REPUBLIC OF LIBERIA

Revised National Healthcare Waste Management Plan

INSTITUTIONAL FOUNDATIONS TO IMPROVE SERVICES FOR HEALTH (IFISH) Project
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ACRONYMS

AIDS - Acquired immunodeficiency syndrome
CDC - Centers for Disease Control & Preventions
DHS – Demographic Health Survey
EIA – Environmental Impact Assessment
EPA – Environmental Protection Agency
EPI – Expanded Program on Immunization
ESS - Environmental and Social Standards
EVD - Ebola virus disease
GDP – Gross Domestic Product
HBV - Hepatitis B virus
HCF's – Healthcare Facilities
HCI's - Health Care Institutions
HCW – Healthcare Waste
HCRW - Healthcare Risk Waste
HCWM – Healthcare Waste Management
HCWMP – Healthcare Waste Management Plan
HIV - Human Immunodeficiency Virus
HMIS – Health Management Information System
IDP - Internally Displaced Persons
LDHS - Liberia Demographic and Health Survey
LHS – Liberia Hydrological Service
MCC – Monrovia City Corporation
MDG – Millennium Development Goals
MMR – Maternal Mortality Rate
MOH – Ministry of Health
MPW – Ministry of Public Works

MWMP – Medical Waste management Plan
NGO - Non-governmental Organizations
NHP – National Health Policy
NPHIL- National Public Health Institute of Liberia
PPE- Personal Protective Equipment
PVC - Polyvinyl chloride
STDs- Sexually Transmitted Diseases
UN - United Nations
WDU's – Waste Disposal Units
WHO – World Health Organization

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EXECUTIVE SUMMARY

Healthcare waste (HCW) can be defined as all wastes generated in a health care setting. These wastes include sharps, non-sharp blood contaminated items, blood, body parts and tissues, chemicals, pharmaceuticals and radioactive materials. Improper management of health care waste exposes health care workers, waste handlers, patients and their families and the community to preventable infections, toxic effects and injuries.

Liberia is plagued with the improper handling and management of wastes generated in the health sector. This situation has great consequences among people involved in health care and may extend to their families and the communities in general.

Improper management of HCW can also have direct and indirect negative impacts on patients, health care workers, local communities and the environment.

In Liberia contaminated waste mismanagement (handling, storage and disposal) raises serious environmental, health and social concerns. There is an urgent need to evaluate health care waste management and disposal, with special attention to the safety related with health care waste infected by HIV/AIDS and by other transmittable diseases such as tuberculosis, Hepatitis, EVD etc.

This HCWMP will provide information to allow health facilities to establish a good HCW management system consistent with the regulatory requirements of Liberia.

This HCWMP describes the roles and responsibilities of individuals and institutions related to HCWM; the organizational structure required at health facilities; procedures for HCW assessments; development of HCW management plans at health facilities; classification of HCW; recommended practices for segregation, waste minimization, handling, collection, storage, transport, treatment, and disposal of various HCW; contingency planning; training; public education; monitoring, evaluation, and corrective action; procurement and budgeting; and special considerations for small facilities, as well as off-site transportation and centralized treatment

Although the 2008 census presented the country's population at 3.47 million, the present population of the country is assumed to be approximately 5.2 million. As of 2019, the population of Liberia was increasing by 2.56% each year.

According to the recent Demography and Health Survey (2019 – 2020), 85% of Liberians use improved source of drinking water. The proportion of residents with basic drinking water service is considerably higher in urban areas than rural areas (83% versus 63%). 24% of the population have basic sanitation service.

The infant mortality rate of Liberia is 63 deaths per 1,000 live births, while mortality between the first and the fifth birthday is 33 deaths per 1,000 children. Mortality during the first month (neonatal mortality) is higher than post-neonatal mortality (37 deaths per 1,000 births versus 25 deaths per 1,000 births) and accounts for 59% of overall infant mortality.

According to the CDC, malaria, acute respiratory infections, diarrhea, tuberculosis, sexually transmitted diseases (STDs), worms, skin diseases, malnutrition, and anemia are the most common causes of ill health.

The preparation of this HCWMP takes into consideration applicable legislations and policies in the context of Liberian law. The HCWMP draws on the Liberian Constitution, the Environment Protection and Management Law of Liberia and other Environmental Guidelines, and recent National Health Policies and Guidelines. It also draws on the requirements of the World Bank Environmental and Social Standards (ESS).

Looking at the administrative framework, the following key institutions have been identified: 1) The Ministry of Health (MOH); 2) The National Public Health Institute of Liberia (NPHIL); 3) The Environmental Protection Agency (EPA); and 4) Health Facilities.

A comprehensive inventory of all HCFs and their generation rates of HCW have not been conducted. However, review of the previous healthcare waste management plan and data collected from assessments conducted over the past months at designated HCFs in some counties can be extrapolated and provide as baseline data of the current situation in Liberia. The Ministry of Health selected the following number and types of healthcare facilities for assessment: 8 county hospitals and 47 clinics.

Based on the above rationale, normalized HCW generation rates were estimated for the healthcare facilities. The estimations take into account bed occupancy rates.

It could be deduced from the above estimation that the infectious (including sharps waste) generation rate per bed per day for the county hospitals is between 0.04 and 0.237 kg/bed/day, with an average of 0.137 kg/bed/day.

At the different facility inspected, general and hazardous waste (including contaminated healthcare waste) pre-collection and collection are usually performed through the use of plastic buckets (with or without a bag inside), cardboard boxes or, in some cases, aluminum buckets (with or without a cover).

All healthcare wastes are removed and transported by the referred employees. However, since lack of pre-collect and collect bags is usual lacking, buckets containing waste are transported and unfilled into containers; afterwards, they are washed or cleaned with wet wiper.

In most of the HCF inspected, waste is bagged, in public containers outside or in dumps site at the back of the HCF, places that are easily accessible to people and animals and also exposed to climatic conditions.

Waste segregated at the source, particularly needles, is usually reintroduced into common waste circuit at collection or temporary storage levels which are not labeled or color coded.

It was observed that at the health facilities, infection prevention control officers are responsible for providing the required training on HCW management. Many of these officers are aware of the importance of HCW segregation and the consequences related to the lack thereof. However, they lack knowledge of the proper disposal of HCW.

Due to the danger HCW poses to the public, it is very important that it is manages properly and in accordance with international guidelines. At present, NPHIL has produced the

National Guidelines for the Safe Management of Healthcare Waste in Liberia (2020). This document has however not been introduced to HCFs across the country or staff trained on its usage.

Healthcare facilities in Liberia use various types of bio-mass incinerators for hazardous HCW treatment. Although County Health teams report the installation of incinerator units at health facilities across the country, field investigation from the counties assessed show that most of these facilities are nonfunctional, out dated and face maintenance problems

Each class of HCW will require specific treatment and the following basic steps should be followed:

- Non-risk HCW: If segregated properly can be disposed with domestic waste.
- Highly infectious waste: All laboratory samples containing body fluids, tissues or faecal stools must always be pre-treated at source. Discard with infectious HCW before it is taken to any disposal facility.
- Sharps require certain measures to be taken to prevent injury and infection during their handling within and outside of the HCFs.

Three (3) scenarios are recommended for the treatment of infectious waste in Liberia. They are: 1) On-site treatment in the facility; 2) Sharing an on-site treatment system to treat waste from several nearby facilities, such as a cluster of hospitals or a hospital and surrounding health centers; and 3) Treatment at an off-site treatment center, such as a central facility outside the city or at the landfill.

For the treatment of pharmaceutical waste in Liberia, four (4) procedures are recommended: (1) Return of expired pharmaceuticals to supplier, (2) Incineration, (3) Inertization, (4) Encapsulation, and (5) Sewer discharge.

Three (3) procedures are recommended for dealing with bulk quantities of cytotoxic/genotoxic waste. They are: (1) Return to supplier; (2) Chemical degradation; and (3) High temperature incineration.

Other hazardous chemical wastes include: spent organic solvents, degreasers and oils used by the engineering staff, mercury from broken thermometers, etc. For these wastes, four (4) general disposal methods are recommended. They are: (1) Return to supplier, (2) Chemical degradation, (3) Encapsulation and disposal in a hazardous waste landfill, or (4) Sewer discharge.

Two (2) methods are proposed for the disposal of healthcare waste in Liberia. They are: (1) on-site disposal system; and (2) off-site disposal system. These systems are recommended to be adopted on a national scale.

The HCFs are responsible for providing a safe, healthy workplace and safe systems of work for all. Further, the management of waste presents a number of potential hazards to employees requiring the appropriate measure of risk identification, risk assessment, and risk control. Healthcare workers have an obligation to follow instructions regarding safe work practices. Relative to the use of PPE, MOH shall ensure that all HCF have adequate PPE for all staff

This HCWMP should not be limited to the preparation of internal guidelines/instructions for the management of healthcare waste but rather a process to sustain and optimize the operation of HCWM systems in healthcare facilities across Liberia

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 standardized basis.

In order to implement this HCWMP, it is necessary for policymakers and those in decision-making positions to appreciate the need for financial allocation to the management of HCW based on plans, which have been developed, budgeted, discussed and further approved by the institutions responsible for the implementation of this HCWMP – MOH/NPHIL

1.0 INTRODUCTION & BACKGROUND

Healthcare waste (HCW) can be defined as all wastes generated in a health care setting. These wastes include sharps, non-sharp blood contaminated items, blood, body parts and tissues, chemicals, pharmaceuticals and radioactive materials. Improper management of health care waste exposes health care workers, waste handlers, patients and their families and the community living in the nearby area of the health facilities, waste collection, transportation, handling and disposal to preventable infections, toxic effects and injuries.

Liberia is plagued with the improper handling and management of wastes generated in the health sector. This situation has great consequences among people involved in health care and may extend to their families and the communities in general. Improper management of HCW can also have direct and indirect negative impacts on patients, health care workers, local communities and the environment.

It is without doubt that 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 properly managed and disposed of. It is also no secret that among the general population, some people (particularly children from densely populated urban communities), usually search for reusable materials in public dumps where some of these healthcare waste materials are improperly disposed of. This behavior exposes these vulnerable group to even greater health risks from the potentially contaminants associated with such materials.

In Liberia contaminated waste mismanagement (handling, storage and disposal) raises serious environmental, health and social concerns. There is an urgent need to evaluate health-care waste management and disposal, with special attention to the safety related with health care waste infected by HIV/AIDS and by other transmittable diseases such as tuberculosis, Hepatitis, Ebola virus disease (EVD) etc.

Presently in Liberia, at the larger health facilities, segregation at the source is encouraged, the major wastes segregated are sharps and anatomic pieces (of big dimension) derivative from surgeries. Waste collection and pre-collection (general and

hazardous health-care waste) is usually performed through the use of plastic garbage bins, with or without a bag, cardboard boxes or, sometimes, with or without cover, within the services. Without distinction, food, medicines, compresses, blood and sore systems, sore bottles, syringes, needles, among other objects, are placed inside the same collection materials. At the district level where the smaller health centers are located, HCW systems are most time non-existence.

Health-care waste is removed and transported by cleaning personnel, using sometimes wheeled containers/recipients. However, since lack of pre-collection and collection bags is usual, buckets containing waste are transported and unfilled into containers; afterwards, they are washed or cleaned with wet wiper. Other kinds of waste are placed in garbage buckets, located in non-specific rooms. In most of the visited health facilities, health care wastes are placed, not bagged, in public containers outside, or in dumps at the back of the facilities. Those places are easily accessible to people and animals and also exposed to climatic conditions.

The goals of proper HCW management are: i) to protect patients and health workers from hazards associated with healthcare waste, ii) to protect the public from the hazards associated with HCW, and iii) to protect the environment. Hence, management of HCW requires a multidisciplinary approach and each health administrative level at the national, regional and district has a role to play to ensure proper waste management. In addition, there is need to involve other stakeholders, partners and line ministries.

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 urgent needs.

This HCWMP will provide information to allow health facilities to establish a good HCW management system consistent with the regulatory requirements of Liberia. Among the major obstacles to good HCW management are bad attitudes and or situations that need to change, such as:

- Some health care workers are unaware of risks associated with HCW.
- Decision-makers do not allocate adequate resources for HCW management.
- Decision-makers are unaware of risks and put a low priority on HCW management.
- Very few persons want to know what happens to HCW.
- Most facilities do not have a plan for HCW management and related training.

The HCWMP describes the roles and responsibilities of individuals and institutions related to HCWM; the organizational structure required at health facilities; procedures for HCW assessments; development of HCW management plans at health facilities; classification of HCW; recommended practices for segregation, waste minimization, handling, collection, storage, transport, treatment, and disposal of various HCW; contingency planning; training; public education; monitoring, evaluation, and corrective action; procurement and budgeting; and special considerations for small facilities, as well as off-site transportation and centralized treatment.

This HCWMP is also consistent with national regulatory requirements, as well as relevant international conventions that Liberia is party to, relevant international best practices such as WHO-UNEP Guidelines for Preparation of National HCWMPs in Sub-Saharan Africa and WBG EHS Guidelines, etc.

2.0 COUNTRY PROFILE

2.1 Liberia's Bio-Physical Environment

2.1.1 Location

Liberia is located on the West Coast of Africa. It lies between longitudes 4.21°N and 8.34°N and latitudes to 7.27°W and 11.31°W. It covers a surface area of about approximately 111,370 km^2 (about 43,506 square miles). The dry land extent is 96,160 km^2 or 37,570 sq. miles.

Liberia is bordered on the west by Sierra Leone, on the north by Guinea, on the east by Côte d'Ivoire and on the south by the Atlantic Ocean. The perimeter is 1,585 km (990 miles), excluding the Atlantic Ocean. The border with Guinea is 563 km (352miles), Cote d'Ivoire 716 km (446 miles), and Sierra Leone 306 km (191 miles).

Figure 1: Map of Liberia (based on a UN map. Source: UN Cartographic Section)

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

2.1.2 Demography and Sanitation

The last population census of Liberia was conducted in 2008. Modalities are presently underway for the conduct of another population census over the next year.

Although the 2008 census presented the country's population at 3.47 million and modalities are underway for the conduct of a new census, the present population of the country is assumed to be approximately 5.2 million. As of 2019, the population of Liberia was increasing by 2.56% each year.[1]

According to the recent Demography and Health Survey (2019 – 2020), 85% of Liberians use improved source of drinking water. The proportion of residents with basic drinking water service is considerably higher in urban areas than rural areas (83% versus 63%). 24% of the population have basic sanitation service. Basic sanitation service is more common in urban areas (35%) as compared to 9% of rural population. The overall fertility rate in Liberia has declined over the past 34 years and has fallen by one child since 2007, from 5.2 to 4.2 children per woman.[2]

[1] World Population Review, Liberia Population 2021 (Live); Retrieved June 2021.

[2] Liberia Institute of Statistics and Geo-Information Services (LISGIS), Ministry of Health and Social Welfare [Liberia], and ICF. 2020. *Liberia Demographic and Health Survey 2019-20: Key Indicators*.

2.1.3 Mortality and Immunization

The infant mortality rate of Liberia is 63 deaths per 1,000 live births, while mortality between the first and the fifth birthday is 33 deaths per 1,000 children. Mortality during the first month (neonatal mortality) is higher than post-neonatal mortality (37 deaths per 1,000 births versus 25 deaths per 1,000 births) and accounts for 59% of overall infant mortality._ There is a rise in neonatal mortality from 26 deaths per 1,000 children in 2013 to 37 deaths per 1,000 children in 2019-20.

