemented until the middle of 2010, the operation cost will have to be financed for a period of 1.5 year. Based on the before carried out estimation, **a total budget of 330.000 US\$** will be needed.

Healthcare waste management is a new subject in Liberia and the MoH&SW will need External Technical Assistance to set up, supervise and monitor the system. Especially during the implementation period MoH&SW should be supported by experienced experts. **A total budget of 200.000 US\$** will be needed to provide this support. The technical support shall include the development of the needed budget

In total it is assumed that for the first phase a total budget of 1,1 million US\$ will be needed to implement and maintain the work packages A-C.

Mid Term Planning - Implementing the MWMP

The second phase shall be carried out within a 5-year period from 2012 to 2016. Main task will be to set up waste management systems in the different county hospitals and the healthcare centers in Liberia. Based on the gained experience from the implementation of the working package A and B centralized treatment systems shall be implemented.

The carried out cost calculation showed that the annually needed budget for the operation of the national healthcare waste system will be about 1 million US\$ per year. For the phase 2, a needed budget of 5 Million US\$ is estimated.

For the enlargement of the healthcare waste system, the possibilities for private sector participation should be elaborated. In case that the second phase shall be mainly financed by donors, an Output Based Aid (OBA) financing mechanism is recommended. Instead of financing treatment equipment or waste management infrastructure, via an OBA mechanism performance-based subsidies to support or fully pay the delivery of the healthcare waste management services should be financed.

For the operation of the system, social franchising (SF) concepts should be used. SF concepts are today successfully used in many donor funded healthcare projects. SF is an approach which applies modern, commercial franchising techniques to achieve social goals. SF for the HCW sector in Liberia can be described as a process in which a provider (the franchisor, e.g. a healthcare waste project) of a successfully HCW management concept (the pilot project in Monrovia) enables others (the franchisees = private companies) to replicate this HCW management business model in order to enlarge the coverage in the other counties in Liberia.

Following the OBA principle, the financing agencies (Donors) shall not target the financing of hardware, but will rather subsidize or fully pay the provided HCW logistic and/or disposal services, following the polluter pays principle. The financial risks of the franchisee will be limited as the payment for the carried out service would be guaranteed by a trustable partner for a fixed period. Further information of the possibilities for OBA and public-private-partnerships are described in the Task Report B3: Financing possibilities for medical waste.

In the Phase II, it is further recommended to implement the Liberia Healthcare Waste Management Behavior Change Communication and Public Awareness Strategy.

Long-Term Planning - Implementing the MWMP

The main task of the third phase (2016-2021) would be to stabilize the introduced healthcare waste management system and to include especially so far not included minor healthcare waste generators (clinics, etc.) in the system.

The cost for the operation of the system will be, as in the second phase, about one million US\$ per year. Increase of the needed budget due inflation and increase of cost must be expected.

Estimated Budget for the Plan Implementation

Indicative Budget of MWM Plan Implementation

	Activities	Cost US\$
1	Infrastructure and Equipment Plan (basic equipment for good housekeeping, interim storage and areas for carrying out the maintenance of the waste equipment)	220,000.
	A centralized waste treatment facility for hazardous healthcare waste in Montserrado / Monrovia region	250,000.00
2	Training plan	
	National HCW Training Program	72,500.00
	Training for Inspection & supervision System	100,000.00
	Behavior change & public awareness plan	870,000.00
3	Monitoring and Evaluation	80,000.00
4	Documentation and Information	25,000.00
5	Incidentals	10,000.00
	Total	1,547,500.00

Estimated equipment and materials required to implement MWMP

Infrastructure requirements

In the healthcare waste management field, a typical problem is the lack of infrastructure needed to store waste and equipment, and to carry out administrative and maintenance functions. This area is the place where all relevant waste management activities are collectively done. Typical tasks to be carried out at this area are:

- Maintaining (cleaning) and repairing waste logistics equipment
- Secured short-term storage of non-risk waste until pick-up by the municipal service provider (storage capacity at least 3 days)
- Secured short-term storage for infectious waste to allow the efficient usage of treatment plants (storage capacity at least 2 days)
- Secured medium term storage for other types of hazardous waste (photo chemicals, heavy metals, pharmaceuticals) until final treatment or pick-up for recycling
- Post-sorting and storage place for valuable non-risk materials (waste for recycling - paper, plastic, glass)
- Documentation and record keeping of the waste streams
- Storage place for logistic equipment (bins, bags, containers, etc.)

