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**Republic of Uganda**

**MINISTRY OF HEALTH**

**HEALTHCARE WASTE (HCW) MANAGEMENT SYSTEMS  
PROGRAMME 09, VOTE 014**

**Improvement of Health Care Waste  
Management in Uganda**

**Design Report**

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## EXECUTIVE SUMMARY

Ministry of Health contracted Carl Bro a/s to develop a healthcare waste management plan. The objectives of the assignment were:

1. Review of available information, study/assess the existing healthcare waste management systems in health units, identify inadequacies and propose possible actions/solutions.
2. Design of appropriate healthcare waste management systems and facilities for all stages of waste management.
3. Development of healthcare waste management guidelines for the different categories of healthcare waste, development of a training manual and preparation of an operation and maintenance manual for the waste management facilities.

This report presents the design of the appropriate healthcare waste management systems and facilities for all stages of waste management system based on findings from the inception phase and consultations with stakeholders during the design phase. The report presents the designs of the various elements of the health care waste management, including separation and intermediate storage, transport and treatment and final disposal. The budgets for investment and operation and maintenance are included in this report.

### Status of Healthcare Waste Management in Uganda

The current health care waste management system in Uganda is inadequate. Generally the current management of healthcare wastes does not ensure occupational and public health safety. The following problems were identified:

- **Technical Problems:** lack of equipment for proper handling, transportation and treatment of wastes, poor infrastructure and inadequate procurement procedures for wastes handling services.
- **Environmental and public health Problems:** most health care waste is disposed of in wastes dumps, which represents risks to the environment (contamination of land and groundwater) as well as risk to public health.
- **Occupational Health Problems:** The health staff and waste handlers lack adequate equipment, education, training and awareness.
- **Institutional and Legislative Problems:** There is no detailed legislation and institutional framework for management of healthcare wastes which also leads to inadequate funding.

In order to improve the management of healthcare wastes it is important that the following key elements are addressed:

- The establishment of a comprehensive system, addressing responsibilities, resource allocation, handling and disposal.
- Awareness raising and training about the risks of HCW and the proper means of handling, treatment and disposal
- Establishment of safe handling, transporting, treatment and disposal options.

The first stage of the Consultancy proposed and analysed 3 scenarios for future management of Health care wastes.

| Scenarios  | Pharmaceutical /Chemical waste + Genotoxic waste, heavy metals etc.                                  | Infectious waste, sharps  | Pathological waste   | General waste / Deactivated HCRW                           | Comments   |
|------------|--|---|--|--|--|
| Scenario 1 | Collected from all HC's; transported to one HCRW treatment facility at national level                | Collection from all HC's and treatment at brick incinerators at sub district and district level         | All HC's: Placenta pits for body parts etc. Burning of other pathological waste in brick incinerators at sub district and district level   | On-site burning/ burial or disposal at dump site/ landfill | This is considered a realistic scenario for immediate implementation   |
| Scenario 2 | Collected from all HC's; transported to HCRW treatment facilities at regional level                  | Collection from all HC's and treatment at sophisticated incinerators at regional level                  | All HC's: Placenta pits for body parts etc. Burning of other pathological waste in sophisticated incinerators at regional level  | On-site burning/ burial or disposal at dump site/ landfill | Due to very high costs and the large need for trained staff at regional level, this scenario is not considered feasible for the next decade    |
| Scenario 3 | Collected from all HC's; transported to HCRW treatment facilities at sub district and district level | Collection from all HC's and treatment at sophisticated incinerators at sub district and district level | For cultural / religious reasons, placenta pits may still be used for disposal of body parts etc. at all hospitals and other HC's. Other pathological waste to be treated in high standard incinerators. | Disposal at controlled dumpsites / sanitary landfills      | Due to extremely high costs and the large need for trained staff at sub district and district level, this scenario is not considered realistic |

The estimated establishment costs and annual operation and maintenance costs for the three scenarios are as follows:

|  | Scenario 1 | Scenario 2 | Scenario 3 |
|--|------------|------------|------------|
| Estimated establishment costs (mill. USHS)                         | 27,112     | 44,784     | 131,272    |
| Estimated annual operation and maintenance costs (mill. USHS/year) | 2,392      | 8,886      | 25,523     |

The most feasible option for introduction based on ease of operation and maintenance of the facilities and on costs, is scenario 1. The system should be introduced concurrently with institutional development and training of health workers and waste handlers as well as with general public awareness campaigns.

### **Recommended Health care waste management system**

The following ways are recommended for handling of different types of wastes:

**Pharmaceutical/chemical wastes:** Collected from all health centres , transported to one treatment facility at national level and final disposal by safe burial.

**Infectious waste, sharps:** Collected from all health centres ,treated using brick incinerators at sub district , district and regional hospitals and final disposal by safe burial.

**Pathological waste:** At all health centres placenta pits for disposal of placentas and body parts. For the rest of pathological wastes burning in brick incinerators at sub district, district and regional hospitals and final disposal by safe burial.

**General Waste and deactivated health care risk waste:** On site burning and burial or disposal on landfill.

Appropriate waste containers and packaging materials will be provided for all health centres and proper segregation at source and intermediate storage will be implemented at all health centres. Containers for sharps should be safe containers with lids with access for putting sharps but stopping retrieval of disposed waste. The containers should be disposed together with the sharps. The rest of the containers should be reusable and have lockable leak proof lids.

### **Implementation Approach**

It is recommended to implement the improved HCRW management system in accordance with a phased implementation plan. In order to get valuable experience before full scale implementation it is proposed that the system is piloted out in 4 districts and based on lessons learnt the necessary adjustments made before nationwide implementation.

For treatment of pharmaceutical/chemical wastes and other types of wastes that cannot be treated at the district level facilities a national facility will be set up near Kampala and this facility can also be used for treatment of health care wastes from other hospitals and health centres and other institutions (i.e. the National Blood bank) in the area of Kampala.

Concurrently with the pilot in 4 districts activities it is recommended that some nation wide activities are also undertaken. The recommended nation wide activities include:

1. Education and training of health care staff in proper sorting and handling of wastes.
2. Public awareness aimed at increasing the understanding and of the need for proper HCW management among the patients and general public.
3. Implementation of use of appropriate waste containers and packaging materials provided for all health centres. Proper source segregation and intermediate storage should be implemented nationwide.

### **Organisational Structure**

The organisational structure for establishing and running the health care system will as much as possible be accommodated within the existing management health sector systems. At National level a national health care management or steering committee will be set up to coordinate and monitor the implementation and promote nationwide improvements in management of health care wastes.

At district level the district health teams will be responsible for waste management and the district director of health services will appoint one member of the district health team to be responsible for monitoring the health care waste management in the district.

At health facility level the responsibility for health waste management will be with the infection control committee and it is proposed a senior member of the facility is made responsible for waste management.

## LIST OF ABBREVIATIONS AND ACRONYMS USED

|       |  |
|-------|--|
| AIDS  | Acquired Immune-Deficiency Syndrome                    |
| DADI  | District Assistant Drug Inspector                      |
| DDHS  | District Director of Health Services                   |
| DDI   | District Drug Inspector                                |
| DHV   | District Health Visitor                                |
| DMO   | District Medical Officer                               |
| EDSP  | Essential Drug Support Programme                       |
| FP    | Family Planning  |
| HA    | Health Assistant                                       |
| HCRW  | Health care risk waste                                 |
| HCW   | Health care waste                                      |
| HCWM  | Health care waste management                           |
| HI    | Health Inspector                                       |
| HSSP  | Health Sector Support Programme                        |
| JCRC  | Joint Clinical Research Centre                         |
| JMS   | Joint Medical Stores                                   |
| KCC   | Kampala City Council                                   |
| LCV   | Local Council Five                                     |
| MAAIF | Ministry of Agriculture, Animal Industry and Fisheries |
| MOH   | Ministry of Health                                     |
| MSF   | Medecins Sans Frontieres (Doctors without frontiers)   |
| NDA   | National Drug Authority                                |
| NEMA  | National Environmental Management Authority            |
| NGO   | Non Government Organisation                            |
| NMS   | National Medical Stores                                |
| OPD   | Out Patients Department                                |
| O-J-T | On The Job Training                                    |
| PHC   | Primary Health Care                                    |
| TOT   | Training of Trainers                                   |
| UNEPI | Uganda National Expanded Programme on Immunisation     |
| UVRI  | Uganda Virus Research Institute                        |
| WHO   | World Health Organisation                              |
| WMO   | Waste Management Officer                               |

### Acronyms

*Safe burial of wastes* - geological isolation of wastes from the environment, appropriate engineering preparations before the site is ready to accept wastes, staff present on site to control operations, and organised deposit and daily coverage of waste.

## **INTRODUCTION**

### **Context**

In July 2003, the Ministry of Health contracted Carl Bro a/s to develop a healthcare waste management plan. The objectives of the assignment were:

1. Review of available information, study/assess the existing healthcare waste management systems in health units, identify inadequacies and propose possible actions/solutions.
2. Design of appropriate healthcare waste management systems and facilities for all stages of waste management.
3. Development of healthcare waste management guidelines for the different categories healthcare waste, development of a training manual and preparation of an operation and maintenance manual for the waste management facilities.

In February 2004, Carl Bro submitted an Inception Report including a presentation of the findings of the first stage of the consultancy of review of available information, a study on the current healthcare waste system, and proposed possible solutions to the current problems.

The Inception Report proposed and analysed 3 different scenarios for the future nationwide management of health care waste. One scenario was recommended for further development and stepwise implementation concurrently with institutional development and training of health workers and waste handlers as well alongside with general public awareness campaigns.

### **Contents of this Report**

This report describes the current waste management system and methods of handling wastes, and presents the recommended waste management system for Uganda. The report describes the technical requirements for the recommended improved system; the implementation strategy; the organisational and institutional arrangements for the improved health care waste system; and the education and training requirements for health staff, waste handlers and general public. Costs and financing for establishment and operating the improved HCWM are described.

Detailed designs of the various components of the system, draft tender documents including drawings and detailed costs analyses are presented in the appendices.

## **CURRENT HEALTH CARE WASTE MANAGEMENT SYSTEM**

### **Organisation and Management of Health Care Wastes**

There is currently no nationally organised system for the management of health care waste in the country. There is a new policy, but there are no detailed standard guidelines or regulations on healthcare waste management.. The individual health centres manage their wastes in their own way. There is no coordination, supervisory support or control from the national or district level. The hospitals, research institutions, health centres and private clinics which are the waste generating institutions dispose their health care wastes using a combination of methods including open pits, open air burning, burying, incineration, discharge into the waste water system, and dumping into the urban authority waste skips.