At present, 87% of women had four or more prenatal care visits, compared to 56% in 2013. Urban women are slightly more likely than rural women to have had four or more prenatal care visits (89% and 85%, respectively). A majority of births (84%) in Liberia are assisted by a skilled medical professional. Assistance at delivery by a skilled provider is more common in urban (89%) than rural (79%) areas.

In 2019, 80% of births occur in health facilities, compared to 56% of births in 2013 that occurred in facilities. Overall, the percentage of facility deliveries is higher in urban areas than in rural areas (83% and 76%, respectively). Women in rural areas are slightly more likely than those in urban areas to receive timely postnatal care (81% versus 78%).

For vaccination coverage among children age 12-23 months and 24-35 months, that 65% of children age 12-23 months have received all basic vaccinations, while only 40% have received all age-appropriate vaccinations. 6% of children age 12-23 months have not received any vaccinations. Among children age 24-35 months, 31% have received all age-appropriate vaccinations.

Among children age 12-23 months, basic vaccination coverage is higher among boys than among girls (67% versus 63%). Coverage is higher in urban than rural areas (66% versus 63%) and higher among children whose vaccination card was seen than among those whose card was not seen (85% versus 28%). Overall, basic vaccination coverage among children age 12-23 months has improved since 2013, rising 10% from 55% to 65%.

The Liberia Demographic and Health Survey (LDHS 2019 – 2020) results further show that 30% of children under age 5 are stunted below minus two standard deviations (-2

SD), and 10% are severely stunted, below minus three standard deviations (-3 SD). Boys are more likely to be stunted (32%) than girls (28%). Children residing in urban areas are less likely to be stunted than those living in rural areas (25% and 35%, respectively). 11% of Liberian children are underweight, with 3% classified as severely underweight. The proportion of underweight children vary by residence, with 13% of children in rural areas and 9% in urban areas being underweight. Between 2013 and 2019-2020, stunting decreased from 32% to 30%, wasting decreased from 6% to 3%, and the proportion of underweight children decreased from 15% to 11%. The proportion of overweight children has increased since 2013, from 1% to 4%.[3]

2.1.4 Health Profile and Diseases

Overall, 45% of women in Liberia suffer from anemia; 23% are mildly anemic, 21% are moderately anemic, and 1% are severely anemic. The prevalence of anemia is higher among women age 15-19 (55%) than among women in the other age groups (40%-44%). Pregnant women (52%) are more likely to suffer from anemia than their breastfeeding (48%) and non-breastfeeding/non-pregnant (43%) counterparts. Also, women living in rural areas (47%) are more likely to be anemic than those living in urban areas (43%).

Malaria, acute respiratory infections, diarrhea, tuberculosis, sexually transmitted diseases (STDs), worms, skin diseases, malnutrition, and anemia are the most common causes of ill health. Hospital records suggest that at least 33% of all inpatient deaths, and 41% of inpatient deaths among children under five years of age, are attributable to malaria. The Plasmodium falciparum parasite is the major source of infection and malaria transmission occurs year-round within all geographic areas.[4]

Diarrheal diseases in Liberia are the second leading cause of morbidity and mortality. According to latest data, Diarrheal diseases deaths in 2018 reached 7.77% of total deaths.[5]

[3] Id.

[4] President's Malaria Initiatives Fighting Malaria and Saving Lives: Liberia, 2017

[5] World Health Ranking Liberia: Diarrheal Diseases; Retrieved June 2021.

2.1.5 Access to Healthcare

According to the Ministry of Health, Liberia's health services was been severely disrupted by conflict. Health workers fled to camps for internally displaced people (IDPs), to secure areas or to neighboring countries. Health facilities were looted and vandalized and medical supplies became unavailable. Government funding stopped and health services collapsed. Following the end of the war, the revitalization of the health services was initiated.

The Ebola virus disease (EVD) outbreak of 2014 and 2015 led to weakening of the Liberian health system and economy. During the outbreak, delivery of routine health services was disrupted primarily because of community distrust, fear leading to decreased care seeking behavior, stigma and lack of adequate PPE and initially a lack of training in how to continue services safely. The Ebola outbreak led to 25,515 cases and 10,572 deaths.[6] With the support of the National Government and health partners, revitalization of the health services resumed in 2015.

The Covid-19 pandemic also severely affected the Liberia's health services. As at 1 June 2021, there have been 2,179 confirmed cases of COVID-19 with 86 deaths.[7] At present, the services are been resuscitated.

2.1.6 Healthcare Delivery and Resources

According to the 2007 National Health Policy of Liberia,[8] healthcare delivery is fragmented and uneven, heavily dependent on donor-funded vertical programs and international NGOs. Disease prevention, and control programs exist for malaria, leprosy, tuberculosis, STDs/HIV/AIDS, and onchocerciasis. Humanitarian relief agencies concentrated their interventions in the most war-affected areas and where refugees and IDPs were resettling. Many health care providers including Community Health Workers are funded by emergency programs, which are being withdrawn as the country stabilizes. The gap created by the reduction in funding for emergency assistance, before development aid starts flowing, has the potential to disrupt health care provision, as witnessed in other post-conflict settings.

[6] PHCPI - Liberia: PHC at a Glance, 2020
[7] John Hopkins University Covid Visual Dashboard, 2021
[8] Ministry of Health & Social Welfare: National Health Policy of Liberia – National Health Plan 2007 - 2011

In 1990 there were 30 Hospitals, 50 Health Centers and 330 Clinics functional. In 2006, 18 hospitals, 50 health centers and close to 286 health clinics were considered to be functional. At present, there are about 1 tertiary hospital, 38 county hospitals, 58 health centers and 753 clinics operational in the country. Many of these facilities are however struggling to attain acceptable performance levels, and are in need of robust infrastructural interventions to become truly functional and respecting referral functions. The hospital component of the health sector is under-sized. Its technical capacity is grossly inadequate.[9]

2.2 Health Needs and Challenges

As noted in the last National Health Policy of Liberia, the health needs and challenges of the country are been addressed. The health needs of a distressed and impoverished population must be alleviated by urgent measures, while starting to invest in the areas that will make the future growth of the health sector possible.

The post-war health needs of Liberia include:-

- Assurance of quality equitable antenatal care and safety in obstetric practices
- Assurance of child health
- Addressing nutrition issues
- Dealing with the current burden of disease
- Meeting population requirements to access safe water and sanitation.

The immediate challenge facing the Liberia health services are *expanding access to basic health care of acceptable quality,* through immediate interventions such as:

- Ensuring the availability of funds at county level to support the continuous delivery of basic services;
- Improving the availability of essential medicines and other critical health commodities;
- Rehabilitating health facilities in under-served areas;

[9] Ministry of Health; Updated Medical Waste Management Plan, March 2015

- Upgrading the skills of health workers and redeploying them to areas where they are most needed;
- Boosting management capacity at all levels to support the delivery of services. The first step in this direction is improving the information base and monitoring and evaluation capacity.
- Improving availability of safe water and sanitary facilities.

3.0 LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The preparation of this HCWMP takes into consideration applicable legislations and policies in the context of Liberian law. The HCWMP draws on the Liberian Constitution, the Environment Protection and Management Law of Liberia and other Environmental Guidelines, and recent National Health Policies and Guidelines.

Preparation of this HCWMP also draws on the requirements of the World Bank Environmental and Social Standards (ESS) 1, 2, 3, 4 and 10.

3.1 Legal Framework

3.1.1 The Liberian Constitution (1986)

Article 20 of the Liberia Constitution states that “a. No person shall be deprived of life…” Article 7 of the Liberia Constitution further 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.”

It is the guiding principle of the Liberian Constitution that the health, environment and wellbeing of all residents of Liberia is protected.

3.1.2 The Public Health Law (1975)

This law is the relevant legislation on matters relating to public health, including control of diseases, environment, sanitation and regulation. Part II, Section 13.9 discusses the cleansing, disinfection or disinfestations of any building or part thereof, and of any article therein likely to retain infection, would tend to prevent or check the spread of communicable disease. It also authorizes steps to be taken to cleanse, disinfect or disinfest such building or part thereof.

Part III discusses environmental sanitation and 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).

3.1.3 The Environmental Protection Agency Act (2002)

The Environmental Protection Agency of the Republic of Liberia was created under the terms of the Environment Protection Agency Act.

Part II, Section 5 of the Act designated the EPA as the principal Liberian authority for environmental management which shall coordinate, monitor, supervise, and consult with relevant stakeholders on all activities for environmental protection.

Part II Section 6 (f) requires the EPA to promote public awareness through public participation in decision making and formal and non-formal education about the protection and sustainable management of the environment, and to allow at minimal or no costs, access to environmental information and records.

Part V Section 32 (1) demands that “every person in Liberia has the right to a clean and healthy environment and a duty to take all appropriate measures to protect and enhance it through the Agency”. Section 32 (2) (b) mandates the EPA to “compel any ministry, public authority, organization and any public officer to take measures to prevent or discontinue any act or omission deleterious to the environment”.

Part V Section 43 mandates the EPA and relevant Agency to establish standards, guidelines and procedures for specific environmental quality, pollution control, toxic substances, hazardous waste and solid waste management.

3.1.4 The Environment Protection and Management Law (2002)

The Environment Protection and Management Law of Liberia is the principal piece of environmental protection legislation in Liberia. It builds on the framework of the Environment Protection Agency Act. In its administration, the law is guided by the principles of sustainable development and the precautionary principle.

Section 15 requires that for every operation, including medical facilities, there should be a comprehensive mitigation plan, which, among other things, shall include a description of activities to be carried out by the operator to mitigate any adverse effects on the environment.

3.2 Policy Framework

3.2.1. National Environmental Policy (2003)

This policy is aimed at improving the physical environment, quality of life and coordination between economic development, growth, and sustainable management of the Liberian society. Key objectives of the policy include:

- The systematic and logical framework with which to address environmental issues;
- Benchmarks for addressing environmental problems in the medium- to long-term;
- The means for generating information and awareness on environmental problems; and
- To demonstrate Liberia's commitment to sustainable management of the environment.

This policy encourages 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 and the EPA Act.

3.2.2 National Health and Social Welfare Policy of 2007

The goal of this policy is to improve the health and social welfare status of the population of Liberia on an equitable basis by: (1) increasing access to and utilization of a comprehensive package of quality health and social welfare services of proven effectiveness, delivered close to the community, endowed with the necessary resources and supported by effective systems; (2) making health and social welfare services more responsive to people's needs, demands and expectations by transferring management and decision-making to lower administration levels; and (3) making health care and social protection available to all people in Liberia, regardless of their position in society, and at a cost that is affordable to the country.

The underlying principle to this policy is that health is a state of complete physical, mental and social well-being, and access to quality health and social welfare services is a precondition for individual and societal development.

3.2.3 National Health Policy and Plan – 2011 to 2021

This policy builds on the previous policy. The policy establishes that the health sector can become more effective by:

a. Improving the timely access to high-impact, evidence-based interventions and strengthening referral between all levels of the system; and

b. Increasing the utilization of services by improving the population's care-seeking behavior, the quality of care and the availability of essential drugs and equipment.

The policy also deduces that the health sector can become more efficient by:

a. Allocating resources among counties according to equitable criteria and optimally distributing resources to health facilities according to population size, utilization and workload;

b. Improving the coordination of all efforts to support health and social welfare services, eliminating duplication and minimizing gaps; and

c. Creating a culture at all levels of the system that values and strives to do more for the population within existing levels of resources

3.2.4 Environmental & Social Management Framework (MOH) 2016

This Environmental and Social Management Framework aims at contributing to maternal and neonatal health services through strengthening (a) the learning environment at the medical school; and (b) health facilities and community services in target health facilities.

The key objectives of the framework are:

a. To assess the main potential environmental and social impacts of planned and future project activities.
b. To recommend environmental and social screening process for project sites and sub-project activities.

c. To develop an environmental management plan for addressing negative impacts during sub-project implementation.
d. To recommend appropriate further environmental work, including preparation of the site-specific management plans for sub-projects.
e. To recommend appropriate capacity building for environmental planning and monitoring in the health sector.

3.2.5 National Guidelines for the Safe Management of Healthcare Waste in Liberia (2020)

This guideline acknowledges that the effective management of healthcare waste is of vital importance to the healthcare sector and people of Liberia. It also acknowledges that the effective management of healthcare waste serves as a guard for the safety of the public, healthcare workers, patients and caregivers.

The key objectives of this guideline are:

a. To manage healthcare wastes at health facilities and increase access to basic services and improved sanitation.

b. To develop a risk-based plan for improving waste management, environmental sanitation and the National Infection Prevention and Control (IPC) protocols.

3.2.6 Liberia National Solid Waste Management Policy (2015 – Final Draft)

This Policy was formulated by the Ministry of Internal Affairs and the Monrovia City Corporation to achieve the following:

a. To ensure that all municipal solid waste generated in settlements in Liberia are collected and transported for disposal in a safe manner to protect public health.

b. To conduct solid waste management service in a transparent and accountable manner and minimize opportunity for unwarranted interference with service providers and customers.

c. To establish cost recovery mechanisms through a range of revenue sources, including fees and taxes, and revenues from recycling and resource recovery.

d. To provide incentives, education and public sensitization to foster cooperation with service providers and cost recovery mechanisms;

e. To sensitize the public to environmental issues, occupational health and safety issues, waste minimization opportunities, and the values of recycling, reuse and resources recovery in a socially inclusive manner.

f. To plan and operate Solid Waste Management activities, considering gender, children and cultural aspects of the local population.

g. To maximize diversion of solid waste from disposal by use of demand management techniques, providing and promoting recycling programs, and encouraging recycling.

h. To ensure that hazardous solid wastes are governed separately by special practices and standards for waste treatment and provisions coded into other hazardous waste related regulations.

i. To ensure solid waste management service providers provide safety materials and equipment for workers and better working conditions to prevent occupational hazards.

j. To ensure workers access to preventive health care and vaccinations for waste-related diseases such as Polio, Typhoid, Tetanus, Hepatitis A and B.

k. To foster environmentally appropriate technologies for management of disposal sites and transfer facilities.

3.2.7 World Bank Group Safeguards Policies

The World Bank's environmental and social framework seeks to prevent and mitigate potential environmental and social impacts associated with the Bank's lending operations that may adversely affect people and their environment.

The World Bank's environmental and social framework is the cornerstone of its support to sustainable poverty reduction. The main objective of these standards is to prevent and

mitigate undue harm to people and their environment in the development process. These standards provide guidelines for the Bank and borrower staff in the identification, preparation, and implementation of programs and projects.

The Bank believes that the effectiveness of programs it supports has substantially increased as a result of attention to these standards. In essence, the standards ensure that environmental and social issues are evaluated in decision making, help reduce and manage the risks associated with a project or program, and provide a mechanism for consultation and disclosure of information.

The following Environmental and Social Standards (ESS) are triggered: i. Assessment and Management of Environmental and Social Risks and Impacts (ESS1); ii. Labour and Working Condition (ESS2), Resource Efficiency and Pollution Prevention and Management (ESS3), Community Health and Safety (ESS4) and Stakeholder Engagement and Information Disclosure (ESS10).

Assessment and Management of Environmental and Social Risks and Impacts (ESS1)

This standard helps ensure the environmental and social soundness and sustainability of projects. It supports integration of environmental and social aspects of projects in the decision-making process.

This standard is triggered if a program is likely to have potential adverse environmental and social risks and impacts in its area of influence. This standard also recommends a hierarchal approach to avoid risks and impacts. It adopts differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable. It utilizes national environmental and social institutions in the assessment and implementation of programs supported by the Bank. It also promotes improved environmental and social performance.