In the Task Report –B4: Estimated equipment and materials required to implement MWMP, detailed recommendations for the planning and building of short HCW storage places are provided. The cost per storage place is estimated to be US\$9,000.

For Montserrado/Monrovia, the set up of one central treatment facility healthcare waste is recommended. The facility should be located at one of the main hospitals (preferably JFK)

and could act at the same time as a storage place for this hospital. A detailed description is provided in the Task Report –B4: Estimated equipment and materials required to implement MWMP||. The cost for the central facility is estimated at US\$17.000.

Equipment and materials needed for project hospitals

For the JFK and the 7 future referral hospitals, it was estimated which kind of equipment and materials will be required to implement an internal healthcare waste logistic system based on this MWMP. In the following, tables are provided with the recommended equipment quantities per site. Additionally, a priced BOQ is provided. It is estimated that in total 140K US\$ will be needed to upgrade the logistic system.

Assessment of Medical Supplies and Medical Waste Management

DISTRIBUTION LIST - WASTE EQUIPMENT										
Improving the Healthcare Waste Management system in Liberias,										
For a detailed description of the equipment, please see annex A of the technical specifications										
Code	Item	JFK	Redempt.	Phebe	Bomi	JJ Dossen	Tubman	Bassa	Renni	Total
PPE-01	Personal Protection Equipment									
PPE-01-01	Safety goggles	10	10	10	7	7	7	7	5	63
PPE-01-02	Working gloves – chemicals	10	10	10	7	7	7	7	5	63
PPE-01-04	Working gloves – general	20	20	20	15	15	15	15	10	130
PPE-01-05	Overalls	10	10	10	7	7	7	7	5	63
LOG-01	Single-use items									
LOG-01-02	Sharps cont. WHO – Large	5	5	5	3	3	3	3	2	29
LOG-01-04	Sharps cont. Plastic – Large	4	4	4	3	3	3	3	2	26
LOG-01-05	Bag - infect - Inc. (Small)	12	12	12	8	8	8	8	5	73
LOG-01-11	Debris Pots for Needle Cutter	5	5	5	3	3	3	3	2	29
LOG-02	Internal equipment									
LOG-02-01	Infectious Waste Bin – Small	40	40	40	25	25	25	25	15	235
LOG-02-09	Outdoor - waste bin	5	5	5	4	4	4	4	3	34
LOG-02-10	Needle Cutter	15	15	15	10	10	10	10	7	92
LOG-03	Log. Equip. waste func.area									
LOG-03-01	Wheelie-Bin 240 litre (General Wa.)	15	15	15	10	10	10	10	7	92
LOG-03-03	Collection Bin - Infect. Waste	15	15	15	10	10	10	10	7	92
LOG-03-04	Bin trolley (infect. Waste)	3	3	3	2	2	2	2	2	19

Assessment of Medical Supplies and Medical Waste Management

DISTRIBUTION LIST - WASTE EQUIPMENT										
Improving the Healthcare Waste Management system in Liberias,										
LOG-03-11	Barrel for solid Haz. Waste	3	3	3	2	2	2	2	2	19
LOG-03-13	Ground scale	1	1	1	1	1	1	1	1	8
LOG-03-14	Pressure Sprayer	1	1	1	1	1	1	1	1	8
OFF-01	Office Equipment									
OFF-01-01	Office Desk	1	1	1	1	1	1	1	1	8
OFF-01-02	Swivel Chair	1	1	1	1	1	1	1	1	8
OFF-01-03	Cabinet, low	1	1	1	1	1	1	1	1	8
OFF-01-04	Storage Shelves	1	1	1	1	1	1	1	1	8
OFF-01-05	Office Auxiliaries & White board	1	1	1	1	1	1	1	1	8
WW-01	Sewage-Equipment									0
WW-01-01	Sink plunger	5	5	5	3	3	3	3	2	29
WW-01-02	Manual Drain cleaner	2	2	2	2	2	2	2	2	16
HOU-01-	Sewage-Equipment									0
HOU-01-01	Mop Bucket & Wringer	4	4	4	3	3	3	3	2	26
HOU-01-02	Janitor Cart	3	3	3	2	2	2	2	2	19
HOU-01-03	Detergents & Disinfectants	3	3	3	2	2	2	2	1	18

