



Assessment of Medical Supplies and Medical Waste Management

E2380 v2

Assessment of Medical Supplies and Medical Waste Management

Final Report





Assessment of Medical Supplies and Medical Waste Management

Table of Contents

Foreword.....	6
1 Introduction	8
2 Policy, legal and administrative framework	10
2.1 Assessment of the Policy, Regulatory (Legal) and Administrative Framework on Healthcare waste management	11
2.2 Identification of permit requirements	13
2.3 Needed public participation or involvement	14
2.4 Time demands needed for obtaining permits and necessary environmental impact requirements.....	16
2.5 National Policy and National Guideline development.....	18
3 Project Description	21
3.1 Project goals and objectives	21
3.2 Project outputs and results	21
3.3 Project implementation plan:	22
3.4 Designation of key and non-key experts and allocation of resources:	23
4 Baseline data on healthcare waste generation	25
4.1 Identification of all Healthcare facilities in the country	25
4.2 Assessment of healthcare waste generation rates.....	26
5 Assessment of Healthcare waste management	33
5.1 Main findings of the HCW management assessment	33
5.2 Recommendations for improvements based on the findings	35
6 Determination of treatment technology.....	39
6.1 Assessment of alternative treatment systems.....	39
6.2 Status of existing waste treatment systems	40
6.3 Methodology for decision making.....	43
6.4 Recommended flow chart.....	46
6.5 General Recommendations and Strategies.....	48



Assessment of Medical Supplies and Medical Waste Management

7	Determination of disposal sites	49
7.1	Status of on-site waste disposal facilities	50
7.2	General HCW disposal Strategies.....	52
7.3	Determination for temporary disposal sites.....	53
8	Medical supplies and medical waste management plan (MWMP), including estimated costs and timeline.....	55
8.1	MWMP - Strategic framework	55
8.2	MWMP – Regulatory Framework.....	58
8.3	MWMP – Logistic approach.....	60
8.4	MWMP - financing possibilities and cost estimations.....	65
8.5	MWMP - Infrastructure and Equipment Plan	72
8.6	MWMP – Vocational Training plan	73
8.7	MWMP – Behavior change & public awareness plan.....	75
8.8	MWMP - Monitoring and Evaluation.....	78
8.9	MWMP - Documentation and Information.....	81
8.10	MWMP – Phased implementation plan	82
9	Appendices	87
9.1	Terms of Reference for this study	87
9.2	Estimated equipment and materials required to implement MWMP	95
9.3	List of people consulted	100
9.4	Record of inter-agency/ forum/ consultation meetings Executive summary and main recommendation	102

List of Tables:

Tab. 1:	List of assessed Healthcare facilities	26
Tab. 2:	Average waste generation rates for non-hazardous and hazardous waste produced by the assessed Healthcare facilities.....	28
Tab. 3:	Normalized average waste generation rates for non-hazardous and hazardous waste produced by the assessed Healthcare facilities.....	30



Assessment of Medical Supplies and Medical Waste Management

Tab. 4: Extrapolation of infectious waste generation rate for all Healthcare facilities in Liberia	31
Tab. 5: Number of WDU reported in County Health Plans, 2007 - 2008	41
Tab. 6: UNICEF WDU distribution list (September - November, 2009).....	41
Tab. 7: Treatment technology options – ECAT.....	71
Tab. 8: Cost estimation – national vocational HCW training & monitoring system	75
Tab. 9: Cost estimation – Behaviour change & public awareness program	78
Tab. 10: MWMP - Phased implementation plan	83
Tab. 11: Distribution list – internal HCW logistic equipment	97
Tab. 12: Estimation of the cost for the internal HCW logistic equipment.....	98
Tab. 13: Estimation of the investment cost for a HCW logistic system, Montserrado.....	99

List of Figures:

Figure 1: Project implementation Plan (Sep.09)	22
Figure 2: Staff resource planning	23
Figure 3: Location of the main project hospitals	27
Figure 4: Expected increase of infectious waste generation rate in Liberia after implementation of HCWM Plan.....	31
Figure 5: Sample national healthcare waste treatment strategy	35
Figure 6: Sample internal healthcare waste logistic system	36
Figure 7: Sample external healthcare waste logistic system.....	37
Figure 8: Overview of possible healthcare waste treatment strategies for Liberia	39
Figure 9: Temperature-Time Diagram of an Incinerator in Liberia	42
Figure 10: Process flow-chart - decision making, selection of Healthcare waste treatment method or technology	46
Figure 11: Process flow-chart - decision making, permit application process for the selected Healthcare waste treatment method or technology	47
Figure 12: Typical Dump Site in a country hospital	49
Figure 13: Only official Solid Waste Disposal Site, Whein Town	50
Figure 14: Framework of a MWMP	58
Figure 15: HCW stream system Liberia	60
Figure 16: Overview of treatment methods for healthcare waste in Liberia.....	64
Figure 17: National Health Plan - Budget	68
Figure 18: Estimated annual HCW management cost for different strategies, Liberia	72
Figure 19: HCW transportation scheme, Montserrado	73
Figure 20: Location of target hospitals, package A	84



Assessment of Medical Supplies and Medical Waste Management

List of Annexes:

- ③ **The Draft Policy: National Healthcare Waste Management Policy**
- ③ **The Draft Guideline: Safe Management of Healthcare Waste in Liberia**
- ③ **Task Report A1: Legal Analysis of the HCW situation in Liberia**
- ③ **Task Report A2: Healthcare Waste Baseline study**
- ③ **Task Report A3: Assessment of the Healthcare waste management situation in Liberia**
- ③ **Task Report B1: Determination of the medical waste treatment technology in Liberia**
- ③ **Task Report B2: Determination of the medical waste disposal sites**
- ③ **Task Report B3: Financing possibilities for medical waste**
- ③ **Task Report B4: Estimated equipment and materials required to implement MWMP**
- ③ **Task Report C1: Development of a national HCW Training Program**
- ③ **Task Report C2: Liberia Healthcare Waste Management Behaviour Change Communication and Public Awareness Strategy**

Foreword

This is the final report of the “Assessment of Medical Supplies and Medical Waste Management Project”, focusing on the final results of the consultant’s activities carried out during a 12 week period from September to November 2009. The final report summarizes the findings of the developed 9 task reports and the developed healthcare waste management policy as well as the developed healthcare waste guideline. The following documents form an integral and important part of this report and can be found in the Annex:

- The Draft Policy: National Healthcare Waste Management Policy
- 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

The project was carried out with the technical and personal support of the Ministry of Health & Social Welfare and the financial support of the International Development Association within the Health System Reconstruction Project (HSRP). The report is developed considering the financial, social and physical conditions prevailing in post-conflict affected Liberia but also includes general recommendations for the first time implementation of a healthcare waste management system in a country. Provided recommendations are mainly based on international accepted healthcare waste policies, treatment and management options, standard operation proceedings and healthcare waste management plans provided by the World Health Organization, by the Basel Convention and by the Stockholm convention. Recommendations are further based on the experience of the consultant company in other countries in eastern and western Sub-Sahara Africa as well as in other post-conflict countries.

The consultant would like to thank all persons who supported this study, the Ministry of Health & Social Welfare, the HSRP, the sixteen healthcare facilities who participated in the healthcare waste study, the Environmental Protection

Assessment of Medical Supplies and Medical Waste Management

Agency (EPA), Monrovia City Corporation (MCC) and the 5-member Technical Sub-Committee, chaired by the representative of the WHO Country Office.

Introduction

Healthcare activities protect and restore health and save lives. At the same time they generate large quantities of waste and by-products that need to be managed safely and disposed of properly. Provided that the waste is properly segregated and separated, most of the waste can be managed in the same way as municipal waste.

The balance (on average 20% according to the WHO depending on segregation systems, size and type of the healthcare facility) might be contaminated with pathogens, chemicals, body fluids or other potential hazardous components and must be handled as hazardous waste. A small fraction may pose a physical or radiological hazard. The disposal of body and organ parts, e.g. from pathology and operational sectors, must be carried out with due regard to religious and ethical considerations. Improper handling, treatment and disposal methods of healthcare waste (HCW) can cause nosocomial infections, occupational accidents, and environmental pollution. It may also result in increased costs for waste management.

The medical supplies and medical waste management project will be carried out recognizing that post-conflict Liberia is amidst a transition from emergency to development assistance. Following 14 years of civil war (1989-2003), Liberia is still plagued by the spread of disease intensified by the lack of basic infrastructure such as safe drinking water supply and sanitation, electricity, roads, education, health, waste management including healthcare waste management systems. Of its population of about 3.3 million, the gross domestic product (GDP) decreased by 50 percent as a result of deteriorated capacity and weak institutions. Half of the trained workforce, including the healthcare workforce, was displaced or fled the country.

In the years leading up to the war, Liberia's waste management system was rudimentary serving basically the nation's capital city, Monrovia, and nearby areas with commercial activity. Regarding the disposal of healthcare waste, hospitals largely relied on incinerators, and health facilities relied on burial pits or open-air burning. Other equipment was brought in by various donors to treat immunization or other program-specific healthcare waste. While these disposal methods prevailed as defaulting practices, they are neither a sound nor a sufficient substitute for a sound national medical waste management policy which must be developed to address the country's needs and to move forward in a constructive manner.

Similarly there is a need to ensure that strategies developed are sufficiently comprehensive to include all kind of waste which exists in the country. It is therefore essential that the national strategy and comprehensive plan address these

Assessment of Medical Supplies and Medical Waste Management

as well as unusable pharmaceuticals and other healthcare commodities that become waste as it is generated, and that the plan keeps pace with international regulations.

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 set up 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.

¹ Article 7 of chapter II of the New Liberian Constitution of 1986.

Specific questions in regard to the legal situation in Liberia considering healthcare 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.

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

For the environmental side, two main acts exist:

- ③ 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;
- ③ 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:

- ③ National Policy on Injection and Healthcare Waste Management. Draft. MoH&SW, September 2005;

Assessment of Medical Supplies and Medical Waste Management

- ③ Immunization Safety Policy and Plan of Action 2006 - 2010. Expanded Programme On Immunization (not dated); and
- ③ Liberia Policy Guidelines for Safety Measures and Management of Waste In Blood Transfusion Programme, 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:

- ③ Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, 1989
- ③ Convention on Persistent Organic Pollutants (POPS), Stockholm, 2001
- ③ 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 department 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 non-hazardous waste generated from Healthcare facilities.

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

Assessment of Medical Supplies and Medical Waste Management

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 a 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:

- a) 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;
- 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 application to prepare an environmental impact study in accordance with section 14 of the 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 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.