Labour and Working Condition (ESS2)

This standard seeks to promote safety and health at work. It also promotes the protection of workers, including vulnerable workers such as women and primary supply workers, as

appropriate. It also seeks to provide workers with accessible means to raise workplace concerns, including concerns relating to occupational health and safety.

Resource Efficiency and Pollution Prevention and Management (ESS3)
This standard is aimed at avoiding or minimizing adverse impacts on human health and the environment by avoiding or minimizing pollution from programs supported by the Bank. It seeks to avoid or minimize generation of hazardous and non-hazardous waste in workplace environment and to minimize and manage the risks and impacts associated with chemicals used in the workplace.

Community Health and Safety (ESS4)
This standard recognizes that programs supported by the Bank can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from may also experience an acceleration or intensification of impacts due to programs supported by the Bank.

This standard also anticipates and avoids adverse impacts on the health and safety of program-affected communities from both routine and nonroutine circumstances and avoids or minimizes community exposure to diseases and hazardous materials. The standard further ensures the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the program-affected communities; and to have in place effective measures to address emergency events.

Stakeholder Engagement and Information Disclosure (ESS10)
This standard recognizes the importance of open and transparent engagement by project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and Implementation.

IFC Environmental, Health, and Safety Guidelines for Health Care Facilities

The EHS Guidelines for Health Care Facilities include information relevant to the management of EHS issues associated with health care facilities (HCF) which includes a diverse range of facilities and activities involving general hospitals and small inpatient

primary care hospitals, as well as outpatient, assisted living, and hospice facilities. Ancillary facilities may include medical laboratories and research facilities, mortuary centers, and blood banks and collection services.

Under Section 1.1 Environmental, the Guideline requires that waste from health care facilities (HCF) can be divided into two separate groups. The first consists of general waste, similar in composition to domestic waste, generated during administrative, housekeeping, and maintenance functions. The second group consists of specific categories of hazardous health care waste.

The Guideline also requires that health care facilities should establish, operate and maintain a health care waste management system (HWMS) adequate for the scale and type of activities and identified hazards. Facility operators should undertake regular assessment of waste generation quantities and categories to facilitate waste management planning, and investigate opportunities for waste minimization on a continuous basis.

3.2.8 Other International Conventions and Treaties

There are several international conventions or treaties to which Liberia is a signatory. The international interventions relevant to the project are presented below in Table 1.

Table 1: International Conventions relevant to the project.

Category	Signatory Convention/Treaty	Year came into force
Chemicals and hazardous wastes conventions	Stockholm Convention on Persistent Organic Pollutants	April 2008
	Rotterdam Convention on the Prior Informed Consent procedures for Certain Hazardous Chemicals and Pesticides in International Trade.	July 2005
	Basel Convention on the control of Transboundary Movement of Hazardous Wastes and their Disposal.	July 1994
Atmosphere conventions/protocols	United Nations Framework Convention on Climate Change (UNFCCC)	June 1994
	Kyoto Protocol to UNFCCC	January 2005
	Vienna Convention for the protection of the Ozone Layer.	December 1992
	Montreal Protocol on Substances that Deplete the Ozone Layer.	December 1992

3.3 Administrative Framework

Looking at the administrative framework the following key institutions have been identified, as they have legal mandates to be involved in healthcare waste management. They are:

1. The Ministry of Health (MOH)
2. The National Public Health Institute of Liberia (NPHIL)
2. The Environmental Protection Agency (EPA); and
4 Health Facilities

The following is a description and main characteristics of the major entities responsible for the implementation of this HCWMP.

3.3.1 Ministry of Health (MOH)

MOH has the statutory responsibility to manage the health sector of the country. The ministry is responsible for the management of all public health facilities and is charged to set guideline for the implementation of safe waste management programs at those facilities, along with privately owned health facilities in the country.

The ministry is also the primary governmental entity responsible to coordinate with national and international partners for improvement in the healthcare waste program of the country.

3.3.2 National Public Health Institute of Liberia (NPHIL)

NPHIL is the public health institute tasked with supporting national health delivery services in Liberia. It works in collaboration with the Ministry of Health to strengthens existing infection prevention and control efforts, laboratories, surveillance, infectious disease control, public health capacity building, response to outbreaks, and monitoring of diseases with epidemic potential.

Recently, the Environmental and Occupational Health Division of the MOH was transferred under NPHIL and maintained its mandate to assess the environmental health of the population and conduct sanitary inspections of all facilities in the country, including health facilities, to evaluate compliance with regard to the Public Health Law.

3.3.3 Environmental Protection Agency (EPA)

The EPA is responsible for monitoring, coordinating, and supervising the sustainable management of Liberia's environment. It is mandated to ensure the conduct of environmental assessment for all facilities in the country that undertake tasks likely to have significant adverse effects on the environment and people. The EPA is required to issue permit for all major operations like the management of waste, including healthcare waste and set guidelines for the disposals of wastes generated from those operations.

3.3.4 Health Facilities

The various healthcare facilities across the country are tasked with ensuring that the HCWMP and all health guidelines issued by MOH and NPHIL are properly implemented. Each health facility will ensure that its waste management system is operational.

4.0 BASELINE ASSESSMENT OF HEALTHCARE WASTE IN LIBRIA

A comprehensive inventory of all HCFs and their generation rates of HCW have not been conducted. However, from review of the previous waste plan and assessments conducted over the past months at designated HCFs in some counties can be extrapolated and provide a baseline data of the current situation in Liberia.

4.1 Identification of all Healthcare Facilities in the Country

The Health Management Information System (HMIS) section of the MOH has some data, but do not have a complete list of HCFs in the country. One reason is that facilities, especially private ones in the urban areas, are popping out often such that MOH is unable to maintain a sophisticated centralized database, uploaded with verified information on these facilities. The various County Health Officers also have access to limited ad-hoc data which is not stored in any easily accessible format. MOH 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.

There are several HCFs that are supported by international non-government organizations (NGOs) across the country. They may be in the position to provide data on the facilities they support. These data have not been collected for a centralized database.

This assessment used all the above sources of information to compile one document. The data were cross-checked to confirm its veracity, and then extrapolated to cover areas of the country where no accurate data exists. The assessment showed:

Total No. of healthcare facility:

- Tertiary Hospital: 1 Health Centers: 58
- County Hospitals: 38 Clinics: 753

4.2 Assessment of Healthcare Waste Generation Rates

This report aims at identifying healthcare waste generators and assessing their waste generation rates. For this, the Ministry of Health selected the following number and types of healthcare facilities for assessment:

- 8 county hospitals;
- 47 clinics

To assess HCW generation rates, the following healthcare facilities were targeted, presented in Table 2:

Table 2: List of assessed healthcare facilities

Type of Facility	**Name of Facility**		**Type of Facility**	**Name of Facility**
County Hospital	Redemption (Montserrado)			**Rivercess County**
County Hospital	Phebe (Bong)		Clinic	Neezuin
County Hospital	C. B. Dunbar (Bong)		Clinic	Sahyah
County Hospital	Jackson F. Doe (Nimba)		Clinic	Timbo Compound
County Hospital	Curran (Lofa)		Clinic	Bodowhea
County Hospital	Jallah Lone (Gbarpolu)		Clinic	Gblosseo
County Hospital	St. Francis (Rivercess)		Clinic	Gozohn
County Hospital	F. J. Grant (Sinoe)		Clinic	Kangbo
			Clinic	Kploh Community
	Gbarpolu County		Clinic	Open Bible Society Mission
Clinic	Bambuta			
Clinic	Fasama (Bade)			**Sinoe County**
Clinic	Gbangay		Clinic	Butaw
Clinic	Gbarma		Clinic	Diyankpo
Clinic	Gbaryamah		Clinic	Doodwicken
Clinic	Gokallah		Clinic	Drapoh
Clinic	Henry Town		Clinic	Edward Memorial
Clinic	Kondesu		Clinic	Elizabeth Nyanti Institute
Clinic	Kungbor		Clinic	Grigsby Farm
Clinic	Tarkpoima		Clinic	Jacksonville
Clinic	Totoquelle		Clinic	Jokoken
Clinic	Yangaya		Clinic	Juahzon
Clinic	Kpayeakwelleh		Clinic	Kabada
Clinic	Weasua		Clinic	Karquekpo
			Clinic	Menweh Walker
	Rivercess County		Clinic	Panama
Clinic	Boegeezay		Clinic	Payne Town
Clinic	Charlie's Town		Clinic	Roselyn Toe Massaquoi
Clinic	Dorbor		Clinic	Saywon Town
Clinic	Gbediah		Clinic	Togbaville
Clinic	ITI		Clinic	Tubmanville
Clinic	Kayah		Clinic	Tuzon
Clinic	Larkpasee			

All the above HCFs were inspected and interviewed for essential information on their institutional structure, services provided, and the waste management system they maintain. The veracity of some of the data collected from these institutions appear questionable, given the reported amounts of waste generated compared to the bed capacity, and bed occupancy rate. From the review process, it was noted that most of the facilities do not have mechanism for recording data on waste generation. For this reason, only data for three (3) county hospitals are used for this report.

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. Results obtained from the three (3) facilities used for this report are similar to those published in a recent report on healthcare waste for a Sub-Saharan country of 0.55 to 1.1 kg/bed/day.[10]

It is recommended by WHO to consider the following composition of HCW for calculation of normalized waste generation rates:

- 80% general healthcare 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 healthcare facilities. The estimations take into account bed occupancy rates.

It could be deduced from the above estimation that the infectious (including sharps waste) generation rate per bed per day for the county hospitals is between 0.04 and

[10] Minas Minoglou, et al. Healthcare Waste Generation Worldwide and Its Dependence on Socio-Economic and Environmental Factors; Sustainability 2017, 9, 220; doi:10.3390/su9020220

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 established. The reason for this is improper waste classification and segregation system in all assessed establishments.

However, due to improvement of the classification and segregation of healthcare at various healthcare facilities in the country, it is expected that the waste generation rate will increase in near future. It is also expected that implementation of a National Guideline for the Safe Management of Healthcare in Liberia will lead to improvement of waste classification and segregation practices by the Healthcare sector. Therefore, better management will further influence the system by reducing infectious waste generation rate by about 8% per year, so that the total increase will be 7% per year.

4.3 Healthcare Waste Collection

At the different facilities inspected, general and hazardous waste (including contaminated healthcare waste) pre-collection and collection are usually performed through the use of plastic buckets (with or without a bag inside), cardboard boxes or, in some cases, aluminum buckets (with or without a cover).

Frequently, collection equipment is placed in the wards. However, in certain cases, nurses use treatment trolleys containing waste buckets (made of plastic, aluminum or cardboard), in order to receive waste generated within healthcare treatments, like cotton, compresses, syringes, needles, etc. Nevertheless, poor hygiene practices are frequent and notorious within HCF. Sometimes, solid and liquid wastes can be found on the floor. Without exception, liquid waste is sent through restrooms and laboratories' sink.

4.4 Cleaning Teams

In Liberia cleaning is performed by HCF internal cleaning teams. These cleaning are done by employees, who, within HCF, are in charge of cleaning and waste collection and storage.

All healthcare wastes are removed and transported by the referred employees. However, since lack of pre-collect and collect bags is usual, buckets containing waste are transported and unfilled into containers; afterwards, they are washed or cleaned with wet

wiper.

4.5 Healthcare Waste Segregation

It was observed that waste segregation practices depend on the specific HCF services, but usually when performed, segregation regards only needles and other sharps and, in some cases, placentas. Indeed, within some of the healthcare facilities, healthcare waste is not properly segregated. It is frequent to find needles and other sharps in garbage buckets.

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

4.6 Storage within the Healthcare Facilities

In most of the HCF inspected, waste is bagged, in public containers outside or in dumps site at the back of the HCF, places that are easily accessible to people and animals and also exposed to climatic conditions.

It must be stated that, due to high poverty levels, it is frequent to find people seeking for reusable materials in those places, where the facilities are not fenced. In some HCF, waste is placed in a closed storage room, at the exterior to the main facility.

4.6.1 Ward HCW Storage and Collection

In Liberia, the generation of healthcare waste begins in the wards of the various health facilities. A review of the previous Updated Medical Waste Management Plan of 2015 regarding practices compared to present indicates that management procedures at the ward level have greatly improved in many facilities. However, more improvements are required; particularly the need of a consistent standard to be applied for all healthcare facilities in the country, regarding appropriate segregation at source and storage.

The following issues were identified as key challenges in the storage and collection of waste at the ward level:

- There currently is no limit to the quantity of healthcare waste placed into bags.

- Medical wards are using a variety of containers for the placement of HCW. A receptacle with a suitable pop-up lid is best for use in wards. This will limit contact with infectious waste.

- Majority of the facilities do not have a guideline for HCW management. It is very important to have a standard system implemented at all healthcare facilities.

- There is still a challenge of proper waste segregation at the ward level. However, the health care workers have a general understanding that HCW should be segregated in terms of general waste and medical waste; and that sharps must be placed in a designated receptacle.

- HCW is collected from the wards and sometimes transported inappropriately, that pose potential health risk to the person transporting the waste to the storage area and others in the facilities.

4.6.2 Designated Waste Storage Areas

The assessment revealed that health facilities' designated waste storage facilities are also poorly managed. The following were found to be the key challenges:

- most of the HCFs did not have any central facility for storage of wastes, after collection from the wards.

- Lack of Emergency Procedures for example in managing spills.

4.7 Waste Transportation within Healthcare Facility

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

Waste evacuation is constant, even in those periods when county HCFs are crowded, neither personnel nor waste are properly protected. Indeed, generally no protective clothing is used. Sometimes, dirty clothes are carried through wheeled support.

4.8 External Collection and Transport

Most of the HCF store their wastes on site. Only few facilities, especially in the urban areas, transport their wastes for disposal.

Although it is a requirement to weigh wastes before leaving the HCF, most of the facilities lack instruments to conduct the weighing. And where such instruments are available, the wastes are hardy weighed. This leads to inconclusive data being obtained. Presently, waste manifest system is not being implemented.

For the few facilities that transport wastes, the wastes are not weighed and accurately recorded before leaving the HCFs. HCRW leaving the HCFs cannot be tracked. A simple recording procedure prior to the waste leaving the system is a good way to ensure that all HCW is treated and disposed of.

An assessment of the transport methods should be conducted. Vehicles that collect the wastes should be secured and cleaned after wastes have been transported for final treatment/disposal. Presently it is not compulsory for the waste transporters to register with authorities or follow set regulations.

4.9 Treatment/ Onsite Disposal Incineration

Only few of the hospitals assessed had incinerators that were operational. Majority of the hospitals and all of the health centers lack workable incinerators.

HCW received at incinerators are not weighed before loading; therefore, it is uncertain how the loading is controlled. The incinerators are not fitted with automatic feeding devices. This and the improper operation of the incinerators increases the risk of the incinerator operator being injured due to vial and ampoules exploding.

During the site visits, the incinerator operators were using questionable personal protective equipment (PPE). It also found that HCW handlers lack adequate training. Furthermore, it was noted during the assessment that some waste handlers have never undergone training. Training is imperative and should be ongoing.

4.10 External Waste Disposal

Waste segregated at the source, particularly needles, is usually reintroduced into common waste circuit at collection or temporary storage levels which are not labeled or color coded. Therefore, general waste and contaminated healthcare waste have the same final destination, usually in the back of the facilities. This is particularly dangerous for medical and cleaning personnel, within HCF, and for waste collecting personnel working in municipal services.