Tab. 11: Distribution list - internal HCW logistic equipment

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Priced Bill of Quantities (BoQ)

The total costs are estimated to

T ECHNICAL SP ECIF ICAT IO NS					
Im pr ov in g th e He althcar e W as te M an ag em ent system in L ib eria					
Fo r a deta i led de sc ri ptio n of the e qui p me nt, ple as e s ee anne x A of the tec hnic a l s pec i fic atio ns					
Co de	Item	Un it	Price	Am o un t	Total Co s ts
P PE -01	P ers ona l P ro tec tio n E qui p me nt				
P PE -01-01	S af ety go ggl es	1	\$ 3,00	63	\$ 189 ,00
P PE -01-02	W or k i ng glov es - c he mi ca ls	1	\$ 5,00	63	\$ 315 ,00
P PE -01-04	W or k i ng glov es - lo gis tic	1	\$ 2,00	130	\$ 260 ,00
P PE -01-05	W or k i ng ov e ral l	1	\$2 5,00	63	\$1 .575 ,00
Tota l					\$2 .339 ,00
LOG -01	O ne - wa y i te ms				
LOG -01 -02	S harps co nt. W HO - Large	10 0	\$1 75,00	29	\$5 .075 ,00
LOG -01 -04	S harps co nt. P las tic - L arge	10 0	\$2 50,00	26	\$6 .500 ,00
LOG -01 -05	B ag - inf ect - Inc . (Sma ll)	10 00	\$4 50,00	73	\$3 2.850 ,00
LOG -01 -11	D ebris Pots fo r Ne edle C utt er	10 0	\$1 80,00	29	\$5 .220 ,00
Tota l					\$4 9.645 ,00
LOG -02	I nterna l equi p me nt				
LOG -02 -01	I nfec t ious W ast e Bi n - S mal l	1	\$4 0,00	235	\$9 .400 ,00
LOG -02 -09	O utdo or - wa s te bi n	1	\$7 0,00	34	\$2 .380 ,00
LOG -02 -10	Ne edle C utt er	1	\$5 0,00	92	\$4 .600 ,00
Tota l					\$1 6.380 ,00
LOG -03	L og. Equi p. w as te f unc. area				
LOG -03 -01	W heeli e- Bi n 240 (Gene ral W a .)	1	\$8 5,00	92	\$7 .820 ,00
LOG -03 -03	C olle cti on Bi n - Infec t. W as te	1	\$4 0,00	92	\$3 .680 ,00
LOG -03 -04	B i n tr ol ley (i nfec t. W as te)	1	\$1 70,00	19	\$3 .230 ,00
LOG -03 -11	B arre l fo r s oli d Ha z. W as te	1	\$8 0,00	19	\$1 .520 ,00
LOG -03 -13	G rou nd s ca le	1	\$1 50,00	8	\$1 .200 ,00
LOG -03 -14	P res s ure S pra ye r	1	\$7 5,00	8	\$ 600 ,00
Tota l					\$1 8.050 ,00
OFF -01	O ffic e E qui pment				
OFF -01-01	O ffic e Des k	1	\$1 00,00	8	\$ 800 ,00
OFF -01-02	S wi vel Chai r	1	\$7 0,00	8	\$ 560 ,00
OFF -01-03	C abi net, low	1	\$7 5,00	8	\$ 600 ,00
OFF -01-04	S to ra ge She lves	1	\$6 0,00	8	\$ 480 ,00
OFF -01-05	O ffic e Aux il ia rie s & W hite board	1	\$2 00,00	8	\$1 .600 ,00
Tota l					\$4 .040 ,00
WW -01	S ew age- E qui pment				
WW -01 - 01	S i nk p lunge r	1	\$ 5,00	29	\$ 145 ,00
WW -01 - 02	M anual Drai n c le ane r	1	\$5 0,00	16	\$ 800 ,00
Tota l					\$ 945 ,00
Tota l					
HO U-0 1	Hous e ke epi ng E qui pme nt				
HO U-0 1- 01	M op B uc ke t & W ringe r	1	\$3 00,00	26	\$7 .800 ,00
HO U-0 1- 02	J a nit o C art	1	\$4 00,00	19	\$7 .600 ,00
HO U-0 1- 03	D ete rge nts & Dis i nf ec tant s	1	\$5 00,00	18	\$9 .000 ,00
Tota l					\$2 4.400 ,00
Total Co s ts					\$ 115 .799 ,00