The potential for the health care institutions to manage their own health care waste is quite good. Most of the health care providers have the knowledge of proper health care waste collection, transportation and disposal and are quite innovative in handling waste in their circumstances. However, there are inadequate appropriate facilities for the waste disposal.

The District Environmental health staff is expected to guide, supervise and monitor the management of wastes, including health care waste in the districts (rural as well as urban). However, the environmental health staff do not seem to have the ability to competently provide technical advice and support on the management of health care waste.

In towns, the urban local authorities are responsible for the provision of containers for waste collection in urban areas, the transportation of the waste from the point of collection to the disposal site and proper disposal of the waste. However, the urban authorities have constraints in providing appropriate containers for collection and transportation of the waste. The urban authorities do not have the capacity for safe disposal of health care waste because the dumpsites they currently use for the general waste disposal are poorly managed and are unsuitable for the disposal of health care waste. There is a general lack of awareness about health care waste disposal among the urban authorities. Although they are expected to regulate and supervise waste management in the urban centres, this does not happen with respect to health care waste.

The MOH is committed to the improvement of health care waste management through development of policy guidelines and standards, supervision and provision of technical support. However, apparently the MOH does not have the resources to fulfil these duties.

The NDA is expected to develop and disseminate guidelines and regulations on the management of pharmaceutical wastes. Above all it is expected to monitor, supervise and control the disposal of pharmaceutical waste at national and district levels. It is the duty of District Drugs Inspectors to keep record on expired drugs and to report to the NDA. However, in general this is not carried out and no overall picture of the total amounts of pharmaceutical waste exists.

The National Environment Management Authority (NEMA) has the mandate and capacity to formulate policies and regulations on environmentally safe disposal of waste. In addition, the National Environmental Statute of 1995 provides the overall legal framework for making specific regulations for the management of health care waste. NEMA has developed the National Environment Policy and Action Plan and possesses the capacity to elaborate specific by-laws and regulations for health care waste disposal.

### **Current Generation of Health Care Waste**

In most hospitals and health centres there are no records kept of the waste generation rates. An estimate of the waste generation rate was made based on one month data available from UVRI, which disposes of waste from Entebbe hospital and also waste estimates from Mubende and Kabale hospitals. The estimated figures were compared to waste generation estimates from other developing countries. Using the available information, the estimated present waste generation rate in the different levels of health facilities is as follows:

**Table 2.1: Healthcare Waste Generation Rates for Different Levels of Health Facilities**

| Health Care Facility | Estimated Waste Generation Rate             | Comments   |
|----------------------|---|--|
| District Hospital    | 0.1 kg/bed day (without pathological waste) |  |
| HC IV                | 1.5 kg/day (without pathological waste)     | Estimates are based on Kabale, Arua, Mbale and Masaka regions with an average of 50 outpatients/day, and an average of 5 inpatients per day. |
| HC III               | 0.6 kg/day                                  | Estimates are based on Kabale Arua, Mbale and Masaka regions with average 25 outpatients/day, and average of 3 inpatients, a month.          |
| HC II                | 0.5 kg/day                                  | Estimates are based on Kabale Arua, Mbale and Masaka regions with average of 25 outpatients/day.   |

It was not possible to make an estimate of the pharmaceutical waste generation rate in the different health centers. In addition to the pharmaceutical waste generated in the health facilities, a major part of the waste is generated by the various importers and the Uganda Revenue Authority. In the feasibility study that was done on the disposal of expired drugs, in 1997, it was estimated that 10% of the imported drugs are expired or unused. The design team has maintained the same estimate.

### Estimated Future Generation of Health Care Waste

To make a forecast on the future waste generation, the following assumptions were made:

- The number of beds per 1,000 inhabitants as well as the generation rate per bed will remain constant for the next 10 years.
- The population growth rate is as stated in the Environmental Policy Action Plan and according to the preliminary census figures for 2002.

The estimated national healthcare waste production for 2003 and the next 10 years are shown below.

**Table 2.2: Forecast on HCWR Generation**

| Year | Sharps<br>(Tons/year) | Infectious<br>Waste<br>(Tons/year) | Pathologi-<br>cal Waste<br>(Tons/year) | Total<br>HCRW<br>(Tons/year) |
|------|-----------------------|------------------------------------|--|------------------------------|
| 2003 | 146                   | 776                                | 358                                    | 1280                         |
| 2004 | 151                   | 802                                | 370                                    | 1323                         |
| 2005 | 156                   | 830                                | 383                                    | 1368                         |

| Year | Sharps<br>(Tons/year) | Infectious<br>Waste<br>(Tons/year) | Pathologi-<br>cal Waste<br>(Tons/year) | Total<br>HCRW<br>(Tons/year) |
|------|-----------------------|------------------------------------|--|------------------------------|
| 2006 | 161                   | 858                                | 396                                    | 1415                         |
| 2007 | 167                   | 887                                | 409                                    | 1463                         |
| 2008 | 172                   | 917                                | 423                                    | 1512                         |
| 2009 | 178                   | 948                                | 437                                    | 1563                         |
| 2010 | 184                   | 980                                | 452                                    | 1616                         |
| 2011 | 191                   | 1013                               | 467                                    | 1671                         |
| 2012 | 187                   | 1049                               | 483                                    | 1728                         |
| 2013 | 204                   | 1083                               | 500                                    | 1787                         |

## Current Handling of Health Care Wastes

### Sharps

#### Segregation of Sharps:

Sharps are items that could cause cuts or puncture wounds and include needles, broken glass, ampoules, lancets and other sharp medical instruments. The handling of sharps varies in different health facilities although the general practice is to separate sharps especially needles and hypodermic syringes into different containers from other waste. The containers used vary although in Kabale district most health centres use safety boxes, which are provided as part of the immunization exercises. Other centres use old JIK containers, which are disposed of with the waste.

Some facilities use plastic sharp containers, which are emptied and reused. In most instances it was noted that the containers are very full, which makes them dangerous during disposal. Although at all the centres visited, the agreed practice is to separate sharps into safety boxes, or well labelled containers, it was noted that in several instances some of the sharps had been discarded in the containers for the other waste.

It was reported that sometimes the sharps are reused (it is mainly sharps in the laboratories which are reused). In this case these are collected and decontaminated using JIK and are later sterilized before reuse.

#### Storage:

In most lower levels of health centres the sharps are stored separately in their containers at the point of generation, until disposal in the mornings or when the facility is cleaned. In hospitals the full containers are still stored in their containers in most instances in the sluice room, or in a designated room.

#### Collection, transportation and disposal:

In most health facilities it is the responsibility of the cleaner or porter to collect, transport and dispose of the sharps. Most waste is collected in the morning as part of the cleaning exercise of the facility. Most facilities and hospitals have no dedicated trolleys for the transportation of the waste.

Although the sharps are supposed to be segregated from other waste, they are disposed of together with the rest of the healthcare waste. The disposal methods vary in the different health facilities with most of the health centres carrying out open air burning of the sharps in their

containers, together with the other waste. In some instances the sharps are burnt at a compost pit, where the unburnt residue is left, other centres burn the waste in pits, while some centres, especially the HCIV have properly constructed covered pits, where the ash is disposed of. It should be noted that at all the centres where the residue was accessible it was noted that not all the sharps were destroyed. This makes it especially dangerous where the residue is collected and disposed of in pits, or where the disposal site is accessible to the public, especially if the sharps are not decontaminated during burning.

A number of centres disposed of the sharps into pit latrines, while others used open pits where the waste was not burnt nor covered. Kabale hospital has a pit with covers for the disposal of sharps although some are burnt at the compost sites. Arua hospital has a sharps disposal pit with a funnel. The sharps containers, which are metallic and reusable are opened directly over the funnel and the sharps slide into the pit without being touched.

### Infectious Waste

Infectious waste is waste suspected to contain pathogens in sufficient quantity to cause disease in susceptible hosts. Although this category includes infected sharps and pathological waste, these are addressed separately in this study.

#### **Segregation:**

The handling of infectious waste is different in different health centres. While at many centres the general waste, i.e. paper, etc. is not separated from other waste, some centres separate the general/dry waste from wet waste or contaminated waste. The waste is put in well-labelled containers, in most instances with lids, and in a number of instances the bins are lined with polythene containers, which makes disposal easier. The containers used are either plastic buckets or metallic containers. These are labelled either as contaminated waste or wet waste.

There are no written guidelines for the separation of waste and sometimes sharps are put into the bins for infectious waste.

The laboratory wastes are handled differently at different facilities. In Kabala District it was reported that infected blood is autoclaved before disposal while the rest of the samples e.g. stool and sputum are discarded into the bins/buckets together with the other waste. Major research laboratories have established procedures, where the infectious waste is autoclaved before disposal.

#### **Storage:**

In most facilities visited the waste is left in the container at the point of generation in the treatment room until disposal. In the hospitals the waste is stored in the sluice room until disposal. In the laboratories the waste is kept in the laboratory until collection.

#### **Collection, Transportation and Disposal:**

In most health facilities the collection and disposal of waste is the responsibility of cleaners or porters. In most hospitals (government owned) the cleaning services are tendered out to private contractors, who employ staff for the cleaning services. The collection and disposal usually form part of the contracted works. The Contractor's staff is not equipped with protective

clothing and are not educated on the dangers of healthcare waste. For NGO and private hospitals dedicated staff are employed for handling of wastes.

Unlike hospitals, most lower level health centres employ one porter in charge of cleaning the centre as well as collection and disposal of the waste.

The centres do not have trolleys for transporting the waste to the disposal site. Different centres use different methods of disposal. Some centres carry out open air burning of the waste in pits or at compost sites. In some cases the residue is disposed of into pits. In some centres the waste is put in shallow pits and burnt occasionally while a few do not burn the waste at all.

In most instances the disposal site is not protected and easily accessible to the public and some sites are located quite near the facilities.

A few centres and research laboratories have functional incinerators (in Arua district most HCIII, IV and hospitals have incinerators), although of the 17 Incinerators inspected only 2 were functioning optimally (1 at Maracha hospital and 1 in Mubende hospital). Most of the incinerators are not properly maintained and have cracks, and do not the required temperatures. Due to improper operation these incinerators may pose a health hazard, especially if the temperature has not reached the sufficient level before waste is applied.

#### Pathological Waste

Pathological waste includes tissue, limbs, and body fluids. Due to poor staffing at most HC IVs, the theatres are not operational and the most common pathological waste at these centres and at HCIIIs is tissue from delivery rooms.