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.

Assessment of Medical Supplies and Medical Waste Management

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 public all documents submitted to the Agency under Part III of this Law and shall duly consider all public comments. To enable public participation, Section 101 explains the access to environmental information and declares that there shall be freedom of access to environmental information

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 a permit within the agency and who is aggrieved by a final determination in a 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 filling 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:
 - a) Identify the nature and magnitude of the anticipated impacts of the project;
 - b) Predict the extent/scale/location of the impacts;
 - c) Identify the timing, the stage at which the anticipated impact is likely to occur and the duration of the impact;
 - d) 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) A detailed description of the proposed project or activity and of activities it is likely to generate;
 - b) A description of the potentially affected environment including specific information necessary for identifying and assessing the environmental effects of the proposed project or activities;
 - c) 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;
 - d) Reasons for preferring the proposal location and rejecting alternative sites;
 - e) 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;
 - f) 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;
 - g) 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;

Assessment of Medical Supplies and Medical Waste Management

- h) A brief description of how the information provided for in this section has been generated;
- i) An identification of gaps in knowledge and uncertainties which were encountered in completing the required information;
- j) The social, economic, cultural and public health effects the project is likely to have on people and society;
- k) The ecological and atmospheric impacts anticipated;
- l) 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
- m) 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.

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.

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' principle is 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 a 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.

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

Assessment of Medical Supplies and Medical Waste Management

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.

Project Description

Project goals and objectives

The overall objective of the project is to

1. Conduct a comprehensive medical supplies and medical waste management assessment of the Liberian situation; and
2. Develop a national medical supplies and 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 reports. The project period is 12 weeks; the project commenced on the 3rd of September 2009 and end with a final workshop on the 27th November 2009.

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.

Project outputs and results

The main outputs and results to be delivered by the Consultant 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

Assessment of Medical Supplies and Medical Waste Management

- ⇒ 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
- ⇒ A inception workshop is carried out on the 16.09.09
- ⇒ A final workshop is carried out on the 27.11.09

The following formal project reports were delivered:

- ⇒ Inception report
- ⇒ Draft report A (included findings and recommendations of Task A1 and A3)
- ⇒ Draft report (include findings and recommendations of A4 and B4)
- ⇒ Draft Final Report (this report)

Project implementation plan:

At the beginning of the project the final workplan for the implementation of the project was developed. This project implementation plan was followed throughout the entire project time.

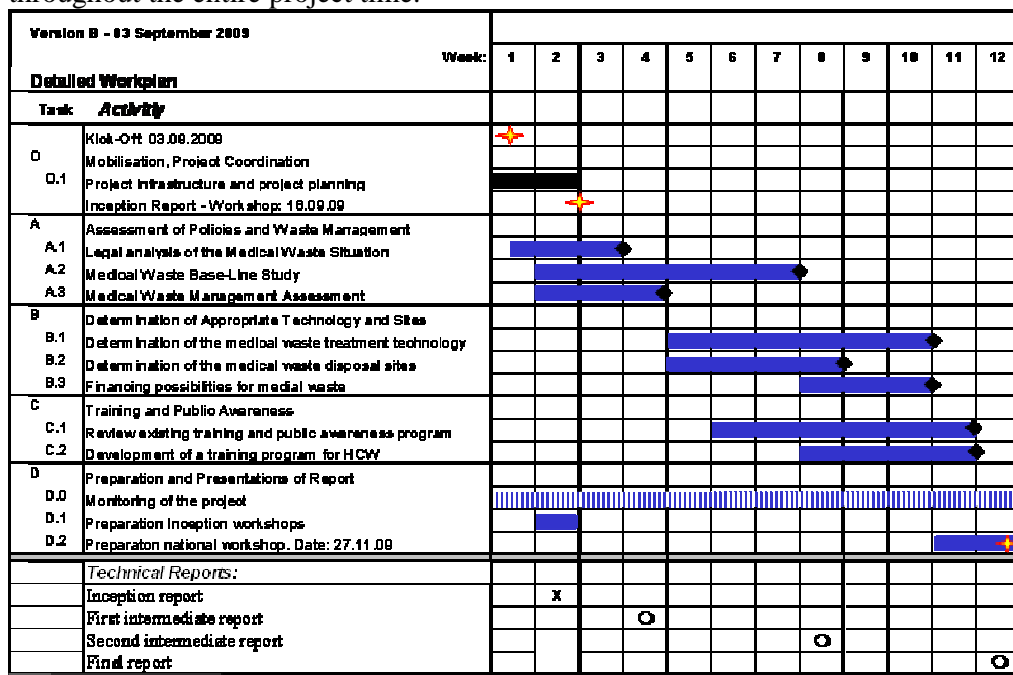


Figure 1: Project implementation Plan (Sep.09)

Certain unexpected difficulties as a not available data basis for healthcare facilities and bed and delays by participating hospital in providing data from the waste assessment resulted in slight delays in the provision of the intermediate reports. At the end of the project, however all technical project

reports could be supplied latest in week 11 of the project, providing the technical committee with a week time for the preparation of the final workshop.

Designation of key and non-key experts and allocation of resources:

All key and non-key experts performed their works as planned. All external experts arrived on time and in accordance to the working plan. The financial resources provided by the consultant company to facilitate the project were considered as sufficient and enabled the experts to carry out the project as planned.

The staff planning showed short comings as follows:

Staff resource planning until 05.12.09	Staff input (in the form of a bar chart)	Staff input (in the form of a bar chart)												Total staff- input					
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	Used	Plan	Remain			
Foreign Experts (1)																			
1	Jan-Gerd Kühling Team Leader	[Home]															19	16	-3
		[Field]															24	24	0
2	Barnaby Caddy Waste Management Expert	[Home]																	0
		[Field]															58	40	-18
3	Pawel Gluszynski Enviro Management Expert	[Home]															13	11	-2
		[Field]															26	24	-2
4	Carrie Hessler-Radelet Public Health Expert	[Home]															9	9	0
		[Field]															6	6	0
																	155	130	-25
Local support staff																			
1	Secretary / Logistic	[Field]															60	60	0
2	Driver	[Field]															45	30	-15
																	105	90	-15

(1): For Foreign experts (except 2), it is expected that they will work in Liberia 6 days per week and 5 days when working at the home office

- Legend:
- = Fulltime
 - ▨ = Parttime, about 2/3 working for the project
 - ▧ = Parttime, about 50% working for the project
 - ▩ = Parttime, about 1/3 working for the project

Figure 2: Staff resource planning

As it can be seen, the staff resources for the three positions:

- ③ Team Leader
- ③ Waste Management Expert
- ③ Enviro Management Expert

had to be increased during the project time to ensure the fulfillment of the tasks as described in the TOR and can be mainly explained due to the to be carried out extra Tasks A4, B4 and C4.

- ③ Task A4: Development of a national policy on healthcare waste and development of national guidelines for healthcare waste management.

- ③ Task B4: Development of recommendations & technical specifications for the supply of urgently needed equipment for the management of healthcare waste.
- ③ Task C3: Provision of a training course on healthcare waste management for staff from the MH&SW, MCC, hospitals and other to introduce general concepts of healthcare waste management.

The carrying out of task A4 was considered as essential by the consultant to increase sustainability of the results of the project. Task B4 was included to provide the client with urgent needed documents. Task C3 had to be included due to the low knowledge level on healthcare waste in Liberia and to enable key staff to better understand core principles of healthcare waste planning. In total about ten unexpected extra working days were needed.

The carrying out of task A2 “Healthcare Waste Baseline Study” and also other task required further more manpower as expected. Due to not available data, etc. it was decided during the project time that the waste management expert should work fulltime for nearly the entire project time. This required additionally 15 working days. Due to the security situation, also the driver was 15 days more required than originally planned.

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.

Identification of all Healthcare facilities in the country

The assessment showed that there was a dearth of available, quality, centralised 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 centralised 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 organisations (INGOs) 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 Montserrado County with Healthcare facility data. The assessment showed:

Total No. of healthcare facility:	509
③ Clinics:	426
③ Healthcare centers	53
③ County Hospitals	29
③ Tertiary Hospitals	(1) JFK, under re-construction

334 of the 509 facilities are operated by the Government, often with support by NGOs or INGOs. 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.

For more details and data, please see the “Task Report A2: Healthcare Waste Baseline study report” in the annex.

Assessment of healthcare waste generation rates

This project aimed to identify Healthcare waste generators and assess 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 centres; and
- three private hospitals.

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

Type of facility	Name of facility
Tertiary Hospital	JFK Hospital, Monrovia
County Hospital 1	Redemption Hospital, Montserrado
County Hospital 2	CH Rennie Hospital, Margibi
County Hospital 3	Phebe Hospital, Bong
County Hospital 4	Government Hospital, Bomi
County Hospital 5	JJ Dossen Hospital, Maryland
County Hospital 6	Martha Tubman Memorial Hospital, Grand Gedeh
County Hospital 7	Liberia Government Hospital, Buhanan, Grand Bassa
Healthcare Centre 1	Saclapea CHC, Nimba
Healthcare Centre 2	Sinje HC, Grand Cape Mount
Healthcare Centre 3	Salala HC, Bong
Healthcare Centre 4	Barnersville HC, Montserrado
Private Hospital 1	ELWA Hospital, Montserrado
Private Hospital 2	St. Joseph's Catholic Hospital, Montserrado
Private Hospital 3	SD Cooper Hospital, Montserrado

Tab. 1: List of assessed Healthcare facilities

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.

Assessment of Medical Supplies and Medical Waste Management

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.