Tab. 12: Estimation of the cost for the internal HCW logistic equipment

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Based on the above the estimated cost for the recommended equipment is US\$ 115,799. Additionally US\$25,000 has to be budgeted for delivery, distribution and commissioning of the equipment.

Needed equipment and materials - central HCW treatment center in Monrovia

Based on the carried out calculation and estimation in the Task Report –B4: Estimated equipment and materials required to implement MWMP, the needed investment for the healthcare waste sector was estimated. Next to containers and transportation vehicle, additionally the needed equipment to fulfil the requirements in accordance with the orange book for the transportation of hazardous goods on public streets and a disinfection system for the disinfection of the containers prior the washing has to be included. The total costs are estimated to be:

No.	Item	Unit	Price	Total Price
1	Autoclave (50kg/h)	2	\$ 90.000,00	\$ 180.000,00
1	Monitoring / spare parts	1	\$ 2.000,00	\$ 2.000,00
1	Transport - light truck	1	\$ 28.000,00	\$ 28.000,00
2	Orange book – equip	1	\$ 1.000,00	\$ 1.000,00
2	Transport container	70	\$ 130,00	\$ 9.100,00
4	Trans. Install & Training	1	\$ 7.500,00	\$ 7.500,00
5	Unforseeable (10%)	1	\$ 22.010,00	\$ 22.010,00
Total Equipment cost				\$ 249.610,00

Tab. 13: Estimation of the investment cost for a HCW logistic system, Montserrado

Assessment of Medical Supplies and Medical Waste Management

List of people consulted

Name	Organization
Charles N. Warjolo	JFK
Comfort Summerville	SHD/MOE
Benjamin C. Soko	MOH/DEOH
Bendu S. Mensah	JFK
Chip Darnett	RBHS
Edith H. Yancy	MPW
Bill O.S. Sackor	MPW
Sylvester Managui	MLMSE
Herbert McGill	CDACH
Watt M. Seelgboh	BHC
Shadi A. Saleh	Caspian HLDS
Paye L. Gondeh	W.R. Services
Josephus M. Jallah	St. J Catholic
Victor Mosarurwa	RBHS
Abraham M. Wenyu	Abraham Robert
J. Abraham Dees	Libra Sanitors
Doris W. Fahngon	MCC
Joseph S. Weah	Pharmacy Board
Eugene S. Caine	Poyry
Jeremy Fischer	WorldBank
Koen Henckaerts	ECHO
Japhet Mbarainah	MC Sanitors
Ruth N. Mondae	ELWA
Alex Harper	DFID
Sahr J. Nyuma	Merlin
Dr. Wannies S. medowald	JFK
David W. Baysah	HSRP
Arabella Greaves	HSRP
Albert Harris	Medical school
Massa T. M. Stubblefield	MCC
Nancy Trotter	MCC
Diorysius Toe	MCC
David K. Morwu	MCC
Jarolyn E. Page	MCC
Sekou J Freeman	MCC
Framis F. Tumba	DEOH/MOH
Clement Peton	WHO
Dr. Moses Pewu	MOH
D. Omarley Yeabah	MOH