Due to the lack of operational incinerators at healthcare facilities for the proper disposal of wastes, many of the facilities disposing on wastes on site have resorted to open burning. This practice should stop henceforth.

For the few facilities that transport their wastes for external disposal, there is no knowledge how these wastes are finally disposed of. These wastes are believed to be disposed of in landfills, without treatment.

4.11 Liquid Waste

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

4.12 HCW Information System

During the review of current practices, it was identified that HCW data is incomplete and inconsistent in all of the facilities assessed. Most of the HCFs do not record their HCW data. For the few that record data, the waste data were sporadic and inconsistent.
Currently, there is no clearly defined standard or control on the generator's activities, handling and storage of HCW and/or labelling requirements. Furthermore, there is a major gap in terms of the registration or regulation of the generators, transporters and treatment disposal facilities.

4.13 Training and Awareness

Training and awareness are considered vital for the appropriate management of HCW. All facilities visited reported that adequate training and awareness are lacking. New staff are usually trained by old staff who underwent training many years ago or also never had.

It was observed that at the health facilities, infection prevention control officers are responsible for providing the required training on HCW management. Many of these officers are aware of the importance of HCW segregation and the consequences related to the lack thereof. However, they lack knowledge of the proper disposal of HCW.

4.14 Perception of Healthcare Waste Related Risks

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

At HCF level, health care personnel mostly have a notion of the risks, but lack of equipment, training and infrastructure is common. Facilities degradation leads to a reduced sensitivity towards this issue. Awareness level on Healthcare Waste related risks is very low among cleaning personnel and the general population.

5.0 HEALTHCARE WASTE MANAGEMENT PRACTICES

5.1 Categories and Definition

Waste generated in HCFs are categorized in broad and specific terms. The term health care waste (HCW) includes all the waste generated in a healthcare setting. Health Care Waste (HCW) refers to all waste that can be considered dangerous or hazardous to either human health or the environment. They are further categorized and classified below. Generally, HCW represents approximately 10-25% of the HCW stream. Definition of key terms are described in the Table 3 below:

Table 3: Definition of key terms.

Key terms	Definition
Identification	Identification and classification on waste material
Segregation/ Containerization	Segregation at the source based on categories: • Sharps (medical needles and other surgical instruments) • Infected waste (biomedical, from surgery, nursery) • General waste (food scraps, paper, plastics Sorting the waste into color-coded plastic bags or containers
On-Site Storage	Separate storage facilities (temporary before waste is transported to treatment facility) Packaging and labeling
Transportation	Using specific containers and designated vehicles to transport waste to treatment facility
Off-Site Storage	Storage at treatment facility

5.1.1 Healthcare Waste (HCW)

Due to the danger HCW poses to the public, it is very important that it is managed properly and in accordance with international guidelines. At present, NPHIL has produced the National Guidelines for the Safe Management of Healthcare Waste in Liberia (2020). This document has however not been introduced to HCFs across the country or staff trained on its usage.

5.2. Types and Risks of HCW

HCW can be categorized as presented in Table 4 follows:

Table 4: Categorization of healthcare wastes.

Types	Examples	Risks/Hazards
Infectious waste	• Items contaminated with blood and body fluids • From isolation wards, laboratory specimens, stools.	• Infection - e.g. AIDS, viral • Hepatitis, respiratory infections, eye and skin infections.
Anatomical waste	• Body parts, organs, blood and other body fluids (urine, saliva, other secretions), fetuses	• Infection, as above
Sharps	• Discarded syringes, needles, blades, knives, lancets, scalpels, broken glass, • Surgical instruments.	• Injuries which help pathogenic organisms to enter the body.
Pharmaceutical waste	• All kinds of outdated/expired medications.	• Toxic substance
Chemical waste	• Solvents, disinfectants, laboratory reagents, mercury from thermometers, batteries	• Poisoning, burns, injuries to the eye or mucous membranes, • Headache.
Radioactive waste	• Unused liquids from radiotherapy, • Diagnostic test kits	• Carcinogenic, mutagenic
Pressurized containers	• Aerosol sprays, asthma inhalers, gas containers,	• Explosion when burned
General Waste	• Same as domestic waste (e.g. packaging, paper, plastic, etc.)	• Non-risk HCW

5.3 Sources of Healthcare Waste

In the Liberian context, the sources that generate healthcare wastes are:

- Hospitals
- Health centers and dispensaries
- Maternity
- Blood banks and blood collection services
- Mortuary and Autopsy Centers
- Clinics
- Dental
- Laboratories
- Drug rehabilitation centers
- Ambulances and Emergency Care

5.4 Healthcare Waste Management

Health Care Waste Management is a process to ensure proper health facility hygiene and safety. It also minimizes the risks associated with the waste outside of the facility. It includes planning and procurement, construction, staff training and proper transportation, treatment and disposal method inside and outside the facility.

It is therefore crucial that each institution, small or large, generating HCW has a HCW management plan and establishes an appropriate infrastructure and mechanisms to manage HCW. This should include establishing waste management committees for larger facilities.

The actual management of waste involves several key steps namely: Identification; segregation/containerization; storage; transportation; treatment; and disposal, presented in Table 5.

Table 5: Steps for Healthcare Waste Management

Step	Location	Healthcare waste stream	Key point
1	In medical unit	Generation	
2		Segregation at source	One of the most important steps to reduce risks and amount of hazardous wastes.
3	In health facility	Collection + on-site transport	Protective equipment; sealed contained; easy to wash transporter
4		On-site storage	Lockable easy to clean storage room; maximum length of time: 24 – 48 hours.
5		On-site treatment/disposal	Adequate storage room; maximum length of time: 72 hours
6	Outside of health facility	Off-site transport	Appropriate vehicle and consignment note. HCF is informed about final destination.
7		Off-site treatment/disposal	Appropriate vehicle and consignment note

The steps and the sub-steps that should be followed when managing HCW within a facility are described in more details below.

5.4.1 Segregation and Containerization

The National Guideline for the Safe Management of Healthcare Waste in Liberia discusses waste minimization based on the integrated hierarchy urges all facilities to reduce waste where possible with segregation being one of the effective ways to minimize HCW. Segregation also reduces the amount of toxic substances release to the environment through disposal of general waste.

Segregation is the process of separating different types of waste and keeping them isolated from each other. This process should be done correctly at the point of generation. Segregation of waste relies on designated staff to correctly identify waste according to its category. Correct segregation ensures that the correct treatment and disposal of waste occurs.

For the segregation of HCW, the staff should identify waste according to waste categories and place them in appropriate containers.

A. <u>General Healthcare Waste</u>

This waste should join the domestic refuse stream for disposal. Color-coded containers should be use: black containers for non-infectious dry waste (e.g. bottles, cans, papers and cartons), and non-infectious wet waste (e.g. kitchen waste).

Aerosol containers may be collected with general HCW once they are completely emptied. Aerosol containers should not be burned or incinerated.

B. <u>Infectious Waste</u>

This waste category should be placed in a yellow container and marked “Infectious”.

- Small amounts of chemical or pharmaceutical waste may be collected together with infectious waste.
- Highly infectious waste, whenever possible, must be sterilized immediately by autoclaving.

Note:

- Never re-sort this waste. If general waste and infectious waste are mixed by accident in one bag, it should be treated as infectious waste.
- Empty container when 3/4th full to reduce the risk of spilling.
- If the yellow container is not available, use any of the available color container and mark with the biohazard waste symbol.
- If the biohazard sticker or label is not available, prepare a label with the following information: Type of waste, origin or where waste is produced in the facility, date collected, for incineration.

C. Body Parts/Human Tissues

Handling practices for body parts and human tissue are as follows:

- Wrap body part/tissue in an intact plastic bag.
- Re-wrap in the red plastic bag.
- Place in a prescribed biohazard box, or any strong box.
- Seal the box with the biohazard stickers/tape, or any strong tape.
- Write the following information on the box: Date collected, origin and destination of the waste.

D. Cytotoxic waste

Most of this category of waste is produced in large hospitals or research facilities, and should be collected in strong, leak-proof containers clearly labeled “Cytotoxic wastes.” Precautions must be taken during the handling of cytotoxic materials. The releases of these products can have adverse environmental impacts. The management of these wastes, in covered and impermeable containers, must therefore be strictly controlled. Solid containers must be used for collection of such waste.

E. Sharps

This category of waste should be placed in a yellow or other relevant sharps box. When such containers are not available, use plastic containers or other rigid box and mark with the words “SHARPS” and indicate with biohazard symbol.

- Sharps should all be collected together, regardless of whether or not they are contaminated.
- Containers should be puncture-proof (usually made of cardboard (per UNICEF/
- WHO recommendations) or metal or high-density plastic and fitted with covers.
- Sharps require that the measures be taken to prevent injury and infection during their handling within and outside of the HCFs.
- Containers should be 3/4th full
- Containers should be tied or placed in a trolley and not the floor

***Note**:*

- Use the appropriate shape and size containers for the sharps to be discarded.
- Do not press sharps to make room for more.
- When 3/4th full, seal the sharps container and place in a red bag for incineration.

F. <u>Hazardous chemicals/Pharmaceuticals</u>

- Large quantities of chemicals should be packed in chemical resistant containers and sent to a designated facility. The identity of the chemical should be clearly marked on the containers.
- Hazardous chemical waste of different types should never be mixed.
- Large quantities of obsolete or expired pharmaceuticals stored in hospital ward or departments should be returned to the pharmacy for disposal.
- Other pharmaceuticals waste generated at this level, such as expired medicines or packaging containing drug residues should not be returned because of the risks of contaminating the pharmacy. It should be deposited in a specific container at the point of generation.
- Wastes with high content of heavy *metals* (e.g. cadmium or mercury) should be collected separately. This waste should be sent to a designated facility.

G. <u>Radioactive Waste</u>

- Place such waste in a lead box and label with the radioactive symbol.

- Radioactive waste should be segregated according to its physical form; solid & liquid and according to its half-life or potency; and short-live in specially marked containers.

NOTE:

i. Radioactive waste is presently not treated in the country, due to lack of a facility. How the waste is handled and managed is the responsibility of the generator.

ii. General rule:

iii. When handling HCW, housekeeping staff and waste handlers should always be provided with and wear appropriate protective clothing. As a minimum the following should be provided: overalls or industrial aprons, boots and heavy-duty gloves.

iv. After wastes are placed in appropriate containers and segregated, the next step is to store the waste. The waste should be collected from the unit/location where it was generated and stored in designated waste storage area until transported to the treatment location. This area should be marked with appropriate warning signage.

v. Designated areas are usually a separate location, yet not too far, from the main building of the HCF. All hospitals, health centers and large clinics should have cold storage units. In facilities where there is a lack of such spaces, daily collection and disposal should be enforced.

vi. The following guidelines should be followed for temporary storage waste before treatment/disposal:

a. The waste must be kept in tight receptacles and under stable temperature conditions when stored temporarily for prolonged period of time.
b. Biodegradable general and hazardous waste should not be kept longer than 2 days to minimize microbial growth, putrefaction and odours.
c. If the waste must be stored longer than 2 days, application of treatment like chemical disinfections or refrigeration is recommended.
d. Maximum storage time should not exceed 48 hours during dry period and 72 hours during rainy/cool period.

e. Non-risk HCW should always be stored in a separate location from the infectious / hazardous HCW in order to avoid cross-contamination.
f. Cytotoxic waste should be stored in lead containers that prevent dispersion.
g. The facility should be limited to authorized personnel.

vii. 5.5 Requirements for Storage Facilities

a. The storage area should have an impermeable, hard-standing floor with rounded floor of concave edges and good drainage, it should be easy to clean and disinfect.
b. There should be water supply for cleaning purposes.
c. Easy access to storage area for staff in charge of handling the waste.
d. It should be possible to lock the storage area to prevent access by unauthorized persons.
e. Easy access for waste collection vehicle and not located near kitchen areas
f. Protection from sun, rain, strong winds, floods, etc.
g. Good lighting and adequate ventilation.

viii. 5.6 Collection and Transportation

ix. The proper collection and transportation of HCW are important in health care waste management. Its implementation requires the direct involvement of the HCF's maintenance services, housekeeping services, fleet services and cooperation of all health personnel.

x. 5.6.1 On-site Collection

xi. The following are recommendations that should be followed by healthcare personnel directly involved in waste handling and collection.

xii. Staff members should ensure that waste bags are tightly closed or sealed when they are about three-quarters ($3/4^{th}$) full.
   a. Light-gauge bags can be closed by tying the neck, but heavier gauge bags will most likely require plastic sealing tag of self-locking type.
   b. Bags should not be closed by stapling.

xiii. Hazardous /infectious waste should be collected on separate trolleys

a. The trolleys should be marked with the corresponding color black /yellow and washed regularly.

xiv. No bags should be removed unless they are labeled with their point of production (hospital ward or department) and contents.

5.6.2 On-site Transportation

- HCW should be transported within the hospital or other facility by means of wheeled barrows or trolleys.

5.6.3 Off-site Transportation

This step in the chain of health care waste management involves transportation of waste to treatment or disposal facilities and certain rules need to be followed:

6.6.3.1 Requirements for Packaging for Off-site Collection

- The HCW generator is responsible for the safe packaging and adequate labeling of waste to be transported off-site and for the authorization of its destination.
- Waste should be placed first in containers (e.g. cardboard boxes or wheeled, rigid, lidded plastic or galvanized bins) before been loaded on to a designated vehicle.
- The bags/containers should be sealed to prevent any spillage during transportation and should be robust to withstand vibration or changes in temperature, or atmospheric pressure.
- Infectious and pathological waste should be bagged in appropriate color-coded bags or other special containers when transported.
- All waste bags or containers should be labeled with basic information on their content and on the waste generator. This information may be written directly on the bag or container or on pre-printed labels, securely attached. Basic information should include but not limited to the following:

  - Type of HCW
  - Form of waste and waste category
  - Date of collection
  - Volume/quantity of waste
  - Precautions to be taken while handling emergency procedures in the event of accident or spillage.

- Destination of the waste

5.6.3.2 Requirements for Off-site Collection Vehicles

- The vehicle that transports special HCW should be used exclusively for this purpose.
- Collection vehicles used for the transport of HCW should not be used for the transport of any other materials that could be seriously affected by contamination such as food, livestock, people or retail goods.
- The HCW should be transported only by accredited transporter or carrier. The transporting organization should be registered specifically for this purpose.
- The vehicle should have an enclosed leak proof body and capable of being locked to secure the waste.
- The vehicle must have a suitable size body with appropriate height.
- The vehicle must have a system to secure the load.
- The vehicle must have a separate compartment for emergency equipment.
- The vehicle must have an interior that will allow steam cleaning.
- Internal finishing of the vehicle should allow it to be steam-cleaned, and the internal angles should be rounded.
- The vehicle should be cleaned at the end of each working day and in the event of any spillage.
- The vehicle should be marked with the name and address of the waste carrier.
- The international hazard sign and emergency telephone number should be displayed on the vehicle or container.
- Empty plastic bags or containers, suitable protective clothing, cleaning equipment, tools, and disinfectant, together with special kits for dealing with liquid spills should be carried always and in a separate compartment.
- The waste must always be properly documented and all vehicles should carry a consignment note from the point of collection to the treatment facility. The information to be indicated on the note must include date of production, place of production, waste quantity, waste category and waste destination.