In the following map, the location of the different facilities is displayed:

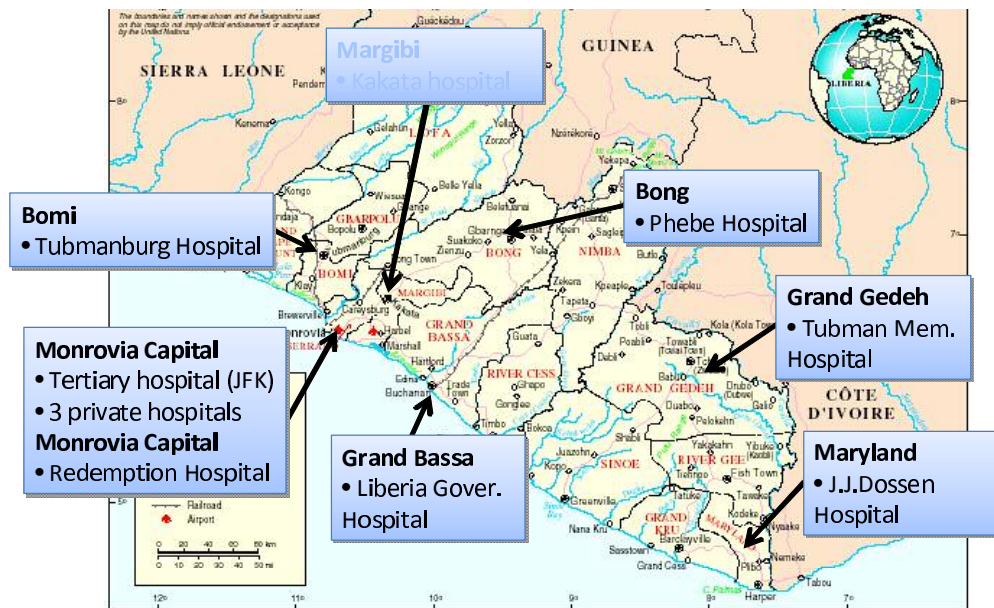


Figure 3: Location of the main project hospitals

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. Moreover the minimum and maximum generation of waste were calculated covering slack and peak situations. The results are presented in the table below.

Healthcare facility	Average generation kg/bed/day	Minimum generation kg/bed/day	Maximum generation kg/bed/day	Bed occupancy rate (%)
---------------------	-------------------------------	-------------------------------	-------------------------------	------------------------

Assessment of Medical Supplies and Medical Waste Management

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)

Tab. 2: Average waste generation rates for non-hazardous and hazardous waste produced by the assessed Healthcare facilities

Due to incorrectly reported quantities of waste, compared to services provided and the number of patient's data from 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.

Results obtained from 12 facilities are similar to those published in an UNDP - GEF survey². 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:³

² Survey of Health-Care Waste Characteristics and Generation Data from Different Countries, UNDP GEF Global Demonstration Project on Healthcare Waste, New York, NY, November 2007.

³ WHO, Fact sheet N°253, Reviewed November 2007, Wastes from Healthcare Activities.

Assessment of Medical Supplies and Medical Waste Management

- 80% general health-care waste, which may be dealt with by the normal domestic and urban waste management system;
- 15% infectious and pathological waste;
- 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.

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
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

Assessment of Medical Supplies and Medical Waste Management

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)
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
<i>Average</i>	0.685	0.129	0.009	0.026	0.009	0.857

Tab. 3: Normalized average waste generation rates for non-hazardous and hazardous waste produced by the assessed Healthcare facilities

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 by the consultant 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:

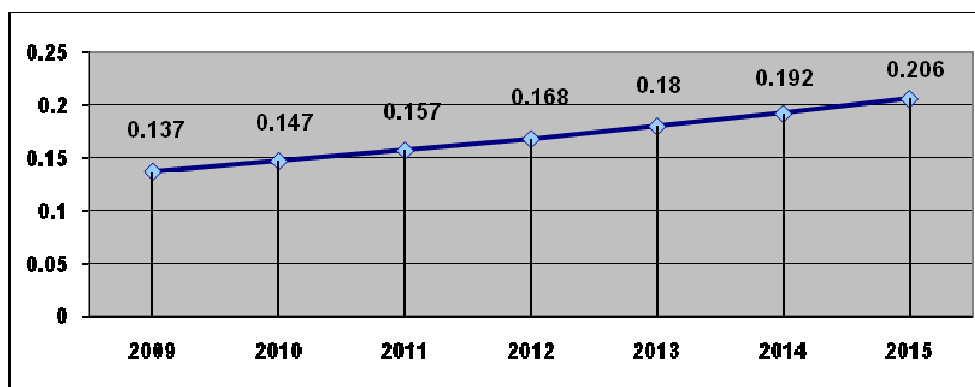


Figure 4: Expected increase of infectious waste generation rate in Liberia after implementation of HCWM Plan

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 stabilise as it has in other countries.

Based on the above infectious waste generation rates, following extrapolation can be made for the entire country:

Type of Healthcare facility	Number of facilities	Number of beds	Infectious waste generation rate	Quantity of infectious waste (kg/day)
Clinics 0 - 5 beds	406	114	1 kg/day	406.0
Clinics > 5 beds	19	191	0.2 kg/bed	38.2
Health Centers < 5 beds	24	38	1 kg/day	38.0
Health Centers > 6 beds	35	631	0.2 kg/bed	126.2
Hospitals	30	2350	0.2 kg/bed	470.0
Total	514	3324		1062.40

Tab. 4: Extrapolation of infectious waste generation rate for all Healthcare facilities in Liberia

Estimated annual quantity of infectious waste generated by all of the above facilities is 387.77 tons. It is advised to repeat assessment of the Healthcare

Assessment of Medical Supplies and Medical Waste Management

waste management system in two years after the HCWM Plan is in place to measure the improvements.

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:

- I. Analyses of applied medical waste management including Healthcare waste guidelines, segregation, collection, transportation, storage and disposal systems
- II. Assessment of Healthcare waste management knowledge, awareness and behaviours at various levels
- III. Identification of financing needs, potential sources of funding, key actors, and necessary budgetary allocation for waste management
- IV. 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 healthcare waste management in the facilities and the evaluation of the general waste recycling situation.

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:

- ③ No systematic planning of the medical waste system
- ③ Unclear organization, no human resource planning
- ③ Unclear responsibilities, unclear or missing instructions
- ③ Not or very weak existing segregation system
- ③ Missing minor, major and fixed waste logistic equipment
- ③ Risky waste logistic practices
- ③ Not existing monitoring & record keeping systems
- ③ Missing instruction for critical and emergency situations

Assessment of Medical Supplies and Medical Waste Management

- ③ High risk working environment with several accidents
- ③ 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 a certain awareness of the problems created by healthcare waste among healthcare 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 bloodborne 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 Healthcare 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 HCWM will increase accordingly, adding a greater financial burden to Liberian society.

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.

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 set up 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:

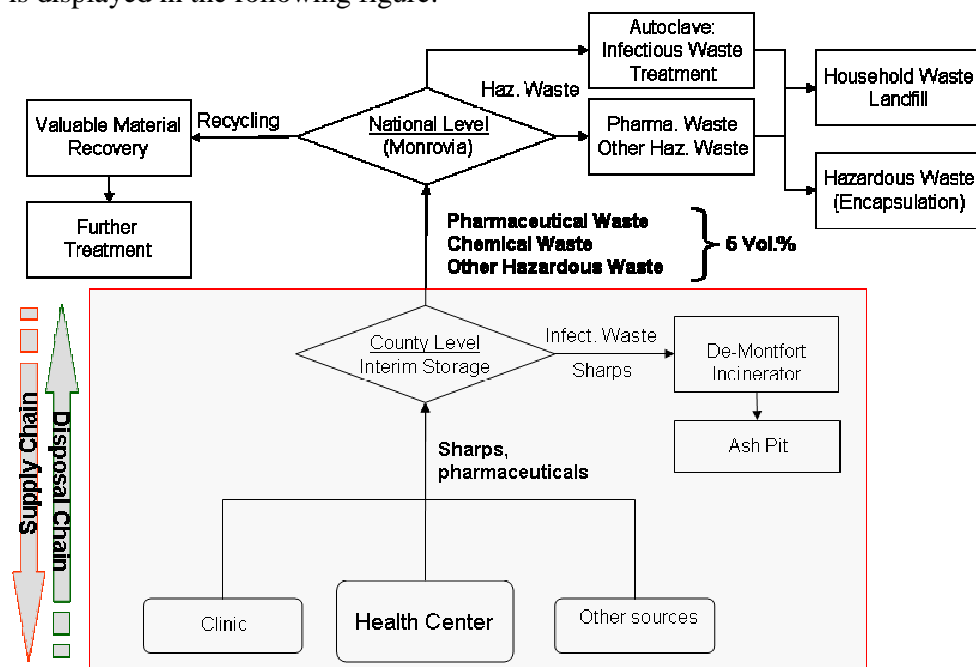


Figure 5: Sample national healthcare waste treatment strategy

Assessment of Medical Supplies and Medical Waste Management

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

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 logistic is 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:

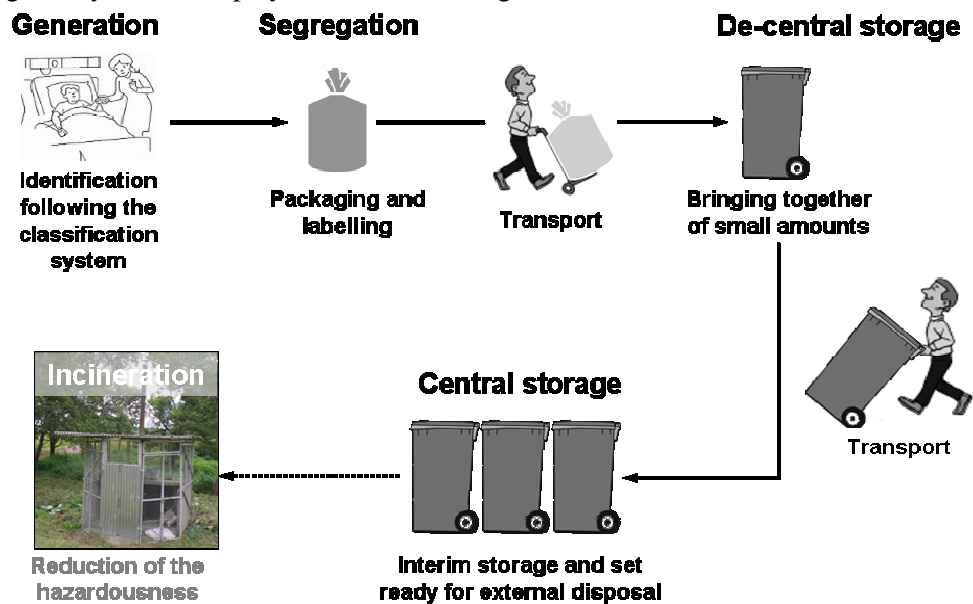


Figure 6: Sample internal healthcare waste logistic system

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 (see chapter 2.5) it is recommended to procure them at least for a number of demonstration hospitals.

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 a demonstration project to demonstrate how a central operated disposal system for hazardous healthcare waste can function.