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Name	Organization
Beatrice N. Kiarie	UNDP-EEU
Dr. Louise Kpoto	MOH
Lucius T. Bolley	Redemption
Doris Bedell	MOE
Howard K. Nyella	MCC
Julia Dennis	MCC
C. Kaye Winter	MCC
Sylvester Toe	MCC
Henry O. Williams	EPA
Edwin Tucker	IIU/MPW
Dan Wilson	IIU/MPW
Henry D. Larway	MOH

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Record of inter-agency/ forum/ consultation meetings Executive summary and main recommendation

Gerd Kühling, Beverly Barta, Dr Peter Clements, Patrick Okoth, Omarley Yeabah, Benjamin Soko, and Francis Thamba.

The purpose of this introductory meeting was for the for the consultant Team Leader and Healthcare Waste Advisor to meet the Technical Sub-committee, discuss the Terms of Reference, and generally ensure that all stakeholders had a common vision of what was expected from this project.

The main recommendations were that a close and amicable working relationship between the consultancy team and the MoH&SW's DEOHS was key to the project's success. The project visibility was discussed and agreed on; the workplan was discussed and agreed on.

- 16 September 2009 - —Assessment of Medical Supplies and Medical Waste Management|| Inception workshop with Twenty-two attendees from MoH, various divisions and departments; DEOH, EPA, CHS, plus WHO and MSF. Jan Gerd-Kuhling led the meeting after an introduction by Dr.

Dahn, the Chief Medical Officer.

The main purpose was to provide training on Healthcare waste management, as well as present initial project findings.

Key outcomes were:

1. Introduction of project team members and brief background of the HSRP project, including staff time and task commitments and selection and locations of the projects' 7 hospitals in 7 counties.
2. Initial two-week findings of the healthcare waste assessment in Liberia, including legal assessment, types of waste, discussion of sharps management, logistics, results of thermometric testing, the first findings from the ROSA questionnaire,
3. The way forward with general and specific strategies was discussed along with incinerations as part of the treatment strategy.

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4. The national framework development in particular the need for a policy along with the national HCW Guidelines and national HCW strategy. The technical committee will work at putting the recommendation together for the World Bank to approve a change in focus on the goal of producing a draft national policy this will be accomplished by narrowing the current tasks, keeping the same time frame and retaining the same budget.

- 23 September 2009 - meeting between WHO and consultant team

The purpose was to gather information regarding the WHO's forthcoming nation-wide Yellow Fever vaccination campaign, and specifically what contingencies were being applied to address the associated medical waste management.

The outcomes of the meeting were that The 3 million syringes and 32,000 cardboard safety boxes will be simply burned in open pits then covered over. It was indicated that budgetary constraints would mean that a more sophisticated burial system (or any other alternative) would probably not be viable.

- 25 September 2009 - Draft policy presentation by Environmental Management Expert to Project and Technical Sub-Committee and EPA Coordinator

The meeting's aim was for the consultant team to give a presentation on the draft policy, and elicit feedback from those present.

Key recommendations were:

1. Henry Williams from the EPA alerted the meeting that an existing draft policy covering Healthcare waste had already been produced by the MoH&SW with support from WHO. Given this was the first time the existence of this document was brought to the meeting's attention, it was recommended that key points from this policy be incorporated into the version that the consultant had presented.

2. The Sub-committee recommended that more in-depth stakeholder consultation was required to formulate such a policy document.

- 15 October 2009 - Coordination meeting with Arabella Greaves, Omarley Yeabah, Benjamin Soko, Francis Thamba, Beverly Barta and Barnaby Caddy

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The key purpose was to provide mutual feedback on the project to date, and also to highlight any pending issues.

The main recommendations were:

1. National Healthcare Waste Management Policy: An update was provided on the current status of the draft policy. It was agreed that the consultant team would provide Mrs Greaves with a final draft version of the document, which would have synthesized and refined the two existing drafts.