#### **Segregation:**

The handling of pathological waste is the same in most of the health units. At most centres attempts are made to segregate the pathological waste from other waste categories. In most hospitals and health centres the tissue from surgical operations or deliveries are put in basins or buckets separate from other waste. Blood generated from operations or deliveries is simply washed down the sink.

In the laboratories donated blood, which is infected, is autoclaved before disposal, while expired blood is either disposed at the units or returned to the blood bank. During the Consultant's team visit to Nakasero Blood Bank it was found that the bags in use were not autoclavable and blood wastes were being disposed of before autoclaving.

#### **Storage:**

In general pathological waste is not stored for long before disposal. In hospitals the waste from operations and deliveries is briefly stored in the sluice room before being taken directly for disposal.

Most hospitals have mortuaries where dead bodies are stored, before being claimed by relatives or if unclaimed disposal by municipal/town authorities.

#### **Collection, Transportation and Disposal:**

Most health centres have a dedicated well-constructed placenta pit where most pathological waste is disposed of except for foetuses, and anatomical waste. Where there is no placenta pit, then the pit latrine is used. It is usually the medical staff that disposes of the waste in the placenta pits.

In most areas the anatomical waste is buried together with unclaimed dead bodies. For the hospitals, which are located within the towns, this is usually the responsibility of municipal/town authorities. For hospitals, which are not located within towns, it is the responsibility of the hospital to dispose of the anatomical waste and some have cemeteries for this.

In some parts of Arua the patients claim the placentas and bury the placentas themselves since it is not culturally accepted to bury the placentas in communal disposal points.

The incinerators at the Nakasero Blood bank are no longer operational and expired blood/wastes are supposed to be disposed of offsite (i.e. at Green Label Incinerator in Nakasongola). The Blood Bank did not have dedicated funds for wastes disposal and during the visit to the Blood Bank by the consultant's team wastes had accumulated on site since the Bank did not have money to pay for disposal.

#### Pharmaceutical Waste

Pharmaceutical waste includes expired, unused, spilt, and contaminated pharmaceutical products, drugs, vaccines and sera that are no longer required and need to be disposed of properly. The category also includes discarded items used in the handling of pharmaceuticals such as bottles or boxes with residues, and drug vials.

#### **Segregation:**

At the health centres, which were visited, there is very little expired drugs. The bulk of pharmaceutical waste at these facilities is package material, which can be disposed of as general waste. In Kabale District, the District Drug inspector attempts to collect expired drugs from private clinics and pharmacies, although not from the government institutions. The collected drugs are stored at the DDHS office. At the centres that reported to have expired drugs, these were stored in the pharmacy, where the valid drugs are stored. A few centres reported that any expired drugs are disposed of with the other waste.

The hospitals i.e. Masaka hospital have significant amounts of expired drugs, which are stored in one building together with other items no longer in use like beds and chairs.

At hospitals and some health centres attempts have been made at recycling the glass bottles, which are used as sample bottles in the laboratories.

#### **Storage:**

All health centres are expected to sort out the expired drugs and submit the list to the District assistant Drug Inspector (DADI) who should ensure safe storage in the District Director of Health services stores until instructions are given by NDA on disposal.

### **Collection, Transportation and Disposal:**

Transportation and disposal of expired/defective drugs from NMS and URA is contracted to Green Label services who dispose of the drugs at their incinerator in Nakasongola. Drugs from the districts are either disposed of directly by health units or pile up in the district stores.

#### Wastes Incineration

Most hospitals and some health centres III and IV have incinerators. However most of the incinerators are either not functioning or are malfunctioning (not achieving the correct temperatures and hence functioning as ovens). The main reasons for the poor state of the incinerator operations due to:

- Poor designs and/or construction- It was found that many of the incinerators in use were not designed for the types of wastes they handle. Most of the locally manufactured/constructed incinerators were constructed from poor quality materials (ordinary not refractory bricks, ordinary sand and cement mix). Construction contracts did not have proper specifications and contracts were not well supervised. Many of the incinerators are not properly sited and are very near wards or next to areas of human habitation i.e. at Nakasero Blood bank, Naguru Teenage Centre and Masaka hospital.
- Poor operation- Generally the quality of staff operating the incinerators, met by the consultancy team during the visits to hospitals and health centres was very poor.( apart from the staff at the Uganda virus research institute, Maracha hospital and Mubende hospital). Most staff operating incinerators did not have adequate training/or were very low calibre and were untrainable. The poor calibre of staff coupled with lack of a waste management system including lack funds and absence of any routine repairs has led to very poor operation of incinerators even for those which were properly built or imported. The majority of incinerators are single chamber with no filters achieving temperatures below 800<sup>0</sup>C and cannot reduce on the levels of toxic gases and incineration of plastics and chlorinated substances at low temperatures can lead to production of dioxins which are very harmful to health.
- Lack of isolation/poor security of the incineration sites- Most of the incinerator sites are not properly isolated and are easily accessible by public (no fencing) and as stated above some are even located next to areas of human habitation.

#### General Waste

##### **Segregation:**

General waste includes paper, plastic, food, glass and waste generated from house keeping activities. Most centres do not provide food for the inpatients except for the very few who cannot get food from home, or who have no attendants to prepare food for them. Although most centres have a designated area from which the attendants prepare food, no containers have been provided for the collection of the waste. The attendants are responsible for the disposal of waste to the compost sites.

In the health facilities attempts are made at some centres to separate the general waste from the other waste, although the healthcare waste is sometimes put in the same bins with the general waste.

**Storage:**

The waste is kept in the generation room until it is taken to the disposal site, although in the hospitals it is usually kept in the sluice room or designated area with the other waste.

**Collection, transportation and disposal:**

The collection and disposal of the general waste is the responsibility of the cleaners or porters. There are no dedicated trolleys for the transporting of waste, and although the waste may be sorted, it is usually put together with the other waste for transportation to the disposal site.

The general waste is usually disposed of together with the infectious waste. In most centres, the waste is burnt or put in pits.

**SUMMARY OF CURRENT HCWM PROBLEMS**

Although most problems are closely related to each other, they may be divided into the following categories in order to provide a general view:

**Mainly Technical Problems:**

- Lack of equipment (bins, boxes, bags etc.) for proper source segregation and storage of the different HCW categories.
- Lack of equipment and facilities for collection, transport and treatment of HCW.
- Lack of safe disposal sites (sanitary landfills and/or controlled/manned dumpsites).
- Poor infrastructure in districts (poor road quality, long transport distances)
- Inadequate specification when tendering for waste management services ( i.e. poor specification of incinerators, poor specification of cleaning services, no clauses on occupational health)

**Mainly Environmental Problems:**

- Waste dumps represent risk to groundwater, air pollution, and land contamination.

**Mainly Public Health Problems:**

- Unsafe dumping / disposal causes a risk to the public health.

**Mainly Occupational Health Problems:**

- Lack of adequate equipment, education, training and awareness causes occupational health problems for workers involved in handling of HCW.

**Mainly Institutional and Legislative Problems:**

- Lack of detailed legislation (regulations etc.) results in unclear determination of duties and responsibilities.
- There is a lack of enforcement of legislation.
- Low awareness on the importance of proper management of HCW at hospital management level.

**Mainly Financial Problems:**

- The current budgets allocated for implementation of improvements and for the recurrent operation and maintenance costs are not sufficient to cover all costs related to implementation and maintenance of the necessary improvements.

**Mainly awareness and attitude problems**

- Many of the staff who handle wastes (cleaners, wastes collectors) at health establishments have a very low awareness on the dangers of the wastes are exposed to occupational hazards. Though the knowledge health workers (doctors, paramedics and nurses), is relatively high on dangers of health wastes the attitudes towards safe handling of wastes and practice is low.

**RECOMMENDED HEALTH CARE WASTE MANAGEMENT SYSTEM**

**Brief Description of the Recommended System**

The recommended waste management system should aim at:

- Avoidance or minimization of secondary impacts from the disposal system
- Prevention of human access and scavenging activities
- Control of contamination of land, air or water
- Avoidance of disease vectors (insects, rodents etc.)

As described in the Inception Report /ref. 15/, the recommended Scenario 1 includes the following ways of handling different types of health care waste:

**Table 3.1: Recommended HCW Handling System**

| <b>Health care waste category</b>                                   | <b>Handling system</b>   |
|---|--|
| Pharmaceutical /Chemical waste + Genotoxic waste, heavy metals etc. | Collected from all HC's; transported to one HCRW treatment facility at national level. The waste will be treated in a modern, sophisticated incineration facility. |
| Infectious waste, sharps  | Collection from all HC's and treatment at brick incinerators at district / regional hospitals  |
| Pathological waste  | All HC's: Placenta pits for body parts etc.<br>Burning of other pathological waste in brick incinerators at district and regional hospitals                        |
| General waste / Deactivated HCRW                                    | On-site burning/ burial or disposal at dump site/ landfill   |

***Separation and intermediate storage of HCW:***

Appropriate waste containers and packaging material will be provided for all health centres. Proper source segregation and intermediate storage will be implemented at all health centres.

For the safe segregation and collection of the different waste, the following types of containers and packaging material are needed:

- Sharps containers to be provided should be safe, secure containers with lids, with access for putting in the sharps, but stopping retrieval of the disposed waste. The containers should be disposed of together with the sharps.
- The containers for the rest of HCW be reusable and have lockable leak proof lids with clear labelling areas. The containers should be supplied with plastic liners to make disposal of wastes safe for handlers.

A detailed description of containers and packaging material recommended for this purpose is attached as Appendix 1.

***Transport and treatment:***

Infectious waste and sharps will be collected from all health centres and transported for treatment in brick incinerators at district level. Some pathological waste (placentas, body parts etc.) will be disposed off in placenta pits at individual health centres. Other pathological waste will be treated in brick incinerators at district level.

A central national treatment facility for pharmaceutical and other special HCRW will be established. This facility should have sufficient capacity to treat pharmaceutical waste from all of Uganda. Waste from all health centres nationwide will be collected at district level and from there transported to this treatment facility. The operation of the treatment and transport system will be organised and controlled directly by Ministry of Health or tendered out to a private operator/operators and controlled and regulated by MOH and NEMA.

***Final Disposal:***

General waste similar to town council/municipal waste will be burned and/or buried within the premises of the health centres or transported for disposal at town council/municipal dumpsites/landfills.

