Sierra Leone

HIV/AIDS Response Project (SHARP)

&

Health Sector Reconstruction and Development Project (HSRDP)

Waste Management Plan

OCTOBER 2002

By

John Tommy

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<td>ADA</td>
<td>Area Development Association</td>
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<td>Community Based Organisation</td>
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<td>District Health Management Team</td>
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<td>NMCP</td>
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<td>OCHA</td>
<td>Organisation for the Coordination of Humanitarian Assistance</td>
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Preface
This Waste Management Plan (WMP) is prepared in accordance with the requirement of the World Bank for the Sierra Leone HIV/AIDS Response Project (SHARP) and Health Sector Reconstruction and Development Project (HSRDP). This plan is intended for both projects.

This plan is prepared as a guideline for all those involved in the implementation of SHARP and HSRDP, this includes primarily the Ministry of Health and Sanitation (MOHS), National HIV/AIDS Secretariat (NAS), Health Sector AIDS Response Group (ARG) local and foreign NGOs and the private sector who would participate in the implementation of the projects, especially the SHARP. It describes the general waste management issues (with particular emphasis on healthcare waste) in Sierra Leone, objectives and implementation strategy for all institutions and persons to be involved and available inputs and resources to successfully implement the plan in an efficient and effective manner over the next 5 year period.

The content of this document is subject to change during implementation depending on the implementation experience, problems faced and changes in strategies. However, amendments/additions to the document will be subject to the MOHS, NAS and the World Bank's agreement.
2. Executive summary

The medical waste study (November 2001) established the need to for a comprehensive waste management plan for Sierra Leone.

Healthcare waste is total waste stream from Healthcare-Waste (HCW) generators, major and scattered sources. It may be solid (hazardous or non-hazardous) or liquid.

SOLID WASTE - Typically composed of,
1. 75-90% is general waste similar to domestic waste and may follow the normal municipal waste stream.
2. 10-25% is hazardous (infectious, toxic, etc) and must be segregated and treated with care to prevent associated risk. This category of waste can be subjected to incineration under supervision by trained staff.

Presently these categories are mixed together and disposed of indiscriminately. The resultant negative consequences cannot be overemphasised. Hence, there is need for this Comprehensive National Medical Waste Management Plan for Sierra Leone.

This action plan for all levels, from chiefdom to national is part of the Sierra Leone Government’s process of developing a HIV/AIDS Response Project (SHARP) and a Health Sector Reconstruction and Development Project (HSRDP). It was executed on behalf of the Ministry of Health and Sanitation, Sierra Leone.

Current situation
From a health and environmental point of view, the following summarized problems were identified.
- Lack of policy, legal framework, guidelines and effective control
- Lack of focused health education and staff training, concerning waste management, particularly medical wastes.
- Deficiency of appropriate equipment and materials.
- Unhygienic handling of wastes within hospitals, posing a threat to health of personnel, patients and visitors.
- Improper handling of wastes by waste handlers, exposing these wastes to scavengers, and causing a serious threat not only to their own health but also to that of the general public and the environment.
- Open dumping and or burning.

Plan of implementation
1. Advocacy at national level to ensure government commitment and financial support,
2. Train staff of the environmental health division in supervision,
3. Develop modules for training; the prevention of Nosocomial infections and healthcare waste management,
4. Training of Trainers (TOT) for all levels,
5. Organize training at District and Chiefdom levels for healthcare workers on the risk associated with Nosocomial infections and the preventive measures,
6. Organize training at District and Chiefdom levels for waste-handlers.

Strategies
- Strengthen the Clinical Waste and Occupational Safety Unit of the EHD
- Advocacy at national level to secure government commitment.
- Develop a national policy and regulatory framework on waste management
- Integrate waste minimization into national purchasing policies.
- Make instruments to develop plan of action with practical targets and budget for the health institutions.
- Develop educational materials and training modules
- Organize training at District and Chiefdom levels for healthcare workers and the community on the risk associated with healthcare waste and safe management practices, with priority for waste-handlers;
- Make available the materials to facilitate medical waste management.
- Ensure that all healthcare establishments segregate their waste into harmful and non-harmful categories;
- Ensure that all healthcare establishments implement safe handling, storage, transportation, treatment and disposal options;
- Include healthcare waste management and prevention of Nosocomial infection into the training curricula of Nurses, Public Health Inspectors, Community Health Officers and Doctors;
- Ensure routine monitoring of impact through process indicators.

Key partners in the implementation of this plan include but not limited to: Ministries of Health and Land, Housing, and the Environment, non-governmental organizations, and waste producers. The target groups are health workers, medical waste handlers, scavengers, municipal waste handlers, managers of healthcare institutions and the general public.

The EHD of MOHS has the statutory responsibility for the safe management of waste (including medical) nationwide. Presently, medical wastes are mixed with municipal waste and disposed of indiscriminately. The existing system of municipal waste collection (public skips and skip trucks) in Freetown has been appraised (Freetown Waste Management Study, June 1995) as economical. It should be improved and elaborated to ensure the safe management of healthcare waste and replicated in the Districts.

A combination of both sanitary landfill and incineration is considered for the comprehensive waste (municipal and healthcare) treatment and or final disposal option for the Sierra Leone situation.

*New land will be acquired for purposes of District landfill sites development; hence involuntary resettlement of relocated socio-economic activities (farming, societal bushes etc) is possible. Consequently compensation will be inevitable. There is no national policy on involuntary resettlement, however, HSRDP is developing one for Sierra Leone, which can be of benefit to this project.*

3. Introduction
3.1 The country (post-conflict situation)
The ten-year old conflict (1991 to 2001) has been accompanied by a deterioration of the health status of majority of Sierra Leoneans. The Human Development Report, July 2000, estimates a life expectancy of 37.9 years. Sierra Leone ranks last in the world in quality of life with a per capita income of US$448.

The healthcare delivery system is divided into National, District, and Chiefdom levels. The epidemiological picture is characterised by a high prevalence of communicable diseases like malaria, respiratory tract and skin infections. There is an explosion of sexually transmitted infections, and data trends suggest an emerging epidemic of HIV/AIDS. According to Ministry of Health and Sanitation sources, over half the healthcare facilities country-wide do not function due to a variety of reasons that include damaged infrastructure, lack of staff, lack of drugs, and medical supplies. The Ministry of Health and Sanitation expects that the thrust of their activities for 2002 will be targeted at rehabilitating the devastated healthcare services, and extending them to newly accessible areas countrywide.

Large and small healthcare facilities, home healthcare, drug users, as well as research and industrial operations generate medical waste. It presents a high risk to human health and the environment because of the hazardous and infectious characteristics of some of its components. The patients and the personnel who handle the waste inside share these risks. Outside the healthcare establishments, the risks are increased due to the non-homogenous nature and the presence of sharp objects such as syringes and scalpels; blades or broken glass that may cause infected injuries. Please see Annex 1 (Tables of Healthcare Facilities in Sierra Leone).

3.2 Sierra Leone HIV/AIDS Response Project (SHARP)
The Sierra Leone HIV/AIDS Response Project will assist the Government of Sierra Leone organize a response to the growing Human Immunodeficiency Virus (HIV) which causes the Acquired Immune Deficiency Syndrome (AIDS), in short HIV/AIDS. In accordance with the main goal of the SHARP the development objectives of this four-year project in Sierra Leone are to (a) contribute to reducing HIV/AIDS prevalence and (b) mitigate the impact of HIV/AIDS on persons infected or affected by HIV/AIDS. It will do so through a multi-sector approach, facilitating activities undertaken in various sectors by public and private organizations, and by communities in the fight against HIV/AIDS. Project-supported activities will complement government, donor, and private sector initiatives. These activities will vary by sector and the specific partner, but will be consistent with the national policy against HIV/AIDS, and premised on the development and expansion of local responses to the epidemic.

In collaboration with other members of the International Partnership Against AIDS in Africa (IPAA), the project will help step up and mainstream the national response against HIV/AIDS, and an array of related infections, including sexually transmitted infections (STIs), Tuberculosis (TB), and other opportunistic infections. The Government of Sierra Leone (Ministry of Development and Economic Planning), UN Theme Group on HIV/AIDS and regional officials of UNAIDS worked closely in the development of this effort and see it as an integral part of the common effort. Thus the project will address HIV/AIDS prevention, care, and support, as well as impact mitigation at the national and sub-national levels. Emphasis will be on prevention among youth, women of child-bearing age, orphans and other vulnerable children, and groups that are particularly vulnerable to HIV/AIDS, including sex workers, the military and ex-combatants, internally displaced people, and refugees.

The proposed project will finance the full spectrum of HIV/AIDS activities including prevention, care, support, and impact mitigation over a four-year period. It will have four components: (1) capacity building, policy coordination and refugee activities; (2) multi-sector responses to HIV/AIDS prevention and care; (3) health-sector responses to HIV/AIDS, STI/TB and other opportunistic infection management, including prevention, care, and support; and (4) civil society initiatives (including communities, NGOs, religious groups and the private sector). These activities will take into account the existing conditions and level of capacity at each administrative structure (national, regional, district, and chiefdoms).

3.3 Health Sector Reconstruction and Development Project (HSRDP)
The project's overall development objective is to help restore the most essential functions of the health delivery system. The project will also help achieve the more specific objectives of:

(a) Increasing access to affordable essential health services by improving primary and first referral health facilities in four districts of the country.
(b) Improving the performance of key technical programs responsible for coping with the country's major public health problems.
(c) Strengthening health sector management capacity to improve efficiency and further decentralize decision-making to the districts.
(d) Supporting development of the private health sector and involvement of the civil society in decision-making.

The first specific objective is limited in scope to the four Districts, which met specific selection criteria (such as importance to the demobilization, resettlement and peace processes; magnitude of the public health problems; clear need to rehabilitate the delivery of services, etc.). Within these four districts, the project focuses on the rehabilitation of priority health facilities, and on support for the delivery of affordable and good quality care by all health facilities of these districts. Through its second specific objective, the project will contribute to reducing the burden of the most important infectious diseases countrywide (i.e., by supporting Malaria, and TB control activities and the Sanitation program). The third specific objective aims to improve efficiency and make decisions in the health sector more responsive to the needs of the population by supporting district health teams country-wide and five key services of the MOHS (i.e., Human Resources Development; Planning, Monitoring and Evaluation; Financial Management; Procurement; and Donor and NGO coordination). The fourth specific objective will improve the quality of services by enacting legislation promoting the private sector, providing incentives to the health providers to establish practices in rural areas and smaller cities, contracting out clinical and non-clinical services with the private sector, and by involving the civil society in decision making in the health administration and in health facilities.

3.4 Project Description
Within the SHARP Project, this study aims to address the Healthcare waste management in Sierra Leone, under the following specific tasks,

Task I:
- Assess the policy, legal, Administrative, as well as the Regulatory Framework concerning health-care waste management and treatment/destruction facilities in Sierra Leone;
- Identify functioning healthcare facilities under Government authority in the country and provide basic information for each facility, such as number of beds, bed occupancy rate, divided into categories: national hospitals, regional hospitals, municipal hospital, military hospitals, private clinics and laboratories, and secondary health-care facilities.
- Assess the healthcare waste generation at (i) Connaught hospital (ii) one major regional hospital (iii) one district hospital, and (iv) one private clinic. To the degree available, details should include the minimum weight of total generated waste at each healthcare facility per week. Composition of the waste should be determined through segregation at the waste end point. Provide an extrapolation of the results to cover the entire country based on agreed assumptions.
- Assess the level of scavenging, recycling taking place inside healthcare facilities; along transportation routes, and at final disposal sites. Identify social issues in relation to scavenging taking place.

Task II:
- Review existing training and public awareness programs on healthcare waste management in hospitals, other healthcare establishments and municipalities and prepare training needs assessment. This would be based on discussions with relevant authorities and personnel to incorporate their views and concerns. Working in conjunction with the relevant Government institutions and municipal councils, prepare a draft-training programme for health-care institutions and municipal councils.
- Taking into account the IEC/BCC HIV/AIDS strategy work being developed under Sierra Leone HIV/AIDS Response Project and other IEC/BCC efforts, suggest themes and modalities for
HIV/AIDS/STI waste awareness campaign programme to reach the general public, health-care workers, dumpsite managers, military personnel, scavengers/pickers families and street children.

Task III:
- Review existing waste management technologies and discuss alternative technologies; storage, transportation, treatment and or final disposal.

Task IV:
- Discuss appropriate waste disposal sites

3.4.1 Methodology
For the purpose of data collection, the following selected health-care facilities were investigated. (1) Connaught hospital (main referral hospital), (2) Port Loko district hospital, (3) Moyamba district hospital, (4) Bo district hospital, (5) Kenema district hospital, (6) George Brook Community Health Centre, (7) Macauley Street Satellite Clinic, and (8) the Brookfield community hospital (Private).

To provide basic data for the study, the following activities were performed:
- Assessment of existing policy, legal, administrative, as well as the regulatory framework concerning health-care waste management and treatment/destruction facilities.
- A survey on generation, collection and disposal of health-care wastes, and the Knowledge, Attitudes and Practices (KAP) of relevant staff concerning hospital waste management from seven-selected health-care facilities was executed. The selected health-care facilities were (1) Connaught hospital (main referral hospital), (2) Bo district hospital, (3) Port Loko district hospital, (4) Moyamba district hospital, (5) Kenema district hospital, (6) George Brook Community Health Centre, (7) Macauley Street Satellite Clinic and (8) Brookfields community hospital (Private).
- Meetings with concerned authorities and hospital officials were held with the following programme. (a) Discussion of the structure of the Ministry of Health and Sanitation with specific reference to Hospital Waste Management. (b) Current management of waste inside the health facilities with special emphasis on equipment, regulations and training of personnel. (c) Current management of hospital waste outside the hospital, focusing on storage places, transportation and disposal.
- Meetings were organised with health authorities, municipal councils, community leaders, heads of healthcare training institutions, military and police personnel: (a) to discuss develop a training assessment programme and (b) to determine IEC/BCC messages and the most suitable modalities for communicating such messages.

3.5 Health Care Waste Management (HCWM) policies practice and challenges

3.5.1 Policy, Legislations and Control
The Ministry of Health and Sanitation has the executive authority for waste management, inside as well as outside the healthcare facilities, in Sierra Leone. The Environmental Health Division of the ministry currently has the direct responsibility of waste management in the country.

Presently, a “Legal Unit” does not exist within the ministry to formulate, promulgate and implement new legislation for the handling and disposal of health care wastes.