2. Waste audit: The audit should have been scheduled to be completed on 15 October, however some people that attended the training took longer than expected to return to their field bases. It was agreed the completed audit forms would be submitted to the Ministry by 23 October.

3. Final workshop: The final project workshop is scheduled to be held on the morning of 27 November.

4. Public Health Expert: Carrie Hessler anticipated arrival in-country on 19 October; meetings with the Sub-committee were arranged to ensure that all stakeholders have a common vision and expectation for project task C = Training & Public Awareness. [Note that Carrie's arrival has been delayed to 26 October].

5. Payment: The MoH&SW have processed the second Consultant payment request and the funds transfer is expected shortly.

6. Data collection beds, occupancy etc: It was agreed that the method of combining Clinton Foundation + MoH&SW data, then extrapolating BOR would provide the best possible data for this project. It was also noted that data collection was difficult and more time consuming than originally expected.

- 28 October 2009 – Coordination meeting with Beverly Barta (RBHS), Dr Peter Clements (WHO), Patrick Okoth (Oxfam), Dr Putu (MoH&SW), Joseph David (MoH&SW – DEOHS), Carrie Hessler (JSI), Barnaby Caddy (JSI), and Arabella Greaves (MoH&SW)

The key purpose of the meeting was to introduce Carrie to the technical sub-committee and discuss task C (Training & Awareness) of the ToR. In addition, data collection relating to task A was discussed, including the results of the waste audit

Key recommendations/outcomes were:

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1. Carrie provided her interpretation of the ToR task C, indicating that the project timeframe was too limited to produce a detailed and context specific public awareness campaign. She underscored that similar JSI projects in other countries had taken 6-9 months to develop. The sub-committee acknowledged that time was short, but thought it reasonable that at minimum a Liberia-specific structured framework could be provided.

2. To satisfy the ToR to the best extent possible, Carrie and the sub-committee agreed that Carrie would:

- Provide a work plan detailing her forthcoming activities including agencies, persons and places to be visited
- Be provided with a MoH&SW counterpart to collaborate with her during her in-country stay
- Draft a formal Liberia-specific public awareness framework by COB 2 Nov 2009
- Chair a de-brief meeting with the sub-committee following her field visits on 6 Nov

3. Regarding the waste audit (task A), no completed forms have been provided to the consultant yet. It was agreed that 13 forms would be submitted by MoH&SW by tomorrow 28 Oct. The two hospitals remaining hospitals that failed to begin the audit (JFK and Catholic) will begin the audit on 27 Oct and provide the completed forms in 14 days (i.e. 17 Nov).

4. Barnaby alerted the sub-committee about the difficulties acquiring quality data regarding health facility bed count, and bed occupancy ratios.

5. The MoH&SW are currently following the status on the consultant team's second progress payment, which so far has not reached the destination bank account.

6. It was agreed by all present that 4 Nov would be the deadline to give comments on the draft policy framework.

- 16 November 2009 - Coordination meeting with World Bank. Present: Barnaby Caddy and Bev Barta (JSI), and Jeremy Fischer (World Bank)

Urban works infrastructure meeting at MCC every Friday 10am. Meeting covers mostly solid waste management. Attended by MCC, WB, private contractors and NGOs

Frank Krah 06 559290 most useful person to contact at MCC

WB EMUS project utilizing 4 private solid waste contractors to pick up and empty the various skips around Monrovia

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- 2 other private contractors operating in Monrovia

In theory, all contractors should be dumping their waste only at Whein Town, but it's likely that some contractors dump where ever they want. Libra Sanitation has approached MCC/WB about the possibilities of building and managing a centrally based incinerator for waste. CHF maybe interested to support Libra.