**Technical Requirements**

Waste segregation and packaging

Segregation and packaging of health care waste generated from all the health care establishments in Uganda should be preferably be standardised and implemented as follows:

**Table 3.2: Recommended colour-coding for health care waste (WHO)**

| Type of waste   | Colour of container and markings   | Type of container  |
|---|------------------------------------|--|
| Highly infectious waste                                   | Yellow, marked “HIGHLY INFECTIOUS” | Reusable plastic container lined with strong leak-proof plastic bag capable of being incinerated |
| Other infectious waste, pathological and anatomical waste | Yellow                             | Reusable plastic container lined with strong leak-proof plastic bag capable of being             |

| Type of waste                     | Colour of container and markings | Type of container                |
|-----------------------------------|----------------------------------|----------------------------------|
|                                   |                                  | incinerated                      |
| Sharps                            | Yellow, marked "SHARPS"          | Puncture proof container         |
| Chemical and pharmaceutical waste | Brown                            | Leak-proof bag or container      |
| General health care waste         | Black                            | Container lined with plastic bag |

**Waste packaging:**

Where treatment and disposal of HHCW will not take place on-site, packaging of the segregated wastes shall be implemented twice including primary packaging which takes place where waste is generated and secondary packaging which takes place at the storage for transportation. Primary packaging of hazardous healthcare waste should be in leak-proof and disposable bags or containers, while secondary packaging should be in leak-proof solid containers for easy transport. Containers for sharps must be puncture-proof and should not be made of glass.

Examples on containers to be used are described in Appendix 1.

Collection, transport and storage of waste

**Collection:**

Waste bags are tightly closed or sealed when they are about but not more than three-quarters full. The waste bags shall be collected daily (or as frequently as required) and transported to the designated storage site.

Sealed sharps containers should be placed in a labeled, yellow infectious health-care waste bag before removal from the hospital ward or department.

**Storage:**

At all HC's, a storage facility for waste should be suitably sited, lockable, hygienic and appropriately sign-posted to store the segregated HCW until the waste is picked up for treatment at the HC or for transport to another facility for external treatment.

Conceptual designs of storage facilities are attached in Appendix 2.

**On-site transport:**

Each of the major HCs (e.g. district and regional hospitals) shall be equipped with one (or more as necessary) trolley or push-cart for on-site transport of the generated HCW. The trolleys or push-carts should be designed to prevent leakage, be easily cleaned and minimize manual handling, and have a solid base to contain spills.

Examples of feasible trolleys / pushcarts are shown in Appendix 3.

**Off-site transport:**

For each district a special closed vehicle should be purchased for safe and separate transport of HCW for treatment. In general the waste should be packed in sealed bags or containers to

prevent spilling during handling and transportation. The containers should be robust to withstand vibrations and changes in temperature during transportation. Examples of suitable vehicles for off-site transportation are shown in appendix 3.

#### Treatment of HCRW at a National Level Incineration Plant

HCRW generated at all HCs shall be treated and disposed of properly at appropriate facilities. Pharmaceutical / chemical waste and genotoxic waste, heavy metals etc. will be collected from all health centres and transported to one high standard treatment facility at national level. The arrangement of such incineration plant, including support facilities and infrastructure is described below. The overall layout and conceptual design of the central treatment facility is described in Appendix 5.

The following elements will be part of the incineration facility irrespective of the actual location.

#### **Plot:**

Depending on the available land, the arrangement of the incineration facility may vary. However, a more or less square plot of 2,500 m<sup>2</sup> (50 times 50 meter) is needed for the facility. The facility could preferably be located next to a large hospital (even within the premises of the hospital if there is sufficient land). Alternatively, the facility could be located next to a disposal area for final disposal of treatment residues. Both options or their combination would improve logistics and thereby save money.

The plot should be fenced by a min. 2 meter high fence, provided with a 5 meter wide gate.

#### **The HCRW incineration plant:**

The incineration plant shall be tendered on the basis of the “Turnkey” principle, i.e. the Tender shall include all designs, services, materials, Contractor’s equipment and plant necessary for a successful completion and functioning of the works, whether or not such designs, services, materials, Contractor’s equipment and plant are specifically indicated in the specifications or on the incineration plant drawings. Due to the complexity of the incineration plants it is recommended that the contracts should be internationally tendered with a clause for joint venture or training of a Ugandan company.

The Turnkey Contractor shall be solely responsible for design, implementation and subsequent function of the project based on the performance specifications given in the tender documents.

The contract shall include the following:

- The detailed design, manufacturing, transportation, installation, erection, completion, testing, commissioning and handing over of the incinerator plant including all electrical and mechanical installations.
- Support to a Ugandan maintenance company for a period of 48 months after taking over.
- A service visit 1 time each year in the defects liability period (2 years).

Further, an option to the contract shall include the following:

- An operation and maintenance contract, according to which the Contractor is fully responsible for the proper operation and maintenance of the incineration plant for a period of 2 years. Within this period, the Contractor will - in parallel with the operation – train the staff of the Client in the proper operation and maintenance of the facility.

The above conditions will ensure that the plant is properly tested and fully operational before handover.

Draft specifications for the Incineration Plant to be included in the Tender Documents are attached in Appendix 6.

**Building for the incineration plant:**

The building for the incineration plant must have an area of 10 x 20 meter. The one end must be provided with a 5 meter wide and 6 meter high steel gate. Walls will be brick walls provided with large ventilation openings below the roof. The roof will be made of corrugated steel plates on steel frames.

The floor will be made of concrete and designed for heavy load. The floor must be provided with foundations for the incineration plant in accordance with the instructions of the incineration plant supplier.

**Foundation for the chimney:**

Outside the one end of the incineration plant building, a concrete foundation for the chimney must be established in accordance with the instructions of the incineration plant supplier.

**Additional service building:**

A 20 meter long and 5 meter wide service building will be established in connection with the one side of the building for the incineration plant. The service building will house a control room for the operation of the incineration plant and toilets and showers for the plant operators. Furthermore, the service building will include a room for a maintenance workshop and spare parts storage.

**Administration building:**

A separate building will include an office for the plant manager and his assistant. Furthermore, this building will include a laboratory for sample taking and measurements of emissions etc. The building will include a toilet.

**HCRW Storage:**

A 50 m<sup>2</sup> separate building will be used as a buffer storage for HCRW received from various health centres throughout the country. The waste will be put here in adequate containers until it can be treated at the incineration plant. The building will be made of normal brickwork, supplied with large ventilation grids below the roof. The roof will be made of corrugated steel plates. A 2-meter wide door for access of small containers etc will be included.

**Washing area:**

A 5 x 5 meter reinforced concrete slab will be established in a corner of the pavement for washing of containers.

**Guardhouse:**

A 10 m<sup>2</sup> guardhouse will be established at the entrance to the facility. Each load of waste arriving at the facility will be checked at the entrance.

**Internal roads and squares:**

The internal roads and squares connecting the individual buildings will be paved with asphalt, designed for heavy load. Furthermore, the car park in front of the administration building will be paved with asphalt.

**External supply:**

*Water Supply*

The Incineration Plant is assumed to be supplied with fresh water (drinking water quality) by extension of the piped water supply from the National Water and Sewerage Supply grid. Sewerage facilities will be provided and treatment for wastewater will be carried out at the landfill site

*Electricity*

Electricity for the Incineration Plant will be from the main grid.

Treatment of HCRW at Brick Incinerators at District level

Infectious waste and sharps and some pathological waste will be collected from all HC's and transported for treatment at brick incinerators at Health Sub district and district / regional hospitals. The arrangement of such brick incineration plant, including support facilities and infrastructure is described below. The overall layout and design of such brick incineration facilities is described in Appendix 7.

The following elements will be part of the brick incineration facilities irrespective of their actual location.

**Plot:**

Depending on the available land, the arrangement of the incineration facility may vary. However, a more or less square plot of approximately 1,000 m<sup>2</sup> is needed for the facility. The facility could preferably be located near a large hospital. Alternatively, the facility could be located next to a disposal area for final disposal of treatment residues. Both options or their combination would improve logistics and thereby save money.

The plot should be fenced by a min. 2 meter high fence, provided with a 5 meter wide gate.

**The brick incineration plants:**

The incineration plants for Regional and district hospitals shall be of the Model Incinerator developed by Ministry of Health ("Mubende" incinerator) and the Mark 3 – De Montfort type with a capacity to handle wastes of 50kg/hour approximately 100 tons per year. It is recommended that the two types be piloted fully integrated with the proper handling and segregation, proper procurement/construction of the incinerators and proper operation and

maintenance. In line with the implementation strategy outlined in section 4 it is recommended that the “Mubende” incinerator is piloted in Masaka and Kabale district while the Mark 3 – De Montfort type is piloted in Arua and Mbale districts.

Draft tender documents for the brick incineration plants are attached in Appendix 8.

**Roof covering the brick incinerators:**

The brick incinerators should be protected against the weather by a roof. A simple roof should be made of corrugated steel plates supported by 4 steel columns. The area of the roof should be at least 5 x 5 meter.

**Service building:**

A 20 meter long and 5 meter wide service building will be established in connection with the one side of the building for the incineration plant. The service building will house a control room for the operation of the incineration plant and toilets and showers for the plant operators. Furthermore, the service building will include a room for a maintenance workshop and spare parts storage.

**Office building:**

A separate building will include an office for the plant manager. Furthermore, this building should include a bathroom with toilet and shower.

**HCRW Storage:**

A 20 m<sup>2</sup> separate building will be used as a buffer storage for HCRW received from various health centres throughout the district. The waste will be put here in adequate containers until it can be treated at the brick incinerator. The building will be made of normal brickwork, supplied with large ventilation grids below the roof. The roof will be made of corrugated steel plates.

**Washing area:**

A 5 x 5 meter reinforced concrete slab will be established in a corner of the pavement for washing of containers.

**External supply:**

*Water Supply*

Reliable water supplies are not available in some hospitals. In the case of incinerators installed at hospitals where the water supplies are inadequate provisions for water supplies have to be made. In cases where the incinerators are off the hospital sites special provisions for water supplies will be provided.

*Electricity*

In areas where the main grid is available the electricity extensions will be made for lighting around the incinerators. For areas without the main grid provisions for solar lighting will be made.

## Final Disposal of Treatment Residues

Slags and other remains from the national level treatment facility and from the brick incinerators at district level should be disposed of in a controlled way at appropriate dumpsites / landfills. If no suitable disposal facilities are available, this waste may be buried within the premises of the treatment facilities.