There is currently no policy on healthcare waste management in Sierra Leone. However, the ministry’s Environmental Health programme has developed a draft Environmental Health policy as an addendum to the existing National Health Policy. Section 3 of the draft policy deals with sanitation of healthcare facilities in general, and clinical waste management in particular. It states “clinical waste are special and should be separated from other rubbish, protected from foraging animals (including humans) and vermin and properly disposed of at a convenient distance from the health care establishment”.

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The draft policy list as goals:
1. Constant maintenance of special care and concern for clinical wastes,
2. Effective destruction of all clinical wastes.

The priorities set are as follows:
1. All discarded human and animal tissues should be effectively buried deep in the earth daily.
2. All health care institutions should identify a site for incineration of all clinical wastes.
3. Such sites should be at a distance so that fumes, smoke and other toxic gases do not pose health hazards to the persons working at or using the services of the facility or those staying in the vicinity.
4. Clinical wastes, including human tissues, discarded dressings, used syringes, needles, blades etc., should be protected from foraging animals and vermin.
5. Such special concern should be manifested in all areas of health care institution/office.
6. Once a day, or at other regular intervals not longer than once a week, the collected material should be properly disposed of.
7. Expired drugs should be returned to the Directorate of Drugs and Medical supplies for efficient technical destruction.

With regard to existing laws, the topic of safe healthcare waste management is not specifically dealt with in either the Public Health Ordinance Act No. 23 of 1960 or the Environmental Protection Act No. 2 of 2000, now in force. However, the Public Health Ordinance specifically deals with the control of infectious patients and the materials associated with them. Sections 44 and 45 of the ordinance make provision for temporary and permanent isolation accommodation of infectious patients for the following reasons.

- To control the movement of patients in order not to spread the infection through their coming into contact with healthy persons.
- To control any waste matter produced by the infectious patients.

Section 50 (1) specifically deals with premises, clothing, bedding, etc., that are infected by an infectious disease patient. It reads:

"Subject to the provision of Section 57, a Medical Officer of Health, being aware of, or reasonably suspecting, the presence of a notifiable disease in his area, may by notice in writing order the evacuation, disinfection, fumigation or demolition of any infected premises or any premises reasonably suspected of being infected; or the disinfection, fumigation or destruction of such articles, including bedding and clothing, as he may suspect as infected.

Provided that no premises shall be demolished unless they are of temporary construction, or are so dilapidated, or in such disrepair that efficient disinfection is impracticable”.

The Environmental Protection Act, like the Public Health Ordinance does on specifically deal with healthcare waste. However, Section 2 makes provision for the establishment of an Environmental Protection Board, Section 34 deals with Environmental standards and states that the Minister may by statutory instrument make regulation establishing national environmental standards for waste amongst others.

Also Section 35 which deals with Toxic and hazardous substances makes the following provisions:

(1) The Minister may on the advice of the Board prescribe activities or substances, which shall be considered hazardous.
(2) The Minister shall take all necessary and appropriate measures to monitor, control and regulate the manufacture, sale, transportation, handling or disposal of toxic and hazardous substances, including toxic and hazardous wastes.

(3) The introduction or importation of toxic or hazardous wastes into Sierra Leone for storage or disposal by any means whatsoever is prohibited.

(4) The possession, introduction or importation into Sierra Leone of internationally banned chemicals or substances is prohibited.

(5) The discharge of any toxic and hazardous substance into the air or in, or under the land and waters of Sierra Leone is prohibited.

(6) Any person who contravenes the provisions of subsection (3), (4) or (5) commits an offence and is liable on conviction to a fine not exceeding two million leones or to a term of imprisonment not exceeding two years or to both the fine and imprisonment.

The Environmental Protection Board, which is Multisectorial, has recently been established in the Ministry of Lands and the Environment.

There are yet no other laws, bylaws or regulations dealing with healthcare waste management in Sierra Leone. In the same manner, there are no proper control systems for hospital waste management.

A survey executed in eight selected healthcare facilities in Sierra Leone revealed that the Ministry of Health and Sanitation does not exercise full control over non-governmental or private hospitals. Likewise, in the hospitals themselves no internal regulations for the nursing and environmental health staff exists on how hygienically and sanitarily to identity and handle hospital-specific wastes.

3.5.2 Hygiene Standard of the Healthcare facilities
There is no organised and effective waste handling and disposal system in the healthcare facilities visited. However, with the exception of Port Loko hospital which practice open burning of its wastes, NGOs have introduced some form of waste segregation and treatment in all the other facilities visited by providing sharp boxes and plastic buckets for other infectious wastes, and low-scale incinerators. Unfortunately, these facilities are not properly and effective utilised. Mixed wastes can be seen in the plastic buckets and storage drums or open storage points outside the hospital.

All the facilities have malfunctioning water tanks, some out of order and not supplying water to the buildings, others too small or rusting. The septic tanks require a clean out and rehabilitation.
In cases where toilets (WCs and pit latrines) do not function, patients and visitors have to defecate in the hospital compounds.

Steps are now being taken to rectify this situation in the western area. A “Feasibility and Design Study” has been completed and tender documents for the rehabilitation works is currently in active progress. The African Development Bank is funding the rehabilitation of the three government hospitals (Connaught, P. C. M. H, and Children’s) plus five Community Health Centres (Cline town, Ross Road, Jenner Wright, Kissy, and Regent).

The new direction of the government healthcare delivery system focuses on the development of preventive services while simultaneously strengthening the existing health delivery system. Sanitary healthcare waste management is a very important preventive service.

3.5.3 Communicable Diseases in Sierra Leone
The last statistical National Medical report was published in 1983. There is hardly any centralised data collection, which can be used for decision-making purposes. Consequently, no statistical data of communicable diseases exist at present.
According to the Ministry of Health and Sanitation, the major causes of morbidity and mortality in Sierra Leone are infectious/communicable diseases, the most common of which are the following:

- Malaria
- Hepatitis
- Respiratory infectious
- Meningitis
- Diarrhoea, Cholera
- Typhus and Para typhus
- Tuberculosis
- Worm Infection
- Infectious skin diseases
- Poliomyelitis
- HIV/AIDS
- Measles

Most of these diseases can be transmitted by unhygienic waste handling, not only in the healthcare facilities amongst the patients and staff, but also in the surrounding community, if the waste is exposed openly to visitors, scavengers of waste and animals. To prevent and control these infectious diseases, effective and safe healthcare waste management is essential.

3.5.4 Existing Waste Management Practices

Inside the Healthcare facilities

The current hygiene standard of waste handling inside the visited HCFs is, compared with the international standard, very low and a cause of great concern. The wastes from the operating theatres, patient wards and laboratories are not collected in one-way receptacles such as bags or containers, but directly in waste or used cardboard boxes without any plastic bags placed within the receptacle to prevent its contamination as they are reused.

Due to the lack of regulations and control, the hazardous infectious wastes are disposed of together with the normal waste. There is no segregation of the waste in the patient wards, and syringes and needles are not separated either.

The interviewed nurses and cleaning staff in the visited hospitals showed very little knowledge of the risks which improper handling of hospital wastes constitutes to them and to the patients, and are not instructed and trained in this area.

After being collected in unsuitable receptacles, the infectious and hazardous waste is handled and transported in the hospital by untrained porters who bring them to general on-site treatment and disposal points or transfer area in the case of Connaught hospital. Therefore, the waste transporting personnel are also highly exposed to health risks.

The on-site storage and disposal areas are located inappropriately, with access for unauthorized personnel. Patients, visitors and animals have the possibility of coming in contact with dangerous items, as there is no effective and conscientious separation of infectious sharp or pointed articles.

In all of the HCFs visited, the lack of rules and standard procedures for regulating management of the waste generated could be observed. The interviewed hospital staff displayed only limited knowledge of the topic in hand, and the lack of standards, awareness, and proper allocation of resources subject both patients and HCF staff to otherwise avoidable risks. These risks take the form of:

- Use of inappropriate receptacles without lids and without bags.
- General lack of hygiene; failure to disinfect receptacles.
• Loose collection of disposable syringes with attached needles and other contaminated sharp objects.
• Complete lack of packaging materials for waste transportation.
• Internal transport of waste under unhygienic and unsanitary conditions.
• Improper disposal of hazardous radioactive waste.

3.5.5 Outside the Healthcare facilities
Off all the eight HCFs visited, only Connaught hospital and other government healthcare institutions in Freetown store their wastes in open public skips (dustbins) which are collected by EHD skip-trucks for off-site final disposal. This service is currently contracted in Freetown, Bo, and Kenema, supervised by the Environmental Health Division of the Ministry of Health and Sanitation (MOHS).

The staff employed to drive the vehicles as well as to manage the open dumpsites have neither the training nor adequate equipment to deal with waste of a hazardous nature, such as infectious HCF waste.

Wastes generated in the healthcare facilities are mostly stored in open drums or areas of MOHS container (Connaught) located within the compound. The storage places are not covered by a shelter or secured by a fence in any of the visited facilities.

The skip (Connaught) is the same as used for carting household waste with a volume of $5m^3$ slightly conical shaped and open. Due to the active prevalence of scavengers and animals, the contents were seen strewn all over the place. This is true of all the Healthcare facilities visited.

The container (Connaught hospital) is transported to the landfill site by a skip-truck without taking the precaution of covering the top. The potential danger of this situation cannot be over-emphasized.

At the open dumpsites, the content of these containers is dumped on the top together with the other municipal garbage. There is no specific location at the dumpsites for infectious waste, and there is no special treatment before or on arrival. The dumpsites are not restricted areas; scavenger activity is in evidence.

Apart from Connaught, all the other Healthcare facilities (7) visited use on-site facilities. They store their wastes in drums without tight-fitting covers; located outside the wards or dump their wastes either on the ground or behind the wards, or burn them either in pits or low-scale incinerators. It is not uncommon to find animals, scavenging in that unsanitary garbage. The drums are emptied either directly into the incinerators or on the ground nearby when the incinerators are either filled or non-functional.

Apart from Connaught hospital and George Brook Community Health Centre, all other HCFs visited have lined pits for the disposal of incinerator ashes. Unfortunately, save for Moyamba hospital, all the other pits are filled with all sorts of HCWs and are over spilling.

During the course of the survey, most of the health institutions reported that hospital wastes such as human body parts, placentas and deceased foetuses are routinely buried. This method of disposal is either done by the hospitals themselves on hospital premises or by relatives in certified burial sites such as cemeteries and is traditionally interned. However, noteworthy is the statement of a landfill supervisor that this type of waste also finds its way to the MOHS garbage containers.

The incinerators at all the visited HCFs, except at Port Loko District hospital which does not have one, show signs of deteriorations.

In summary, infectious and hazardous waste as well as human body parts are collected, transported and disposed off (on-site) together with common waste, exposing it to unauthorized persons and to animals at the storage, treatment (incineration) and disposal sites. Only in Freetown is medical wastes transported off-site to open dumpsites. All district facilities visited practice on-site waste management, which requires a lot of improvement in segregation, storage, transportation, treatment and or final disposal.
3.5.6 Water Supply and Sanitation

Healthcare waste is total waste stream from Healthcare-Waste (HCW) generators, major and scattered sources. It may be solid (hazardous or non-hazardous) or liquid

Solid Waste - Typically composed of,
- 75-90% is general waste similar to domestic waste and may follow the normal municipal waste stream.
- 10-25% is hazardous (infectious, toxic, etc) and must be segregated and treated with care to prevent associated risk. This category of waste can be subjected to incineration under supervision by trained staff.

Presently these categories are mixed together and disposed of indiscriminately. SHARP will initially provide incinerators for the four-SHARP District and has funded the development of this Comprehensive National Medical Waste Management Plan for Sierra Leone.

Sanitation - Liquid waste mainly composed of,
1. Used water (Sullage) which are presently led into open drains that ends in either soak-away pits or nearby grass fields as the case may be.
2. Sewage (water fouled with excreta) from water closets, which are led into septic tanks followed by soak-away pits.

Latrines - toilet facilities in the hospitals are generally inadequate and there are signs of unsightliness. An endemic problem in the healthcare facilities visited seems to be the wastewater systems. Clogged sewage pipes and open drains cause permanent unsanitary conditions. Sewage and sullage over-flowing, offensive odour, and mosquito breeding are evident. Cause for the clogging is the improper disposal of wastes, which are sometimes flushed down the water closets.

We presently have three types of latrines for excreta disposal in our healthcare facilities. These are:
1. Traditional Pit Latrines
2. Ventilated Improved Pit (VIP) Latrine
3. Septic Tank System (water closet – septic tank – soak-away pit)

Freetown (capital city) and the District Hospitals have a combination of 3 plus 1 or 2 above. The Peripheral Health Units have either 1 or 2 or both as the case may be.

Toilet facilities are inadequate and there are signs on unsightliness. An endemic problem in the healthcare facilities visited seems to be the wastewater systems. Clogged sewage pipes cause permanently unsanitary conditions, sewage over-flowing from septic tanks, offensive odour, and mosquito breeding. Cause for the clogging is improper disposal of wastes, which for the lack of receptacle are sometimes ignorantly flushed down the water closets.

The septic tanks are desludged by means of Sucker Trucks and the sludge is eventually either emptied in Sludge Polders were available or grass fields away from the community, for drying. Generally, sewage is led into a septic tank, from where the effluent ends into clogged soak-away pits. However, emptying and cleaning of these septic tanks are not performed regularly, reducing the effect of their treatment function to practically zero. They’re no central sewage systems throughout the country.

Water Supply - Unlike hospitals in Freetown, which are connected to public water mains, district hospitals have, hand-dug wells fitted with electric lift-pumps to overhead storage tanks. The water yield of the wells does not meet the daily water needs of the healthcare facilities. There are problems with storage tank leaks due to rust.

3.5.7 Awareness and Training on medical waste
The staffs at the hospitals are little conscious about the risk associated with medical waste and/or nosocomial infections; measures to prevent these are rarely enforced. In the wards or outside the facility, they do not segregate wastes. Waste handlers are not provided with protective clothing (gloves, mask, boots, apron and overall).

Investigations reveal that there is no specifically structured training and awareness on medical waste management in the country. The following institutions exist for the local training of Healthcare personnel in Sierra Leone:

- College of Medicine and Allied Health Sciences; trains Medical Doctors
- Paramedical School; trains Community Health Officers
- National School of Hygiene; trains Public Health Inspectors
- School of Midwifery; trains Nurse Midwives
- Dispensing Technician School; trains Pharmacy Technicians
- MCH Programme; trains Maternal and Child Health Aides and Traditional Birth Attendants

Meetings with the respective heads of these institution reveals that Healthcare waste management is not elaborated in any of their curriculum/syllabuses.

**Instruction and Training of Personnel**

The first and most important step towards sanitary waste management inside the hospitals is to settle the matter of responsibilities.