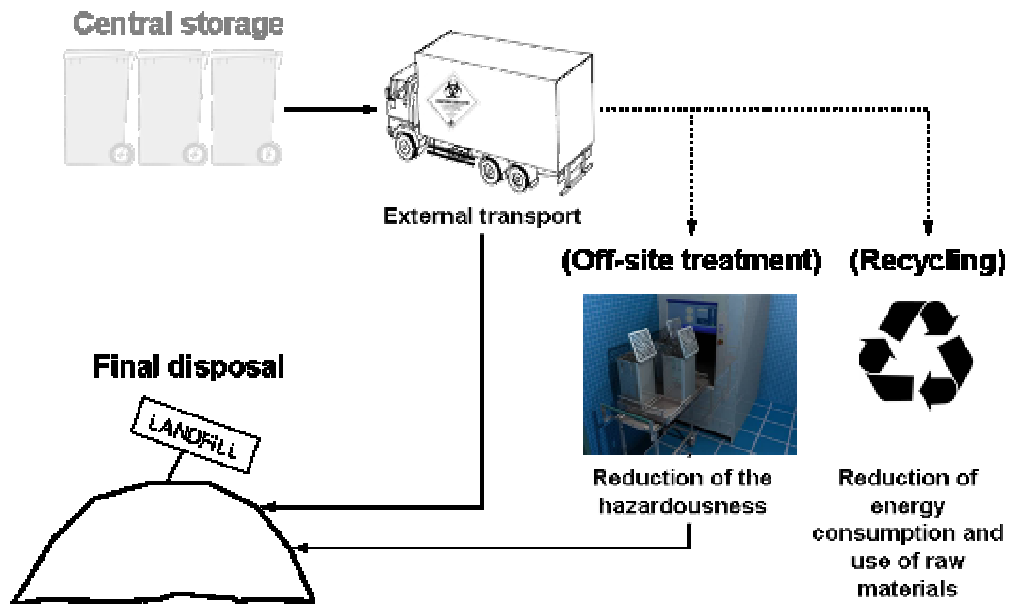


Figure 7: Sample external healthcare waste logistic system

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.

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 non-existent system on occupational health and safety. Based on the example of needle stick accidents the principles of improved safety systems should be demonstrated including:

- ③ Vaccination of healthcare staff against at least HBV and Tetanus
- ③ Carrying out of risk assessments on needle stick accidents and implementing of counter measures
- ③ 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).

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.

Determination of treatment technology

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

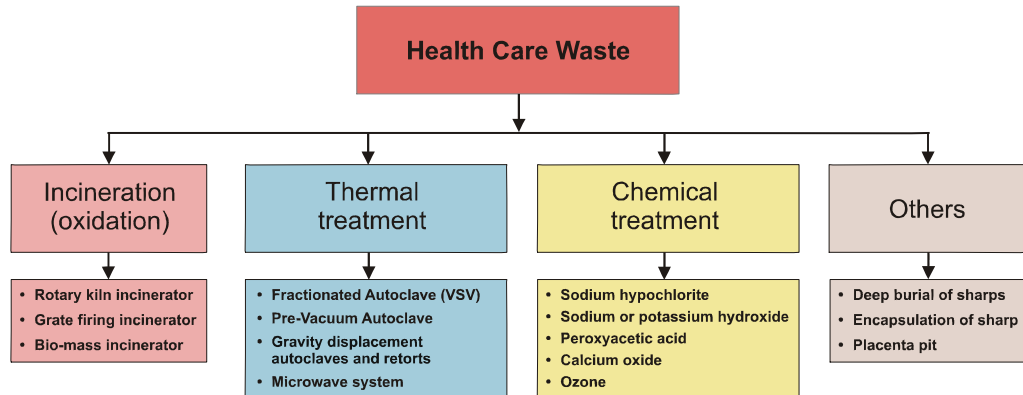


Figure 8: Overview of possible healthcare waste treatment strategies for Liberia

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 (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, 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

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 the resource 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 set up of incinerators is not recommended.

Cost analysis for a sample treatment system with a capacity of 100 kg/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 sterilise 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 or post 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.

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 use do not contain "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

Assessment of Medical Supplies and Medical Waste Management

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
River Gee	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 outdated and may face maintenance problems. Some older units are being replaced by the De Montfort WDU model 2006 and 2007, delivered by UNICEF. Fifteen new De Montfort units have been installed as of November 2009.

County	WDU Gen 1, 2006 model	WDU Gen 2, 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
Grand Bassa	1	2	3	Buchanan, Districts #2, #3, & #4
Grand Cape Mount	1	2	3	Sinje, Dambala, Gola-Konneh
Grand Gedeh	1	2	3	Zwedru, Konno, Pennoken
Grand Kru	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
Montserrado	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
River Gee	1	2	3	Fishtown, Kilepo, River Gbe
Sinoe	1	2	3	Greenville, Pynestown, Jedepo
Total	17	30	47	

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

Information was verified for the following sites:

- Bomi: Operating unit in Tubmanburg.
- Bong: No unit in Salala (small clinic). In Phebe installed but not yet operating.

Assessment of Medical Supplies and Medical Waste Management

- Grand Bassa: In Buchanan installed but has no money to buy wood.
- Grand Cape Mount: Delivered to Sinje but not installed.
- Grand Gedeh: Installed in MTM Hospital, Zwedru but not used. Old incinerator is used instead.
- Margibi: Installed in CH Renie Hospital, Kakata but was awaiting approval from EPA.
- Maryland: JJ Dossen Hospital, Harper used only for EPI campaign.
- Montserrado: Operating units in J.F.K. Hospital (self design), 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.

For 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.

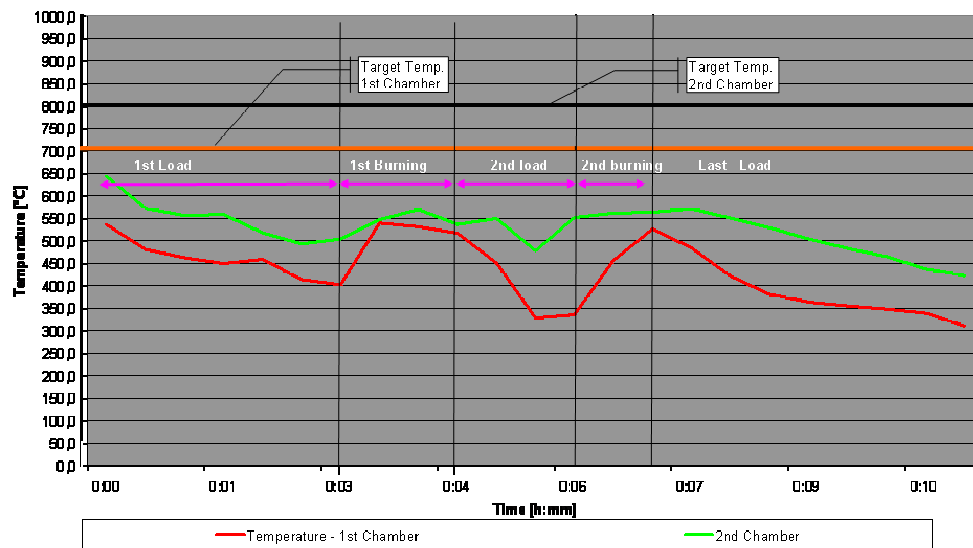


Figure 9: Temperature-Time Diagram of an Incinerator in Liberia

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 standard 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 organised 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 1 kg 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 contents 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.

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:

- ③ hazardous waste incineration, collection, transportation, landfilling including non-hazardous waste (Section 64; Annex I, 18 a and b),
- ③ Decisions of policies and programmes 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 never the less 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:

- ③ suitable policies and guidelines on Healthcare waste management should be drafted and adopted,
- ③ 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),

Assessment of Medical Supplies and Medical Waste Management

- ③ international guidelines and technical recommendations developed by the Basel Convention, Stockholm Convention, and World Health Organization should be adhered to,
- ③ financial resources (project financial security/sustainability) should be made available; and
- ③ 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 products 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 areas 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 of 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 application 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:

Assessment of Medical Supplies and Medical Waste Management

- 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.

Recommended flow chart

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

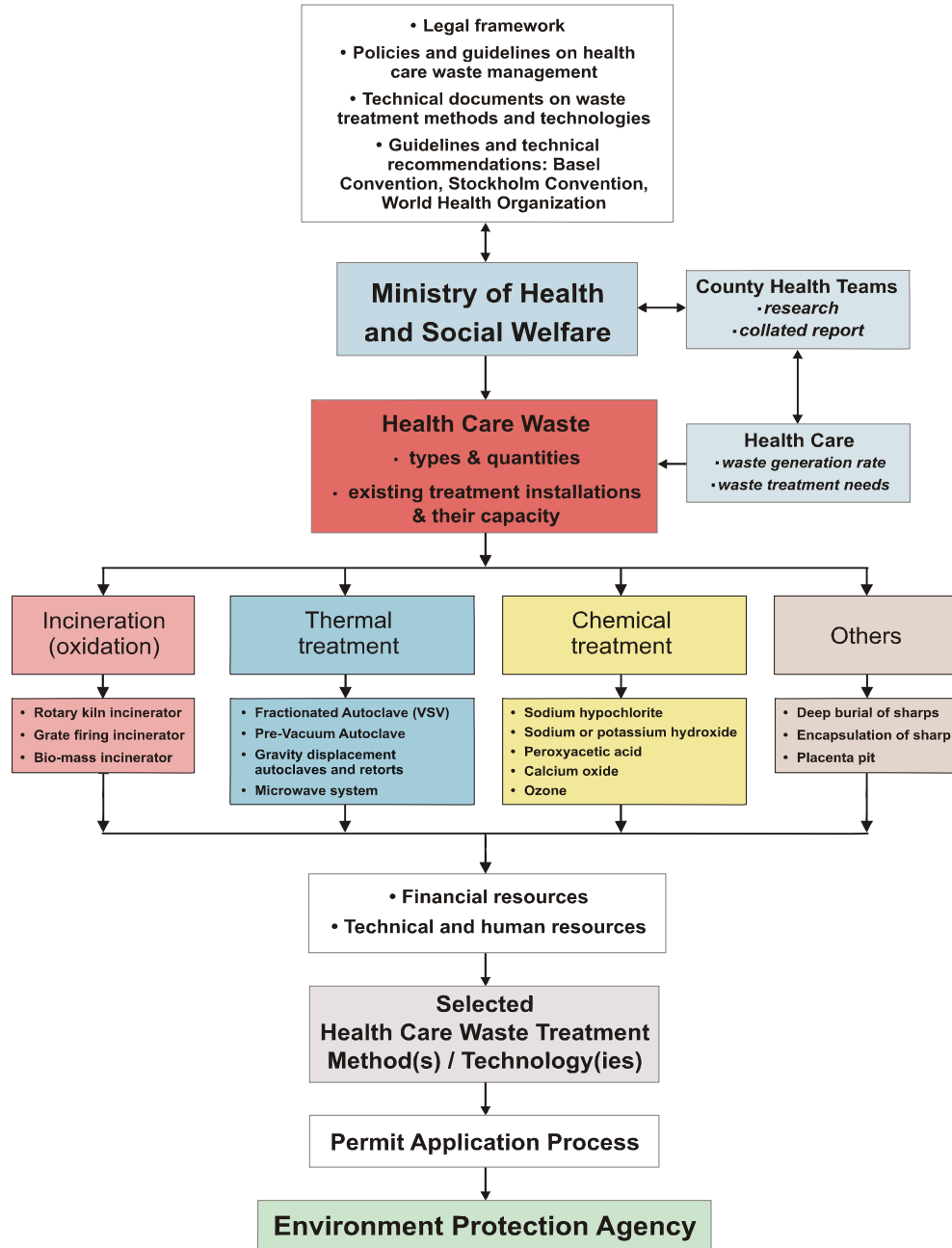


Figure 10: Process flow-chart - decision making, selection of Healthcare waste treatment method or technology