5.7 Consignment Note

The waste taken to a treatment and disposal facility should be accompanied by a consignment note. In the Liberian context, this note will be known as “Manifest Document” (Sample as Appendix 1).

- The transporter shall provide the waste generator with a copy of the consignment note for the generator’s waste records.
- The transporter and the generator shall separately maintain a copy of the consignment note.
- The manifest document should contain information of both the transporter and the generator, even if the generator is also the transporter.
- Any waste generator transporting waste should meet all the requirements of a transporter.
- The transporter or generator transporting the waste should have the consignment note/manifest document in his/her possession in the vehicle while transporting the waste.
- The tracking document should be available upon demand by any traffic enforcement agency personnel and/or waste management officers.
- The transporter shall provide the facility receiving waste with a copy of the original tracking document.

5.8 Routing

HCW should be transported by the quickest possible route. This should be planned before the journey begins.

6.0 TREATMENT OF HEALTHCARE WASTES

6.1 Status of Existing Treatment System

Healthcare facilities in Liberia use various types of bio-mass incinerators for hazardous HCW treatment. Although County Health teams report the installation of incinerator units at health facilities across the country, field investigation from the counties assessed show that most of these facilities are nonfunctional, out dated and face maintenance problems.

This is presently no organized transportation system for HCW across the country. And health facilities do not share installation capacity and many of the facilities in the rural areas use bio-mass burners for their own waste only.

There is presently no uniform system and strategy for the treatment of healthcare waste in practice in Liberia. Although the National Guideline for the Safe Management of Healthcare Waste in Liberia has been prepared by NPHIL, it has not been rolled out to administrators and health facilities in the country.

6.2 General Treatment of Healthcare Waste

Each class of HCW will require specific treatment and the following basic steps should be followed:

- Non-risk HCW: If segregated properly can be disposed with domestic waste.
- Highly infectious waste: All laboratory samples containing body fluids, tissues or faecal stools must always be pre-treated at source by autoclaving or disinfected in a concentrated 2% solution of sodium hypochlorite and then placed in appropriate bags. Discard with infectious HCW before it is taken to any disposal facility.

- Sharps require certain measures to be taken to prevent injury and infection during their handling within and outside of the HCFs. Two possibilities currently exist to dispose of needles and syringes:

    - They can be collected in safety boxes that are then disposed of by means of incineration or encapsulation.
    - They can also be destroyed on the spot using a needle destroyer or separating the needle from the syringe using a device where the needle drops directly in a puncture-proof container.

- Pharmaceutical waste: non-hazardous pharmaceutical waste can be managed jointly with municipal waste. However, potentially hazardous and hazardous pharmaceutical wastes should be managed as hazardous.

    - They should be returned to a national central collection point to ensure that they are properly neutralized or incinerated at temperatures above 1200ºC.

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- Cytotoxic pharmaceutical wastes must be collected separately from pharmaceutical waste and return to supplier and if not possible, incinerate at high temperature. This is for reasons of occupational safety.

- Blood and body fluids waste should be disposed of with at a hazardous sanitary landfill.

- Body fluids and excreta of infected patients with hazardous communicable diseases shall not be discharged to the sewerage system. Because there is no strict separation between the waste and drinking water installations and the sewerage system connected to the waste water plant.

- Large quantities of chemicals should be returned to the supplier for encapsulation. Incineration of certain combustible wastes is possible but landfill is not recommended.

- Waste with high contents of heavy metals should normally be treated in specific recycling/treatment facilities.

- The following items should NEVER BE INCINERATED or be sent for incineration: pressurized gas containers, PVC plastics, glass vials, X-ray/photographic materials and batteries.

- Waste with heavy metals, in particular mercury or cadmium should never be incinerated. Export these items to countries with specialized facilities.

6.3 Treatment of Infectious Waste

Treatment of infectious waste is the process by which the character of infectious waste is changed through disinfection or the destruction of pathogens rendering the waste non-infectious and reducing the risk of spreading disease. At a minimum, treatment may mean isolating and burying the waste to prevent access by people and allowing natural decomposition to destroy the infectious pathogens.

In general, treatment involves a thermal, chemical, biological, or irradiative process that achieves a high level of disinfection. This provides greater protection to waste handlers, transporters, workers at a dumpsite or landfill, and scavengers.

Treatment may also include a physical process (such as a grinder, shredder or compactor) to reduce waste volume and render the waste unrecognizable for aesthetic or cultural purposes. In the case of sharps waste that will be discarded in an uncontrolled manner at a dumpsite, proper treatment requires the removal of both biological and physical hazards. The ideal treatment process is one that renders the waste completely harmless without giving rise to other health and environmental problems.

Infectious waste shall be treated by steam, incineration, or an alternative process approved by the MOH or NPHIL. If treatment is not available, final disposal by burial in the manner described below is permitted on an interim basis. Pathological waste can also be buried directly in burial grounds or cemeteries as described in the section on “Final Disposal.” Treatment should occur as soon as possible after collection, transportation, or the end of the storage period.

Three (3) scenarios are recommended for the treatment of infectious waste in Liberia. They are:

1) On-site treatment in the facility;
2) Sharing an on-site treatment system to treat waste from several nearby facilities, such as a cluster of hospitals or a hospital and surrounding health centers;
3) Treatment at an off-site treatment center, such as a central facility outside the city or at the landfill; and

For isolated health facilities, particular in the rural areas, onsite treatment is recommended. For hospitals and health centers in suburban areas, sharing of on-site treatment system is recommended. The system should be set up at a health facility with the most favourable conditions. For hospitals and health centers in the cities and urban areas, off-site treatment facilities are highly recommended.

Considering the best scenario that may be selected for specific health facility, two (2) processes are recommended:

1) Thermal Process; and
2) Chemical Process

The thermal process will use an autoclave for the wet heat treatment and operate between 100°C to about 180°C. using steam disinfection method.

The thermal process may also use the dry heat (hot air) treatment method using conduction, natural or force convection or thermal radiation.

The chemical process uses disinfectants such as dissolved chlorine dioxide, bleach (sodium hypochlorite), peracetic acid, or dry inorganic chemicals to treat the waste. To enhance exposure of the waste to the chemical agent, the waste should be shredded or grind. The waste should go through a liquid system to remove and recycle the disinfectant. Heated alkali may also be used to digest tissues, pathological waste, anatomical parts in heated stainless-steel tanks.

6.4 Analyses of Preferred Treatment Systems

Due to infrastructure constrains across Liberia for the operation of preferred treatment method, an assessment was undertaken during the field on alternative technologies for waste treatment and destruction. The assessment confirmed a lack of adequate treatment and disposal systems in the country, 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 HCF.

The two most common treatment methods observed are incineration (oxidation) and steam treatment (thermal decontamination). While incineration has certain advantages such as the possibility to treat a wider waste spectrum, economic analysis showed strong disadvantages, especially in regard to operational costs and maintenance. Field observations showed that the more advanced incinerators are not in operation due to budgetary constraints for operational and maintenance costs. Most of the facilities have resorted to using manually-built incinerators or burying all waste in pits, without treatment. Incinerator is also not recommended for operation in densely populated areas like cities, due to it adverse effect the emission has on the atmosphere.

The steam treatment system is less costly to operate and maintain. As some hospitals already operate autoclave stosterilise medical equipment, there already exists a basic knowledge of the operation and maintenance of this type of system.

Incinerator was found to be the preferred treatment system in the country, with the De Montfort units widely in circulation. Unfortunately, most were broken and not operational. Several facilities have employed hybrid or manually built units. However, any incinerator plant used should have all the following units:

- Furnace or kiln as the primary combustion chamber
- Afterburning chamber as the secondary chamber
- Dry, wet or catalytic flue gas cleaning device system
- Wastewater treatment plant

The incinerators should also employ one of the following firing technologies:

- Degassing and/or gasification (pyrolysis)
- Rotary kiln
- Grate incineration specially adapted for HCW
- Fluidized bed incineration.

The incineration plant should be operated by well trained and qualified personnel. There should be periodic maintenance of the plant, ensuring cleaning of combustion chamber, de-clogging of air inflows and fuel burners. The operators should be provided personal protective equipment. A standard environmental monitoring protocol should also be implemented. An audit and reporting system should also be implemented.

6.5 Spill Control

During the handling of HCW, spillage is probably the most common type of emergency involving infectious and other hazardous material or waste. Spills include: accidental tipping over of containers, and dropping and breaking of containers. Likewise, it also involves spills which may occur mainly because of splashing during manual transfer, overfilling, and leaks in process equipment and piping.

The following guideline should be used for spill control:

- Vacate and secure the area to prevent further exposure of other individuals
- Provide first aid and medical care to injured individual.
- Inform the designated person (e.g. waste management officer), who should coordinate the necessary actions.
- Determine the nature of the spill.
- Limit the spread of the spill.
- Vacate all people not involved in the cleaning of the spillage involves, particularly for hazardous substance.
- Neutralize or disinfect the spilled or contaminated material.
- Collect all spilled and contaminated material (sharps should never be picked up by hand). Spilled material and disposable contaminated items for cleaning should be placed in the appropriate waste bags or containers.

- Decontaminate or disinfect the area.
- Decontaminate or disinfect any tools that were used.
- Seek medical attention if exposure to hazardous material has occurred during the operation.
- Remove any contaminated clothing.
- Flush out contaminated eyes and skin as soon as possible at a suitable water supply. If sharps are involved, use a mechanical means, such as tongs, forceps, or dustpan and broom. Do not use your hands to pick up any sharps items, even if gloves are worn.

Every healthcare facility should have a spill control kit with the following as minimal content:

1. Disposable Latex gloves
2. Heavy Duty Reusable gloves
1. Roll barrier tape
4. Cable ties
5. Absorbent paper towels
6. Anti-bacterial wipes
7. Dust Masks
8. Dust pan and brush
9. Disposal plastic aprons
10. Micron plastic bags
11. Laminated procedures
12. Syringe and needle to suck up chemical

7.0 TREATMENT OF PHARMACEUTICAL WASTE

Pharmaceutical waste is any waste that contains medicinal drugs that are expired, unused, contaminated damaged or no longer needed.

For the treatment of such waste in Liberia, four (4) procedures are recommended::

(1) Return of expired pharmaceuticals to supplier,
(2) Incineration,
(3) Inertization,
(4) Encapsulation,
(5) Sewer discharge.

The Ministry of Health shall ensure that importers of medical products in the country maintain contact with their supplying pharmacies or companies. Said suppliers shall commit to received expired or damaged products from their clients. This is the preferred method of handling this waste stream.

Should said waste be incinerated, Pyrolytic or Rotary kiln incinerators are particularly well suited for the treatment of pharmaceutical waste since the temperatures reached often exceed 1,200-1,400°C, thus, ensuring both complete combustion and near to zero toxic exhaust gases. Pharmaceuticals should be introduced into the furnaces as a reasonably small proportion of the total fuel feed. It is suggested that as a sensible “rule of thumb” no more than 5% of the fuel feed into the furnace at any one time is
pharmaceutical material.

If the pharmaceutical waste cannot be returned to the suppliers or disposed of by incineration, another alternative is inertization. By this practice, solid pharmaceutical waste is removed from packaging or containers, ground up and then mixed with cement, lime, and water. The following ratio is recommended: 65% pharmaceutical waste, 15% lime, 15% cement, and 5% water. The homogeneous mixture should be allowed to harden into cubes or pellets. The hardened mass should then be disposed in a hazardous waste landfill engineered to prevent groundwater contamination. And in the absence of a hazardous waste landfill, the hardened mass may be disposed in a restricted portion of a

sanitary landfill or buried in specially designed trenches or burial pits within the healthcare facility premises. In the latter case or if a sanitary landfill is not available, the trenches or pits must be lined with clay or a membrane liner to prevent leaching into groundwater, secured with a fence to restrict access, and eventually capped to prevent percolation of water. A waste minimization program should be in place so that only small amounts of pharmaceutical waste are disposed of in this manner

A fourth alternative for the treatment of pharmaceutical waste is encapsulation. By this treatment method, solid, semi-liquid, or liquid pharmaceutical waste could be placed in drums. These drums are filled to 3/4th their capacity. The drums are then filled with cement mortar or clay, sealed, then buried in a hazardous waste landfill engineered to prevent groundwater contamination.

Again, in the absence of a hazardous waste landfill, the sealed drums may be buried in a restricted area of the landfill. As with inertization, a waste minimization program should be in place so that only small amounts of pharmaceutical waste are disposed of in this manner.

A fifth alternative for the treatment of pharmaceutical waste applies only to moderate quantities of relatively mild liquid or semi-liquid pharmaceuticals, such as such as: vitamin solutions, cough syrups, eye drops, saline solutions, intravenous fluids, etc. It is acceptable to discharge these liquid drugs into a sanitary sewer while diluting with large amounts of water. Antibiotics and chemotherapy drugs should not be discharged into the sanitary sewer.

7.1 Cytotoxic/Genotoxic Waste

Cytotoxic or chemotherapeutic waste is either bulk agents or materials, such as vials or gloves, contaminated with amounts of chemotherapy agents. They are, also called antineoplastic agents or cytotoxic drugs, and have the ability to kill or stop growth of living cells. They are used in the chemotherapy of cancer, which is usually performed in specialized health centers. However, if unwanted and discharged into the environment they can have very serious effects, such as interfering with reproductive processes in various life forms. Their disposal must therefore be handled with care. They require special handling procedures because of their toxic characteristics.

For the treatment of such cytotoxic waste, all minimization options should be considered prior to treatment methods. A careful inventory management procedure should be followed for preparation, storage, administration and waste segregation that result in reducing the amount and type of material that needs special disposal.

The following principles should be followed for the handling and disposal of cytotoxic waste:

- Dispose sharps, containers, and cytotoxic waste according to the appropriate procedure in a plastic bag designed for hazardous waste.
- Do not clip or recap needles. Discard the needle-syringe unit into a convenient and appropriately labeled, puncture-proof container.
- Discard all gauze, tubing, bags, and bottles etc. in appropriately labeled bags and seal. Remove gown and gloves and discard in a similar manner.
- When disposing cytotoxic/genotoxic waste, wear personal protection equipment (latex-free gloves, low-permeable gown with long sleeves and solid front, face mask designed for aerosols).
- Clean up spills using available chemicals and disposable towels or sponges.
- For large spills, double gloving is recommended.
- If direct exposure occurs, immediately rinse the area with running water. In case of exposure with eyes, rinse eyes with an eyewash solution or sterile saline. Report all episodes of drug exposure to concerned physician immediately. Wash face and hands completely with running water.

Three (3) procedures are recommended for dealing with bulk quantities of cytotoxic/genotoxic waste. They are:

(1) Return to supplier;
(2) Chemical degradation; and
(3) High temperature incineration.

The preferred method is for bulk quantities of cytotoxic/genotoxic agents to be repackaged, marked appropriately and returned to the supplier for processing. Cytotoxic/genotoxic waste should be segregated from other pharmaceuticals and kept separately in clearly marked containers with rigid walls. They should ideally be safely packaged and returned to the supplier for disposal. If the waste cannot be returned to the supplier, chemical degradation methods exist for chemotherapy agents.

Incineration of cytotoxic/genotoxic agents is only permitted in specialized dual-chamber incinerators which is operated at very high temperatures, above 1200 ºC, with a minimum residence time of 5 seconds, and is fitted with gas cleaning equipment. An after-burner (i.e. the secondary chamber) is important for the destruction of cytotoxic waste, as it is possible that cytotoxic/genotoxic solutions could become aerosolized following the initial combustion in the primary chamber. As a result, without a higher temperature secondary chamber, degraded cytotoxic/genotoxic material may be emitted from the chimney. The secondary combustion chamber consequently ensures that such cytotoxic/genotoxic substances are fully incinerated.