Each healthcare facility should have a Public Health Inspector to be responsible for the hygiene of the entire hospital activities, which naturally includes the waste management inside the HCF area. This responsible person must be endowed with the necessary authority to carry out this task. He has to supervise and must have the right and duty to report directly to the Medical Superintendent.

It has been previously stated that untrained personnel directly involved in handling hospital solid wastes are exposed to a high risk of infection, which is extended to patients and other health personnel. Training, together with proper equipment for collection and transportation, is the only way to improve the present unsanitary conditions.

Not only doctors and nurses, but also all the hospital staff has to be made aware of the hazards of mishandling hospital wastes. They must be able to recognised the types of waste and know how to handle each type correctly.

The self-learning process is recommended for medical staff training. This is elaborated in annex 6.

**IEC/BCC Messages**

The following messages were determined at meetings with Health Educationists, National AIDS Control Programme Staff and other related partners:

1. Make sure that clean needles are used for injections.
2. Unclean needles and syringes transmit deadly diseases like AIDS.
3. Put sharps into sharp boxes for disposal.
4. Dispose of used condom in a safe manner to prevent access to children.
5. Exposure to hospital waste can make you sick.
6. Always put on gloves, overalls, and boots ad mask when handling medical wastes.
7. Mark your segregated wastes as infectious and non-infectious for easy identification.
8. Put infectious wastes in yellow plastic bags and normal wastes in black plastic bags.
9. Picking in hospital wastes exposes you to deadly diseases.
10. Never re-open sealed infectious waste bags.
11. HIV can be transmitted when the skin is cut or pierced using an unsterilised needle, razor blade, knife or any other tool.
12. Store all infectious waste in sealable containers.
The following strategies could be employed to implement the above.

1. Advocacy at national level
2. Community meetings
3. Radio and television discussions
4. Workshops and seminars
5. Newspapers and leaflets

The following methods can be considered for public education on risks, waste segregation, or waste disposal practices;

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

**Training Plan of action**

- Assess and establish training needs.
- Adopt modules for nosocomial infections and medical waste management.
- Train District trainers and develop District and Chiefdom level training plans.
- Secure training materials.
- Plan and organise District and Chiefdom level training.

**3.5.8 Healthcare facilities**

According to MOHS’ Directorate of Planning and Information, there are currently 32 and 417 functioning Hospitals and Peripheral Health Units (PHU) in the country; as detailed in table below.

The Peripheral Health Units according to the MCH/EPI Programme Manager, Dr. A. L. Seisay, and his programme has an operational policy to ensure that all PHUs are equipped with incinerators and staff train to manage medical waste. All sharps will put in sharp-boxes for final disposal.
Table Showing the Number and Distribution of Functioning Hospitals and Peripheral Health Unit as of 6-Jan-02

<table>
<thead>
<tr>
<th>Region/Districts</th>
<th>Hospitals</th>
<th>PHUs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>Secondary</td>
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<tr>
<td>Sierra Leone</td>
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<tr>
<td>Eastern Province</td>
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<tr>
<td>Kailahun</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kenema</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Kono</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Northern Province</td>
<td>0</td>
<td>5</td>
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<td>1</td>
</tr>
<tr>
<td>Kambia</td>
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</tr>
<tr>
<td>Koinadugu</td>
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<td>1</td>
</tr>
<tr>
<td>Port Loko</td>
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<td>3</td>
</tr>
<tr>
<td>Tonkolili</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Southern Province</td>
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<td>4</td>
</tr>
<tr>
<td>Bo</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Bonthe</td>
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<td>2</td>
</tr>
<tr>
<td>Moyamba</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pujehun</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Western Area</td>
<td>7</td>
<td>12</td>
</tr>
</tbody>
</table>

**Infectious waste classification and generation**

A classification of hospital wastes has been worked out for the special needs of Sierra Leone according to the kind of treatment and disposal they require.

**Classification**

- **Type A**: Normal Waste similar to domestic waste
- **Type B**: Patient's waste requiring special management within the hospital
- **Type C**: Infectious Waste requiring special management inside and outside the hospital
- **Type D**: Human Parts requiring special treatment for ethical reasons
- **Type E**: Other Hazardous Waste similar to industrial wastes
- **Type F**: Recyclable material
- **Type G**: Sludge from the hospital wastewater treatment plant.

**Generation**

For the purpose of estimating the amount of infectious waste (Types C and D) that would requires special care for the country, the adopted unit values from Ghana will be considered for this project under the current situation.

- Waste Types A and B: 1.20 kg/bed/day
- Waste Type C: 0.15 kg/bed/day
- Waste Type D: 0.05 kg/bed/day

- Specific weight of waste Type A, B and C: 200 kg/m³

Taking into account the above-listed unit values, the total amount of wastes Types C and D in the respective districts considered are estimated to come to:

**Waste Type C**

1. **Port Loko District**
   - 268 beds x 0.15 kg/bed/ day x 7 days = 300 kg/week
2. **Koinadugu District**
   - 100 beds x 0.15 kg/bed/ day x 7 days = 105 kg/week
3. **Bombali District**
   - 60 beds x 0.15 kg/bed/ day x 7 days = 63 kg/week
4. **Kenema District**
   - 365 beds x 0.15 kg/bed/ day x 7 days = 383 kg/week
5. **Kono District**
   - 60 beds x 0.15 kg/bed/ day x 7 days = 63 kg/week
6. **Bo District**
   - 334 beds x 0.15 kg/bed/ day x 7 days = 351 kg/week
7. **Bonthe District**
   - 64 beds x 0.15 kg/bed/ day x 7 days = 67 kg/week
8. **Pujehun District**
   - 43 beds x 0.15 kg/bed/ day x 7 days = 45 kg/week
9. **Moyamba District**
   - 60 beds x 0.15 kg/bed/ day x 7 days = 63 kg/week
10. **Western Area (Freetown)**
    - 1207 beds x 0.15 kg/bed/ day x 7 days = 1267 kg/week
### Waste Type D

<table>
<thead>
<tr>
<th>District</th>
<th>Beds</th>
<th>Weight per Bed/day</th>
<th>Days</th>
<th>Total Weight/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Loko District</td>
<td>268</td>
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<td>7</td>
<td>100</td>
</tr>
<tr>
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<td>100</td>
<td>0.05</td>
<td>7</td>
<td>35</td>
</tr>
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<td>Bombali District</td>
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<td>0.05</td>
<td>7</td>
<td>21</td>
</tr>
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<td>Koinadugu District</td>
<td>365</td>
<td>0.05</td>
<td>7</td>
<td>128</td>
</tr>
<tr>
<td>Kono District</td>
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<td>0.05</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Bo District</td>
<td>334</td>
<td>0.05</td>
<td>7</td>
<td>117</td>
</tr>
<tr>
<td>Bonthe District</td>
<td>64</td>
<td>0.05</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Pujehun District</td>
<td>43</td>
<td>0.05</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Moyamba District</td>
<td>60</td>
<td>0.05</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Western Area (Freetown)</td>
<td>1207</td>
<td>0.05</td>
<td>7</td>
<td>422</td>
</tr>
</tbody>
</table>

*These estimates will assist in determining capacities of incinerator required for the respective Districts.*

Wastes Type E (hazardous wastes) has not been separately collected up to now. Only after implementing a new classification and separation of all wastes generated in the hospitals can practicable give information on this waste fraction be obtained.

#### Waste receptacles and collection

According to the investigations made at the hospitals, one of the main problems of hygienic waste handling is the lack of appropriate receptacles. In nearly all cases, infectious waste together with syringes and needles, etc. are openly collected and transported in open buckets, intended for the cleaning service but not for infectious hospital waste handling.

Therefore, thorough attention has to be given to providing the hospitals with adequate equipment for the collection of the waste.

- Waste type A and B can be handled as is done now, drums and plastic buckets with tight-fitting covers respectively.
- The collection and transport of Waste Types C and D must be improved substantially.

In areas where waste of Type C is generated, metallic circular bag-holders with lid shall be employed. In these bag holders, polythene bags should be provided. For better identification the bags should be coloured, and sharp and pointed objects such as syringes blades or glass must be collected in puncture-resistant containers (sharp boxes) before being disposed of in the bags.

The filled bags should be closed off using plastic strips, which, once fastened in place, should not be reopened. Then, they are removed from the bag holder and placed at the transfer area for their removal by the collection service direct to the disposal sites. Neither re-use of the disposable receptacles nor compression of the waste is permissible.

The most appropriate receptacles for waste Type D (human body parts) are conical shaped plastic buckets with a hermetically sealing plastic lid and a handle for easy handling. If, for economic reasons, it is not possible to acquire this type of receptacle, plastic bags can be used as for the waste Type C. They must have a different colour so that the collection service can distinguish them.

A general upgrading of the hospital’s internal collection equipment (bins, carts, storage areas and protection equipment, etc.) is recommended.
Transport and Storage in the Hospital

The waste has to be removed each day from the transfer areas and taken to a storage place. Rubber-wheeled carts with a bin made of plastic or non-rusting metal should be used for this should have a smooth surface for easy cleaning and disinfecting. Moreover, the dimensions must be appropriate for easy manoeuvrability along the route to be followed inside the hospital.

The storage of the different types of waste has to be done in the corresponding places according to the following requirements.

- Solid waste types A and B should be deposited in the containers used for domestic refuse.
- Waste Type C should be deposited in a special storage room to which only authorized personnel have access.
- Waste Type D should be immediately transported to a cemetery and buried as existing cultural practices demand.
- Waste Type E must be stored according to the regulations for industrial hazardous waste.
- Radioactive wastes must be stored in a radiation-safe place until their radioactivity has decreased to the point where they are no longer considered radioactive, and then disposed of according to the instructions given by authorized officials.

In none of the visited hospitals was there an appropriate room for the storage of the waste Type C. Therefore, in most of the hospitals remodelling will be necessary.

Treatment of Waste

The management of the hospital wastes outside the hospital depends on the kind of treatment they have to undergo:

- Waste Types A and B, normal waste and patient's waste can be transported and disposed of together with other urban waste, once they have been removed from the hospital premises.
- Wastes Types C and D, infectious waste and human body parts, require special transport and treatment, which will be described further.
- Waste Type E, other hazardous waste, must be disposed of according to the regulations for industrial hazardous waste.

Treatment of hospital waste means any method, technique or process designed to change the biological character or composition of any regulated medical waste so as to reduce or eliminate its potential for causing disease.

Regarding the adequate sanitary disposal of healthcare waste as a treatment method, and by considering the specific needs and possibilities for Sierra Leone, only two technical alternatives can be taken into consideration for waste Type C:

1. Incineration (modern for regional referral hospitals and improvised for District hospitals and PHUs)
2. Controlled disposal in sanitary landfills

Controlled disposals in sanitary landfills have the following reported advantages

- It is a recognised and proven method of disposal of this waste category
- The technology is applicable to all infectious wastes and does not require pre-processing of the waste.
- The control is easy and evident
- It is the most economic method.

However, current practices (open dumping) at the existing dumpsites (Freetown, Bo, and Kenema) militate against this option for the time being. Consequently, and taking into consideration the dangers associated with healthcare waste and in particular HIV, HBV, and HCV transmissions, incineration followed by ash burial in lined pits within the compound should be improved and promoted. Nevertheless, since typically almost 80% of the total wastes generated by healthcare institutions are generally comparable to domestic wastes, sanitary landfill is inevitable. Consequently, the existing (4) open dumpsites should be upgraded to sanitary landfills and new sanitary landfills developed in every district currently without one. This will then allow for the landfilling
of those categories of waste that should not be incinerated. Recommended criteria for the selection, development and operation of sanitary landfill sites are attached as annex 6.

As outlined earlier, infectious hospital waste Type C can be buried at sanitary landfills, provided the following precautions are taken:

- The hospital waste must be transported to an already filled-up area of the sanitary landfill. This landfill, or at least the selected area, should be fenced in so that it will have restricted access.
- The hospital waste has to be dumped directly from the truck into the pit without any handling by labourers.
- The same excavation material from the pit must cover it immediately, preferably.
- The areas where infectious wastes have been buried must be marked and documented to avoid re-opening by further disposal of hospital wastes.

Instruction and training of solid waste personnel, as described in this report, must also be extended to the personnel working on the sanitary landfill.

3.5.9 Legal Requirements

Legislation
There is a lack of legislative framework, by-laws and guidelines for the management of hospital wastes in Sierra Leone. The objective should be to set up a legal structure that will be maintained and updated by a Ministry of Health and Sanitation legislation unit. By-laws or regulations on the following themes should be laid down.

- Precise definition of all terms to describe the management of hospital waste
- Classification of hospital wastes
- Internal management of solid waste in health care institutions
- External management of solid waste from health care institutions
- Guidelines for the section of hospital solid waste-handling equipment and materials
- Determination of responsibilities
- Fines and penalties for non-compliance.

The general guidelines for the management of healthcare wastes is attached as annex 7

Control Institutions
Legislation alone is a useless instrument without an official organ to monitor compliance and the power to enforce it by punishing non-compliance

Therefore, an effective control system of the hospital waste management must be established. As described before, it can be organised on two levels.

1. Responsible self-control by a qualified member of their own staff for the executing institutions, the hospitals for sanitary hospital-internal handling, and the Environmental Health Division for the management outside the hospital. This should cover collection transportation, treatment and disposal.
2. Official control by health inspectors of the ministry who should exercise control over governmental, private and mission operated health care institutions and has the legal power to caution and/or punish.
3.6 Existing institutional arrangements

3.6.1 Structure of Government Health Authority

STRUCTURE OF CONTROL – RESPONSIBILITIES OF WASTE MANAGEMENT

Minister of Health and Sanitation: She is the head of the ministry and responsible for the formulation of policies and legislation.

Director-General of Medical Services: He is the professional head of the ministry and adviser to the minister on all professional matters.

Director of Clinical Services: He is one of the two Deputies and assists the Director-General Medical Services with his functions, with particular reference to clinical services.

Senior Medical Superintendent: He is the overall head of the hospital administration and reports to the Director-General Medical Services. He is therefore also head of the hospital waste management. He supervises the day-to-day running of the hospital, and the doctors as well as the senior matron reports to him. In turn, the matrons, nurses and ward staff report to the doctors and the senior matron.

Environmental Manager: He is the head of all public health inspectors based in the hospital. He assigns the health inspector to exercise hospital waste handling. All public health inspectors are in theory, controlled by the Chief Health Superintendent. In practice, they are supervised by the respective senior medical superintendents in hospitals were public health inspectors are posted.
Senior Sanitary Engineer: He heads the Waste Management Unit within the MOHS. He and his staff are currently responsible for the sanitary transport and disposal of all (municipal and hospital) wastes disposal in the country.