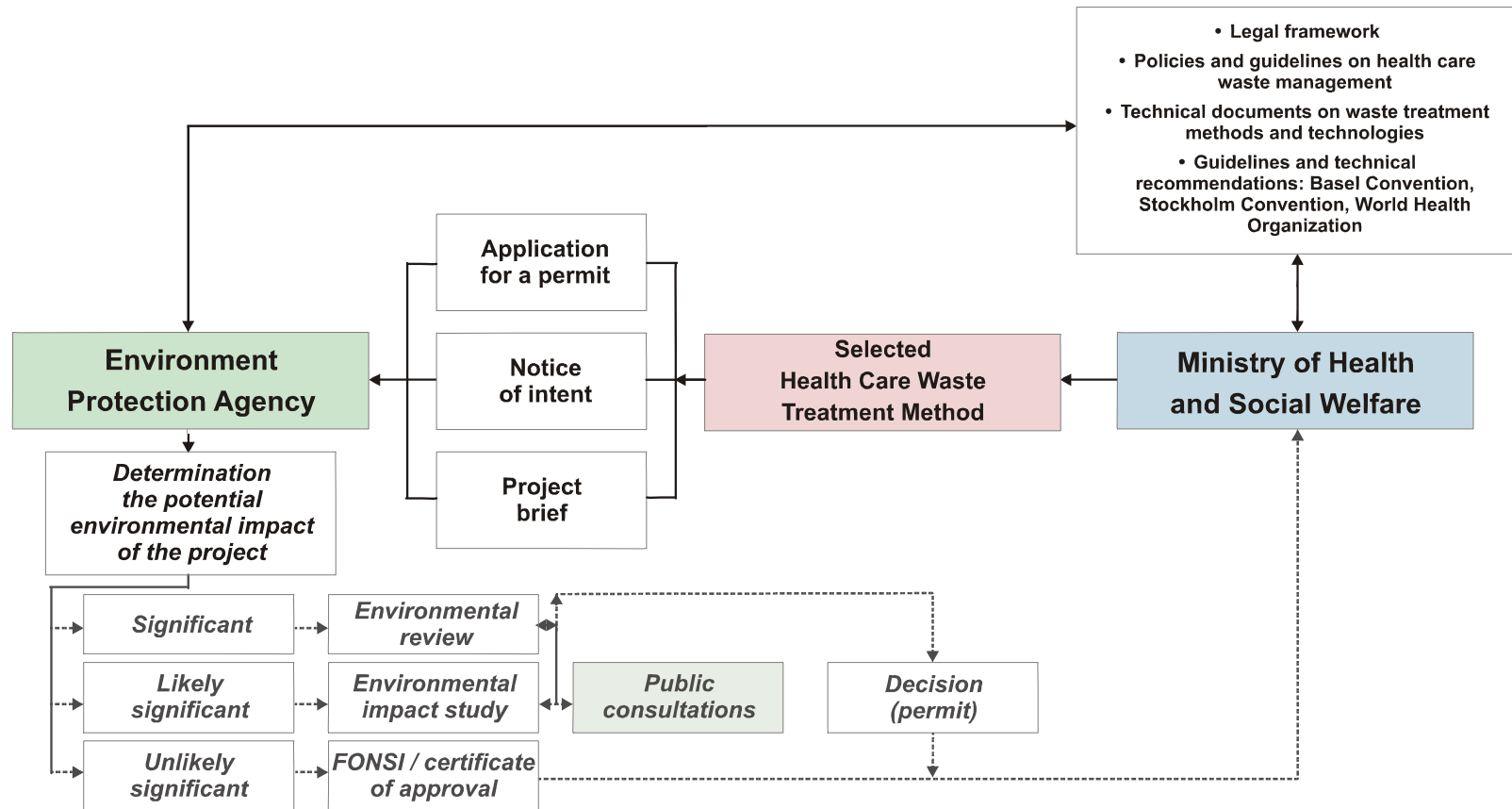


Figure 11: Process flow-chart - decision making, permit application process for the selected Healthcare waste treatment method or technology

General Recommendations and Strategies

The most common alternative for the safe decontamination of infectious Healthcare waste is today 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 processes are suitable for the disinfection of waste conforming to the definition in Section 10a 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 set up 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.

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 into or onto 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 within the next years a nation wide system of engineered sanitary landfills will be set up. It must be expected that it might even take several years until simple dumpsites will be available in the different cities and villages. Proposed solutions can be delineated between on-site and off-site:

On-site



Figure 12: Typical Dump Site in a country hospital

Assessment of Medical Supplies and Medical Waste Management

- Properly designed and constructed placenta 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



Figure 13: Only official Solid Waste Disposal Site, Whein Town

- Development of controlled landfill 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 Montserrado County. Non-hazardous waste then disposed of at the Whein Town landfill.

Status of on-site waste disposal facilities

Except Monrovia, Healthcare facilities in Liberia have no access to organised 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 burnt or rarely treated in WDU;
- sharps are burnt or in case of facilities having no WDU disposed of in a waste pit;
- pathological waste is disposed of in placenta pit or buried in ground;
- expired pharmaceuticals are stored but small quantities are also burnt or disposed of to waste pit or latrine;

Assessment of Medical Supplies and Medical Waste Management

- Chemical waste is disposed of down a drain.

Due to lack of hydro-geological studies and documentation, and law enforcement, for most 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 their own 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 1328 kg 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 picks up the non-medical waste once per week.

CH Rennie Hospital, Margibi

Solid waste is disposed of in a burning pit, which is 90% filled. The size of the pit is about 3 x 4 meters and 2 meters deep. A placenta pit is about 4 meters deep, not filled. Open septic tanks for liquid waste exists.

Phebe Hospital, Bong

General waste is burned and buried in an open pit within the hospital grounds (please see report B2). Pathological waste is disposed of in a placenta pit, mostly filled. A new incinerator is on-site but had yet to 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.

JJ Dossen Hospital, Maryland

All waste generated from the hospital grounds is burned in the open pits. Placentas and body parts are disposed of in a pit.

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 disposed of in a placenta pit. There is no burial pit but a stockpile of mixed waste scheduled for burning in De Montfort 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 2 x 2 meters and 1.5 meters deep. In accordance with the MSF manual waste is covered with palm leaves, and occasionally with soil.

General HCW disposal Strategies

The disposal of hazardous Healthcare waste, especially untreated waste on dumpsites is today not recommended anymore. 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 whatever recycling or treatment of the original Healthcare waste has been possible, will require access to land for disposal. Allowing waste to accumulate at hospitals or elsewhere constitutes 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:

- ③ Permanent control - The disposal location should be under some form of permanent control such as protected by a fence, secure cover or staff
- ③ Controlled waste emplacement – Wastes should be deposited in a controlled way at a disposal site and not scattered around irresponsibly
- ③ Engineered construction – A disposal site, no matter how small or simple in design, should be constructed in a safe and properly engineered manner
- ③ 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 segregate so infectious waste is not mixed with other types of non-hazardous (solid waste) and hazardous waste (chemicals, pharmaceuticals, etc.).

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. If later also in 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 2m deep, excavated in partially decomposed municipal wastes and preferably covered daily. At a depth of 2m re-excitation by scavengers or animals should be prevented. The burial of potentially infectious and sharps wastes is unlikely to cause additional pollution problems at a controlled landfill. Its engineered design should minimise 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

- ③ Access to site and working areas possible for waste delivery and site vehicles.
- ③ Presence of site personnel capable of effective control of daily operations.
- ③ Division of the site into manageable phases, appropriately prepared, before landfilling starts.
- ③ Adequate sealing of the base and sides of the site to minimise the movement of wastewater (leachate) off the site.
- ③ Adequate mechanisms for leachate collection, and treatment systems if necessary.
- ③ Organized deposit of wastes in a small area, allowing them to be spread, compacted, and covered daily.
- ③ Surface water collection trenches around site boundaries.

Assessment of Medical Supplies and Medical Waste Management

- ③ Construction of a final cover to minimise rainwater infiltration when each phase of the landfill 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.

Medical supplies and medical waste management plan (MWMP), including estimated costs and timeline

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.

Motto:

**A safe and efficient HCW management system is working in all
Healthcare Facilities across the Country!**

Policy Options

As it appears from the above formulation of the various elements of the Vision the 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 the further development of the HCWM in Liberia.

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

Centralised versus decentralised implementation of improved HCWM:

Assessment of Medical Supplies and Medical Waste Management

- 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 rationalising 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 would 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. Phase: National and Referral Level

- Start with pilot projects and gathering of data, development of guidelines and implement training programmes.

Assessment of Medical Supplies and Medical Waste Management

2. Phase: County Level

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

3. Phase: Clinics & other Primary Health Facilities

- Including of primary health facilities into the all over system.

Time Frame

The implementation of the vision is based on fundamental changes and improvement of the current HCWM system. Therefore this MWMP is aimed to be implementing the first steps within a period of not less than 2 + 5 years.

After five years the plan has to be revised and upgraded for another five years.