- CHF currently implementing a livelihoods project focusing on primary waste collection at household level (wheelbarrow boys etc). Project is for 2 and half years with \$2.5m budget and supported by Gates Foundation. The project will look at recycling, composting, segregating waste.
- Jeremy provided documents on EMUS project (same one that's available on the web)
- EMUS will support finance and systems management in MCC
- MCC collects revenue from various sources (approx \$70k/annum from taxes from waste, dump fees). However not currently clear how these revenues are being expended (definitely not on waste management)
- Poyry consultants have been contracted to fix problems with Whein Town dump
- No plans to build any sanitary landfills/dumps outside of greater Monrovia.
- No major bi/multi lateral donors interested specifically in waste besides
- WB (which sources its funds from Lib Recon Trust Fund - LRTF).

27 November 2009 - Final Workshop and presentation, attended by all stakeholders (see table below).

No.	Name	Organization	Telephone
1	Charles N. Warjolo	JFK	06470182
2	Comfort Summerville	SHD/MOE	06586681
3	Benjamin C. Soko	MOH/DEOH	06520911
4	Bendu S. Mensah	JFK	06579135
5	Chip Darnett	RBHS	06364171
6	Edith H. Yancy	MPW	06550498

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No.	Name	Organization	Telephone
7	Bill O.S. Sackor	MPW	06527887
8	Sylvester Managui	MLMSE	06522634
9	Herbert Mcgill	CDACH	077065305
10	Watt M. Seelgboh	BHC	06882716
11	Shadi A. Saleh	Caspian HLDS	06221441
12	Paye L. Gondeh	W.R. Services	077332094
13	Josephus M. Jallah	St. J Catholic	06737559
14	Victor Mosarurwa	RBHS	06883432
15	Abraham M. Wenyu	Abraham Robert	06525190
16	J. Abraham Dees	Libra Sanitors	06545119
17	Doris W. Fahngon	MCC	06447811
18	Joseph S. Weah	Pharmacy Board	06539698
19	Eugene S. Caine	Poyry	06578557
20	Jeremy Fischer	WorldBank	06741869
21	Koen Henckaerts	ECHO	06547337
22	Japhet Mbarainah	MC Sanitors	06857736
23	Ruth N. Mondae	ELWA	06565601
24	Alex Harper	DFID	077738420
25	Sahr J. Nyuma	Merlin	06569419
26	Dr. Wannies S. medowald	JFK	06602286
27	David W. Baysah	HSRP	06550234
28	Arabella Greaves	HSRP	077801981
29	Albert Harris	Medical school	06514282
30	Massa T. M. Stubblefield	MCC	06516081
31	Nancy Trotter	MCC	06674665
32	Diorysius Toe	MCC	077004896

33	David K. Morwu	MCC	06492227
34	Jarolyn E. Page	MCC	06415951
35	Sekou J Freeman	MCC	06887815
36	Framis F. Tumba	DEOH/MOH	06520940
37	Dr. Peter Clement	WHO	06522998
38	Dr. Moses Pewu	MOH	06550219
39	D. Omarley Yeabah	MOH	06669906
40	Beatrice N. Kiarie	UNDP-EEU	06885980
41	Dr. Louise Kpoto	MOH	077702609
42	Lucius T. Bolley	Redemption	06825309

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No.	Name	Organization	Telephone
43	Doris Bedell	MOE	06635797
44	Howard K. Nyella	MCC	06022300
45	Julia Dennis	MCC	06600193
46	C. Kaye Winter	MCC	06523664
47	Sylvester Toe	MCC	06495515
48	Henry O. Williams	EPA	06587734
49	Edwin Tucker	IIU/MPW	06516732
50	Dan Wilson	IIU/MPW	06516732
51	Henry D. Larway	MOH	077059806
52	Barnaby Caddy	JSI	06809827
53	Jan-Gerd Kühling	ETLog Health	077148419
54	Insalf Salame	JSI	06528322

The workshop was opened by Dr. Pewu from the MoH&SW, followed by an interactive presentation by the project Team Leader Jan Kühling. The key objective of the workshop was for the consultants to present the project results:

- Healthcare waste – Situation Analysis, Framework Analysis, Proposed New MCW Policy, The National Medical Supplies
- Framework analysis: Legal, financial and human resources situation
- Proposed new HCW policy and guideline for HCW – the tool for future activities; and
- The national medical supplies and medical waste management strategy and plan