3.6.2 Healthcare Institutions
The Healthcare institutions in Sierra Leone can be divided into five groups on the basis of the mode of management and ownership.

1. **Government**
   Government healthcare facilities (hospitals, health-centres, and clinics) are the most extensive of these groups. These comprise a network of institutions spread throughout the country. The functionaries that run and administer these institutions are directly employed and remunerated by the Government of Sierra Leone through the Ministry of Health and Sanitation. The effects of National Health Policy and activities are most significantly felt in these institutions.

   Government health institutions are sub-divided into four groups.
   1. Referral Hospitals (secondary at district levels and tertiary at regional levels).
   2. Community Health Centres
   3. Maternal Child Health Posts
   4. Community Health Posts
   
   *Items 2, 3, and 4 above constitute the Peripheral Health Units.*

2. **Industry**
   Industrial Hospitals and Clinics are healthcare facilities usually established and administered by specific industrial enterprises. Even though they are subject to overall National Health Policy guidelines and regulations, they are to all intents and purposes autonomous. The staff are employed and remunerated by the respective industries. Unlike government hospitals that cater to the general public, industrial health care institutions usually only service employees of the respective industries and dependent relatives.

3. **Missions**
   These were established and run by religious groups. Their staff are employed and remunerated by these Missionaries. In general, they are subject to national health policy conditions and regulations. Their clientele include members of the general public.

4. **Defence (Military and Police) and Education**
   The ministries of defence and education run these as the case may be. The clientele of these hospitals in principle comprise members of the Sierra Leone Military, Police, Educational Institutions and their dependant relatives. Government pays the bulk of the staff in these hospitals.

5. **Private Organizations**
   Next to government-run organizations, private healthcare facilities comprise the bulk of support in Sierra Leone. Due to their higher quality of services rendered or provided, they cater to the most privileged members of the Sierra Leone community. Individual doctors or associates thereof mainly own these health institutions. The administration is autonomous, and they pay their own staff. They are operated very often without subventions from external sources, and they charge cost-covering fees for their services.
4. The HCWM Plan

4.1 Plan description

4.1.1 Goal and objectives
The overall goal is to establish a comprehensive system of waste management in Sierra Leone in order to improve public health and reduce environmental impacts from handling of healthcare waste (municipal and healthcare) by its proper disposal.

Objectives:
1. To improve the management of wastes in all healthcare institutions
2. To support private initiative (Private sector and NGOs) in safe healthcare waste management
3. To raise awareness of managers, health staff (public, private and NGO) and the general public about the importance of safe management of healthcare waste.
4. To develop the institutional capacity of EHD in the safe management of healthcare wastes

<table>
<thead>
<tr>
<th>Problems/Issues</th>
<th>Objective to be achieved</th>
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<tbody>
<tr>
<td>Lack of policy, legal framework, guidelines, and effective control.</td>
<td>To improve the management of wastes in all healthcare institutions</td>
</tr>
<tr>
<td>Deficiency and lack of appropriate technology, equipment and materials</td>
<td>To support private initiative (Private sector and NGOs) in safe healthcare waste management</td>
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<tr>
<td>Advocacy, focused health education and staff training, concerning hospital waste management</td>
<td>To raise awareness of managers, health staff (public, private and NGO) and the general public about the importance of safe management of healthcare waste.</td>
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<td>Private not motivate</td>
<td>To develop the institutional capacity of EHD in the safe management of healthcare wastes</td>
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<tr>
<td>Lack of compliance</td>
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</tr>
<tr>
<td>Unhygienic handling of wastes within the hospitals, posing a threat to personnel, patients, and visitors</td>
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<tr>
<td>Lack of training</td>
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</tr>
<tr>
<td>Improper handling of wastes outside the institutions, exposing these wastes to scavengers, and causing a serious threat not only to their own health but also to that of the public and the environment.</td>
<td></td>
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</tbody>
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4.1.2 Target groups and benefits

<table>
<thead>
<tr>
<th>Target groups</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health staff</td>
<td>• Existing Health staff trained on medical waste</td>
</tr>
<tr>
<td>Private healthcare institutions</td>
<td>• Safe management of healthcare waste</td>
</tr>
<tr>
<td>Healthcare training institutions</td>
<td>• Safe environment (land, water, and air)</td>
</tr>
<tr>
<td>Waste Handlers</td>
<td>• Prevention and control of disease transmission</td>
</tr>
<tr>
<td>Landfill staffs</td>
<td>• Healthy Population</td>
</tr>
<tr>
<td>General Public</td>
<td>• Economic Growth</td>
</tr>
<tr>
<td>Scavengers</td>
<td>• Improved life expectancy</td>
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</tbody>
</table>

Among the priority health problems of Sierra Leone are malaria and water/sanitation related diseases. These diseases can be transmitted by unhygienic waste handling, not only in the healthcare facilities amongst the patients and staff, but also in the surrounding community, if the waste is exposed openly to visitors, scavengers of waste and animals. To prevent and control these infectious diseases, effective and safe healthcare waste management is essential. Regarding the lack of appropriate waste management policies and legislation, the EHD of MOHS should develop these instruments through a collaborative workshop involving all stakeholders including the Law officers department. The ensuing ordinance should be enacted and enforced by the public health inspectors through sanitary courts established by law.
## 4.1.3 Key interventions (activities) per objectives and performance indicators

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Activities/Actions to be undertaken to achieve the objective</th>
<th>Key performance indicators</th>
</tr>
</thead>
</table>
| **1. To improve the management of wastes in all healthcare institutions**  | 1.1 Equip all healthcare facilities with appropriate equipments and material for collection of healthcare waste.  
1.2 Equip all healthcare facilities with appropriate facilities (trolleys, waste bags, sharp boxes and bins and skips) for medical waste management.  
1.3 Provide adequate and wholesome water supplies in all facilities  
1.4 Provide wheelbarrows for all healthcare facilities for transportation to medical wastes to incinerators  
1.5 Construct adapted incinerators for District hospitals and PHUs  
1.6 Equip personnel involved in medical waste management with adequate and sufficient protective clothing (boots, gloves, nose masks, overalls, etc) | **Process/outputs**  
By the end of the project:  
- All healthcare wastes are collected and Disposed in a safe and environment-friendly manner  
- All personnel involved in medical Waste management must possess Appropriate safety equipment in all Public and private healthcare Facilities.  
- A national policy for healthcare waste Management is developed  
- The public health ordinance is Reviewed, enacted and enforced.  
**Outcome:**  
- All healthcare facilities (public, Private and NGO) possess equipment for Waste storage.  
- All healthcare facilities (public, Private and NGO) has dust bin for Storage of normal waste within their Compound  
- All healthcare facilities has equipments For safe internal transportation of their Waste  
- All Referral and regional hospitals Has modern incinerators  
- All District hospitals and PHUs has Improvised incinerators. |
| **2. To support private initiative (Private sector and NGOs) in safe healthcare waste management.** | 2.1 Private and NGO healthcare Facilities manage their waste in a safe And environment-friendly manner.  
2.2 Private and NGO healthcare Facilities provide protective clothing For their waste handlers  
2.3 Private and NGO healthcare facilities Train their staffs and sensitise patients And visitors on risks | **Process/outputs**  
- The private sector and NGOs are Motivated and pay more interest in Medical waste management  
**Outcome:**  
- All private and NGOs healthcare Facilities manage their waste in a safe And environment-friendly manner.  
- All private and NGOs healthcare Facilities provide protective clothing for Their medical waste handler. |
| **3. To raise awareness of managers, health staff (public, private and NGO) and the general public about the importance of safe management of healthcare waste.** | 3.1 To train health staffs (private, public And NGO), Trainer Trainers, Paramedics, and sanitary worker in Healthcare facilities.  
3.2 To sensitise patients and the general public | **Process/outputs**  
- Personnel involved in are conscious of The risk related to medical waste, Appropriate behaviour and practices in Their handling and are capable to Formulate internal strategies for safe Medical waste management.  
**Outcome:**  
- All medical and paramedical staff Trained in medical waste management  
- All aides, cleaners and maintenance Staffs are sensitised about medical Waste management  
- At least 90% of the population are Sensitised about risk related to medical Waste management. |
### 4.1.4 Risks and mitigating actions

<table>
<thead>
<tr>
<th>Risks</th>
<th>High/Substantial/Moderate</th>
<th>Mitigating Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Contamination of Drinking</td>
<td>Moderate</td>
<td>Appropriate design, sites and operation of sanitary landfills, leachate treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and control, water quality testing.</td>
</tr>
<tr>
<td>2. Release of Pollutants into the air</td>
<td>High</td>
<td>High temperature ((1000-1200^\circ C)) incineration, installation of flue gas</td>
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<tr>
<td></td>
<td></td>
<td>cleaning devices, air quality testing and materials containing chlorine or heavy</td>
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<td></td>
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<td>metals will not be incinerated.</td>
</tr>
<tr>
<td>3. Occupational hazards</td>
<td>Substantial</td>
<td>Provision and ensuring routine use of protective clothing, staff training and first</td>
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<tr>
<td></td>
<td></td>
<td>aid</td>
</tr>
<tr>
<td>4. Diseases transmission</td>
<td>Moderate</td>
<td>Limited access to disposal sites, fencing of disposal sites, separate cells for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>medical wastes, public sensitisation (radio, TV, posters, leaflets, newspapers, etc)</td>
</tr>
</tbody>
</table>
4.1.5 Implementation strategy/methodology

Waste receptacles and collection
According to the investigations made at the hospitals, one of the main problems of hygienic waste handling is the lack of appropriate receptacles. In nearly all cases, infectious waste together with syringes and needles, etc. are openly collected and transported in open buckets, intended for the cleaning service but not for infectious hospital waste handling. Therefore, thorough attention has to be given to providing the hospitals with adequate equipment for the collection of the waste.

In Annex 7 of this plan, the general requirements for receptacles are described. According to this, the following system will be recommended for the hospitals in Sierra Leone.

- Waste type A and B can be handled as is done now, drums and plastic buckets with tight-fitting covers respectively.
- The collection and transport of Waste Types C and D must be improved substantially.

In areas where waste of Type C is generated, metallic circular bag-holder with lid shall be employed. In these bag holders, polythene bags will be provided. For better identification the bags will be coloured, and sharp and pointed objects such as syringes blades or glass must be collected in puncture-resistant containers (sharp boxes) before being disposed of in the bags.

The filled bags are closed off using plastic strips, which, once fastened in place, should not be reopened. Then, they are removed from the bag holder and placed at the transfer area for their removal by the collection service direct to the on-site disposal site. Neither re-use of the disposable receptacles nor compression of the waste is permissible.

The most appropriate receptacles for waste Type D (human body parts) are conical shaped plastic buckets with a hermetically sealing plastic lid and a handle for easy handling. If, for economic reasons, it is not possible to acquire this type of receptacle, plastic bags can be used as for the waste Type C. They must have a different colour so that the collection service can distinguish them.

A general upgrading of the hospital’s internal collection equipment (bins, carts, storage areas and protection equipment, etc.) is recommended.

Transport and Storage in the Hospital
The waste has to be removed each day from the transfer areas and taken to a storage place. Rubber-wheeled carts with a bin made of plastic or non-rusting metal should be used for this should have a smooth surface for easy cleaning and disinfecting. Moreover, the dimensions must be appropriate for easy manoeuvrability along the route to be followed inside the hospital.

The storage of the different types of waste has to be done in the corresponding places according to the following requirements.

- Solid waste types A and B should be deposited in the containers used for domestic refuse.
- Waste Type C should be deposited in a special storage room to which only authorized personnel have access.
- Waste Type D should be immediately transported to a cemetery and buried as existing cultural practices demands.
- Waste Type E must be stored according to the regulations for industrial hazardous waste.
- Radioactive wastes must be stored in a radiation-safe place until their radioactivity has decreased to the point where they are no longer considered radioactive, and then disposed of according to the instructions given by authorized officials.
In none of the visited hospitals was there an appropriate room for the storage of the waste Type C. Therefore, in most of the hospitals remodelling will be necessary.

**Treatment of Waste**

The management of the hospital wastes outside the hospital depends on the kind of treatment they have to undergo:

- Waste Types A and B, normal waste and patient's waste can be transported and disposed of together with other urban waste, once they have been removed from the hospital premises.
- Wastes Types C and D, infectious waste and human body parts, require special transport and treatment, which will be described further.
- Waste Type E, other hazardous waste, must be disposed of according to the regulations for industrial hazardous waste.

Treatment of hospital waste means any method, technique or process designed to change the biological character or composition if any regulated medical waste so as to reduce or eliminate its potential for causing disease. Regarding the adequate sanitary disposal of health-care waste as a treatment method, and by considering the specific needs and possibilities for Sierra Leone, only two technical alternatives can be taken into consideration for waste Type C:

1. Special incineration
2. Controlled disposal in sanitary landfills

Controlled disposals in sanitary landfills have the following reported advantages

- It is a recognised and proven method of disposal of this waste category
- The technology is applicable to all infectious wastes and does not require pre-processing of the waste.
- The control is easy and evident
- It is the most economic method.

However, current practices (open dumping) at the existing dumpsites (Freetown, Bo, and Kenema) militate against this option for the time being. Consequently, and taking into consideration the dangers associated with health-care waste and in particular HIV, HBV, and HCV transmissions, the current practice of incineration without flue-gas cleaning should be improved and promoted until the dumpsite are upgraded to sanitary landfills.

As outlined earlier, infectious hospital waste Type C can be buried at sanitary landfills, provided the following precautions are taken:

- The hospital waste must be transported to an already filled-up area of the sanitary landfill. This landfill, or at least the selected area, should be fenced in so that it will have restricted access.
- The hospital waste has to be dumped directly from the truck into the pit without any handling by labourers.
- The same excavation material from the pit must cover it immediately, preferably.
- The areas where infectious wastes have been buried must be marked and documented to avoid re-opening by further disposal of hospital wastes.

Instruction and training of solid waste personnel, as described in this report, must also be extended to the personnel working on the sanitary landfill.

The operation of incinerators proposed within this plan may result in certain nuisances that will negatively impact the existing environmental and social set up.

However, considering the reduced daily quantities of waste to be incinerated by the healthcare facilities, it is evident that the negative social and environmental impacts will be relatively negligible and the nuisance caused
will be less harmful. Nevertheless, it would be necessary to take the precautions in the installation and operations of the incinerators:

- To select a site for the incinerator at a considerable distance from the hospital, far away from the medical wards.
- It is necessary to preferably operate the incinerators at night to reduce smoke nuisance.
- All ash residues should be buried in lined pits within the compound.