Framework of the MWMP

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

1. Establishing of a Steering Committee and Working Group on HCWM “Waste Committee” (partly done, need 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

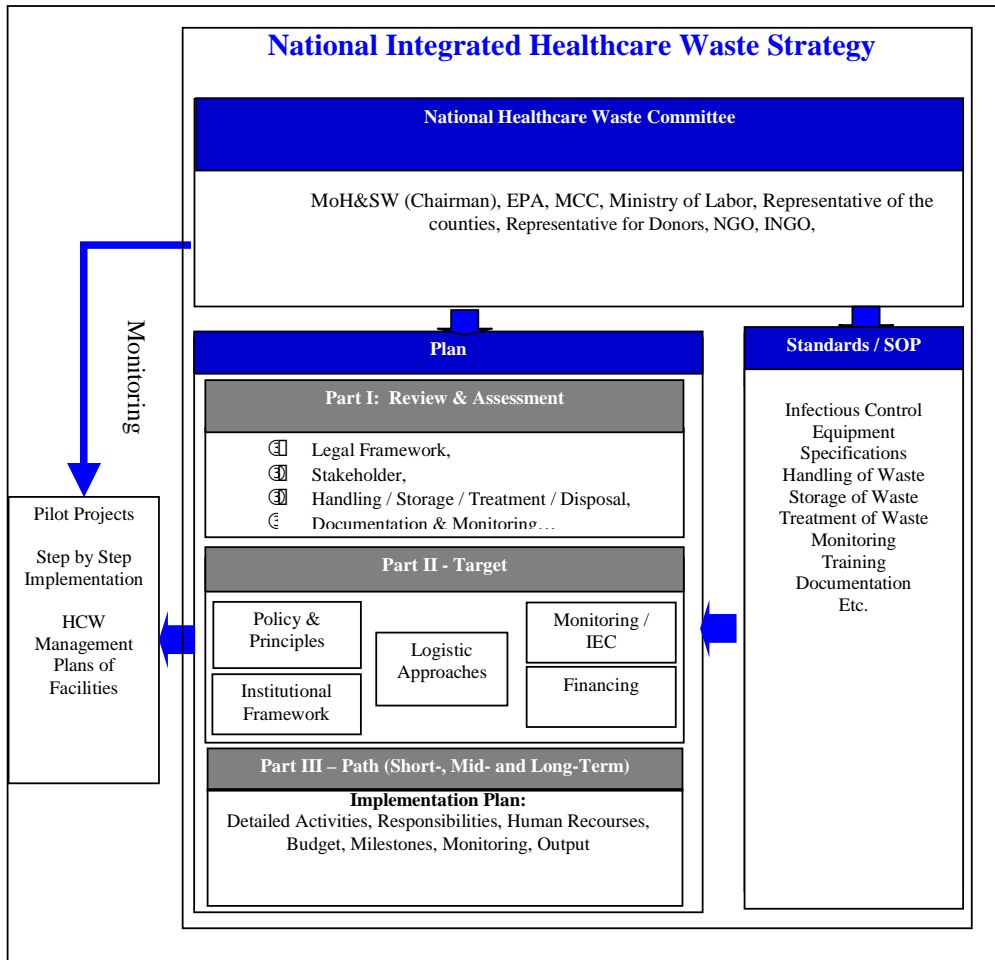


Figure 14: Framework of a MWMP

MWMP – Regulatory Framework

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

Internal Healthcare Waste Management	<ul style="list-style-type: none"> ③ Standards on HCW segregation and HCW streams ③ Standards on HCW collection and internal transportation
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Assessment of Medical Supplies and Medical Waste Management

	<ul style="list-style-type: none"> ③ Standards on HCW interim storage
External Processes of Healthcare Waste Management	<ul style="list-style-type: none"> ③ Treatment of HCW (also applicable for on-site treatment within Healthcare facilities) ③ Validation Procedures for the treatment of waste ③ Guideline on external transportation of HCW ③ Certification Procedure for external transport entities ③ Guideline on safe Disposal of HCW
Monitoring	<ul style="list-style-type: none"> ③ Monitoring guideline for Environmental Hygiene Management Commission and National Institute for Hygiene and Epidemiology (Collection, Transport, Storage, Treatment, Training, Documentation) ③ Evaluation sheets for internal audits insider the Healthcare facilities ③ Template for record keeping for waste amounts
Accidents and spillages response	<ul style="list-style-type: none"> ③ Guideline and procedure how to collect accidents and incidents occurring in Healthcare facilities and related activities like storage transport and treatment ③ Template for incident report form
Capacity Development – Education	<ul style="list-style-type: none"> ③ Concept for training and awareness building ③ Curriculum and certification system for training activities
Reporting & Documentation	<ul style="list-style-type: none"> ③ Development of Transport documents (transfer notes...) ③ Report guideline for yearly report of Healthcare facilities

	<p>③ Report guideline for yearly report of Environmental Hygiene Management Commission and National Institute for Hygiene and Epidemiology</p> <p>③ Report guideline for yearly report of MoH</p>
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MWMP – Logistic approach

For the determination of to be managed amounts of Healthcare Waste, the set up 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:

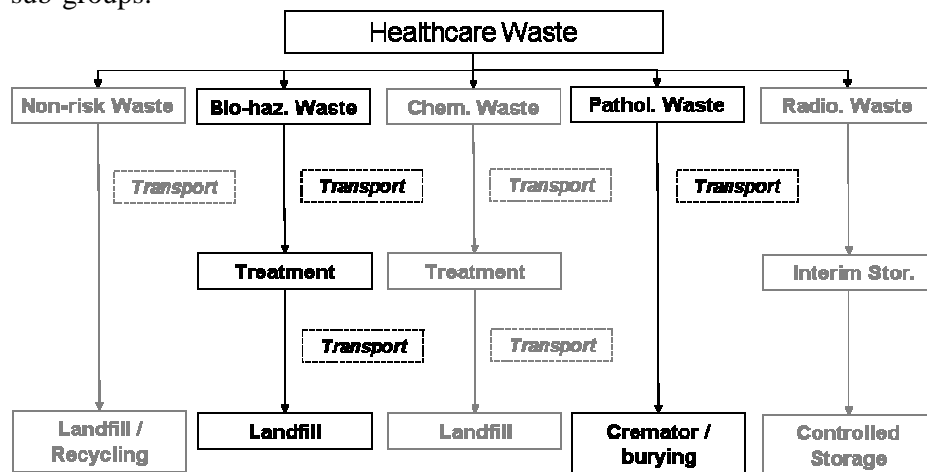


Figure 15: HCW stream system Liberia

Waste stream I:

- ③ Non-risk Waste: Household waste and waste for recycling
- ③ Definition according to the Liberia regulation: Non-risk, general waste comparable to household waste or waste from markets

Waste stream II:

- ③ Bio-hazardous Waste: Infectious waste and sharp items
- ③ Definition according to the Liberian regulation: Infectious waste and sharp waste

Assessment of Medical Supplies and Medical Waste Management

Waste stream III:

- ③ Chemical waste (including pharmaceutical waste, cytotoxic waste)
- ③ 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:

- ③ Pathological waste and body parts
- ③ Definition according to the Liberia regulation: Pathological waste

Waste stream V:

- ③ Radioactive waste
- ③ Definition according to the Liberia regulation: Radioactive waste

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 into different categories such as domestic or municipal type Healthcare waste and hazardous Healthcare Waste, except waste water 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.

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 outlined in the draft Guideline: “Safe Management of Healthcare Waste in Liberia” published in Nov. 2009.

Storage Facilities should be labelled 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 yard”. A “waste yard” is the place where all the relevant waste management activities are bundled. To concentrate certain tasks, the set up of multi-functional buildings (waste storage area) is recommended.

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 planned 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 organisation 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.

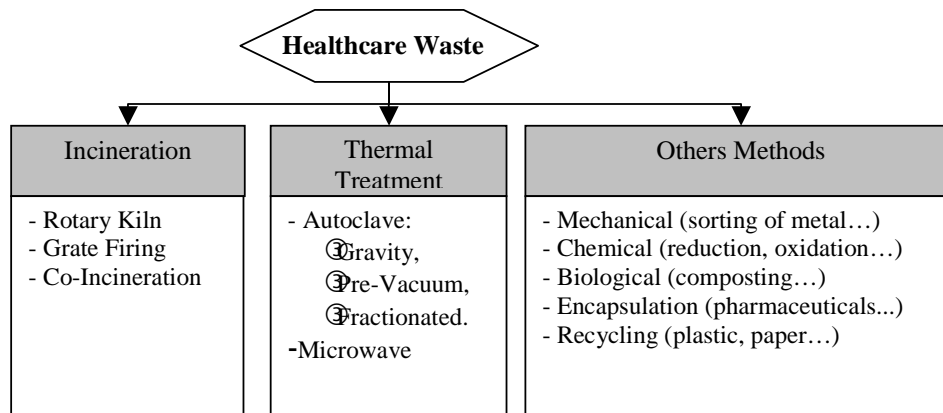


Figure 16: Overview of treatment methods for healthcare waste in Liberia

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.

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.

Assessment of Medical Supplies and Medical Waste Management

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

Assessment of Medical Supplies and Medical Waste Management

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
MINISTRIES/AGENCIES	Budget	Revised	Budget
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. Basic Package of Health Services

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

Assessment of Medical Supplies and Medical Waste Management

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 BPHS.

3. Infrastructure Development:

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

4. Support Systems.

Support Systems are the planning and management functions required to deliver the BPHS. 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”.

***Note:** It is planned that the NHP will incrementally and pragmatically decentralize decision-making, especially to the county level.*

In the following, an overview of the budget planning is provided.

National Health Plan Multi-Year Budget (2007 - 2010)

AREA	YEAR				Total
	2007	2008	2009	2010	
Human Resource for Health	15300000	19149000	19608000	20079000	74136000
Health Support System	6800000	6963000	7130000	10952000	31845000
Basic Package (PHC)	15300000	19149000	19608000	20079000	74136000
Infrastructure	1700000	1741000	8913000	12778000	25132000
Social Welfare	1700000	1741000	1783000	1869000	7093000
Subtotal	40800000	48743000	57042000	65757000	212342000
Transition Gap & Health Plan Implementation Costs	\$13600000	\$16247000	19014000	\$21904000	70765000
Total	\$54400000	\$64990000	\$76057000	\$87617000	283064000

Figure 17: National Health Plan - Budget

According to the budget planning, about 7 Million US\$ are planned for Health Support Systems in 2009 / 2009. Considering the estimated financing needs of 1 million US\$ per annum for healthcare waste, this would be up to 15% of the total budget of the health support systems or **>1% of the total healthcare budget**. It is considered as not realistic that the Liberian healthcare sector will be willing or able to spend within this National health budget planning period this amount.

The financing proposal is heavily based on external aid and it is expected that 40 to 60% of the total budget will be financed by external sources (US\$40 million

Assessment of Medical Supplies and Medical Waste Management

funding per year). A risk exists that the replacing of the humanitarian funding dollar with developmental funding will result in less funding. In the following picture the proposed funding mechanism are displayed.