### **Disposal site for national level incinerator:**

It is assumed that the disposal site would cover an area of approximately 1,200 m<sup>2</sup> (30 x 40 meter). With an average depth of 3 m below surface, this will provide a total landfill volume in the order of 2,300 m<sup>3</sup>. Furthermore, it is assumed that the waste will be provided with a daily cover (10% of waste volume) and a final cover of 1 meter thickness. This leaves an effective volume for waste disposal of 1,300 m<sup>3</sup>, corresponding to more than 30 years disposal capacity.

The proposed general layout of the disposal site is shown in Appendix 9.

From the beginning of the operation, a limited part of the disposal area (e.g. 300 m<sup>2</sup>) will be excavated to a depth of approximately 3 meter below surface. Waste disposal can then start at one corner of this area. 50-100 cm thick layers of waste will be built in at the time. Each layer is to be provided with a daily cover of soil. When a total height of 2 meters has been reached, the waste will be covered finally by a 1 meter thick soil layer. Additional disposal area must be excavated in parallel with the infilling and final covering of waste.

A fence surrounding the whole landfill must be established in order to prevent access of unauthorised persons and uncontrolled unloading of waste. The fence should be at least 2 metres high and should be provided with a lockable gate at the entrance.

### Treatment and disposal of other waste generated at health care facilities

Placenta pits already established at most HC's may also be used in future for disposal of anatomical waste for practical and cultural/ religious reasons. In remote areas where health centers have no access to an incinerator these pits could also be used for the disposal of infections waste. Attention should be paid to the siting of the burial pit. The pit should be sited far away from the open water and burial pits should not be sited in areas with a high water table.

The pit should be 1 to 2m wide, 2 to 5 m deep. The bottom of the pit should be lined with clay or low permeable material. An earth mound should be constructed around the mouth to prevent water from entering. A fence should be constructed around the pit to prevent unauthorized entry. The waste should be covered at the end of the day with at least 10cm of soil or a mixture of lime and soil. The pit should be permanently sealed with a soil cover when the waste is with in about 0.5m of the ground surface.

General waste may be burned or buried within the premises of the health centres or it may be transported for controlled disposal at a controlled dumpsite / landfill if such facility exists in the area.

## IMPLEMENTATION STRATEGY

### Assumptions

The following assumptions are recommended be made to ensure the sustainability of an improved HCWM system for Uganda:

1. The Government of Uganda is aware of the situation related to health care waste management in the country and therefore commits itself to support the Ministry of Health to set up and run a HCWM system.
2. The Government of Uganda is aware that the sustainability of a management can only be guaranteed when sufficient budget is allocated for running it. In the case of the improved HCWM system, the Government is well aware of and will cover the costs for running the system through the operational budgets of the health sector.
3. The Ministry of Health commits itself to provide the necessary resources and manpower to set up and start running an improved health care waste management system.
4. The district and regional hospitals will receive health care waste for incineration produced by other health centres (HC II - IV) within the district.
5. The health care staff of the district, being well aware of the situation related to health care waste management, commit themselves to take part in the newly set up HCWM system in order to improve the public health and the environment.
6. After an initial Pilot Phase, the initiated system will be assessed and evaluated, which will result in adjustments and corrective actions if needed.

### Phased Implementation

#### General Phased Implementation Approach

It is recommended to implement the improved HCRW management system in accordance with a phased implementation plan. Firstly, the improved management system represents so many changes to the current practise that it is hard to imagine that such uniform, nationwide system can be implemented in one step in an optimal way. Both the technical solutions and the organisational arrangements will probably need revisions to a certain extent in order to be sustainable and meet the demands. This can only happen in an optimal way if revisions are based on valuable experience that has been gained from a pilot phase. Secondly, considerable costs are related to the establishment and operation of the improved system. Therefore, it is appropriate to level out the investments on a certain period of years and thereby also gradually increase the annual operation and maintenance costs.

The recommended overall timing of the implementation is summarised in Table 3.1. A more detailed implementation plan is shown in Appendix 11.

**Table 3.1: Recommended Overall Phased Implementation Schedule**

| Implementation Stage | Activity                        | Time Schedule |
|----------------------|---------------------------------|---------------|
| Preparation Phase    | Detailed planning and tendering | 2005/6        |

|  |  |                    |
|--|--|--------------------|
| Phase 1 –<br>Pilot implementation                          | Procurement / construction period        | 2006               |
|  | Operation                                | 2007 – 2010        |
|  | Revision of planned nationwide system    | 2009               |
| Phase 2 –<br>Nationwide<br>implementation phase            | Revised detailed planning and tendering  | 2009               |
|  | Procurement / construction period        | 2009 – 2012        |
|  | Operation                                | From 2011          |
| <i>Phase 3 –<br/>Redesign and re-<br/>investment phase</i> | <i>Detailed planning and tendering</i>   | <i>2012</i>        |
|  | <i>Procurement / construction period</i> | <i>2015 – 2017</i> |
|  | <i>Operation</i>                         | <i>From 2016</i>   |

Note: Phase 3 is not covered by this project, but represents the recurrent revisions and re-investments to be made in future.

### Implementation Activities

Many different activities are related to the successful implementation of the improved HCW management system in Uganda. These activities are briefly described in the following section. For the timing of the individual activities, reference is made to the draft implementation plan in Appendix 11.

**Table 3.2: Implementation Activities**

| No. | Activity   |
|-----|--|
|     | <b>Detailed Planning and Tender Phase</b>  |
| 0.1 | <b>Approval of implementation plan by all key stakeholders:</b><br>When the Design Report and the Tender Documents have been prepared it is of great importance to have it approved by all relevant parties involved in the implementation. Workshops and individual meetings should be held with all involved institutions at national and local level. For the local level, it may be decided only to include stakeholders from the selected districts to be included in the pilot implementation phase.   |
| 0.2 | <b>Selection of sites for facilities:</b><br>This includes the site for the national treatment (and disposal) facilities in the area/surroundings of Kampala. Also sites for district level treatment and disposal facilities must be located in each of the districts involved in the pilot implementation phase. A comprehensive site selection procedure including execution of EIA's should be followed in order to ensure a proper site selection. Regarding the execution of this process, reference is made to the Draft Site Selection Guideline included in Appendix 10 to this report. |
| 0.3 | <b>Review and update of Tender Documents:</b><br>After the above consultation with all relevant parties and after execution of the site selection process, the Tender Documents must be reviewed and updated in order to address the findings from the above activities.   |
| 0.4 | <b>Tender and contracting period:</b><br>Upon approval of the revised Tender Documents, the establishment of facilities and procurement of equipment included in the pilot implementation phase can be tendered. Open tenders will be held; bids will be evaluated; and contract negotiations will be held with contractors and suppliers.   |
|     | <b>Phase 1.1 – Pilot Implementation</b>  |
| 1.1 | <b>Construction and procurement of facilities and equipment:</b><br>Upon start of construction required equipment will be procured through open tendering.   |

| No.  | Activity   |
|------|--|
| 1.2  | <b>Establishment of operation and monitoring organisations:</b><br>Parallel to the construction the operating and monitoring organisation and where necessary the operational staff/private organisation recruited/procured.   |
| 1.3  | <b>Pilot operation of facilities and system:</b><br>The contractors for the plant and equipment will during commissioning commence the pilot operation of the system as part of O-J-Training of staff/private operators in addition to testing the works.  |
| 1.4  | <b>Education and training of staff at all levels in operation of the system:</b><br>The operational staff will receive the necessary training. The monitoring and supervision staff will receive O-J-T support through Consultancy TA.   |
| 1.5  | <b>Awareness raising activities in the pilot areas:</b><br>Awareness raising among health care staff and public will be carried out through mass media campaigns, posters and other ICE media.   |
| 1.6  | <b>Assessment of results from pilot operation:</b><br>A continuous assessment will be carried out. A mid term assessment will be carried out at the end of the first year of operation and adjustments made. A final evaluation will be made in 2006.  |
| 1.7  | <b>Revision / adjustment of proposed nationwide HCRW management system:</b><br>Based on the results of the final evaluation a revised HCWM system will be designed.  |
| 1.8  | <b>Approval of revised nationwide HCRW management system:</b><br>After approval of the revised HCWM system implementation of a nationwide system will commence.  |
|      | <b>Phase 1.2 – Immediate nationwide Improvement Activities</b>   |
| 1.9  | <b>Education and training of staff at all HC's in proper HCW management:</b><br>Training for staff for all HCs will commence with the carrying of Regional Training of Trainers who will in turn carry out the training in the regions for all staff. Training institutions will participate in the training and will be encouraged to include HCWM in the training of new health care cadres. |
| 1.10 | <b>Implementation of containers for proper HCW segregation and handling at all HC's:</b><br>Containers for health care waste management will be procured and provided to all health centres nationwide and proper handling of wastes within health units promoted.   |
| 1.11 | <b>Awareness raising activities:</b><br>Awareness raising activities through media and posters for the general public will be carried out.   |
|      | <b>Phase 2 – Nationwide Implementation</b>   |
| 2.1  | <b>Prepare updated tender documents:</b><br>Upon approval of the revised HCWM system new tender documents will prepared.   |
| 2.2  | <b>Tender and contracting period:</b><br>Procurement of services for HCWM will be carried out.   |
| 2.3  | <b>Construction and procurement of facilities and equipment:</b><br>Parallel to procurement of service providers and construction of HCWM facilities, procurement of equipment will be carried out.  |
| 2.4  | <b>Establishment of operation and monitoring organisations:</b><br>A nationwide operation and maintenance system will be established. Monitoring organisations will be set up to continuously oversee and ensure the proper operation of the system.   |
| 2.5  | <b>Operation of nationwide HCRW management system:</b><br>Operation of a nationwide HCRW management system will be launched.   |
| 2.6  | <b>Initial education and training of staff at all levels:</b><br>Education and training of all staff will commence with the refresher training of training of trainers who in turn will carry out the training of all the staff.   |
| 2.7  | <b>Awareness raising activities:</b><br>Continuous awareness training of general public and of health care staff will be carried out.  |
| 2.8  | <b>Assessment of results from nationwide operation of the system:</b><br>After one year of operation an assessment of the system will be carried out.  |
| 2.9  | <b>Agree on relevant adjustments / changes to nationwide HCRW management system:</b><br>Based on the results of the assessments relevant adjustments to the system will be made.   |
| 2.10 | <b>Implement changes in parallel with re-investments to be made in facilities:</b><br>Upon approval of the changes relevant changes including reinvestments in facilities will be made.  |

### The Scale of the Pilot Implementation

All types of treatment and disposal facilities to be included in the nationwide HCW management system should be tested during the pilot phase in order to obtain experience on how the system and the facilities work at all levels, from the national treatment facility down to the health centres at level II. Thus, a certain minimum scale of implementation is required in the pilot phase to make the system work and to gain the relevant experience.