_The De Montfort Family of Incinerators is recommended for the purposes of this plan. Please see annex 9._

**Water Supply and Sanitation**

The existing water and sanitation system needs to be improved. New reliable wells and adequate toilets facilities should be provided. The drains should be rehabilitated to facilitate free-flow of used water. Sucker trucks should be provided for routing desludging of fill septic tanks. Healthcare staff should have related training. Please see annex 10.

**Legal Requirements**

*Legislation*

There is a lack of legislative framework, by-laws and guidelines for the management of hospital wastes in Sierra Leone. The objective should be to set up a legal structure that will be maintained and updated by a Ministry of Health and Sanitation legislation unit. By-laws or regulations on the following themes should be laid down.

- Precise definition of all terms to describe the management of hospital waste
- Classification of hospital wastes
- Internal management of solid waste in health care institutions
- External management of solid waste from health care institutions
- Guidelines for the section of hospital solid waste-handling equipment and materials
- Determination of responsibilities
- Fines and penalties for non-compliance.

There are no effluent standards; it is therefore recommended that WHO the Environmental Protection Board in establishing national standards for Sierra Leone adapts guidelines for effluent standards. Defaulters should be prosecuted and appropriately punished by the sanitary courts, which should be so empowered by the proposed reviewed Public Health Ordinance.

*Control Institutions*

Legislation alone is a useless instrument without an official organ to monitor compliance and the power to enforce it by punishing non-compliance.

Therefore, an effective control system of the hospital waste management must be established. As described before, it can be organised on two levels.

- Responsible self-control by a qualified member of their own staff for the executing institutions; the hospitals for sanitary hospital-internal handling, and the Environmental Health Division for the management outside the hospital. This should cover collection transportation, treatment and disposal.

- Official control by health inspectors of the ministry who should exercise control over government, private and mission operated health care institutions and has the legal power to caution and/or punish.
4.1.6 Institutional arrangements and implementation responsibilities

(a) Institutional arrangements
MOHS as the responsible national body for the country’s healthcare system is, in the exercise of its activities most closely related to environmental protection issues. MOHS derives its duties and powers from the Public Health Ordinance; Act No.23 of 1960, whereby it is responsible for overall sanitation services.

The Environmental Health Division (EHD) is currently entrusted with the comprehensive waste management throughout the country. From 1982 to 1994, the Freetown services received German Technical and Financial Assistance. Since 08/94 EHD performs this service without exterior support.

Within the hierarchical structure of MOHS, EHD is placed under the Environmental Health (Sanitation) Manager. It is headed by the Senior Sanitary Engineer, who reports, via the Manager, via the Deputy Director General of Medical Services, via the Director General Medical Services, to the Minister of Health and Sanitation.

(b) Implementation responsibilities
Since 1993, the EHD of MOHS has overall responsibility for ensuring safe waste management countrywide. Its duties cover:
- Planning and budgeting
- Management, monitoring and control
- Operation performance (collection, disposal and treatment)
- Maintenance and repair of vehicle fleet and equipment
Overall administration and accounting.

**Monitoring Staff**

The EHD monitoring staffs consist of the Senior Sanitary Engineer, Sanitary Engineer (2), Mechanical Engineer and Public Health Inspectors. The monitoring staff’s professional qualification and experience comply fully with most of their monitored duties. However, due to lack of the involved professional background, certain responsibilities, in particular in the fields of impact monitoring and mitigation and waste treatment, are despite remarkable efforts, carried out only in a rudimentary way.

The Senior Sanitary Engineer, with his overall supervisory and controlling functions within the Division and coordination of its activities with bordering performances of the other Departments’ divisions is particularly overburdened. He is not in a position, neither from his workload nor (despite his eager interest and commitment) from his professional training point of view, to perform and pursue the waste management in an environmentally friendly manner, unless he has undergone intensive relevant training, possibly including on-site experience in overseas. The senior of the two sanitary engineers has recently been assigned with the special responsibilities of healthcare waste management and occupational safety. **This unit requires immediate strengthen of its capacity to supervise/implement this plan.**

In the Districts, this responsibility is carried out by Senior Health Inspectors who like the Senior Sanitary Engineer needs training in waste management in an environmentally friendly manner. It is therefore, considered as a need measure to the implantation of this subproject, to engage an international advisory services in the field of design, planning, construction and landfill operations for a project duration s/he will also be expected to carryout on the job training of the staff. EHD lacks the capacity. In effect, this provision will ensure capacity building and training. The Public Health Laboratory at Connaught should be strengthened to carry out sampling and laboratory analysis of water sources, landfill leachates and incineration emissions; the laboratory manager will require transportation, equipments, and materials to perform this responsibilities.

SHARP makes provision for the strengthening of the EHD to ensure effective supervision and safe management of healthcare waste. It also makes provision for the four SHARP-Districts in terms of provision of equipment and materials, construction of incinerators, staff training and community sensitisation.

It is the view of the consultant that for effective coordination of this plan at the national level, the EHD Sanitary Engineer charged with the responsibilities of clinical waste and occupational safety unit be seconded to ARG. S/he will be at the level of a programme to ensure a sufficiently high profile to enable the officer to report directly to the directly to the Director General of Medical Services and participate in the Top Management Team meetings of the MOHS. This is in line with the position of Programme Managers within MOHS. The ARG team includes professionals in Health Education, Monitoring and Evaluation, and Health Administration. This proposed arrangement would allow for dependency on these professionals for their respective expertise in implementation of this plan for the five-year project duration and ensure continuity, as the officer will simply revert to the mainstream of MOHS.

**Implementation coordination**

The EHD sanitary engineer responsible for healthcare waste management will be seconded ARG. ARG help the NAS and NAC in formulating the health part of the control and prevention of HIV/AIDS. This will not only pertain to the public health sector but also to the private sector and even beyond the health sector, defining norms and standards for all medical activities undertaken by NGOs CBOs. Regular coordinating meetings will be held as directed by NAS wherein progress will be reviewed and where necessary implementation adjustments will be made as deemed necessary.
## 4.2 Implementation schedule/plan

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</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Equip all healthcare facilities with appropriate equipments and material for collection of healthcare waste.</td>
<td>2003</td>
<td>2007</td>
<td>X</td>
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<tr>
<td>1.2</td>
<td>Equip all healthcare facilities with appropriate facilities (trolleys, waste bags, sharp boxes and bins and skips) for medical waste management.</td>
<td>2003</td>
<td>2007</td>
<td>X</td>
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<td>1.3</td>
<td>Provide adequate and wholesome water supplies in all facilities</td>
<td>2003</td>
<td>2007</td>
<td>X</td>
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<tr>
<td>1.4</td>
<td>Provide wheelbarrows for all healthcare facilities for transportation of medical wastes to incinerators</td>
<td>2003</td>
<td>2004</td>
<td>X</td>
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<td>1.5</td>
<td>Construct adapted incinerators and lined pits for healthcare facilities</td>
<td>2003</td>
<td>2004</td>
<td>X</td>
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<td>1.6</td>
<td>Equip personnel involved in medical waste management with adequate and sufficient protective clothing (boots, gloves, nose masks, overalls, etc)</td>
<td>2003</td>
<td>2004</td>
<td>X</td>
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</tbody>
</table>
### Objective 2: To support private initiative (Private sector and NGOs) in safe healthcare waste management.

<table>
<thead>
<tr>
<th>Sub-Objective</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Ensure private and NGO healthcare Facilities manage their waste in a safe and environment-friendly manner.</td>
<td>2003</td>
<td>2007</td>
<td>X X X X X X X X X X X X X X X X X X X</td>
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<tr>
<td>2.2 Ensure private and NGO healthcare Facilities provide protective clothing for their waste handlers</td>
<td>2003</td>
<td>2007</td>
<td>X X X X X X X X X X X X X X X X X X X</td>
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</table>

### Objective 3: To raise awareness of managers, health staff (public, private and NGO) and the general public about the importance of safe management of healthcare waste.

<table>
<thead>
<tr>
<th>Sub-Objective</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Train health staffs (private, public and NGO), Trainers, Paramedics, and sanitary worker in healthcare facilities.</td>
<td>2003</td>
<td>2004</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td>3.2 Sensitise patients and the general public</td>
<td>2003</td>
<td>2007</td>
<td>X X X X X X X X X X X X X X X X X X X</td>
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</tbody>
</table>
### Objective 4: To develop the institutional capacity of EHD in the safe management of healthcare wastes

<table>
<thead>
<tr>
<th>Objective</th>
<th>Details</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
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<th>Year 12</th>
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<th>Year 14</th>
<th>Year 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Design and or adapt an improvised incinerator</td>
<td>2003</td>
<td>2003</td>
<td>X</td>
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<tr>
<td>4.2</td>
<td>Design and or adapt tools for the pre-collection of medical wastes in healthcare facilities</td>
<td>2003</td>
<td>2003</td>
<td>X</td>
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<td>4.3</td>
<td>Elaborate internal guidelines for medical waste management</td>
<td>2003</td>
<td>2003</td>
<td>X</td>
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<td>4.4</td>
<td>Develop a healthcare waste management policy</td>
<td>2003</td>
<td>2003</td>
<td>X</td>
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<td>4.5</td>
<td>Review and update Public Health Ordinance</td>
<td>2003</td>
<td>2003</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>4.6</td>
<td>Enact and enforce the Public Health Ordinance</td>
<td>2003</td>
<td>2007</td>
<td>X</td>
<td>X</td>
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<tr>
<td>4.7</td>
<td>Rehabilitate existing dumpsites to sanitary landfills</td>
<td>2003</td>
<td>2004</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>4.8</td>
<td>Construct new sanitary landfills</td>
<td>2003</td>
<td>2003</td>
<td>X</td>
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<td>4.9</td>
<td>Provide technical and training assistance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4.10</td>
<td>Overseas Training</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.11</td>
<td>Strengthen the Public Health Laboratory at Connaught Hospital</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3 HCWM Plan implementation monitoring and evaluation

4.3.1 Monitoring activities and strategy
- Monthly supervision and reports at District Level by Senior Health Inspector
- Quarterly Supervision from national level by Sanitary Engineer and ARG
- Quarter meetings both at District and national level to review progress by Sanitary Engineer, DHMT, ARG

4.3.2 Evaluation activities and strategy
- Annual review, midterm evaluation and end of project evaluation (ARG and Sanitary Engineer)

4.3.3 Reporting

<table>
<thead>
<tr>
<th>Report name</th>
<th>What will it contain?</th>
<th>Frequency of production (quarterly and annually)</th>
<th>Production responsibility</th>
<th>To whom it will be submitted?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Supervisory</td>
<td>Status of project implementation, activities, constrains</td>
<td>Monthly (Districts) Quarterly (national)</td>
<td>Senior Health Inspector Sanitary engineer</td>
<td>DHT, HQ, ARG, NAS</td>
</tr>
<tr>
<td>2. Minutes</td>
<td>Proceedings of meeting</td>
<td>Quarterly meetings</td>
<td>Designated reporter</td>
<td>HQ, MOHS, ARG, NAS</td>
</tr>
<tr>
<td>3. Review</td>
<td>Progress report</td>
<td>Annually</td>
<td>ARG</td>
<td>HQ, MOHS, ARG, NAS</td>
</tr>
<tr>
<td>4. Laboratory</td>
<td>Concentrations of the various constituents in air, soil, and water samples.</td>
<td>Monthly</td>
<td>Laboratory Manager</td>
<td>HQ, MOHS, ARG, NAS</td>
</tr>
<tr>
<td>4. Evaluation</td>
<td>Project achievements and challenges</td>
<td>Midterm End of Project</td>
<td>ARG</td>
<td>HQ, MOHS, ARG, NAS</td>
</tr>
</tbody>
</table>
5. ANNEXES

Annex 1 – Tables on Healthcare Facilities in Sierra Leone as of November 2001

An enquiry of nearly all-existing healthcare facilities in Sierra Leone are summarise in the following tables.

Table 1: Summary of the hospitals by districts, type, and ownership as of November 2001

<table>
<thead>
<tr>
<th>No</th>
<th>District</th>
<th>G</th>
<th>P</th>
<th>M</th>
<th>I</th>
<th>TOTAL</th>
<th>FUNCTIONAL</th>
<th>Not FUNCTIONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bo</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Moyamba</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Pujehun</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Bonteh</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Kenema</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Kono</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Kailahun</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Bombali</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Koinadugu</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Kambia</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Port Loko</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>Tonkolili</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Western Urban</td>
<td>8</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>19</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>Western Rural</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>23</td>
<td>13</td>
<td>11</td>
<td>5</td>
<td>52</td>
<td>33</td>
<td>19</td>
</tr>
</tbody>
</table>

Source: MCH/EPI progress report July 2001

Note: OWNERSHIP KEY
Table 2: Summary of the Peripheral Health Units (PHUs)

<table>
<thead>
<tr>
<th>No</th>
<th>District</th>
<th>No. of PHUs</th>
<th>No of functioning PHUs</th>
<th>No. of non-functioning PHUs</th>
<th>No. of PHUs supported by NGOs</th>
<th>No. of PHUs to be rehabilitated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kenema</td>
<td>66</td>
<td>49</td>
<td>17</td>
<td>46</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Kono</td>
<td>52</td>
<td>4</td>
<td>48</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>Port Loko</td>
<td>86</td>
<td>58</td>
<td>28</td>
<td>32</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>Moyamba</td>
<td>85</td>
<td>55</td>
<td>30</td>
<td>8</td>
<td>52</td>
</tr>
<tr>
<td>5</td>
<td>Pujehun</td>
<td>46</td>
<td>34</td>
<td>12</td>
<td>25</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>Kailahun</td>
<td>55</td>
<td>10</td>
<td>45</td>
<td>5</td>
<td>52</td>
</tr>
<tr>
<td>7</td>
<td>Bonthe</td>
<td>39</td>
<td>21</td>
<td>18</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>8</td>
<td>Tonkolili</td>
<td>65</td>
<td>34</td>
<td>31</td>
<td>15</td>
<td>51</td>
</tr>
<tr>
<td>9</td>
<td>Bo</td>
<td>68</td>
<td>65</td>
<td>3</td>
<td>29</td>
<td>27</td>
</tr>
<tr>
<td>10</td>
<td>Kambia</td>
<td>31</td>
<td>21</td>
<td>10</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td>11</td>
<td>Koinadugu</td>
<td>37</td>
<td>9</td>
<td>28</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>12</td>
<td>Bombali</td>
<td>79</td>
<td>16</td>
<td>63</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Western Area Urban</td>
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<td>20</td>
<td>0</td>
<td>4</td>
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<td>Western Area Rural</td>
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<td>10</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: MCH/EPI progress report July 2001

Table 3: Summary of government hospitals by category, number of existing beds, bed occupancy rates, functioning and not functioning.