The MCC's budget, which has a far broader scope than municipal waste management, was reduced from US\$385k in 2008/2009 to US\$286k in 2009/10. Through dumping fees at Whein Town landfill and various taxes, it is estimated that the MCC receives around US\$70k/annum in revenue directly related to waste management. The World Bank supported EMUS project (see details above) is the major significant source of funding for waste management in Liberia with a budget of \$18.4m.

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:

- ③ small HCFs (without beds),
- ③ medium HCFs (up to 100 beds),
- ③ large HCFs (100 to 499 beds, or "Group A" facilities),
- ③ very large HCFs (500 beds or more, or "Group B" facilities),
- ③ medium-size clusters (treating between 300 to 1000 kg/day),
- ③ large clusters (treating more than 1000 kg/day), or
- ③ 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
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Assessment of Medical Supplies and Medical Waste Management

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.

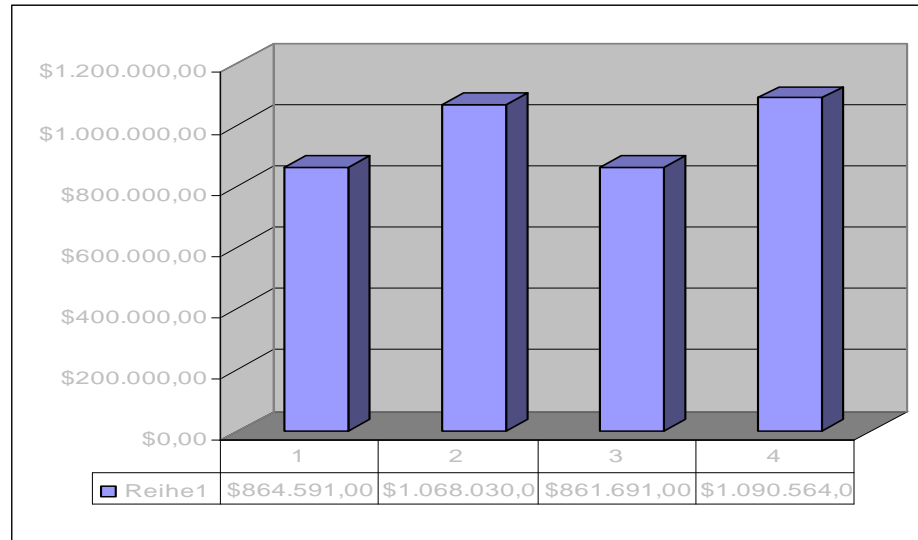


Figure 18: Estimated annual HCW management cost for different strategies, Liberia

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

Assessment of Medical Supplies and Medical Waste Management

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. The figure below shows how transport logistics could be developed for Montserrado:

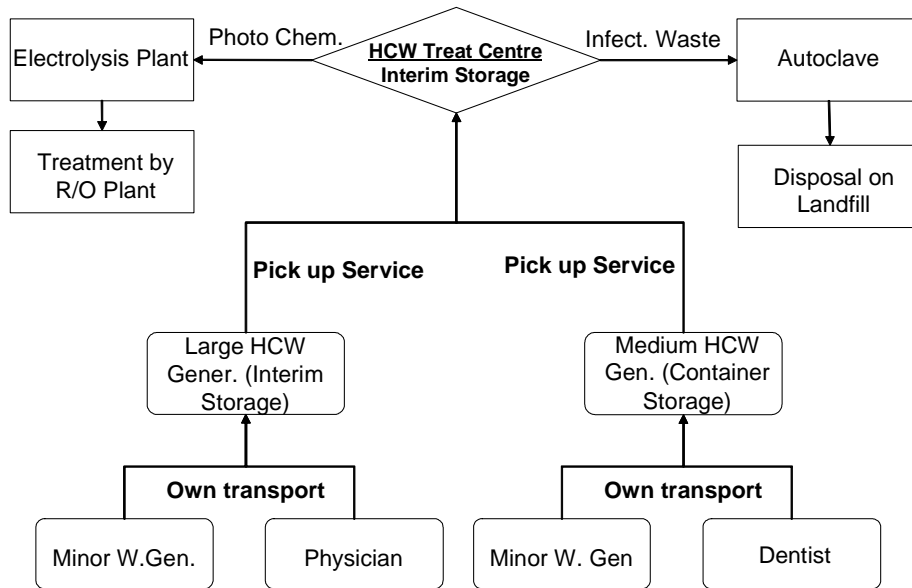


Figure 19: HCW transportation scheme, Montserrado

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

Assessment of Medical Supplies and Medical Waste Management

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

Assessment of Medical Supplies and Medical Waste Management

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

Assessment of Medical Supplies and Medical Waste Management

communications 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

Assessment of Medical Supplies and Medical Waste Management

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. It is assumed that efforts in rural areas will be less intensive.
- Costs estimates below are based on RBHS public awareness campaign costs

Budget line items	Costs
Print- Posters, leaflets, counselling cards, birthing kit materials, advocacy fact sheets, etc.	\$500,000

Assessment of Medical Supplies and Medical Waste Management

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

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

Assessment of Medical Supplies and Medical Waste Management

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).

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.

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 & 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 	Until end 2011
Phase 2	Mid-term	All county hospitals & healthcare centers	<ul style="list-style-type: none"> - 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

Assessment of Medical Supplies and Medical Waste Management

			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:
 - ④ Improvement of the internal healthcare waste logistic system in the main hospitals in Liberia including the set up of needed infrastructure
 - ④ Demonstration of the cooperation & integration possibilities of EPI and HCW activities
 - ④ Demonstration of possibilities for a “referral system” for healthcare waste, combination of supply and disposal chain

- ▶ **Cost estimation: 220.000 US\$**

Assessment of Medical Supplies and Medical Waste Management



Figure 20: Location of target hospitals, package A

- ▶ **Work Package B** (On county level). Main Targets:
 - ④ Demo project for a comprehensive, county wide solution from clinics to tertiary hospital
 - ④ Pilot project for the first time introduction of Autoclaves in Liberia
 - ④ Demonstration of the advantages of the centralization of waste treatment services in Monrovia
 - ④ 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:
 - ④ Development and introduction of a national vocational training system for HCW
 - ④ Development and introduction of a monitoring & supervision system
 - ④ Development and introduction of a reporting system
 - ④ 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

Assessment of Medical Supplies and Medical Waste Management

the 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

Assessment of Medical Supplies and Medical Waste Management

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.

Appendices

Terms of Reference for this study

I: BACKGROUND:

Background Specific to this Assignment

Post-conflict Liberia is currently transitioning from emergency to development assistance. In the health sector, a National Health Policy and corresponding 5-year (2007 – 2011) National Health Strategic Plan have been formulated and endorsed by Government; thereby, providing the framework for health sector reform and development.

Massive destruction and vandalism of public and private infrastructure during the 14-year civil conflict resulted in a near collapse of available waste management systems, both solid and medical waste management facilities. Prior to the civil conflict, solid waste disposal systems were limited mainly to concession areas and the nation's capital city, Monrovia.

Currently, the Monrovia City Corporation oversees a rudimentary secondary solid waste collection system. The system basically transports solid waste from communal skip bins to a temporary landfill at Whein Town on the out sketch of the city. Although the municipality plans to develop the landfill into an environmentally sound waste disposal site, no specific provisions have been made for medical waste disposal.

In the past, major hospitals throughout Liberia relied on incinerators for disposal of medical waste. At smaller health facilities, especially in rural areas, medical waste was and continues to be disposed through either burial or pit/open-air burning; as is the current practice at several major hospitals including the national referral hospital, the JFK Medical Center (JFKMC). Efforts are currently underway through the Expanded Program of Immunization (EPI) component of the Child Survival Programme to install incinerators in some of the health facilities in the country.

While, the MH&SW has developed a basic policy on disposal of used medical supplies, particularly immunization materials; it needs to be broadened. For example, there is grave concern about the disposal of radiological materials, given the urgent need to safely dispose of or deactivate the old cobalt machine used during the '80s at the JFKMC in treating cancer patients.

It is significant to note that very little is being done to adequately address the issue of medical waste disposal and management. Installation of the EPI incinerators

Assessment of Medical Supplies and Medical Waste Management

cannot adequately address the challenges of waste management without a national strategy and plan of action on Healthcare waste management.

II: Objectives of the Assignment:

The Ministry of Health and Social Welfare, in collaboration with relevant line ministries and agencies, desires to fully address issues relating to the disposal and management of medical supplies/products and medical waste.

1. Conduct a comprehensive medical supplies and medical waste management assessment of the Liberian situation; and
2. Develop a national medical supplies and medical waste management strategy and plan, including both physical investments and training activities.

III: Scope of Services

The work shall be carried out according to the following tasks:

Task 1: Assessment of Existing Policies and Waste Management Practices

- Assess the Policy, Regulatory (Legal) and Administrative Framework on Healthcare waste management.
- Identify permit requirements, including environmental building, and other permits and procedures that Healthcare waste treatment/destruction facilities would need to address.
- Outline any public participation or involvement and procedures used in Healthcare waste management. List the key stakeholders to be contacted and how.
- Assess the typical time demands for proposed facilities to obtain permits for Healthcare waste management and address environmental impact requirement, list the lead agency to be contacted
- Identify all Healthcare facilities in the country and include basic information for each facility such as the number of bed, bed occupancy rates and specialists, divided into the following categories: Tertiary Hospitals (if any), County Hospitals, health centres and clinics, and all private institutions in the country.

Assessment of Medical Supplies and Medical Waste Management

- Assess the Healthcare waste generation at (i) one tertiary hospital; (ii) seven county hospitals; (iii) five major health centres; and (iv) three private hospitals. The details should include the minimum weight of the total waste generated at each Healthcare facility per week. The composition of the waste should be determined through segregation at the waste end point, and the results should be extrapolated to cover the entire country.
- Examine the current status of Healthcare waste management in Liberia, including available technology; quantity and type of Healthcare waste facilities.
- Identify the potential source of funding, key actors, and necessary budgetary allocation for waste management
- Assess the level of scavenging, if any, or recycling taking place inside the Healthcare facilities; along the transportation routes and at the final sites. Determine social issues in relation to scavenging taking place.
- Review and analyse existing Healthcare waste guidelines, segregation (i.e., posters and color-coded bins), collection and disposal systems at the facilities with due regard for the level of separation, storage, the frequency of collection, and environmental and health impact for existing treatment.
- Assess Healthcare waste management knowledge and behaviours at various levels of health facilities (e.g., observe Healthcare waste management procedures, evidence of used syringes and/or loose sharps in or around site).