Cytotoxic/genotoxic waste should never be disposed of in a landfill other than after encapsulation or inertization. Cleaning staff handling these drugs must avoid crushing cartons or removing the product from its packages. They may only be discharged in a sewerage system after chemical decomposition and must not be discharged untreated into surface water drains or natural watercourses.

7.1.1 Special Treatment for Cytotoxic/genotoxic

For special treatment of cytotoxic/genotoxic waste, a drum should be filled to 50% capacity with drugs, after which a well stirred mixture of lime, cement and water in the proportions of 15:15:5 (by weight), should be added and the drums filled to capacity. A larger quantity of water may be required sometimes to attain a satisfactory liquid consistency. The drums should then be sealed by seam or spot welding and left to set for 7 to 28 days. This will form a firm, immobile, solid block in which the wastes are relatively securely isolated. The drum can then be placed at the working face of a landfill which has been lined with an impermeable layer of clay or membrane.

Even when used carefully, some cytotoxic/genotoxic waste in minimal quantities remains in vials, in tubing and IV bags, or on gloves, gowns, gauze and syringes. These small quantities are hard to extract from the materials, very toxic, and cannot be deactivated with water. It is recommended that waste contaminated with only trace amounts of cytotoxic agents be encapsulated and buried in hazardous waste landfills or restricted sections of a sanitary landfill engineered to prevent groundwater contamination.

7.2 Treatment of Other Hazardous Wastes

Other hazardous chemical wastes include: spent organic solvents, degreasers and oils used by the engineering staff, mercury from broken thermometers, etc. For these wastes, four (4) general disposal methods are recommended. They are:

(1) Return to supplier,
(2) Chemical degradation,
(3) Encapsulation and disposal in a hazardous waste landfill, or
(4) Sewer discharge.

It is good to ensure that appropriate provisions are made in purchase contract of chemicals so that spent or outdated chemicals to the original supplier for disposal. Shipment for the purpose of returning the waste should comply with international agreements including the Basel Convention.

It may also be possible to degrade or neutralize some chemical waste such as acid or base at a special treatment facility. If neither of these alternatives is possible, the chemical waste should be encapsulated in small quantities in drums and buried in an approved hazardous waste landfill engineered to prevent groundwater contamination. Large amounts of disinfectants should not be encapsulated because they are corrosive and sometimes flammable. Hazardous chemical waste of different compositions should be stored separately to avoid unwanted chemical reactions.

7.3 Mercury Waste

Mercury can be found throughout a HCF in products such as: thermometers, sphygmomanometers, dilation and feeding tubes, batteries, thermostats, fluorescent tubes, laboratory fixatives, and some medicinal preservatives. Mercury is neurotoxic and

can damage the central nervous system; especially during fetal and childhood development. Mercury exposure can also cause tremors, impaired vision and hearing, paralysis, insomnia, emotional instability, developmental deficits during fetal development, attention deficit, and developmental delays during childhood.[11] Mercury vaporizes and may stay in the atmosphere for up to a year. It also accumulates in the sediments of rivers and lakes, where it is transformed into a more toxic form, methylmercury, which builds up in fish tissue.

This necessitated the WHO to issue recommendations for the safe use of Mercury in HCF as follows:

- HCF to develop mercury clean-up and waste handling and storage procedures that minimize and eliminate patient, occupational, and community exposures.

- Countries that have access to affordable alternatives should develop and implement plans to reduce the use of mercury equipment and replace them with mercury-free alternatives.

- Increase efforts to reduce the number of unnecessary use of mercury equipment.

- Replaced devices should be taken back by the manufacturer or taken back by the alternative equipment provider.

- Promote the principles of environmentally sound management of HCW containing mercury, as set out in the UN Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal.

[11] Harvey, Jamie (2000) "White Paper on Mercury Elimination," Jamie Harvey, presented at Setting Healthcare's Environment Agenda, October 16, 2000.

- Support the allocation of human and financial resources to ensure procurement of mercury free alternatives and a sound management of health-care waste containing mercury.

Success of a mercury reduction and elimination program is highly dependent on facility-wide education and understanding of the adverse impacts of mercury to the environment, public health, and worker health and safety. Experience has demonstrated that education and communication program within HCF is imperative for the support of staff and ultimate success. Development of any program requires not only financial resources and administrative support, but also a long-term vision and commitment, especially as mercury-free alternatives become more and more available and affordable.

Until such time that a centralized mercury recovery, recycling or engineered storage facility is available, it is recommended that all liquid mercury be collected in impermeable rigid plastic containers containing enough water to prevent volatilization of mercury in the air space of the container. The containers should be kept close, labeled “MERCURY WASTE,” and stored in locked cabinets or steel drums to prevent unauthorized access. Ideally, cabinets or steel drums should be ventilated to the outside air. If glass bottles are used, the bottles should be placed in plastic containers to prevent breakage. An alternative is to encapsulate the mercury using commercially available amalgam powder or powdered sulfur to form a solid and reduce volatilization during storage. The resulting amalgam should be stored in closed, labeled containers.

The basic elements of mercury spill clean-up procedures are:

1) Determine the extent of the spread of the mercury spill;
2) Evacuate the immediate area, restrict public access, close doors and temporarily shut off local ventilation to prevent spreading vapors;
3) Put on personal protection equipment such as rubber gloves and an apron;
4) Use a small scoop, cardboard or folded paper to collect the large mercury beads and place them in a rigid plastic container with water;
5) Use a medicine dropper, syringe, aspirator bottle, or pipette to suction all the remaining mercury droplets including those that fall under carpets or in crevices in the floor.

6) Place all the mercury in the air-tight plastic container with water
7) Clean hands and personal protection equipment thoroughly;
8) Open windows and aerate the area with fans for at least 24 hours to eject and dilute any remaining vapors to the outside air;
9) Seal, label, and store the container.

7.4 Management of Ampoules

Ampoules can be crushed on a hard impermeable surface or in a metal drum or bucket using a stout block of wood or hammer. Workers doing this should wear protective equipment, such as eye protection, boots, clothing and gloves. The crushed glass should be swept up, placed in a container suitable for sharps objects, sealed and disposed of in a landfill. The liquids released from the ampoules should be diluted and disposed of.

Ampoules should not be burnt or incinerated as they will explode, possibly causing injury to operators and damage to the furnace or incinerator. Melted glass will also clog up the grate of a furnace or incinerator if the operating temperature is above the melting point of glass. Ampoules of cytotoxic/genotoxic or anti-infective drugs must not be crushed and the liquid discharged to sewers. They should be treated using the encapsulation or inertization disposal methods.

8.0 DISPOSAL OF HEALTHCARE WASTE

8.1 Disposal Sites Determination

The disposal of waste is a critical problem for healthcare. Existing disposal practices are sporadic due to the lack of clear national 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. Most time, this is 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.

Two (2) methods are proposed for the disposal of healthcare waste in Liberia. They are: (1) on-site disposal system; and (2) off-site disposal system. These systems are recommended to be adopted on a national scale. On-site disposal system involves the treatment and disposal of waste at each healthcare facility, while off-site disposal system involves the transport of waste from a healthcare facility to a centralized location for treatment and disposal. This system can serve several healthcare facilities.

8.2 Status of On-site Waste Disposal Facilities

Except for urban communities in Montserrado County, healthcare facilities in Liberia have no access to organized external services for waste disposal. Therefore, HCW is managed on-site with some sort of burn or bury process. These include:

- solid and infectious waste, often including sharp items, are collected together, buried, open burnt or rarely treated;
- sharps are burnt, or in case of facilities having no treatment unit, disposed of in a waste pit;
- pathological waste is disposed of in placenta pit or buried in ground;
- pharmaceutical waste is burnt or disposed of in waste pit or latrine;
- chemical waste is disposed of down a drain.

Due to the lack of hydro-geological studies and documentation, and law enforcement, for most of the inspected facilities, disposal locations are chosen mainly on the basis of availability of space, rather than distance to the groundwater table. The pits, in most cases, are not designed, constructed and maintained according to any recommended standard.

8.3 Status of Off-site Waste Disposal Facilities

To serve the urban communities in Montserrado County, the Ministry of Health and NPHIL is constructing a centralized HCW treatment and disposal facility at Disco Hill, Margibi County. This site is expected to receive wastes from the major health centers from the urban communities in Montserrado County, to include Monrovia and Paynesville. The waste will be treated and finally disposed at the site according to national standard. Construction of the site has not been completed and it has not been opened for operation. Hence, the various hospitals and healthcare centers in the urban areas of Montserrado County that do not have complete on-site disposal system utilize the services of waste handling agencies to collect and dispose of their healthcare waste. These agencies do not have their own approved disposal sites and lack special vehicles for the waste collection. In fact, there are scanty records of the final disposal sites of the waste.

8.4 General HCW Disposal Strategies

The disposal of hazardous healthcare waste, especially untreated waste, on dump sites is today not recommended any more. Several objections exist, objections out of cultural or religious reasons or objections based on a perceived risk about the release of pathogens to air and water or 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 infectious diseases than controlled disposal at specially prepared sites or well operated municipal landfills, even if the place is not designed according to modern standards (engineered, sanitary landfill).

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

- Permanent control – The disposal location should be under some form of permanent control such as protected by a fence, secure cover or staff.

- Controlled waste emplacement – Wastes should be deposited in a controlled way at a disposal site and not scattered around irresponsibly.

- Engineered construction– A disposal site, no matter how small or simple in design, should be constructed in a safe and properly engineered manner.

- Hydrogeological isolation – The purpose of disposal is to isolate waste 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 groundwater.

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 Environmental staff of NPHIL and County Environment Officers of the EPA, in collaboration with Environmental Health Technicians and County Health Officers.

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

8.5 Selection of Temporary Disposal Sites

Presently, a landfill waste facility serves only the urban areas of Montserrado County, to include Monrovia, Paynesville and suburban communities. Healthcare waste from these locations can use the landfill facilities at Wein Town and soon to come on stream Cheeseman Landfill facility as temporary disposal sites. Should landfill sites be

constructed in other counties, these will be preferred site for HCW disposal. The destruction of pathogens by treatment prior to disposal further increases suitability of the residual wastes for landfill. A possible option would be the 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. Sample of Waste Deposit Form to be used at such disposal sites is presented as Appendix 4.

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, excavation by scavenger will 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 minimize the possibility of off-site transport of pollutants and the physical-chemical conditions within partially decomposed municipal waste would accelerate biodegradation of the organic components in the healthcare waste. Using such temporary disposal facility, the following goals should be achieved;

- Access to site and working areas possible for waste delivery and site vehicles.
- Presence of site personnel capable of effective control of daily operations.
- Division of the site into manageable phases, appropriately prepared, before landfilling starts.
- Adequate mechanisms for leachate collection, and treatment systems, if necessary.
- Organized deposit of wastes in a small area, allowing them to be spread, compacted, and covered daily.
- Surface water collection trenches around site boundaries.
- Construction of a final cover to minimize rain water infiltration when each
- phase of the landfill is completed.

9.0 COLLECTION AND DISPOSAL OF WASTEWATER FROM HCF

9.1 Characteristics and Hazards of Wastewater from HealthCare Facilities

1) Wastewater from healthcare establishments is of a similar quality to urban wastewater, but may also contain various potentially hazardous components.

2) The principal area of concern is wastewater with a high content of enteric pathogens, including bacteria, viruses, and helminths, which are easily transmitted through water.

3) Contaminated wastewater is produced by wards treating patients with enteric diseases and is a particular problem during outbreaks of diarrheal disease.

4) It may also contain various potentially hazardous components, such as microbiological pathogens, hazardous chemicals, pharmaceuticals and radioactive materials which are discussed below:

   a) Small amounts of chemicals from cleaning and disinfection operations are regularly discharged into sewers.
   b) Small quantities of pharmaceuticals are usually discharged to the sewers from hospital pharmacies and from the various wards.
   c) The toxic effects of any chemical pollutants contained in wastewater on the active bacteria of the sewage purification process may give rise to additional hazards.

9.2 Wastewater Management

1) The basic principle underlying effective wastewater management is a strict limit on the discharge of hazardous liquids to sewers.

2) Only in an outbreak of acute diarrheal diseases should excreta from patients be collected separately and disinfected.

3) Where water use is commonly high, sewage is usually diluted.

4) For effluents treated in treatment plants, no significant health risks should be expected, even without further specific treatment of these effluents.

9.3 Connection to a Municipal Sewage System

It is acceptable to discharge the sewage of healthcare establishments to sewers without pre-treatment, provided that the following requirements are met:

1) The municipal sewers are connected to efficiently operated sewage treatment plants that ensure at least 95% removal of bacteria;
2) The sludge resulting from sewage treatment is subjected to anaerobic digestion, leaving no more than one helminth egg per liter in the digested sludge;

3) The waste management system of the healthcare establishment maintains high standards, ensuring the absence of significant quantities of toxic chemicals, pharmaceuticals, radionuclides, cytotoxic drugs, and antibiotics in the discharged sewage;

4) Excreta from patients being treated with cytotoxic drugs may be collected separately and adequately treated (as for other cytotoxic waste).

5) In normal circumstances, the usual secondary bacteriological treatment of sewage, properly applied, complemented by anaerobic digestion of sludge, can be considered as sufficient.

6) During outbreaks of communicable diseases, effluent disinfection by chlorine dioxide (chlorine powder) or by any other efficient process is recommended.

7) If the final effluent is discharged into coastal waters, disinfection of the effluent will be required throughout the year.

9.4 On-Site Treatment or Pre-Treatment of Wastewater

1) Healthcare facilities, particularly those that are not connected to any municipal treatment plant, should have their own sewage treatment plants e.g. septic tanks.

2) Efficient on-site treatment of sewage should include the following operations:
   a) Primary treatment
   b) Secondary biological purification. Most helminths will settle in the sludge resulting from secondary purification.
   c) Tertiary treatment. The secondary effluent will probably contain at least 20 mg/liter suspended organic matter, which is too high for efficient chlorine disinfection. It should therefore be subjected to a tertiary treatment, such as lagooning. If no space is available for creating a lagoon, rapid sand filtration may be substituted to produce a tertiary effluent with a much-reduced content of suspended organic matter (<10mg/liter).
   d) Chlorine disinfection. To achieve pathogen concentrations comparable to those found in natural waters, the tertiary effluent will be subjected to chlorine disinfection to the breakpoint. This may be done with chlorine dioxide (which is the most efficient), sodium hypochlorite, or chlorine gas, chlorine powder.

3) Disinfection of the effluents is particularly important if they are discharged into coastal waters.

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9.4.1 Sludge Treatment

1) The sludge from the sewage treatment plant requires anaerobic digestion to ensure thermal elimination of most pathogens.

2) Alternatively, it may be dried in natural drying beds and then incinerated together with solid infectious healthcare waste.

3) On-site treatment of hospital sewage will produce a sludge that contains high concentrations of helminths and other pathogens.

9.5 Minimal Safety Requirements for Sewerage Treatment

For healthcare establishments that apply minimal programs and are unable to afford any sewage treatment, the following measures should be implemented to minimize health risks:

1) Patients with enteric diseases should be isolated in wards where their excreta can be collected in buckets for chemical disinfection; this is of utmost importance in case of cholera outbreaks, and strong disinfectants will be needed.

2) No chemicals or pharmaceuticals should be discharged into the sewer.