<table>
<thead>
<tr>
<th>No</th>
<th>HOSPITAL</th>
<th>No of beds</th>
<th>Average Bed Occupancy</th>
<th>TYPE OF HOSPITAL</th>
<th>LOCATION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bo District</td>
<td>334</td>
<td>250</td>
<td>Regional</td>
<td>Bo</td>
<td>Functional</td>
</tr>
<tr>
<td>2</td>
<td>Bonthe District</td>
<td>64</td>
<td>20</td>
<td>District</td>
<td>Bonthe</td>
<td>Functional</td>
</tr>
<tr>
<td>3</td>
<td>Moyamba District</td>
<td>60</td>
<td>36</td>
<td>District</td>
<td>Moyamba</td>
<td>Functional</td>
</tr>
<tr>
<td>4</td>
<td>Pujehun District</td>
<td>43</td>
<td>40</td>
<td>District</td>
<td>Pujehun</td>
<td>Functional</td>
</tr>
<tr>
<td>5</td>
<td>Kenema District</td>
<td>255</td>
<td>204</td>
<td>District</td>
<td>Kenema</td>
<td>Functional</td>
</tr>
<tr>
<td>6</td>
<td>Kailahun Hospital</td>
<td>0</td>
<td>0</td>
<td>District</td>
<td>Kailahun</td>
<td>Destroyed</td>
</tr>
<tr>
<td>7</td>
<td>Daru Hospital</td>
<td>7</td>
<td>5</td>
<td>District</td>
<td>Daru</td>
<td>Functional</td>
</tr>
<tr>
<td>8</td>
<td>Kono District</td>
<td>60</td>
<td>30</td>
<td>District</td>
<td>Kono</td>
<td>Functional</td>
</tr>
<tr>
<td>9</td>
<td>Bombali District</td>
<td>60</td>
<td>42</td>
<td>District</td>
<td>Makeni</td>
<td>Functional</td>
</tr>
<tr>
<td>10</td>
<td>Koinadugu District</td>
<td>100</td>
<td>70</td>
<td>District</td>
<td>Kabala</td>
<td>Functional</td>
</tr>
<tr>
<td>11</td>
<td>Magburaka</td>
<td>0</td>
<td>0</td>
<td>Regional</td>
<td>Magburaka</td>
<td>Vandalised</td>
</tr>
<tr>
<td>12</td>
<td>Mile 91</td>
<td>20</td>
<td>14</td>
<td>District</td>
<td>Mile 91</td>
<td>Functional</td>
</tr>
<tr>
<td>13</td>
<td>Port Loko</td>
<td>68</td>
<td>50</td>
<td>District</td>
<td>Port Loko</td>
<td>Functional</td>
</tr>
<tr>
<td>14</td>
<td>Lungi</td>
<td>50</td>
<td>40</td>
<td>District</td>
<td>Lungi</td>
<td>Functional</td>
</tr>
<tr>
<td>15</td>
<td>Kambia</td>
<td>0</td>
<td>0</td>
<td>District</td>
<td>Kambia</td>
<td>Destroyed</td>
</tr>
<tr>
<td>16</td>
<td>Connaught</td>
<td>300</td>
<td>221</td>
<td>Main Referral</td>
<td>Freetown</td>
<td>Functional</td>
</tr>
<tr>
<td>17</td>
<td>Rukupa</td>
<td>42</td>
<td>40</td>
<td>District</td>
<td>Freetown</td>
<td>Functional</td>
</tr>
<tr>
<td>18</td>
<td>Macauley Street Hospital</td>
<td>40</td>
<td>35</td>
<td>District</td>
<td>Freetown</td>
<td>Functional</td>
</tr>
<tr>
<td>19</td>
<td>Military Barracks</td>
<td>250</td>
<td>150</td>
<td>Military</td>
<td>Freetown</td>
<td>Functional</td>
</tr>
<tr>
<td>20</td>
<td>Police Barracks</td>
<td>30</td>
<td>25</td>
<td>Police</td>
<td>Freetown</td>
<td>Functional</td>
</tr>
<tr>
<td>21</td>
<td>Macauley street</td>
<td>40</td>
<td>35</td>
<td>District</td>
<td>Freetown</td>
<td>Functional</td>
</tr>
<tr>
<td>22</td>
<td>PCM Hospital</td>
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<td>122</td>
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<td>Freetown</td>
<td>Functional</td>
</tr>
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<td>23</td>
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<td>146</td>
<td>117</td>
<td>Referral</td>
<td>Freetown</td>
<td>Functional</td>
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<tr>
<td>24</td>
<td>Goderich Hospital</td>
<td>42</td>
<td>20</td>
<td>District</td>
<td>Freetown</td>
<td>Functional</td>
</tr>
</tbody>
</table>

Total 2161 1566
Functioning PHUs refers to those providing, at least the following services, maternal health, promotion of growth monitoring and breast-feeding and immunisation.

**Table 4: Current Statistics (November 2001) in visited hospitals.**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of hospital</th>
<th>HOSPITAL TYPE</th>
<th>No. Of beds</th>
<th>Ave. No. Of Outpatients per month</th>
<th>No. Of Hospital Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Connaught 1</td>
<td>Referral</td>
<td>300</td>
<td>1200</td>
<td>634</td>
</tr>
<tr>
<td>2.</td>
<td>Bo Government</td>
<td>Regional</td>
<td>334</td>
<td>1650</td>
<td>219</td>
</tr>
<tr>
<td>3.</td>
<td>Port Loko District</td>
<td>District</td>
<td>68</td>
<td>1500</td>
<td>92</td>
</tr>
<tr>
<td>4.</td>
<td>Brookfields Community</td>
<td>Private</td>
<td>40</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>5.</td>
<td>Kenema Government</td>
<td>Regional</td>
<td>255</td>
<td>900</td>
<td>105</td>
</tr>
<tr>
<td>6.</td>
<td>Moyamba Government</td>
<td>District</td>
<td>60</td>
<td>1050</td>
<td>175</td>
</tr>
<tr>
<td>7.</td>
<td>Macauley Street Satellite Clinic</td>
<td>District</td>
<td>40</td>
<td>4500</td>
<td>30</td>
</tr>
<tr>
<td>8.</td>
<td>George Brook Community Centre</td>
<td>Health Centre</td>
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<td>450</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>1100</strong></td>
<td><strong>11340</strong></td>
<td><strong>1306</strong></td>
</tr>
</tbody>
</table>

*These healthcare facilities are all functional and the statistics are as of November 2001.*
## Annex 2: Monitoring Plan

<table>
<thead>
<tr>
<th>Activity</th>
<th>Technical Details</th>
<th>Parameters To be Measured</th>
<th>Methods to be used</th>
<th>Sampling Locations</th>
<th>Frequency of Measurements</th>
<th>Institution for implementation</th>
<th>Institution for monitoring implementation</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality Tests</td>
<td>Relates to pollution/Contamination</td>
<td>Chemical and micro organisms</td>
<td>Laboratory and physical analysis</td>
<td>Landfill effluents and potentially affected watercourses</td>
<td>Monthly</td>
<td>Public Health Laboratory</td>
<td>Environment Officers NAS/ARG/EHD</td>
<td>2003-2007</td>
</tr>
<tr>
<td>Air Quality analysis</td>
<td>-Do-</td>
<td>Odour, visibility, chemicals</td>
<td>Visual observation and laboratory analysis</td>
<td>Landfill sites and incinerator-chutes</td>
<td>Daily for odour and visibility, and monthly for air analysis</td>
<td>Public Health Laboratory</td>
<td>Environment Officers NAS/ARG/EHD</td>
<td>2003-2007</td>
</tr>
<tr>
<td>Soil analysis</td>
<td>-Do-</td>
<td>Chemical and micro organisms</td>
<td>Laboratory and physical analysis</td>
<td>Construction and landfill sites</td>
<td>Monthly</td>
<td>Public Health Laboratory</td>
<td>Environment Officers NAS/ARG/EHD</td>
<td>2003-2007</td>
</tr>
</tbody>
</table>

**Total USD**
Annex 3: PERSONS AND INSTITUTION CONTACTED

- The Ministry of Lands, housing, country planning and the environment, at National Level.

- Ministry of Health and Sanitation at National level

- Paramount Chiefs, Elders, general public of target communities and local NGOs of Koinadugu, Moyamba, Bombali and Kono districts.

- The respective District Health Management Team Members.

- Programme Managers of the Malaria Control, Tuberculosis Control, Onchocerciasis Control, HIV/AIDS and Environmental Health Programmes of the Ministry of Health and Sanitation and their respective District Focal Point Persons in Moyamba, Bombali, Kono and Koinadugu Districts.

- Regional Environment Officers.

- Mr. Foday Koroma - Entomologist, MOHS

- Mr Daniel Tholley - Hydro geologist, National Onchocerciasis Control Programme.

- Dr. Br ma Kargbo - Current National AIDS Control Programme Manger; he is the outgoing OCP Manager.

- Dr. Abdulai Jalloh – OCP Manager, Sierra Leone.
Annex 4: REFERENCES

1. Health-care waste Management Study for Sierra Leone, November 2001


3. Involuntary Resettlement (OD 4.30, June 1990)


6. National Environmental Policy


8. Sierra Public Health Ordinance

9. Draft National Environmental Health Policy


11. Sierra Leone Integrated Health Sector Investment Project (IHSIP), Supervision Mission (April 15 – 27, 2002); AIDE-MEMOIRE

12. Safe management of wastes from health-care activities, WHO 1999

13. George Tchobanoglus, Hilary Theisen & Samuel Vigila. Integrated Solid Waste Management
Annex 5: The SELF-LEARNING PROCESS

The training of medical staff will heavily rely on a self-learning process. The advantages of self-learning are several: It diminishes the absence of staff from their sites. It gives the student time to reread and to ponder over difficult issues. It might stimulate a discussion between members of a Health center team. It might be a cheaper solution than calling health staff to a central training venue, which includes per diems and overnight costs (but this should not be a decisive factor).

Practically it will take this form:
A group of up to 20 health staff, preferably of mixed level will be brought together for 1 or 2 days and will be taught general principles of the subject. A pre-test is essential to assess the level of knowledge and possibly to probe the attitude. The result of the test should be used to address the identified weaknesses.

The participants then will be sent back to their working place with the task to study the module(s). It should be emphasized that the materials must not be studied alone but mutual assistance is recommended; making use of the existing experiences and knowledge in the team. An underlying assignment is to strengthen the teamwork. During the process, if at all possible, the Trainer/Supervisor will visit the sites to resolve existing difficulties.

After about 4 weeks the same groups will be recalled and the learning process will be discussed and evaluated. This should take 2-3 days, depending of the level of achievement. The theory should be reviewed extensively to assess the students’ accomplishments. Some practical exercises can be added as well as some case studies for which the participants can propose answers after working in groups on possible solutions.

This process can be repeated; if necessary a limited number of modules can be treated in one cycle.

At the end of the training the students have to sit for an exam and –if possible– pass a practical exercise like a role-play. The agent then receives a certificate and will be entitled to be responsible for the safe management of healthcare wastes. Above average students can be integrated in the trainer/supervisory team.

Limitations of the approach
It will be obvious that not everything can be taught by this approach. It has to be supplemented by other ways of learning; interpersonal communication, attitudes, practical procedures etc. must be learned in a different setting. Anyhow, a continuous training needs assessment using; a variety of different methods to reinforce the knowledge and skills of the health staff and positively change their attitude can be employed.

It might be difficult to motivate the health workers to study at home. The classical seminar type of training has been a source of additional income. To stimulate interest for this form of learning a process of certification should be introduced. This can go together with another form of motivation, again within the context of continuing training, e.g. an attractive medical book, a specific medical instrument, a rewindable radio to listen to educational broadcasts etc.

Another important issue that has to be addressed is that each training session needs in addition to written material for the participants, also a guide for the trainers. Adult education needs a different approach than formal education. There seems to be sufficient expertise and experience in Sierra Leone to elaborate these trainer modules.
**Recommendations**
- Develop and introduce the self-learning method
- Develop additional innovative approaches to inform health staff
- Every training module should come together with instructions for the trainer.

**Plan of implementation**
1. Select cooperating NGOs and CBOs
2. Elaborate the theoretical model of self-learning
3. Define instructions for the self-learning method
Annex 6: CRITERIA FOR SELECTING, DEVELOPING AND OPERATING SANITARY LANDFILL SITES.

A sanitary landfill is a contained and engineered structure, which leads to anaerobic biodegradation and consolidation of compacted waste materials within confining layers of compacted soil. In a sense, a sanitary landfill is a bioreactor. At a sanitary landfill, there are no nuisance impacts of constant burning, smoke, flies, and unsightly rubbish heaps. However, because the waste is not exposed to rainfall, surface runoff or groundwater, leachate consists largely of the waters generated during biodegradation. Therefore, leachate generated from a sanitary landfill is typically much more concentrated in organics and metals than the leachate generated from an open dump, often by a factor of more than 10, and thus needs to be properly treated. Similarly, because of the anaerobic nature of decomposition, methane is generated and needs to be properly ventilated.

Sanitary landfills located in arid areas with limited potential infiltration may have more relaxed design requirements than those located in wet areas. Similarly, sanitary landfills located on coastal lands underlain by naturally undrinkable groundwater may have more relaxed design requirements than those in inland areas overlying potential usable groundwater regimes.

In summary, as described below, a sanitary landfill design would need to have structural integrity over the long term, provide for daily cover of fresh waste, and incorporate mitigating measures to manage leachate and gas produced within the landfill cells.

A sanitary landfill is a step-by-step construction activity involving daily layering, compacting, and soil covering of waste into cells. The site should not be subject to seasonally high groundwater levels or to periodic flooding. The site preparation and landfill operations must be designed to minimize contact of surface runoff and percolating rainwater with the waste. This requires diversion of up gradient surface drainage away from the landfill operational area, sloping of the cells to avoid ponding of waters on top of them, and compaction of waste and soil as each cell is being constructed so that infiltration potential is minimized.

At sites where potentially usable groundwater exists in unconfined layers, any rain and surface runoff waters which percolate through the waste and become contaminated leachate need to be collected. The leachate collection system consists of a network of perforated pipe within a gravel bed, which is placed over the landfill liner. At a minimum the liner would consist of a layer of impermeable clay soil placed in thin layers at optimum moisture content and compacted with a roller. At large landfills receiving municipal waste for major metropolitan areas or at co-disposal landfills where hazardous waste quantities could be received in significant quantities, additional liners made from impermeable geomembrane material may be necessary to protect sensitive groundwater resources. The landfill liner and the leachate collection network need to be properly sloped to enable gravity flow of contaminated water to treatment ponds.