In addition to the establishment of the national treatment facility, it is recommended to implement the HCW management system in the 4 districts included in the survey carried out during the inception phase of the project. These 4 districts (Arua, Masaka, Kabale and Mbale) are considered representative for all 56 districts in Uganda, apart from the capital - Kampala District.

As it appears from Table 3.3, the number of health centres and hospitals at the 4 districts correspond to 10% of the total number of health centres and hospitals in Uganda. This is considered a suitable scale for the pilot implementation.

Basically, the national treatment facility is supposed to treat pharmaceuticals and chemical wastes that cannot be treated at the district level facilities. However, the amounts of these waste types do not at all occupy the capacity of even the smallest high standard incineration plants available on the market. Anyway, there is a need for at least one national level treatment plant that is capable of treating pharmaceuticals and other health care risk waste. Therefore, in addition to treatment of these waste types, the national treatment plant can also be used for treatment of other types of health care waste generated at hospitals and health centres in the area of Kampala, where the plant is supposed to be located.

**Table 3.3: No. of Health Facilities included in the 2 Implementation Phases /ref. 3/**

| Health Facilities   |                  | Phase 1<br>Initial implementation |                    |                    |                   |               | Phase 2<br>Nationwide<br>implementation | Total       |
|---------------------|------------------|-----------------------------------|--------------------|--------------------|-------------------|---------------|---|-------------|
|                     |                  | Arua<br>District                  | Masaka<br>District | Kabale<br>District | Mbale<br>District | Sub-<br>Total | All other<br>districts                  |             |
| Government<br>owned | Hospitals        | 1                                 | 1                  | 1                  | 2                 | 5             | 51                                      | 56          |
|                     | HC IV            | 4                                 | 7                  | 5                  | 3                 | 19            | 124                                     | 143         |
|                     | HC III           | 21                                | 11                 | 11                 | 18                | 61            | 589                                     | 650         |
|                     | HC II            | 29                                | 14                 | 46                 | 15                | 104           | 741                                     | 845         |
|                     | <b>Sub-Total</b> | <b>55</b>                         | <b>33</b>          | <b>63</b>          | <b>38</b>         | <b>189</b>    | <b>1505</b>                             | <b>1694</b> |
| NGO<br>owned        | Hospitals        | 2                                 | 3                  | 0                  | 0                 | 5             | 37                                      | 42          |
|                     | HC IV            | 1                                 | 1                  | 0                  | 1                 | 3             | 5                                       | 8           |
|                     | HC III           | 7                                 | 4                  | 4                  | 6                 | 21            | 126                                     | 147         |
|                     | HC II            | 3                                 | 20                 | 10                 | 4                 | 37            | 325                                     | 362         |
|                     | <b>Sub-Total</b> | <b>13</b>                         | <b>28</b>          | <b>14</b>          | <b>11</b>         | <b>66</b>     | <b>493</b>                              | <b>559</b>  |
| Private<br>owned    | Hospitals        | 0                                 | 0                  | 0                  | 0                 | 0             | 3                                       | 3           |
|                     | HC IV            | 0                                 | 0                  | 0                  | 0                 | 0             | 3                                       | 3           |
|                     | HC III           | 0                                 | 0                  | 0                  | 0                 | 0             | 12                                      | 12          |
|                     | HC II            | 0                                 | 0                  | 0                  | 0                 | 0             | 262                                     | 262         |
|                     | <b>Sub-Total</b> | <b>0</b>                          | <b>0</b>           | <b>0</b>           | <b>0</b>          | <b>0</b>      | <b>280</b>                              | <b>280</b>  |
| <b>Total</b>        |                  | <b>68</b>                         | <b>61</b>          | <b>77</b>          | <b>49</b>         | <b>255</b>    | <b>2278</b>                             | <b>2533</b> |

On the basis of the figures from Table 3.3, the pilot implementation phase will include the following facilities and equipment:

- 1 national level treatment facility, including a sophisticated incineration plant
- 1 national level disposal facility for treatment residues
- 4 district level treatment facilities, including 4 brick incinerators
- 4 district level disposal facilities for treatment residues
- 255 HCW storage facilities at 10 hospitals and 245 HC's (level II-IV).
- 1 vehicle for transport of HCRW from all health centres within each district
- 1 vehicle for transport of HCRW from the district stores to the national facility
- Medical wastes containers at all hospitals and health centres involved in the pilot phase

As it appears from Table 3.1 and the draft implementation plan in Appendix 11, the nationwide implementation will not start before year 2008. In order to obtain visible nationwide improvements on the handling of HCW within short time, it is recommended to include some immediate nationwide improvement activities in the pilot phase, although they are not directly linked to the pilot activities. These immediate activities would include education and training of staff at all health facilities in proper sorting and handling of waste. Also public awareness campaigns could help to increase the understanding of the need for proper HCW management among patients and the general public.

These immediate improvement activities require procurement of containers and bags to be used for the internal sorting and handling of HCW at the health facilities all over the country. This equipment will be included in the budget for the pilot phase.

## **ORGANISATIONAL – INSTITUTIONAL SET-UP**

The proper management of healthcare waste depends largely on good administration and organization, with clearly defined responsibilities. Healthcare providers have a “duty of care” for the environment and for public health, and have particular responsibility in relation to the waste they produce. It is important for all concerned to understand that health-care waste management is an integral part of health care, and that creating harm through inadequate waste management reduces the overall benefits of health care.

This principle would mean that the Ministry of Health should be responsible for, among other healthcare responsibilities, organizing a safe and environmentally sound management system for the healthcare waste generated by all hospitals and health centres in the country. The heads of health-care establishments are responsible for health protection and safety at the workplace and should bear legal responsibility for the safe disposal of health-care waste generated in their establishments.

For establishing and running a health care waste management system in the country, it is important that an organization structure be set up at three levels, i.e. at the National level, the District or Regional Level and at the health facility. In order not to establish parallel management structures, the management of the healthcare waste should be accommodated within existing management systems.

## **National Level**

At the national level it is important that all relevant stakeholders are represented in the management and monitoring of the national healthcare waste management plan. These will include Ministry of Health, as the major stakeholder, which will cooperate with other relevant ministries, the private sector, NGOs and professional organisations, as necessary, to ensure implementation of the action plan. For the implementation of the action plan a National HCW Management or Steering Committee with representatives from relevant stakeholders should be formed.

The representation on the committee to include representatives from:

- Ministry of health
- NEMA
- NDA
- Ministry of Local Government
- Ministry of Finance
- Representative Districts

The National Healthcare Waste Management team will be responsible for the start up of the system, including creating awareness, and preparation of a National Action Plan. The national HCWM system should be viewed as a continuous process with periodic monitoring and review by the national HCWM team. The team should carry out audits on the waste management systems, and based on reports of success and deficiencies regularly update the HCWM system, to ensure occupational and public health, as well as cost effectiveness of waste disposal.

## **Organisation of the District HCW Management**

At the district level, a Waste Management Team, WMT, should be organized to take care of the HCW management issues for the whole district. In order not to create new management structures at the district. The District Health Team, DHT, should take over the responsibilities of the proposed WMT. The DDHS should appoint one member of the DHT to be responsible for monitoring the HCWM system in the district, and report to the DHT.

The appointed officer will be responsible for enforcing HCWM regulations and guidelines put in place by the Ministry of Health, and working closely with the Waste Management Officers in the health sub-districts and hospitals to ensure the success of the HCWM system. It is important that the appointed officer works closely with the district environmental officer and the town council/municipal medical officer.

The District Health Team shall be responsible for the following tasks:

- Preparation of HCWM plan for the whole district
- Seeking approval of the district local government of the prepared plan
- Implementation of the prepared plan
- Monitoring the plan implementation
- Review of the plan implementation
- Recommendation for improving the whole plan
- Preparation of periodic reports and reporting to District local Council

The position of the District Health Team in relation to other actors in the process of healthcare waste management is shown in Figure 1.

### **Organisation of the HCWM at the Health Facilities**

#### **Organisation of HCW Management Teams at Hospitals**

The proper management of healthcare waste requires active participation by trained and informed staff. The success of any system will depend on the appreciation by hospital management for a proper healthcare waste management system. It is of importance that issues concerning healthcare waste management are discussed at a managerial level, and not left to the discretion of junior staff. The head of the hospital should appoint a waste management team, WMT, in order to develop a waste management plan for the hospital. Where they exist, the role of the WMT could be taken over by the infection control team. At some hospitals which were visited it was noted that the infection control was the responsibility of relatively junior members of staff who do not have the capacity to influence decision making in the hospital, therefore where existing infection control teams are to take over the responsibilities of the WMT, these need to be strengthened to include members of the hospital management team.

In addition to a waste management team, the head of the hospital should appoint a waste management officer, WMO, who will be responsible for the development of the HCWM plan in the hospital and for the day-to-day operation and monitoring of the waste management system. It is essential that the WMO has direct access to all members of the hospital staff and knows how the medical and support staff work in the hospital. The WMO ideally should be neither too senior nor too junior since he/she shall need to devote enough time to the waste management issues, and at the same time he/she shall need to have sufficient experience and influence to make any changes. Normally, at the hospitals the WMO can be the infection control officer.

At the hospital the WMT should comprise the following:

- Management representative;
- Heads of hospital departments, including chief pharmacist;
- Matron (or senior nursing officer);
- Chief accountant;
- Head of housekeeping or cleaning services; and
- WMO

#### **Organisation of HCW Management Teams at Health Centres (health sub-districts)**

Health centres II and III are under the management of a sub-district, at HC IV. Although at each health centre there should be a member of staff responsible for the healthcare waste management, these should be under the management of a waste management team at the sub-district. In order to prepare a HCWM plan and to start running the management system, the head of each health sub-district should designate a waste management officer, WMO, with overall responsibility for the development of the HCWM plan in the sub-district, who in turn will appoint officers at the HC IIIs and HC IIs in the sub-district, who will be responsible for the operation and monitoring of the day-to-day operation of the HCWM system at each health

centre. The WMO will be responsible for the monitoring of the waste management system in the sub-district and will also act as a focal point with regulatory authorities/agencies concerning enforcement and compliance issues. With the present staffing norms of the different health units in Uganda, the WMO in a sub-district can best be the public health nurse or a Clinical officer.