3) Sludge from hospital cesspools should be dehydrated on natural drying beds and disinfected chemically (e.g. with sodium hypochlorite, chlorine gas, or preferably chlorine dioxide).

4) Sewage from healthcare establishments should never be used for agricultural or aquaculture purposes.

5) Hospital sewage should not be discharged into natural water bodies that are used to irrigate crop, to produce drinking water, or for recreational purposes.

6) Small-scale rural healthcare facilities that apply minimal waste management programs may discharge their wastewater to the environment.

7) An acceptable solution would be natural filtration of the sewage through porous soils, but this must take place outside the catchment area of aquifers used to produce drinking-water or to supply water to the facility.

9.6 Sanitation

1) Human excreta are the principal vehicle for the transmission and spread of a wide range of communicable diseases, and excreta from hospital patients may be expected to contain far higher concentrations of pathogens, and therefore to be far more infectious, than excreta from households.

2) Adequate sanitation in every healthcare facility should be provided.

3) The fecal -oral transmission route- and other routes such as penetration of the skin must be interrupted to prevent continuous infection and re-infection of the population.

9.7 Safe Management of Wastes from Health-Care Activities

The healthcare facility should ideally be connected to a sewerage system.

1) Where there are no sewerage systems, technically sound on-site sanitation such as the simple pit latrine, ventilated pit latrine, and pour-flush latrine, and the more advanced septic tank with soak-away or the aqua-privy should be provided.

2) In temporary field hospitals during outbreaks of communicable diseases, other options such as chemical toilets may also be considered.

3) In addition, convenient washing facilities should be available for patients, personnel, and visitors in order to limit the spread of infectious diseases within the healthcare facility.

10.0 REQUIREMENT FOR OCCUPATIONAL HEALTH AND SAFETY PRACTICES

The HCFs are responsible for providing a safe, healthy workplace and safe systems of work for all. Further, the management of waste presents a number of potential hazards to employees requiring the appropriate measure of risk identification, risk assessment, and risk control. Healthcare workers have an obligation to follow instructions regarding safe work practices. Their responsibilities and obligations are explained below.

10.1 Occupational Health and Safety Provisions

The following provisions for Occupational Health and Safety for staff handling healthcare waste should be implemented:

1) Healthcare waste management policies or plans should include provision for the continuous monitoring of workers' health and safety to ensure that correct handling during segregation, storage, collection, transportation, treatment and disposal procedures of waste are being followed.

2) Essential occupational health and safety measures include the following:
   a) Training of workers on infection transmission.
   b) Provision of personal protective equipment;
   c) Establishment of an effective occupational health program that includes immunization, post-exposure prophylactic treatment, and medical surveillance.

3) Training in health and safety should ensure that workers know of and understand the potential risks associated with healthcare waste, the value of immunization against viral HBV among other diseases, and the importance of consistent use of personal protection equipment.

10.2 Employer Responsibilities

The Government of Liberia is the largest employer of healthcare workers in the country. The Ministry of Health also regulates the activities of all healthcare workers, whether said workers are employed in the private sector. The Ministry of Labor also ensure the

protection of all employees in the private sector of Liberia. Hence, the relevant agencies shall ensure the following:

1) HCF management is responsible to provide appropriate information, education, training and ensuring that safe systems of work are developed and maintained at all HCFs.

2) Key among the responsibilities is to provide information on HBV vaccination among other required vaccinations and a register of vaccinated personnel maintained.

3) Standard operating procedures should:
   a) Specify accepted waste management practices, waste segregation procedures and approved waste handling procedures;
   b) Detail appropriate steps required for waste generators, and handlers;
   c) Specify personal protective equipment required for waste handling tasks;
   d) Detail spill management strategies and designate trained personnel for spill management onsite;
   e) Identify first aid resources and needle stick injury treatment protocol; and
   f) Specify how to operate the information, education, training and safe working systems.

10.3 Personal Protective Equipment (PPE)

Relative to the use of PPE, MOH shall ensure that all HCF have adequate PPE for all staff and ensure the following are adhered to:

1) Supervisors and all workers are encouraged to assess risks and provide suitable PPE for the nature and degree of the hazard they are likely to be exposed to.

2) PPE must be worn when required.

3) PPE is the last option in the hierarchy of hazard controls and should only be used if elimination, engineering controls and or changes to work practices do not adequately remove/reduce the risks.

4) Waste collectors should be made aware of their obligations/responsibilities.

5) Waste collectors are under a statutory obligation to wear appropriate PPE. The risk of spills or splash exposures necessitates the wearing of face and eye protection. Protection of the legs is also required.

6) Carrying of HCW bags is to be minimized and where it cannot be avoided, the waste collector should wear protective garments and apron to minimize the risk of injury.

7) Protective garments should be worn whenever collecting waste, even if the process involves wheeling a securely covered waste trolley to the holding area.

8) The type of protective clothing used will depend on the risk associated with the healthcare waste, but the following should be made available to all personnel who collect or handle healthcare waste:
   a) Helmets, with or without visors-depending on the operation.
   b) Face masks-depending on operation.
   c) Eye protectors (safety goggles)-depending on operation.
   d) Overalls (coveralls)-obligatory.
   e) Industrial aprons-obligatory.
   f) Leg protectors and/or industrial boots-obligatory.
   g) Disposable gloves or heavy-duty gloves (waste workers) obligatory.

9) Operators of manually loaded incinerators should wear protective face visors and helmets.

10) During ash and slag removal and other operations that create dust, dust masks should be provided for operators.

11) Employees should comply with health care waste management policies, procedures and instructions given on correct use of safety and protective

equipment for the protection of their own health and safety and the health and safety of others

10.4 Workers' Protection

Further, relative to workers' protection, MOH shall ensure the following:

1) The individuals responsible for management of healthcare waste should ensure that all risks are identified and that suitable protection from those risks is provided.

2) A comprehensive risk assessment of all activities involved in HCW management, carried out during preparation of the waste management plan, will allow the identification of necessary protection measures.

3) Once assessment is completed, personnel should receive suitable training.

4) Measures should be designed to prevent exposure to hazardous materials or other risks, or at least to keep exposure within safe limits.

10.5 Infection Control

Relative to infectious control, MOH shall ensure the following:

1) The infection control committee has responsibilities to review:
   a) the provision and installation of facilities and protective equipment;
   b) work practices;
   c) incidents and accidents;
   d) provision and status of information, education and training;

2) An effective management tool is to provide a link between the infection control committee and the facility management by reporting on progress and challenges.

10.6 Monitoring Performance of Infection Control

Further, relative to infectious control, MOH shall ensure the following:

1) Incident and accident reporting and recording is an essential management information system for identifying causative factors of injuries relating to waste handling.

2) Incident and accident reporting and recording should facilitate costing of associated financial loss and enable management to make injury prevention investment decisions based upon accurate data.

3) Waste treatment, operating and disposal costs should be reviewed periodically to evaluate any fluctuations.

10.6.1 Hygiene

1) Regular washing and maintenance of equipment used to contain and transport waste should be done by providing hand-washing facilities for employees

2) It is important for healthcare facilities to promote regular hygiene procedures that comply with Infection Prevention and Control (IPC) Guideline.

3) It may be useful also to designate specific areas for equipment maintenance in hygienic workplaces that are properly equipped with emergency shower rooms and drainage to sewers or septic tanks.

4) Emergency shower rooms should be provided in all healthcare facilities.

10.6.2 Immunization

1) Covid-19, Viral hepatitis B and Tetanus immunizations should be provided for healthcare personnel and waste handlers.

2) Each HCF is required to conduct immunization for all newly employed staff.

3) The HCF should also maintain and keep long term records of vaccinations.

10.7 Precautions for Sharps, Blood and Body Substance Exposures

Precautions must be implemented to protect against exposure to sharps, blood and body fluids. These precautions include:

1) Providing a purposely designed sharps container as close as practicable to the point of generation of the sharps;

2) Providing appropriate PPE for potential blood and body substance exposures;

3) Conducting compliance checks to confirm that people wear protective clothing;

4) Investigating all incidents to identify causes of exposures.

5) Take remedial action to eliminate risks;

6) Infection Control Committees or an appropriate forum must review incident reports and confirm appropriate action taken;

7) Train staff in first aid and injury management procedures for sharps injury and body substance exposure;

8) Reinforce the need for staff to report all incidents and injuries;

9) Analyze statistics to identify any risk exposure trends for necessary interventions.

10.8 Response to Injury and Exposure

All personnel who handle healthcare waste should be trained to deal with injuries and exposures.

1) The training program should include the following elements:
   a) Immediate first-aid measures, such as cleansing of wounds and skin, and irrigation (splashing) of eyes with clean water;
   b) An immediate report of the incident to a designated responsible person;
   c) Retention, if possible, of the item involved in the incident;

d) Details of its source for identification of possible infection;
e) Additional medical attention in an accident and emergency
f) Medical surveillance;
g) Blood or other tests if indicated;
h) Recording of the incident;
i) Investigation of the incident; identification and implementation of remedial action.

2) Waste handlers are particularly at risk from the waste. In all stages, they require:-
a) PPE
b) Hold waste containers at the handle or at the top of liner bag
c) Avoid any waste falling on the floor during collection and transportation
d) Non-complying waste (in terms of segregation) should not be sorted by hand.
e) Waste storage/chamber should be well ventilated and compartmentalized.
f) Cloak rooms for changing and showering
g) Waste handlers should also receive post exposure prophylaxis for HIV/AIDS

11.0 HEALTHCARE WASTE MANAGEMENT PLAN (HCWMP)

This HCWMP should not be limited to the preparation of internal guidelines/instructions for the management of healthcare waste but rather a process to sustain and optimize the operation of HCWM systems in healthcare facilities across Liberia. It is the intention of the Ministry of Health and its development partners that through the setting up of institutional structures, the implementation of this management plan within the next two (2) years will result in improved HCW management in Liberia.

This HCWMP endeavors to resolve the HCWM challenges in Liberia that comprise the following components:

1. Legal, Policy and Institutional Frameworks
2. Standardize Healthcare Waste Management Practices.
3. Capacity-building, training, and awareness-building measures.
4. Waste information system
5. HCWM pollution prevention
6. Improved treatment and disposal practices
7. Periodic Review

11.1 The HMWMP Strategic Framework

Vision of the Strategy

The Vision of Liberia's HCWMP 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.

Policy Options

The following policy goals, continued from the previous MWMP, should be adopted for the further development of the HCWMP of Liberia:

1. Centralized versus decentralized implementation of improved HCWM:

    - Initiatives taken by MOH and NPHIL are necessary to ensure common standards for HCWM, as well as fostering environmental guidelines pertaining to HCWM.

    - A central institution should coordinate all activities pertaining to development of common standards with respect to HCWM. This institution shall be MOH/NPHIL.

    - Capacities at all levels will be strengthened to enable them to be responsible for implementing HCWM systems in their respective facilities.

2. Private versus public services:

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

3. Regulation:

    - There is an urgent need to implement the National Guideline for the Safe Management of Healthcare Waste in Liberia, developed by MOH/NPHIL that establishes common standards for waste segregation, transport, treatment and disposal.

4. 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.

5. Treatment:

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

6. Final disposal:

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

7. Finance:

- Adopt duty-of-care as well as polluter-pay-principle for the life cycle of the HCW.

Implementation

1. National and Referral Level:

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

2. Phase: County Level

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

3. Clinics & other Primary Health Facilities:

- Include clinics and primary health facilities into the all over system

Timeframe

The implementation of the vision is based on fundamental changes and improvement of the current HCWM system. Therefore, this HCWMP is aimed at implementing the first steps within a period of 2 years. After two years the plan has to be revised and upgraded.

11.2 The HCWMP 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 standardized basis. The following standards and safety operation procedures shown in Table 6 below must be developed and implemented:

Table 6: Procedures for Healthcare Waste Management.

Guidelines	Description
Internal Healthcare Waste Management	• Standards on HCW segregation and HCW streams • Standards on HCW collection and internal transportation • Standards on HCW interim storage
External Processes of Healthcare Waste Management	• Treatment of HCW (also applicable for on-site treatment within healthcare facilities) • Validation Procedures for the treatment of waste • Guideline on external transportation of HCW • Certification Procedure for external transport entities • Guideline on Safe Disposal of HCW
Monitoring	• Monitoring guideline for Environmental Hygiene Management Commission and National Institute for Hygiene and Epidemiology (Collection, Transport, Storage, Treatment, Training, Documentation) • Evaluation sheets for internal audits inside the Healthcare facilities • Template for record keeping for waste amounts.

Accidents and spillages Response	• Guideline and procedure on how to collect accidents and incidents occurring in healthcare facilities and related activities like storage transport and treatment • Template for incident report form.
Capacity Development – Education	• Concept for training and awareness building • Curriculum and certification system for training activities
Reporting & Documentation	• Development of Transport documents (transfer notes…) • Report guide line for yearly report of healthcare facilities • Report guideline for yearly report of Environmental Hygiene Management Commission and National Institute for Hygiene and Epidemiology • Report guideline for yearly report of MoH

11.3 HCWMP Components for Financial Allocations

In order to implement this HCWMP, it is necessary for policymakers and those in decision-making positions to appreciate the need for financial allocation to the management of HCW based on plans, which have been developed, budgeted, discussed and further approved by the institutions responsible for the implementation of this HCWMP – MOH/NPHIL.

The areas that will need financial allocation include;

i) Investment on waste handling facilities, e.g. waste storage areas or refuse transfer stations, incinerators and fencing off the waste handling site.

ii) Fuel for operating on-site incinerators.

iii) Capital Investment cost – for the purchase of equipment such as;
- trolleys, trolley bins,
- waste bins,

- weighing scales for weighing waste generated on daily basis in the hospitals or health centers,
- Workers' personal protective gear (helmets, plastic goggles, respirators, heavy duty gloves, gumboots, overall and aprons).
- shovels,
- steel rods for poking the fire,
- brooms,
- Waste-ash-buckets for use at the refuse storage areas, incinerator and final waste disposal area.

iv) Maintenance cost – to maintain HCWM equipment such as:
- Repairing incinerators, and replacing them as they become obsolete.
- Repairing and replacing trolleys and trolley bins,
- Performing regular maintenance for the building structures and fences that surround waste management storage and treatment areas.

v) Operating cost – for the purchase of consumable materials required for daily implementation of good segregation practices which include;
- Safety boxes for sharps,
- Bin-liners of different colors and sizes for different waste generation areas.
- Stickers for labelling waste.

vi) Funds for contractual services for out sourced waste from the facility and cleansing services.

vii) Meeting transportation cost within the facility or to the waste treatment sites.

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Appendix 1

TERMS OF REFERENCE (TOR)

TO

DEVELOP HEALTHCARE WASTE MANAGEMENT PLAN

TO SUPPORT THE IMPLEMENTATION OF THE INSTITUTIONAL FOUNDATIONS TO IMPROVE SERVICES FOR HEALTH (IFISH) PROJECT

1. Introduction

The Government of Liberia has received funding from the World Bank to implement the INSTITUTIONAL FOUNDATIONS TO IMPROVE SERVICES FOR HEALTH (IFISH) Project. The overall objective of the project is to improve health service delivery to women, children, and adolescents in Liberia. The project will build on the ongoing quality improvement and resilience-building activities implemented by the WBG and GFF, particularly in the post-EBV period. Specifically, the project will support completing, operationalizing, and improving the efficiency of the new Redemption Hospital in Caldwell, Montserrado County as well as construction and equipping of Phase 2 of the Redemption Hospital to ensure an efficient hospital for the entire population, with a continued focus on women and children. The project will also provide continued (selected) and conditional support to undergraduate and post-graduate training to ensure that essential skilled human resources are available to improve health outcomes.