The ponds would be designed to encourage anaerobic decomposition, followed by aerobic decomposition. To the extent possible, full evaporation in the final pond is desired so that no discharge of treated effluent is necessary. If full evaporation is not possible, recycling of treated effluent back to the landfill (on the completed areas of fill), discharge to a sewage treatment plant, or tanker haul to a sewage treatment plant is recommended. Discharge to surface water is not acceptable unless the treated effluent can be assured of not having a significant adverse impact on the water quality requirements of the receiving water.
In addition to leachate management, landfill gas management is a critical component of every sanitary landfill design. Minimum requirements are that the landfill gases would need to be properly ventilated. During site preparation, the landfill side slopes are lined with impermeable clay to curtail lateral migration of the gases, and then lined with coarse rock or gravel to allow gases to escape to the atmosphere. Within every 0.1 hectare, or less, of the waste cell development area, landflling would be conducted around a gas ventilation structure consisting of either a perforated pipe packed in gravel or a rock-filled wire mesh enclosure.

Construction of a sanitary landfill occurs in regular phases, over the life of the site. At the start of construction, the access road, entrance gate, weighbridge, fencing, water supply and Phase I waste cell areas are constructed. Leachate treatment facilities to handle flows generated at the peak period over the life of the site are constructed from the onset. Once the capacity of the Phase I waste cell area is nearly utilized, the Phase II waste cell area requires site preparation and construction (i.e., the Phase II liners, leachate collection networks, gas ventilation systems etc). And so on, over the life of the site, until each Phase of the landfill is completed. Each Phase typically has 3 to 5 years of waste capacity.

Each sanitary landfill is uniquely designed to conform to the soil, geologic, topographic, and water resource conditions of the site. To minimize the costs of operating a sanitary landfill, the first and most critical step is proper siting in a location, which enables economic operations and cost-effective environmental protection. Also, proper siting is essential to minimizing the cost of waste collection.

The following site selection criteria are provided as guidance. A proposed landfill site can be selected even though it does not meet each of the screening criteria. Engineering design can mitigate inadequate site conditions; but at a cost. When selecting a site, which does not meet all of the screening criteria, possible engineering solutions, which would bring the site into conformance with the intent of the unmet criteria, shall be incorporated in the design. Criteria, which shall be addressed as part of a screening process, neither includes, but is not limited to, the following:

- Adequate land area and volume to provide sanitary landfill capacity to meet projected needs for at least 10 years.
- A site accessible within 30 minutes travel time (a function of road and traffic conditions) is to be sought, even if it means buying land, because of the need to avoid adversely affecting the productivity of collection vehicles. At distances greater than 30 minutes travel, for collection operations to be economic, investment in either large capacity collection vehicles (5 tons. per load or greater) or transfer stations with large capacity vehicles (20 tons. or greater) would be necessary.
- If transfer stations are necessary, landfill sites should be accessible within 2 hours travel time one-way from the transfer station.
- Groundwater’s seasonally high table level (i.e., 10 year high) is at least 1.5 meters below the proposed base of any excavation or site preparation to enable landfill cell development
- Soils above the groundwater’s seasonable high table level are relatively impermeable (preferably, less than $10^{-9}$ meters/second permeability when undisturbed).
- No environmentally significant wetlands of important biodiversity or reproductive value are present within the potential area of the landfill cell development, unless they have adequate capacity to absorb/assimilate the pollution loadings anticipated.
- None of the areas within the landfill boundaries are part of the 10-year groundwater recharge area for existing or pending water supply development.
- No private or public drinking, irrigation, or livestock water supply wells within 500 meters down gradient of the landfill boundaries, unless alternative water supply sources are readily and economically available and the owner(s) gives written consent to the risk of well abandonment.
- No known environmentally rare or endangered species breeding areas or protected living areas are present within the site boundaries.
- No significant protected forests are within 0.5km of the landfill cell development area.
- No major lines of electrical transmission or other infrastructure (i.e., gas, sewer, water mains) are crossing the landfill cell development area, unless the landfill operation would clearly cause no concern or rerouting is economically feasible.
- No underlying limestone, carbonate or other porous rock formations which would be incompetent as barriers to leachate and gas migration, where the formations are more than 1.5 meter in thickness and present as the uppermost geologic unit.
- No underlying underground mines which could be adversely affected by surface activities of landfilling, or mines resources, which could be rendered less accessible by landfilling, unless the owner(s) gives explicit consent.
- No residential development within 0.25km from the perimeter of the proposed landfill cell development.
- No visibility of the proposed landfill cell development area from residential neighbourhoods within 1km. If residents live within 1km of the site, landscaping and protective berms would need to be incorporated into the design to minimize visibility of operations.
- No perennial stream within 0.03km down gradient of the proposed landfill cell development, unless culverting or channelling is economically and environmentally feasible to protect the stream from potential contamination.
- No significant seismic risk within the region of the landfill, which could cause destruction of berms, drains or other civil works, or require unnecessarily costly engineering measures.
- No fault lines or significantly fractured geologic structure within 0.5 km of the perimeter of the proposed landfill cell development, which would allow unpredictable movement of gas or leachate.
- Topography amenable to development of sanitary landfill by the Cell (Bund) and/or Trench method. The Area method is not preferred because of its higher energy and soil cover requirements.
- Availability on-site of suitable soil covers materials to meet the needs for intermediate (minimum of 30cm depth) and final cover (minimum of 60cm depth), as well as bund construction (for the Cell method of landfill). Preferably, the site would also have adequate soil to also meet daily cover needs. However, daily cover (usually a minimum of 15cm depth of soil) needs can be alternatively met by using removable tarps or by removing the previously laid daily soil cover at the start of each day for reuse at the end of the same day. For purposes of this siting, assume that at least 1 cubic meter of daily, intermediate, and final soil cover is needed for every 10 cubic meters of compacted waste.
- No Siting within 3 km of a turbojet airport and 1.6 km of a piston-type airport. For sites located more than 3 km and less than 8 km from nearest turbojet airport (or more than 1.6 km and less than 8 km from the nearest piston-type airport), no consideration is to be given unless the aviation authority has provided written permission stating that it considers the location as not threatening to air safety.
• No sitting within a floodplain subject to 10-year floods and, if within areas subject to a 100-year flood, must be amenable to an economic design, which would eliminate the potential for washout.
• Avoid sitting within 1km of socio-politically sensitive sites where public acceptance might be unlikely (i.e., memorial sites, churches, schools).
• Area accessible by a competent paved public road, which can accommodate the additional truck traffic without significant effect on traffic flow rates. From the public road into the site, the access road to be constructed should be less than 10km for large landfills serving metropolitan areas and less than 1km for small landfills serving secondary cities.
Annex 7: GENERAL GUIDELINES FOR THE MANAGEMENT OF HEALTHCARE WASTES.

1. Definitions and Classification of Health-care Wastes
Health-care waste includes all waste generated by health-care establishments, research facilities, and laboratories. In addition, it includes the waste originating from "minor" or "scattered" sources — such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.). These residues can be more or less hazardous depending on their origin within the hospital.

According to WHO, from the total of wastes generated by health-care facilities, almost 80% are general waste comparable to domestic waste. It comes mostly from the administrative and housekeeping functions of health-care establishments and may also include waste generated during maintenance of health-care premises. The remaining approximately 20% of wastes are regarded as hazardous materials that may be infectious, toxic or radioactive and may create a variety of health risks. This study is concerned almost exclusively with the hazardous health-care wastes.

The correct treatment of health-care waste must be based upon consideration of various aspects, including the health and safety of all persons within the hospital (staff, patients and visitors), and the protection of the population outside the hospital from contagious diseases. The specific physical and or chemical properties of the waste with regard to its potential to harm the environment must also be considered.

Consequently, health-care wastes may be classified into groups based on the management techniques which experience has shown are appropriate in each case. Thus, depending on the kind of treatment they require, healthcare waste in Sierra Leone can be classified as follows:

**Type A: Normal Waste**
Waste similar to domestic waste and not requiring any special treatment. This is the waste produced by the hospital administration, the cleaning service, the kitchens, stores and workshops.

**Type B: Patients' Waste**
Waste that requires special handling within the hospital. The aim of such handling is to prevent dispersal of pathogens within the hospital, since these are potentially able to infect persons whose resistance has already been diminished due to illness, advanced age, stress, trauma, lesions, etc. This risk is being aggravated by the concentration of germs in certain areas. Outside the hospital, these wastes can be handled similarly to those of Type A. This waste type generally derives from normal inpatient wards: outpatient examinations room, and first aid areas.

**Type C: Infectious Waste**
Waste that requires special handling inside and outside the hospital. This group comprises all waste from isolation wards in which patients with highly infectious diseases are accommodated and infectious residues from clinical laboratories for microbiological investigations.

This category of waste also includes all disposable waste from all hospital areas that constitute a real risk of infection when being disposed of, such as needles and sharp objects and objects that are covered with blood or human secretion.
Type D: Human Parts
This waste type requires special treatment, not so much to prevent infections, but rather for ethical reasons. This group comprises parts of human bodies generated in operating theatres, delivery rooms, morgues, autopsies, etc.
Examples are organic tissue, placentas and amputated limbs.

Type E: Other Hazardous Waste
This group covers waste types that, for legal reasons or because of their physical or chemical properties necessitate special handling.
Hospitals provide a service and hence have technical infrastructures that can also generate hazardous wastes similar to industrial wastes.
This type also includes radioactive material that may also be handles by authorised personnel, and other wastes classified by legal regulations as hazardous.

Type F: Recyclable Material
Non-contaminated materials from the administration, stores, workshops and so on, should be recycled or reused for reasons of environmental protection.

Type G: Sludge from the Hospital Wastewater Treatment Plant
This sludge can be heavily contaminated and requires additional treatment before being disposed off.

The present study is primarily concerned with the infectious and pathological wastes, Type C and Type D.

2. Segregation and Collection
Every site within the HCF at which waste is generated must be equipped with a sufficient number of waste containers, and emphasis should be placed on the need to segregate “risk waste” from other waste, and to use appropriate packaging and marking.

HCF wastes Types B and C should always be collected in disposable receptacles that meet the following requirements.
- Leak-resistant
- Impervious to moisture
- Of sufficient strength to prevent tearing or bursting under normal conditions of use and handling
- Non-transparent
- Seal-able to prevent transmission of micro-organisms

Polythene bags with a minimum thickness of 100 microns and a size of approx. 60cm x 100cm fulfil these conditions if sharp and pointed objects (syringes, scalpel blades, etc.) are previously placed in cut- and puncture-resistant containers, such as disposable plastic bottles or cardboard boxes.

The filled bags are closed off using a plastic strip, which, once fastened in place, cannot be reopened. It is then removed from the bag holder and placed at the transfer area for its removal by the collection service/waste handler in cases of on-site disposal.

Neither re-use of the disposable receptacles nor compression of the waste is permissible.
For Type D waste, the receptacles should be placed directly in the area where the waste is generated. They must then be sealed and deposited in the corresponding transfer area.

The transfer or storage areas should be set apart from other facilities, be sufficiently well ventilated, and have sanitary facilities for personnel to wash and disinfect their hands.

3. Transports and Storage within the Hospital
The waste should be removed each day from the transfer areas and taken to a storage place. This must be done with care in order to prevent the rupturing or opening of the bags, resulting in release of harmful pathogens into the environment.

Waste of Types A and B, once from within the HCF, can be treated as domestic wastes.

Waste of Types C and D must be transported to a special storage room. This depot must be situated so as not to affect other facilities of the hospital, such as kitchen, laundry, wards, etc. in anyway. It must take the form of an enclosed space to which only authorized personnel have access.

The waste stored in the depot must be picked up daily, and the depot area must be washed out afterwards each time. The carts used for internal transport of the waste must also be regularly cleaned and disinfected.

4. Transports Outside the Hospital
Waste belonging to the Types A and B can be transported by the same service that collects municipal household waste or the waste handler in the case of on-site disposal.

If waste Type C is not treated and disinfected in the hospital area, this waste must be transported by special collection tours. The vehicles used for this transportation can be of varying standards, according to the destination of the waste.

(a) Transport to a central treatment plant:
It is recommended to transport the infectious waste to the central treatment plants in specially designed vehicles which do not compress the waste and which have equipment that prevents the bags from sliding around during transport. The interior of the vehicle must be easy to clean and the floors have raise edges to retain any liquids that may escape from the bags, and it must be adequately ventilated.

(b) Transport to a sanitary landfill site:
In the case that the infectious waste is not to be transported to a central treatment plant but directly to the sanitary landfill site for burying in restricted areas, transport can be carried out in a different way. In the special case where the bags with the waste no longer have to be manipulated by personnel but can be dumped directly onto the prepared excavations, transportation can be done by normal waste collection trucks.

HCF wastes Type D (human body parts and deceased foetuses) should be sealed in plastic containers or plastic bags, which can be transported in the special vehicles, designed for transport of wastes Type C or in any other pick-up or delivery van that is suitable.

5. Medical waste treatment methods
Studies carried out recently have shown that common patients’ waste, with the exception of that from patients with infectious-contagious diseases, is no more contaminated with micro-organisms
than domestic waste, which means that its transport and final disposal does not pose a major risk to the health of the general community outside the hospital.

Accordingly, in the case of the waste included in Types A and B, there is no sanitation-related reason for not transporting and disposing of them together with other urban waste, once they have been removed from the HCF premises.

In contrast, the waste types included in groups C and D, namely infectious and human part, definitely require special management and handling from their production all the way to their final disposal, including treatment which ensures elimination of their harmful properties in order to minimize the risk of contamination and infection.

The terms “sterilization”, “disinfection” and “decontamination” are used in discussions of medical waste. They need to be precisely defined in any regulation:

Sterilization denotes the killing of all living organism in a material. If it is done thermally, it needs temperatures over 134 °C and is, in the opinion of experts, too restrictive for the treatment of all hospital waste materials.

By including in the term “treatment” as the adequate ways of disposal of HCF waste, the following methods of treatment can be distinguished:

- **Special Incineration**
  Incineration of both the infectious and the organic types of HCF waste is a recognized and proven method of eliminating their hazardous properties. This method of treatment also has the advantages of great reduction of the waste volume and the gaining of calorific energy, which can be used for heating and steam production. Various different technologies and patents for combustion are available on the market today, most of which are adequate.

- **Sterilisation by Heat**
  This type of waste treatment is generally performed in autoclaves by steam treatment at high temperatures. It is recommended for microbiological cultures from clinical or research laboratories, which should not leave the investigation area.

  It is not adequate for the large total volume of HCF waste that needs treatment.