#### Organisation and Operation of the Central Health Care Risk Waste Management System

Under the recommended HCWM system, a national incinerator will be provided for the treatment of HCRW which can not be treated at the district incinerators. This will necessitate a nationally organized HCRW collection, storage and transportation system. The Central system should be under the management of Ministry of Health, which can privatize parts of the system, e.g. collection and running the treatment plant, but still retain the responsibility of ensuring the proper implementation of the system.

All HCRW should be collected from the public health centres and stored at the district storage, under the custody of the District Drug Inspector, from where it will be collected and transported to the central facility. The HCRW from hospitals will be collected from the respective hospitals. The privately or NGO operated health centres and pharmacies will be responsible for the transportation of their healthcare risk to the district storage facility, where they will have to pay the costs of destruction of their waste. The privately owned or NGO operated pharmacies and health centres in Kampala district, will be required to enter a service contract for the transportation and destruction of their HCRW at the national facility.

Due to the expected small amounts of HCRW, the national incinerator is expected to treat other HCW from surrounding hospitals and health centres. The collection of this HCW will have to be included in the HCWM system. Privately owned hospitals and health centres will be covered under the service contract.

#### Organisation and Operation of the District Health Care Waste Management System

With decentralization of services the district healthcare waste management system will be operated under the supervision of the district health care authorities, i.e. the DDHS. Since the District Healthcare Waste Management System, i.e. district incinerator, collection and disposal facility, will play a major role in the HCWM system it is important to assess the possible alternatives and make sound recommendations to the Ministry of Health, on the organization and operation of the district facilities.

Several alternatives can be proposed for the organization and operation of the District healthcare waste management system, which will consist of a brick incinerator and disposal site to be constructed at a selected site, waste storage and a dedicated waste collection vehicle.

##### **Alternative 1:**

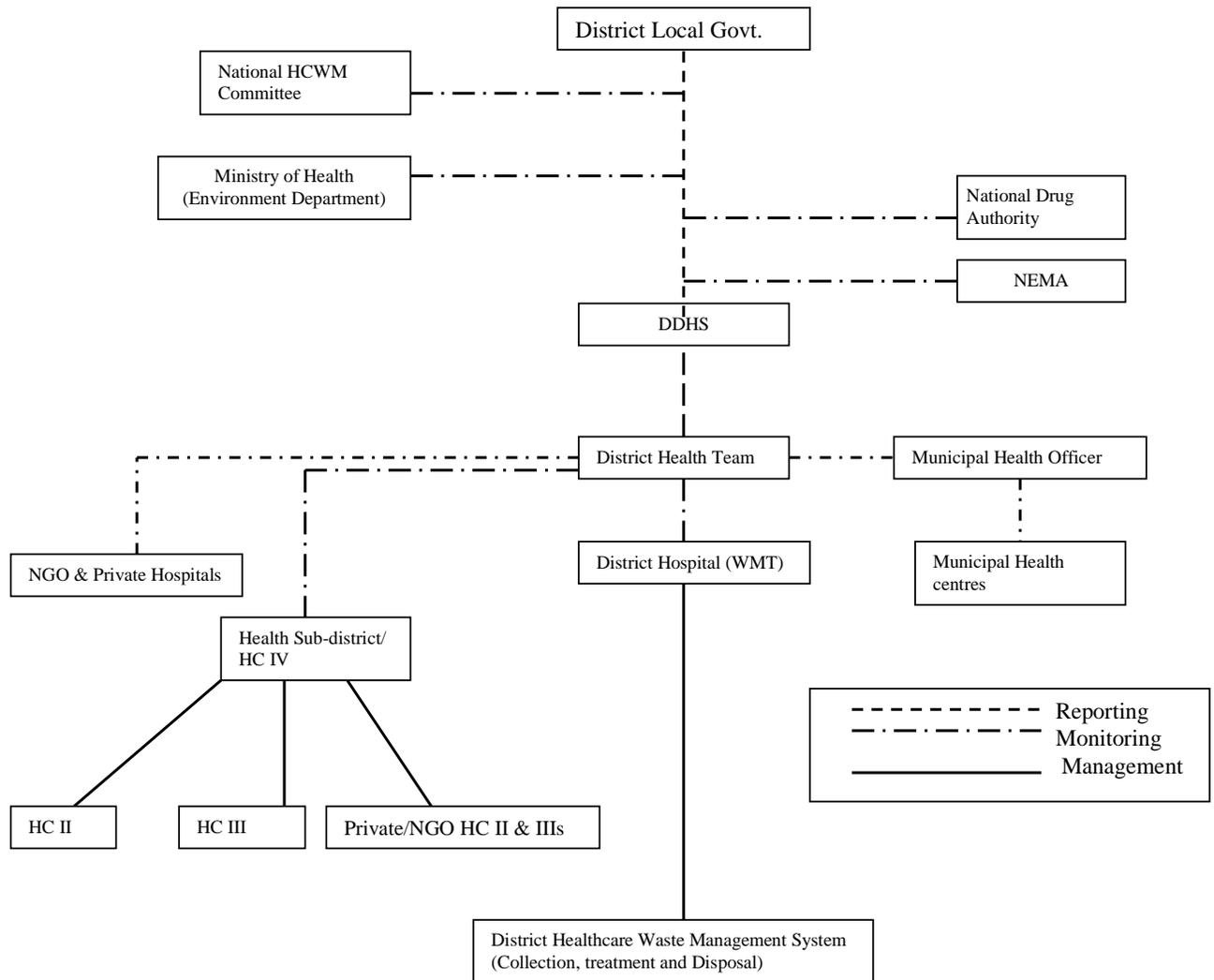
The District HCWM system operates under the waste management team, WMT, of the District Hospital. The organization structure of this alternative is shown in **Figure 4.1**.

This alternative would allow the WMT of the District Hospital to recruit direct labourers to work with the waste collection and treatment using the district incinerator installed at a selected site. The WMT of the District Hospital will collect waste treatment fees from other Public

Health Centres including town/Municipal centres in the district and pay the contracted workers and other necessarily related costs. All privately or NGO operated centres will be required to pay for the proper disposal of their waste.

The advantage of this alternative is that the DHT does not need to devote much time to the waste treatment issue, but confine itself to monitoring the proper operation of the system. However, there are also disadvantages of this option. The management will increase the workload on the hospital administration and the administration of the collected funds may be difficult under the present financial regulations.

**Figure 4.1: Alternative 1 proposed for the organization structure and operation of the District HCWM system.**



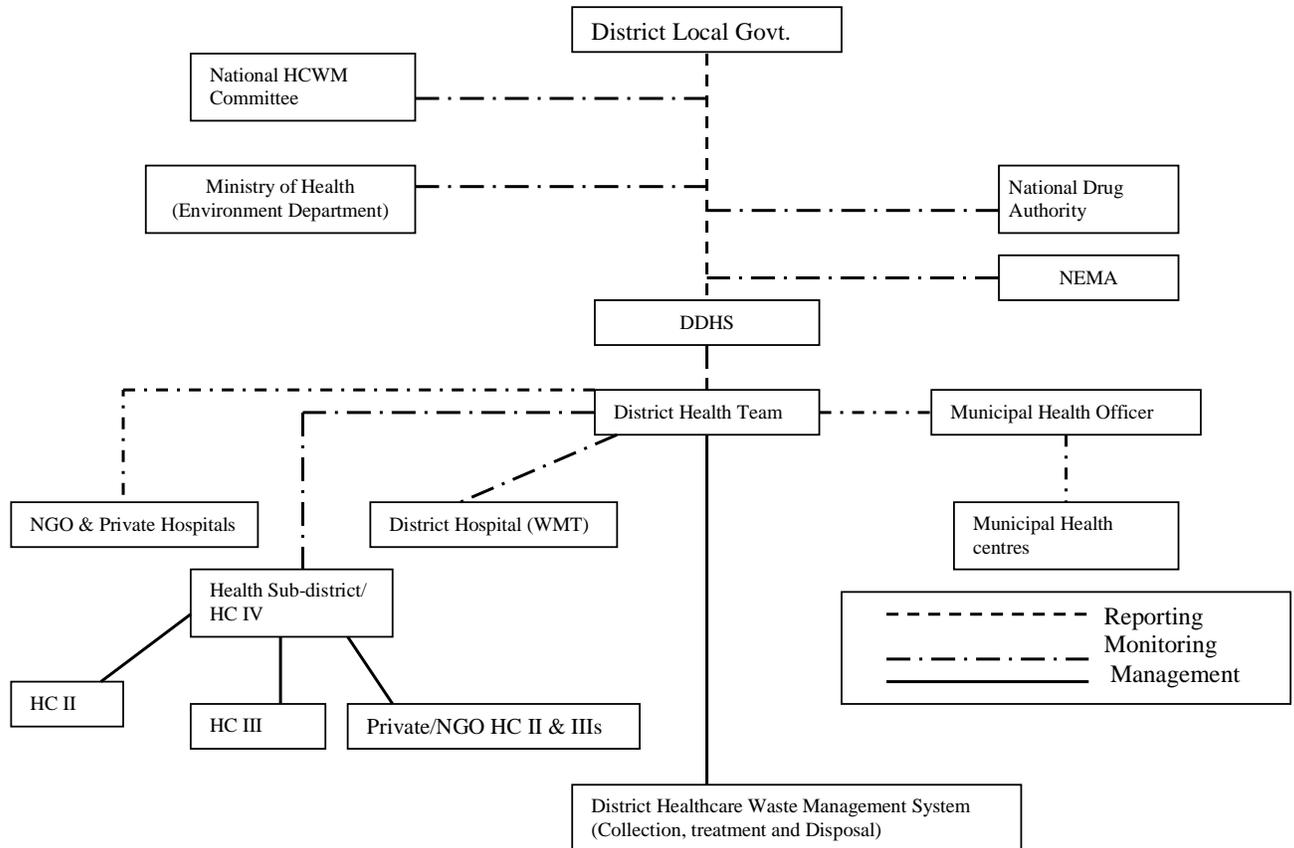
**Alternative 2:**

The District HCWM system, the collection, treatment and disposal of the waste, will be part of, and operate under, the DDHS office under the management of the DHT. The organization structure of this alternative is shown in **Figure 4.2**.

With this alternative, DHT will directly supervise the collection of the waste as well as the operation of the treatment and disposal units. The DDHS, through the District Service Board can recruit a group of direct labourers to work at proposed treatment plant as well in the waste collection system. The DHT will also collect waste treatment fees from Privately and NGO operated health centres (indirectly through the help of the DDHS’s Accounting Division) that have waste collected and treated at the treatment site and pay the contracted workers and other necessarily related costs. The DHT can also privatise the running of part or all the HCWM system. If part or all the HCWM system is privatised the DHT retains the responsibility of ensuring the proper implementation of the system.