Task 2: Determination of Appropriate Technology and Sites

i) Determination of the Technology

For the type and qualities of Healthcare waste generated in the study area:

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

Assessment of Medical Supplies and Medical Waste Management

On the basis of this assessment,

- Recommend a process flow for the economically and environmentally sound treatment and final disposal of Healthcare waste leading to the selection of appropriate technology. The government and/or the facility should make the final decision on choice.

ii) Determination of the Disposal Sites

If a site for disposal exists, collect all existing plans of suitable sites to be considered for the location of the treatment facility (ies) and review general transport and traffic systems relative to appropriate sites.

For consideration of a suitable site, the following should be taken into account;

- (a) Accessibility to the site,
- (b) Distance from Healthcare facility to the site
- (c) Distance to sensitive areas
- (d) Future development plans of the area
- (e) Possibility to acquire the area
- (f) Cultural & historical relevance of the site
- (g) Public opinions
- (h) Noise and nearby impact to nearby areas
- (i) Topography of the site.

Public consultations/hearings must be held as part of the final assessment of sites for the treatment facility.

Analysis of the site -

Analyse the above information to determine whether;

- a) there is sufficient appropriate material on the site for daily and final cover,
- b) The site soil, hydrological and geological conditions would ensure adequate protection of any ground and surface water used for drinking and/or irrigation.

If the sites prove to be unsuitable, provide recommendations stating the reasons.

Financing

a) Government contribution

Assess the current capacity of the government including municipality in financing effective solid waste treatment and disposal with emphasis on Healthcare waste management.

b) Private sector participation as service provider

Assessment of Medical Supplies and Medical Waste Management

Assess public-private partnerships and cost recovery at all levels, based on possibilities of polluter pays principle, where each Healthcare facility pays according to the volume of waste generated.

Task 3: Training and Public Awareness

- Review existing training and public awareness programmes on Healthcare waste management at hospitals and other Healthcare establishments and identify the strengths, weaknesses and opportunities of the current practices.
- Working in conjunction with the relevant government institutions and municipal council, prepare costed training programme and well targeted capacity building campaign programme including the general public, and more specifically health workers, municipal, dump site managers, incinerator operators (if that is the choice of the technology), nurses, scavengers/pickers families and street children. The design of the material required for the awareness building programmes should be discussed with the relevant authorities and general public to ensure that their concerns that are deemed appropriate are incorporated in the design of the programme layouts, mitigation measures and community communication programmes. The training and awareness building and the management programme shall be appropriately costed and the plan shall be presented in the national workshop.

DESCRIPTION OF THE WORK

Task 4: Preparation and Presentations of Reports

- The Consultant is expected to prepare and present for discussion at joint meetings of the National Waste Management Steering Committee and other stakeholders a full draft report of the assessment, focusing on the significant environmental and human health issues. A suggested outline/table of contents for the report is attached hereto as Annex A.

Output/Deliverables:

- Inception report.....end of week 2
- Draft reports (2), including diagramsend of week 4
photos and maps where necessary and week 8

Assessment of Medical Supplies and Medical Waste Management

- Final Reportend of week 12

The Consultant is expected to provide 8 (eight) spiral bound final reports with diagrams, photos/pictures and maps where necessary to the MH&SW, as well as 2 (two) CDs containing electronic copies of the report and data collected during the assessment/study period.

IV: Study supervision and time schedule

Oversight of this assignment is the responsibility of the Environmental Division of the Ministry of Health and Social Welfare (MH&SW) through the Technical Sub-Committee of the National Waste Management Steering Committee (NWMSC). This committee is currently chaired by the MH&SW, and co-chaired by the Environmental Protection Agency (EPA). The 5-member Technical Sub-Committee is being chaired by a representative of the WHO Country Office

The consultant shall begin work not later than two days after the effective date of the contract. It is anticipated that the consultant would complete the outputs of the work over a maximum duration 12 weeks in the field for data collection and collation and of report writing and finalization of the document after the review has been carried out by the MH&SW.

It is anticipated however, that the consultant will propose a clear schedule with critical milestones, and make all possible efforts to complete the work at the appointed time of **3 months**.

V: Required Competencies/Profile of the Consultant

Qualification and Experience for Team Members

Position	Qty	Qualification	Experience
Team Leader	1	S/he should be either: <ul style="list-style-type: none">- Public Health Specialist- Waste management specialist- Sanitary Engineer- Environmental Management specialist	Over 10 years experience in Health waste management - Experience in waste management assessment

Assessment of Medical Supplies and Medical Waste Management

Waste Management Specialist	1	<ul style="list-style-type: none"> - MSc Engineering or relevant field - Specialization in waste management or related field 	<ul style="list-style-type: none"> -5-10 years of practical experience in waste management or related field - Should have good Interpersonal skills - Experience in leading teams - Experience in Waste Management Training
Environment Management Specialist	1	<ul style="list-style-type: none"> - BSc in Environmental Science - Specialization in environmental health management 	<ul style="list-style-type: none"> -5-10 years of practical experience in environmental waste management - Experience in Waste Management Training
Public Health Specialist	1	<ul style="list-style-type: none"> - MPH or related health Science field - Specialization in Public Health with additional training in environmental health or health education 	<ul style="list-style-type: none"> -5-10 years in environmental health, health education or related field - Experience in Public Health and Environmental Training

Qualification and Experience of the Consulting Firm

- Technical competency in scientific, health, environment and engineering fields in particular sanitary engineering
- Competency in the private- partnership on Healthcare waste management
- Experience on Healthcare waste management in Africa is an advantage
- Experience of working in and /or consultancies in post conflict states
- Skills in training and institutional strengthening

ANNEX A.

SUGGESTED TABLE OF CONTENTS FOR THE REPORT ON MEDICAL SUPPLIES AND MEDICAL WASTE MANAGEMENT

Executive summary

I: Introduction

II: Policy, legal and administrative framework

Assessment of Medical Supplies and Medical Waste Management

- III: Project Description
- IV: Baseline data on Healthcare waste generation
- V: Assessment of Healthcare waste management
- VI: Determination of technology
- VII: Determination of disposal sites
- VIII: Medical supplies and medical waste management plan (MWMP), including estimated costs and timeline
 - Healthcare waste management infrastructure and systems
 - Management and training for institutions and agencies
- IX: Appendices
 - Terms of Reference for this study
 - Estimated equipment and materials required to implement MWMP
 - List of people consulted
 - References
 - Record of inter-agency/ forum/ consultation meetings

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:

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

Assessment of Medical Supplies and Medical Waste Management

Priced Bill of Quantities (BoQ)

The total costs are estimated to

TECHNICAL SPECIFICATIONS					
Improving the Healthcare Waste Management system in Liberia					
For a detailed description of the equipment, please see annex A of the technical specifications					
Code	Item	Unit	Price	Amount	Total Costs
PPE-01	Personal Protection Equipment				
PPE-01-01	Safety goggles	1	\$3,00	63	\$189,00
PPE-01-02	Working gloves - chemicals	1	\$5,00	63	\$315,00
PPE-01-04	Working gloves - logistic	1	\$2,00	130	\$260,00
PPE-01-05	Working overall	1	\$25,00	63	\$1.575,00
Total					\$2.339,00
LOG-01	One-way items				
LOG-01-02	Sharps cont. WHO - Large	100	\$175,00	29	\$5.075,00
LOG-01-04	Sharps cont. Plastic - Large	100	\$250,00	26	\$6.500,00
LOG-01-05	Bag - infect - Inc. (Small)	1000	\$450,00	73	\$32.850,00
LOG-01-11	Debris Pots for Needle Cutter	100	\$180,00	29	\$5.220,00
Total					\$49.645,00
LOG-02	Internal equipment				
LOG-02-01	Infectious Waste Bin - Small	1	\$40,00	235	\$9.400,00
LOG-02-09	Outdoor - waste bin	1	\$70,00	34	\$2.380,00
LOG-02-10	Needle Cutter	1	\$50,00	92	\$4.600,00
Total					\$16.380,00
LOG-03	Log. Equip. waste func.area				
LOG-03-01	Wheelie-Bin 240 (General Wa.)	1	\$85,00	92	\$7.820,00
LOG-03-03	Collection Bin - Infect. Waste	1	\$40,00	92	\$3.680,00
LOG-03-04	Bin trolley (infect. Waste)	1	\$170,00	19	\$3.230,00
LOG-03-11	Barrel for solid Haz. Waste	1	\$80,00	19	\$1.520,00
LOG-03-13	Ground scale	1	\$150,00	8	\$1.200,00
LOG-03-14	Pressure Sprayer	1	\$75,00	8	\$600,00
Total					\$18.050,00
OFF-01	Office Equipment				
OFF-01-01	Office Desk	1	\$100,00	8	\$800,00
OFF-01-02	Swivel Chair	1	\$70,00	8	\$560,00
OFF-01-03	Cabinet, low	1	\$75,00	8	\$600,00
OFF-01-04	Storage Shelves	1	\$60,00	8	\$480,00
OFF-01-05	Office Auxiliaries & White board	1	\$200,00	8	\$1.600,00
Total					\$4.040,00
WW-01	Sewage-Equipment				
WW-01-01	Sink plunger	1	\$5,00	29	\$145,00
WW-01-02	Manual Drain cleaner	1	\$50,00	16	\$800,00
Total					\$945,00
Total					
HOU-01	Housekeeping Equipment				
HOU-01-01	Mop Bucket & Wringer	1	\$300,00	26	\$7.800,00
HOU-01-02	Janitor Cart	1	\$400,00	19	\$7.600,00
HOU-01-03	Detergents & Disinfectants	1	\$500,00	18	\$9.000,00
Total					\$24.400,00
Total Costs					\$115.799,00

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

Assessment of Medical Supplies and Medical Waste Management

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	Tranport container	70	\$ 130,00	\$ 9.100,00
4	Trans. Install & Training	1	\$ 7.500,00	\$ 7.500,00
5	Unforseable (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

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

Assessment of Medical Supplies and Medical Waste Management

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

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

- 3 September 2009 – Kick-Off meeting between Arabella Greaves, Jan-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.

Assessment of Medical Supplies and Medical Waste Management

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 Coordinator and Technical Sub-Committee and EPA

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

Assessment of Medical Supplies and Medical Waste Management

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:

Assessment of Medical Supplies and Medical Waste Management

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

Assessment of Medical Supplies and Medical Waste Management

- - 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 may be 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

Assessment of Medical Supplies and Medical Waste Management

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

Assessment of Medical Supplies and Medical Waste Management

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.

Assessment of Medical Supplies and Medical Waste Management

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.

Assessment of Medical Supplies and Medical Waste Management

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.