The key comments, recommendations and conclusion from discussions included:

1. It was explained that to assess current sharps waste management practices, the ROSA tool was used, as well as field visits and interviews with a broad cross section of Healthcare facility workers.
2. It was highlighted that some Healthcare facilities still lack fundamental infrastructure such as incinerators
3. The MoH&SW raised the issue that the ROSA tool was not in Liberian English and therefore could potentially be difficult for staff to understand clearly. It was explained that other methods were used to cross check information such as face to face interviews and field visits.
4. The ROSA questionnaire was completed by a broad cross section of Healthcare workers, and was as representative as possible.
5. According to official data, there are 140 incinerators in Liberia. In reality there are many more, however a large number are currently not in use due to breakdown or lack of fuel.
6. It was expressed that there was potentially a lack of local capacity to run and maintain DeMontfort incinerators, but the presenter underscored that these incinerators were a temporary solution only. And that although very much needed, it was necessary to develop longer term strategies in parallel.
7. Private sector solid waste management companies explained that some Healthcare facilities contract individuals to dispose of their Healthcare waste. This is not surprisingly, as final disposal is not usually done in a safe manner. It was suggested that these private companies could become involved in constructing a central treatment facility, which was built to government approved technical specifications. Given there is currently no specific budget lines in MoH&SW to manage Healthcare waste, it was recommended that donors should be made aware of this funding shortfall.
8. The ECHO representative questioned whether the quoted US\$1m p.a. for HCW was for recurrent or investment costs. It was explained that this figure is only estimation, and that naturally start up costs will be higher as proper HCWM begins to be implemented.
9. The World Bank representative explained that Whein Town is a sanitary landfill, rather than merely a dumping site.
10. The head of DEOH at MoH&SW and World Bank representative explained that the committee for HCWM could benefit from being more proactive. The TOR could be strengthened and the membership could possibly be amended. This committee could become permanent, and that the importance of decentralization should be noted.
11. Questions were asked regarding what to do with ash once bio-hazardous waste has been incinerated. The presenter explained that lined engineered ash pits could be used, as well as encapsulation.
12. PPP models were discussed following suggestions from the private sector that waste firms could potentially be responsible for managing the incinerators in hospitals, or conversely managing a central treatment plant.

13. Libra Sanitation expressed that it was potentially interested in building and managing a treatment plant, if government could provide technical specifications for design and operation. It was noted though that there is currently no budget for HCWM, making it currently unattractive for private companies to make large capital outlays.
14. The WHO representative explained that PPP is a potential for Liberia, but underscored the importance of government monitoring and ensuring compliance.
15. The concept of transporting waste from clinics to Healthcare centers/hospitals had merit; however substantial improvement in logistics were necessary.
16. It was agreed that adhering to international standards was beneficial; however it was important to adapt those standards to fit the Liberian context.
17. The EPA is developing a policy on waste management and calls for the Waste Management Committee to be fully engaged.
18. Representatives from the funeral home industry explained that they deposited chemical liquid waste direct to septic tanks, given they currently have no alternatives.
19. Expired pharmaceuticals are a public health threat in Liberia, and that more care must be taken to ensure they do not end up in landfill or dump sites.
20. There is no radioactive waste in Liberia.
21. Sustainability for HCWM should be driven from country, and not from donor community. This can include broad capacity building programmes.
22. A hybrid phase out approach is needed to move from majority donor financing to GoL financing. This will ensure accountability and theoretically sustainability.
23. The WHO representative explained that low costs solutions like policy and guidelines development would be beneficial to reduce harmful HCWM practices.
24. Public awareness at all levels is critical for Liberia to move forward, specifically regarding syringes.
25. The attendees agreed that the information provided at the workshop was valuable, and that developing a policy and guidelines were necessary. It was underscored that government's ability to enforce the guidelines once they were accepted was equally important.

**Mr. Yeabah from MoH&SW DEOH
thanked all the participants and officially closed the workshop.**