The project is designed to be implemented through the following components:

***Component 1. Improved service delivery*:** This component will support the following activities: ***Operationalizing new Redemption Hospital Phases 1 and 2*:** This will support the design, construction and supervision for Phase 2, and equipment procurement and installation for both Phases 1 and 2 of the new Redemption Hospital.

- ***Enhancing human resource skills in select areas*:** To enable quality health services to be delivered at all levels, qualified skills and personnel are required. A request has now been made by the University of Liberia, representing the A.M.D. Medical College and LCPS, to further provide financing for a period of five years (2020-25) to address a financing gap for continuing the undergraduate support and an additional 48 post-graduates in the four specialties described above, and 19 post-graduates in other specialties.
- ***Building on and scaling-up the successes of primary and hospital PB:*** The project would expand its support to selected primary care and hospital level services through PBF to enable the focus on key health outcomes for women, children and adolescents that would complement and be supported by the institutional strengthening DLIs.
- ***Support to the national Community Health Assistant Program.*** The project would support the

Community Health Program in selected counties by financing the incentives provided to the Community Health Assistants (CHA). The CHAs would be specifically monitored for reporting of agreed indicators that would improve the quality of antenatal and postnatal care and follow-up in the community, including the link between the community and health facilities.

- ***Supporting improved access to adolescent health care through community-based interventions:*** Selected interventions would be financed by the project to support the longer-term objective of contributing to reduced teenage pregnancies and maternal mortality. This will support contracting an experienced non-governmental organization to enhance community engagement and behavior change (learning from the Sahel Women's Empowerment and Demographic Dividend Project - SWEDD) towards teenage pregnancy and appropriate health care.
- ***Ensuring basic quality of service delivery through increased availability of essential drugs/supplies:*** The project would finance, in collaboration with other partners, any urgent need to procure and provide selected drugs and supplies required to save lives of mothers and neonates (oxytocin, misoprostol, magnesium sulphate, intravenous antibiotic for mother and newborn, intravenous fluids, oxygen and blood).

Component 2. Institutional strengthening to address key binding constraints: This component will finance the following activities:

- **Enhanced and reliable data availability and evidence-based decision making***:* Reliable and timely data availability or evidence-based decision making to enable effective service delivery is unsystematic and weak. There is limited accountability in data reporting and where data exists, it is often partial or outdated. This sub-component would incentivize to improve the current lack of regular availability of robust data.
- **Effective supply chain management***:* This proposed component would aim to work with the donor partners currently supporting to strengthen management systems to support the reach of drugs and supplies to the last mile, including family planning and reproductive health commodities. The donor support includes – strengthening procurement management and forecasting, improving Inventory management and logistics, warehousing - accessibility, security, stock management, information systems.
- **Improved human resource management***:* This proposed component would support MOH's development and implementation of an effective human resource strategy and performance management system. This would include addressing critical inefficiencies in the current system that impact on the effectiveness of service delivery and the motivation and accountability of staff.

- **Improved adolescent health (with focus on girls) as measured by specific marker indicators**: This sub-component would support MOH to provide inputs and monitor the Female Health Counsellors that would be recruited through the Bank's Education project in high schools in Liberia, to enhance the sexual and reproductive health knowledge and behavior of adolescents in school, and monitor and support girls who drop-out because of a pregnancy.
- **Strengthened citizen engagement***:* This sub-component would strengthen community and citizen engagement by improving their access to information and capturing their voice and feedback will improve state responsiveness in addressing constraints to access. Improved accountability will help encourage service providers to "supply" the services for which they are responsible.

Component 3. Project Management. This component will be financed using regular IPF parameters and would include administrative support to the Project Implementation Unit, including contractual specialists and administrative supplies. It would also include support for financing the independent verification agency/organization for DLI verification.

2. Objective

The operation of the New Redemption will generate healthcare waste that will need to be managed to safeguard the environment and public health. Improper management of healthcare waste poses a significant risk to patients, healthcare workers, the community and the environment. Considering this, a Healthcare Waste Management Plan (HCWMP) that is appropriately costed with clear institutional arrangements for its execution is required during operation phase of the New Redemption Hospital. The objective of the assignment is to develop a HCWMP which when implemented will ensure proper health and environmentally sound, technically feasible, economically viable, and socially acceptable systems for management of healthcare waste generated during operation of the New Redemption Hospital.

The Specific Objective of the assignment include:

- Identified the existing practice and problems of healthcare waste management in healthcare facilities.
- Review and Update the National Health Care Waste Management Plan (HCWMP) incorporating strategic short, medium, and longtime plan for the development and implementation of the HCWMP for the Redemption Hospital including other health facilities to be identified.
- Identify the appropriate approach and technology for effective and sustainable management of the Health Care Wastes generated from the Redemption Hospital and other health facilities to be financed by the project.
- Investigate and outline potential sources of revenue for the handling of all the healthcare wastes at the facility which include generation of wastes, transportation of waste, management of wastes and disposal of wastes.

- In addition, continue education and awareness and campaign to the local community and its environment. Provide suggestion if necessary for private sector involvement for safe disposal of waste and handling.

3. Scope of the Study

There is an existing National Healthcare Waste Management Plan developed by the Government of Liberia. The Consultant is expected to update the current HCWMP to develop a facility specific HCWMP for Redemption as annex and that incorporates the principles and objective of the National HCWMP. This will require review of relevant documents including, but not limited to, the National HCWMP, the Project Appraisal Document, the project Environmental and Social Management Plan, relevant Environmental and Social Standards of the World Bank Environmental and Social Framework, national environmental laws, policies and guidelines, national healthcare wastes management procedures and guidelines, and GIIP such as WHO HCWM guidelines, the National Environmental Health and WASH Package for healthcare facilities. The Consultant is also expected to undertake stakeholder consultation as appropriate.

The Consultant will undertake the following specific tasks:

Task I: Review of Policy, Legal, Administrative Framework and Baseline Data

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

(ii) Review and analyze existing healthcare waste management practices including storage, collection and disposal systems with emphasis on the level of separation, the frequency of collection; and environmental and health impacts for existing treatment options.

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

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

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

Task II: Determination of Technology and sitting Facility

For the types and quantities of health care waste generated during the operation of the New Redemption Hospital, assess alternative technologies and facility sizes for treatment and destruction. The assessment shall compare the alternatives based on capital cost, operating cost, ease of operation, local availability of spare parts, local availability of operational skills, demonstrated reliability, durability, and potential environmental impact. The technologies to be considered include, but not limited to, safe land filling, incineration, sterilization (Autoclave and Microwave) and Chemical disinfections. Based on this assessment, recommend a process flow for economic and environmentally sound treatment and final disposal of healthcare waste leading to selection of appropriate technology.

Task III: Training, Public Awareness, and Capacity Building Program

Review existing training and public awareness programs on healthcare waste management at national level to identify gaps in existing program and recommend training, awareness and capacity building initiatives for effective implementation of the HCWMP.

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

Task IV: Infection and Prevention Control Measure

During the operation of the facility, infection control and waste management plan will be detailed and address the following key environmental and social risk associated with the Redemption Hospital and its mitigation measure. The following will be address during this period: risk during management of medical waste; risk due to improper healthcare waste management; risk associated with incineration of waste. Other essential plan that should be incorporated into the HCWM document include but not limited to plan for mitigation of waste associated with the functional of the hospital, responsibility for the implementation of the plan and the use of personal protective equipment (PPE) and infection prevention practice.

4. Output/HCWMP

The final output, at a minimum, is expected to address specific healthcare waste management issues, mitigation measures and monitoring activities related to the operation of the New Redemption Hospital. A specific HCWMP for the proposed Redemption Hospital is expected to include expected amount of waste to be generated, roles and responsibilities, waste minimization, waste segregation (appropriate guidance on color code, waste categorization etc.), waste pre-treatment on-site (where applicable via autoclave etc.), in-site and of-site waste transport, of-site waste disposal, OHS, trainings, community health and safety, cost, and timeline, and monitoring etc. according to national requirements and GIIP (such as WHO HCWM guidelines). The report should include at least the following sections:

(i) Executive Summary

(ii) Introduction/Background (including project description)

(iii) Baseline Data

(iv) Policy, Legal and Administrative Framework

(v) Potential Environmental and Social Impacts and Proposed Mitigation Measures

(vi) Healthcare Waste Management Plan, Costs, and Responsibilities

(vii) Training, Awareness and Capacity Building Plan
(viii) Monitoring and Evaluation Plan

(ix) Appendices

- List people consulted
- References
- Record of Inter-agency / forum/ consultation meetings

5. Consultant Qualifications and Experience

The Consultant is required to have the following minimum qualifications and experience:

(i) The consultant should have at least a master's degree and a minimum of 4 years' experience with technical competence in health, environmental and engineering fields. Competence in sanitary engineering will be an asset. Competence in private sector participation field and skills in training and institutional strengthening is desirable.

(ii) The Consultant must have demonstrated experience in developing HCWMP or similar documents (including ESMP and ESIA) for Bank-financed project either locally or internationally.

6. Deliverables and Reporting

I. The Consultant will prepare and submit to the project coordinator of IFISH, an Inception Report, including a work plan and implementation schedule, the methodology of carrying on the assignment, within one week of award of contract.

II. Conduct specific field visits and meetings to the targeted teams and facility for stakeholders inputs and reviews

III. The Consultant will submit a draft HCWMP within four weeks of the award of contract and revise the draft report to incorporate comments of the World Bank, the Government and other interested parties and submit a Final Report incorporating all changes and modifications required to the Project Coordinator of IFISH within six weeks after award of contract. The assignment will be considered completed only after final clearance of the report by the MOH through its Project Implementation Unit and the World Bank. The assignment should be completed within six weeks after award of contract.

7. Programed of work

Activities	**Timeframe (Days)**
Preparation and inception report	7 days
Field visit and stakeholder engagement	7days
First Draft report	14 days
Review from the WB	7 days
Revised and final Report	7 days

Appendix 2

Type of Facility	Name of Facility/Office	Persons(s) Consulted
Ministry of Health/NPHIL	NPHIL/MOH	Jane MaCauley; Dehwehn
		Yeabeah; Jefferson Dahnlo
Lofa County	County Health Officer	John Doedeh
Bong County	County Health Officer	Henry Sackie
Sinoe County	County Health Officer	Darius Geeplah; Stephen Jekeh
County Hospital	Redemption (Montserrado)	Fasia MaCauley; Blackie Smith
County Hospital	Phebe (Bong)	Jefferson Sibley; Alberto Phyne
County Hospital	C. B. Dunbar (Bong)	Kelvin Keytue
County Hospital	Jackson F. Doe (Nimba)	Abraham Jusuf; Eric Flomo
County Hospital	Curran (Lofa)	Blama Sirleaf; Samuel Seegbeh
County Hospital	Jallah Lone (Gbarpolu)	Peter George; Massa Massaquoi
County Hospital	St. Francis (Rivercess)	Deborah Mambu; Makasia Sackor
County Hospital	F. J. Grant (Sinoe)	Alvin Gray; Roselyn Togba
	Gbarpolu County	
Clinic	Bambuta	Marie Gaye; Samuel Zinnah
Clinic	Fasama (Bade)	Steven Barnes
Clinic	Gbangay	Joshua Towoah
Clinic	Gbarma	Gbeh Tweh
Clinic	Gbaryamah	Elizabeth Samukai
Clinic	Gokallah	Ida Jerboe
Clinic	Henry Town	J. Mulbah Nakamue; Morris Metteh
Clinic	Kondesu	Anhony Tamba
Clinic	Kungbor	Mssa Massaquoi
Clinic	Tarkpoima	James Flomo
Clinic	Totoquelle	Tenneh Manjae
Clinic	Yangaya	Avis Tamba; Sieleaf Johnson
Clinic	Kpayeakwelleh	James Janyan
Clinic	Weasua	Korpo Jallah; Brima Kromah
	Rivercess County	
	County Health Team	Andrew Tweh
Clinic	Boegeezay	T. Nathaniel Benson; Eunice Josiah
Clinic	Charlie's Town	George Cee; Olivia Doe
Clinic	Dorbor	Clara Mandeh; Simeon Doe
Clinic	Gbediah	Konah Flomo; Joanna Boeyon
Clinic	ITI	Catherine Sangar; Sam Flody
Clinic	Kayah	James Clarke
Clinic	Larkpasee	Lydia Moore; Catherine Dunwillie
Clinic	Neezuin	Nancy A. Borlay
Clinic	Sahyah	Shannis Fanciah; Stephen Johnson
Clinic	Timbo Compound	Mercy
Clinic	Bodowhea	Emmanuel Jackson
Clinic	Gblosseo	Charlsetta Johnny; Charles Toby
Clinic	Gozohn	James Glaygbo; Sophia Gbah

Type of Facility	Name of Facility/Office	Persons(s) Consulted
Clinic	Kangbo	James Gaysaynee; Mary Gbelee
Clinic	Kploh Community	Emmanuel Zaizay; Nyeedeh Kangar
Clinic	Open Bible Society Mission	Watchen Johnson; Martha Faah
	Sinoe County	
Clinic	Butaw	Kaifala Sheriff; Sylvester Broh
Clinic	Diyankpo	Beatrice Sneh; Roland Dormoh
Clinic	Doodwicken	Prince Fiah
Clinic	Drapoh	George Worjloh
Clinic	Edward Memorial	
Clinic	Elizabeth Nyanti Institute	Zora Peters
Clinic	Grigsby Farm	Melchizedek Jallah; Solie Lombeh
Clinic	Jacksonville	Abraham Dugbeh; J. Newton Klaybor
Clinic	Jokoken	Wisdom Tulay
Clinic	Juahzon	Austin Doepoh
Clinic	Kabada	Susannah Jennoe; Isaac Dari
Clinic	Karquekpo	Framces Funnebo; Thomas Gbe
Clinic	Menweh Walker	Mafau Fofana; Augustine Saylee
Clinic	Panama	Christpher Togba; Melvon Geleplay
Clinic	Payne Town	Evelyn Smith
Clinic	Roselyn Toe Massaquoi	Theresa Kanwea
Clinic	Saywon Town	Stephen Pion; Patrick Nyeswah
Clinic	Togbaville	Jefferson Neuwon; Marie Borbor
Clinic	Tubmanville	Wilfred Tarpeh; George Worjloh
Clinic	Tuzon	Rebecca Garduoslein; Christopher Smith

Appendix 3

Ministry of Health
Republic of Liberia

Healthcare Waste Management Program

MANIFEST DOCUMENT

A. Transporter of Waste

Name:_____ Address:_____
Telephone No.:_____ Accreditation No.:_____

Type of Waste Transported:_____ Quantity (kg):_____

B. Medical Facility Collected From

Name:_____ Address:_____
Telephone No.:_____

Daily Load No.:_____ Date of Collection:_____
Contact Person:_____

C. Waste Treatment Facility

Name of Treatment Facility:_____
Address:_____
Name of Manager/Authorized Representative:_____
Telephone No.:_____

Signature of Manager/Authorized Representative:_____
Date Received by the Treatment Facility:_____

Appendix 4

Ministry of Health
Republic of Liberia

Healthcare Waste Management Program

WASTE DEPOSIT FORM

A. Incinerator Operator

Supervisor:_____ Telephone No.:_____

Date	Waste Category	Quantity	Source	Transporter