- **Disinfecting by Steam**
  Another type of thermal; treatment used for pathological waste is the application of heat at about 100°C, thus transforming infectious wastes into harmless residues. The waste is collected in bags consisting of several layers of paper, with the inside reinforced by a layer of plastic. These bags are placed in a hermetically sealed chamber into which steam is pressed in order to inactivate the pathogens. To ensure that the steam penetrates all parts of the charged waste, the air in the chamber is first evacuated to create a vacuum prior to admitting the pressurized stream. This process is repeated several times following a set pattern lasting approximately 25 minutes.

  Once this treatment has been completed, the waste can be handled as household waste and disposed of in sanitary landfills.
• **Microwave Disinfecting**
  Another method used to disinfect clinical waste in stationary or mobile plants is heating it by microwave energy.

The waste material to be treated by microwaves must first be broken down and shredded to a certain size. As the microwave-process only works in the presence of water, and as clinical wastes are generally rather dry, the shredded waste mixture must be moistened beforehand by adding water and stream.

In a pipe-shaped screw conveyor, the shredded and dampened material is continuously transported under microwave generators to be heated by irradiation. The waste temperature to guarantee the temperature time schedule of decontamination regulates the screw conveyor speed.

• **Chemical Disinfecting**
  There are many techniques for disinfection by chemical means, but none of them has been proven to be effective for treatment of hospital waste.

Equipment is available for shredding or granulating and then disinfecting waste by means of disinfectant liquid; however, its use is generally quite problematic, and there is no guarantee that the disinfectant liquid used will penetrate to all parts of the batch of waste undergoing treatment.

In addition, chemical liquids impose an additional burden on the environment, as chemical disinfectants themselves are inherently hazardous chemicals. Therefore, the use of chemical disinfectants may actually increase personal and environmental risks associated with the management of HCF wastes.

• **Controlled Disposal in Sanitary Landfills**
  Human pathogens live and grow best in an environment that most closely resembles the conditions prevailing in the human body. Conditions in the exterior environment are, for the most part, not conducive to the survival and growth of human pathogens. Studies have demonstrated the rapid death of selected human pathogens after burial in a sanitary landfill, and indicate that land filling can be a satisfactory mechanism for the treatment and disposal of health-care wastes.

For these reasons, infectious Health-care waste of Type C can be buried in sanitary landfills if certain precautions are taken.

• **Burial in Cemetery or Incineration in Crematorium**
  Health-care wastes Type D, human body parts and placentas, can be buried in certain areas of cemeteries or be incinerated in crematoria.

• **Chemical-Physical Treatment**
  As far as the wastes included in Type E are concerned, discussion of details is dispensed with here, since these wastes are not restricted to Health-care facilities and their management should be generally regulated by legislation covering industrial hazardous wastes.
Radioactive waste produced in health-care establishments is of very low-level radioactivity and has a short-life. Residues should be stored safely until their radioactivity has decayed to the point that they are no longer considered radioactive, and then be disposed of according to their other characteristics (e.g. chemical, infectious or general) and in conformity with national regulations.

6. Instructions and Training of Personnel
The technological advance which have been made in health-care call for control of microbiological contamination and hospital infections to be interdisciplinary; in other words, involving not only the physicians, as in the past, but instead spanning an entire groups of professionals with different specialised tasks. Only in this way is it possible, for example, to prevent infections stemming from poor handling of waste. This aspect ought to be of great concern to all persons working in the field of medicine since it imposes additional problems on the basic task of treating patients in order to restoring their health.

Every health-care facility should implement and supervise training and maintenance programmes for the health-care, maintenance and technical personnel. Doctors, paramedics and administrative health-care personnel must, for example, know how to separate infectious and other hazardous waste from non-hazardous refuse and how to handle it.

Training of solid waste personnel should also be directed at the municipal collection and disposal services. Solid waste personnel on collection trucks or at disposal sites must be able to differentiate wastes by colour or other codes in order to handle each type properly. Programmes should include the following themes:

- Categories of health-care waste and rapid assessment
- Segregation, storage and collection methods and equipment
- Treatment and disposal methods.

The general public needs to be informed about the risk associated with exposure to infectious health-care wastes. This can be achieved by advocacy, seminars with groups, workshops, print media (flyers, posters, newspapers, etc), radio and television discussions and jingles.

7. Monitoring and Control
Together with an appropriate legislation regulating waste management inside and outside the health-care institutions and the installation of the appropriate infrastructure, an effective control system of the health-care waste management must be established.

The control of the safe management of waste from health-care facilities should be organized on two levels.

**Level 1**
Responsible self-control of the executing institutions by a qualified member of their own staff, both for the internal sanitary handling, as well as of the municipal services for the management outside the hospital, the collection, transportation, treatment and disposal.

**Level 2**
Public Health Inspectors of the Ministry of Health and Sanitation should be charged with official control, with the power of caution and sanction over all health-care facilities.
8. Waste receptacles and collection

According to the investigations made at the hospitals, one of the main problems of hygienic waste handling is the lack of appropriate receptacles. In nearly all cases, infectious waste together with syringes and needles, etc. are openly collected and transported in open buckets, intended for the cleaning service but not for infectious hospital waste handling.

Therefore, thorough attention has to be given to providing the hospitals with adequate equipment for the collection of the waste.

In Annex B of this study, the general requirements for receptacles are described. According to this, the following system will be recommended for the hospitals in Sierra Leone.

- Waste type A and B can be handled as is done now, drums and plastic buckets with tight-fitting covers respectively.
- The collection and transport of Waste Types C and D must be improved substantially.

In areas where waste of Type C is generated, metallic circular bag-holder with lid shall be employed. In these bag holders, polythene bags will be provided. For better identification the bags will be coloured, and sharp and pointed objects such as syringes blades or glass must be collected in puncture-resistant containers (sharp boxes) before being disposed of in the bags.

The filled bags are closed off using plastic strips, which, once fastened in place, should not be reopened. Then, they are removed from the bag holder and placed at the transfer area for their removal by the collection service direct to the on-site disposal site. Neither re-use of the disposable receptacles nor compression of the waste is permissible.

The most appropriate receptacles for waste Type D (human body parts) are conical shaped plastic buckets with a hermetically sealing plastic lid and a handle for easy handling. If, for economic reasons, it is not possible to acquire this type of receptacle, plastic bags can be used as for the waste Type C. They must have a different colour so that the collection service can distinguish them.

A general upgrading of the hospital’s internal collection equipment (bins, carts, storage areas and protection equipment, etc.) is recommended.

9. Transports and Storage in the Hospital

The waste has to be removed each day from the transfer areas and taken to a storage place. Rubber-wheeled carts with a bin made of plastic or non-rusting metal should be used for this should have a smooth surface for easy cleaning and disinfecting. Moreover, the dimensions must be appropriate for easy manouevrability along the route to be followed inside the hospital.

The storage of the different types of waste has to be done in the corresponding places according to the following requirements.

- Solid waste types A and B should be deposited in the containers used for domestic refuse.
- Waste Type C should be deposited in a special storage room to which only authorized personnel have access.
- Waste Type D should be immediately transported to a cemetery and buried as existing cultural practices demands.
- Waste Type E must be stored according to the regulations for industrial hazardous waste.
• Radioactive wastes must be stored in a radiation-safe place until their radioactivity has decreased to the point where they are no longer considered radioactive, and then disposed of according to the instructions given by authorized officials.

In none of the visited hospitals was there an appropriate room for the storage of the waste Type C. Therefore, in most of the hospitals remodelling will be necessary.

10. Treatment of Waste
The management of the hospital wastes outside the hospital depends on the kind of treatment they have to undergo:

• Waste Types A and B, normal waste and patient’s waste can be transported and disposed of together with other urban waste, once they have been removed from the hospital premises.

• Wastes Types C and D, infectious waste and human body parts, require special transport and treatment, which will be described further.

• Waste Type E, other hazardous waste, must be disposed of according to the regulations for industrial hazardous waste.

Treatment of hospital waste means any method, technique or process designed to change the biological character or composition if any regulated medical waste so as to reduce or eliminate its potential for causing disease. Regarding the adequate sanitary disposal of health-care waste as a treatment method, and by considering the specific needs and possibilities for Sierra Leone, only two technical alternatives can be taken into consideration for waste Type C:

1. Special incineration
2. Controlled disposal in sanitary landfills

Controlled disposals in sanitary landfills have the following reported advantages

• It is a recognised and proven method of disposal of this waste category
• The technology is applicable to all infectious wastes and does not require pre-processing of the waste.
• The control is easy and evident
• It is the most economic method.

However, current practices (open dumping) at the existing dumpsites (Freetown, Bo, and Kenema) militate against this option for the time being. Consequently, and taking into consideration the dangers associated with health-care waste and in particular HIV, HBV, and HCV transmissions, the current practice of incineration without flue-gas cleaning should be improved and promoted until the dumpsite are upgraded to sanitary landfills.

As outlined earlier, infectious hospital waste Type C can be buried at sanitary landfills, provided the following precautions are taken:

• The hospital waste must be transported to an already filled-up area of the sanitary landfill. This landfill, or at least the selected area, should be fenced in so that it will have restricted access.
• The hospital waste has to be dumped directly from the truck into the pit without any handling by labourers.
• The same excavation material from the pit must cover it immediately, preferably.
• The areas where infectious wastes have been buried must be marked and documented to avoid re-opening by further disposal of hospital wastes.

Instruction and training of solid waste personnel, as described in this report, must also be extended to the personnel working on the sanitary landfill.

11. Legal Requirements

Legislation
There is a lack of legislative framework, by-laws and guidelines for the management of hospital wastes in Sierra Leone. The objective should be to set up a legal structure that will be maintained and updated by a Ministry of Health and Sanitation legislation unit. By-laws or regulations on the following themes should be laid won.

• Precise definition of all terms to describe the management of hospital waste
• Classification of hospital wastes
• Internal management of solid waste in health care institutions
• External management of solid waste from health care institutions
• Guidelines for the section of hospital solid waste-handling equipment and materials
• Determination of responsibilities
• Fines and penalties for non-compliance.

Control Institutions
Legislation alone is a useless instrument without an official organ to monitor compliance and the power to enforce it by punishing non-compliance.

Therefore, an effective control system of the hospital waste management must be established. As described before, it can be organised on two levels.

1. Responsible self-control by a qualified member of their own staff for the executing institutions, the hospitals for sanitary hospital-internal handling, and the Environmental Health Division for the management outside the hospital. This should cover collection transportation, treatment and disposal.

2. Official control by health inspectors of the ministry who should exercise control over governmental, private and mission operated health care institutions and has the legal power to caution and/or punish.
Annex 8: The De Montfort Family of Medical Waste Incinerators

All the incinerators (displayed on the following page) are variations on the same basic design. The Mark 1 incinerator is now used in many parts of the world. It burns up to 12kg/h of waste. The Mark 2 is the Mark 1 with a larger secondary combustion chamber to increase the retention time and improve the flue gas emission quality.

The Mark 3 is designed for hospitals up to 1000 beds, and burns at about 4 times the rate of Marks 1 & 2. (50-kg/h approx.)

The Mark 4 is a version of the Mark 1 specifically designed for use in emergency situations where low cost and a minimum of expensive materials and techniques are priorities. It contains only two metal components, and uses firebricks only where these are absolutely necessary. It will nevertheless attain very similar combustion temperatures as the others but the expected life is less than 1 year.

The Mark 5 incinerator is thermodynamically the same as the Mark 3, but modified to carry the weight of a much higher chimney for use where a high chimney is a legal requirement or where the proximity of other buildings makes a high chimney necessary to disperse smoke and fumes.

Incinerator Mark 7 is the flat pack version for use in disaster or emergency situations and in settings where necessary materials or skills are not available in the country or area.

The Mark 8 has the same throughput as the Mark 1, is as Mark 4 in terms of construction but is designed for an extended life. The Mark 8 can also be built in those countries where firebricks are not of uniform dimensions and cannot therefore be bound together.

For information and construction plans please contact Professor D.J Pickens:

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The De Montfort Family of Medical Waste Incinerators

Mark 1
(12kg/h)

Mark 2
(12kg/h)
With Emission Reduction System

Mark 3
(50kg/h)
With Emission Reduction System

Mark 4
(12 kg/h, 1-year life, minimum cost)

Mark 5
As Mark 3 but modified for tall chimney

Mark 6

Mark 7
(12 kg/h) Built from Pre-fabricated Components for rapid assembly

Mark 8
As Mark 4 but for extended life
Annex 9: HEALTHCARE WASTE MANAGEMENT TRAINING PLAN

Rationale for training in health-care waste management

The medical waste study (November, 2001) established a lack of awareness about risks associated with unhygienic management of healthcare waste in Sierra Leone. Hence, the needs for a national training plan.

Healthcare waste is special in that it has a higher potential of infection and injury than any other type of waste. Therefore, it has to be handled with sound and safe methods wherever generated. Inadequate handling of health-care waste may have serious public health consequences and impact on the environment. Healthcare waste management is, therefore, an important and necessary component of environmental health protection.

Hospitals and healthcare establishments have responsibilities and a “duty of care” for the environment and public health, particularly in relation to the waste they produce. They also carry a responsibility to ensure that there are no adverse health and environmental consequences as a result of waste handling, treatment and disposal activities. Unfortunately, health-care waste management is, in many regions, not yet carried out with a satisfactory degree of safety.

The proposed training programme aims at transmitting the basic skills for the development and implementation of a healthcare waste management policy, including the components outlined in this programme. In this way, healthcare facilities can take steps towards securing a healthy and safe environment for their employees and communities.

The objectives of the training on HCW

1. To raise awareness on public health and environment hazards that may be associated with inappropriate segregation, storage, collection, transport, handling, treatment and disposal of health-care waste;

2. To provide information on hazards and sound management practices of health-care waste for the formulation of policies and the development or improvement of legislation and technical guidelines;

3. To identify waste management practices and technologies that are safe, efficient, sustainable, economic and culturally acceptable; to enable the participants to identify the systems suitable for their particular circumstances;

4. To enable managers of health-care establishments to develop their waste Management plans;

5. To enable course participants to develop training programmes for the different categories of staff that handle, treat or dispose of health-care waste.

At the end of the course the participants should be able to demonstrate individually that they have achieved the course objectives and competence in health-care waste management.

Target groups for the course on HCW
The course is targeted at managers, regulators and policy makers, which are involved in health-care waste management. The main professional categories are the following:

1. Officials from national or regional authorities involved with developing policies
2. In health-care waste management;
3. Environmental or health and safety regulators;
4. Environmental health professionals;
5. Hospital managers and other administrators of health-care establishments;
6. Representatives of local authorities;
7. Waste collection, treatment and disposal managers;
8. Manufacturers of medical devices, chemicals and pharmaceutical