The advantages of this alternative are that the equity principle can easily be implemented and that the treatment process will easily be monitored. This alternative, however, does also have some disadvantages. The DHT will have to devote more time to the waste treatment issue and the monitoring works might require DHT to have more professional staff.

**Figure 4.2: Alternative 2 proposed for the organization structure and operation of the District HCWM system.**



Although each of the proposed alternatives proposed for setting up and running a health care waste management system in districts has its own advantages and disadvantages as analysed above, it is recommended that alternative 1 be selected for the system. One of the main reasons for this recommendation is that this alternative would offer better coordination during the implementation of the system.

## Costs and FINANCING

### Estimated Establishment Costs

The Inception Report /15/ included a first estimate on implementation costs. A more precise estimate has been elaborated on the basis of the draft designs of the system elements (Appendix 1 – 6). Furthermore, the implementation costs are divided in costs related to the pilot implementation phase (Phase 1) and the costs for the further nationwide implementation (Phase 2). The estimated costs for establishment of the systems included in the 2 phases are presented in the two tables below.

**Table 5.1: Phase 1 - Establishment Costs for Pilot Implementation**

| Pos. No.   | Item   | Unit costs (mill. USHS) | No. of units | Total (mill. USHS) |
|--|--|-------------------------|--------------|--------------------|
| 1.1  | 1 Sophisticated incinerator, with flue gas cleaning at national level (Capacity: 80 kg/hour ~ 200 tons/year)                     | 1,720                   | 1            | 1,720              |
| 1.2  | Infrastructure, buildings and support equipment for national level incineration facility   | 500                     | 1            | 500                |
| 1.3  | Disposal area for incineration residues, National level  | 25                      | 1            | 25                 |
| 1.4  | Brick incinerators (e.g. De Montfort), capacity: 50 kg/hour ~ 100 tons/year  | 12                      | 4            | 48                 |
| 1.5  | Infrastructure, buildings and support equipment for brick incinerators at 4 districts  | 75                      | 4            | 300                |
| 1.6  | Disposal areas for incineration residues, 4 districts  | 25                      | 4            | 100                |
| 1.7  | Vehicle for transport of HCRW from 4 district stores to the national facility (collection approx. 4 times per year) <sup>1</sup> | 56                      | 1            | 56                 |
| 1.8  | Storage facility for HCRW at each HC (separate, locked storage room)   | 5                       | 255          | 1,275              |
| 1.9  | Vehicles for transport of HCRW from all health centres within each district (1 vehicle per district)                             | 56                      | 4            | 224                |
| 1.10   | Medical wastes containers (nationwide)   |                         |              | 217                |
| Sub-total  |  |                         |              | 4,465              |
| Contingencies (10%)                                    |  |                         |              | 447                |
| <b>Phase 1 - Total estimated implementation costs:</b> |  |                         |              | <b>4,912</b>       |

Notes: 1: In the pilot phase, the vehicle for collection of HCRW from the 4 districts can also be used for collection of other HCW from health facilities in the Kampala area to be treated at the national facility.

**Table 5.2: Phase 2 – Additional Establishment Costs for Nationwide Implementation**

| Pos. No.   | Item  | Unit costs (mill. USHS) | No. of units | Total (mill. USHS) |
|--|---|-------------------------|--------------|--------------------|
| 2.1  | 1 Sophisticated incinerator, with flue gas cleaning at national level (Capacity: 80 kg/hour ~ 200 tons/year)                        | 1,720                   | 0            | 0                  |
| 2.2  | Infrastructure, buildings and support equipment for national level incineration facility  | 500                     | 0            | 0                  |
| 2.3  | Disposal area for incineration residues, National level   | 25                      | 0            | 0                  |
| 2.4  | Brick incinerators (e.g. De Montfort), capacity: 50 kg/hour ~ 100 tons/year   | 12                      | 52           | 624                |
| 2.5  | Infrastructure, buildings and support equipment for brick incinerators at district level  | 75                      | 52           | 3,900              |
| 2.6  | Disposal areas for incineration residues, District level  | 25                      | 52           | 1,300              |
| 2.7  | Additional vehicle for transport of HCRW from the 56 district stores to the national facility (collection approx. 4 times per year) | 56                      | 1            | 56                 |
| 2.8  | Storage facility for HCRW at each HC (separate, locked storage room)  | 5                       | 2,278        | 11,390             |
| 2.9  | Vehicles for transport of HCRW from all health centres within each district (1 vehicle per district)                                | 56                      | 52           | 2,912              |
| 2.10   | Medical wastes containers   |                         |              | 0                  |
| Sub-total  |   |                         |              | 20,182             |
| Contingencies (10%)                                    |   |                         |              | 2,018              |
| <b>Phase 2 - Total estimated implementation costs:</b> |   |                         |              | <b>22,200</b>      |

### Estimated Annual Costs

The Inception Report included a first estimate on total annual costs. A more precise estimate has been elaborated on the basis of the draft designs of the system elements (Appendix 1 – 6). Furthermore, the annual costs are divided in costs related to the pilot implementation phase (Phase 1) and the costs for the further operation of the nationwide system (Phase 2). The estimated annual costs for operation of the systems included in the 2 phases are presented in the tables below.

**Table 5.3: Phase 1 – Annual Costs**

| Pos. No.                                     | Item  | Unit costs (USHS/year) | No. of units | Total (USHS/year)  |
|--|---|------------------------|--------------|--------------------|
| 1.1  | 1 sophisticated incinerator, with flue gas cleaning (treatment of approx. 200 tons/year) – Plant O&M costs                        | 180,000,000            | 1            | 180,000,000        |
| 1.2  | 1 sophisticated incinerator, with flue gas cleaning – Capital costs (25% of investment per year)                                  | 430,000,000            | 1            | 430,000,000        |
| 1.3  | Infrastructure, buildings and support equipment for national level incineration facility – O&M costs                              | 51,000,000             | 1            | 51,000,000         |
| 1.4  | Disposal area for incineration residues, National level – O&M costs   | 3,500,000              | 1            | 3,500,000          |
| 1.5  | Mark 3 – De Montfort brick incinerators at district level – O&M costs   | 2,500,000              | 4            | 10,000,000         |
| 1.6  | Mark 3 – De Montfort brick incinerators at district level – Capital costs (25% of investment per year)                            | 3,000,000              | 4            | 12,000,000         |
| 1.7  | Infrastructure, buildings and support equipment for district level incineration facilities – O&M costs                            | 3,018,750              | 4            | 12,075,000         |
| 1.8  | Disposal area for incineration residues, District level – O&M costs (as for Pos. 1.4)   | 3,500,000              | 4            | 14,000,000         |
| 1.9  | Transport of HCRW from district stores to national facility (collection 4 times per year)   | 23,200,000             | 1            | 23,200,000         |
| 1.10   | Operation and maintenance of storage rooms within each HC   | 100,000                | 255          | 25,500,000         |
| 1.11   | Transport of HCRW from all health centres within each district (collection once per week) – Estimated 50% of Pos. 1.9             | 11,600,000             | 4            | 46,400,000         |
| 1.12   | Containers + packaging materials, nationwide (10% of containers to be replaced annually sharps containers to be replenished 100%) |                        |              | 90,000,000         |
| <b>Sub-total:</b>                            |   |                        |              | <b>897,675,000</b> |
| <b>Contingencies (10%):</b>                  |   |                        |              | <b>89,767,500</b>  |
| <b>Total estimated annual O&amp;M costs:</b> |   |                        |              | <b>987,442,500</b> |

Notes: Pos. 1.1: O&M cost estimated at the level of 900,00 USHS/ton (See inception report)

Pos. 1.2: Capital costs: 25% of investment per year: 430,000,000 USHS/year

Pos. 1.3: Maintenance: 5% of investment per year: 25,000,000 USHS/year

Salaries (10 workers): 26,000,000 USHS/year

Estimated total annual costs: 51,000,000 USHS/year

Pos. 1.4: O&M: 10% of investment per year: 2,500,000 USHS/year

|  |                      |
|--|----------------------|
| Salaries (1 worker):                                 | 1,000,000 USHS/year  |
| Estimated total annual costs:                        | 3,500,000 USHS/year  |
| Pos. 1.5: Estimated maintenance costs:               | 1,000,000 USHS/year  |
| Estimated operation costs (fuel + salaries):         | 1,500,000 USHS/year  |
| Estimated total annual O&M costs:                    | 2,500,000 USHS/year  |
| corresponding to (if operated at max. capacity):     | 25,000 USHS/ton      |
| Pos. 1.7: Maintenance: 5% of investment per year:    | 18,750 USHS/year     |
| Salaries (3 workers):                                | 3,000,000 USHS/year  |
| Estimated total annual O&M costs:                    | 3,018,750 USHS/year  |
| Pos. 1.9: Capital costs: 25% of investment per year: | 14,000,000 USHS/year |
| Estimated maintenance costs:                         | 5,600,000 USHS/year  |
| Estimated operation costs (fuel + salaries):         | 3,600,000 USHS/year  |
| Estimated total costs per vehicle:                   | 23,200,000 USHS/year |

In the Pilot Phase, the vehicle is also used for collection of other HCW from health facilities in the area of Kampala

**Table 5.4: Phase 2 – Additional Annual Costs**

| <b>Pos. No.</b>                              | <b>Item</b>   | <b>Unit costs (USHS/year)</b> | <b>No. of units</b> | <b>Total (USHS/year)</b> |
|--|---|-------------------------------|---------------------|--------------------------|
| 1.1  | 1 sophisticated incinerator, with flue gas cleaning (treatment of approx. 200 tons/year) – Plant O&M costs                        | 180,000,000                   | 0                   | 0                        |
| 1.2  | 1 sophisticated incinerator, with flue gas cleaning – Capital costs (25% of investment per year)                                  | 430,000,000                   | 0                   | 0                        |
| 1.3  | Infrastructure, buildings and support equipment for national level incineration facility – O&M costs                              | 51,000,000                    | 0                   | 0                        |
| 1.4  | Disposal area for incineration residues, National level – O&M costs   | 3,500,000                     | 0                   | 0                        |
| 1.5  | Mark 3 – De Montfort brick incinerators at district level – O&M costs   | 2,500,000                     | 52                  | 130,000,000              |
| 1.6  | Mark 3 – De Montfort brick incinerators at district level – Capital costs (25% of investment per year)                            | 3,000,000                     | 52                  | 156,000,000              |
| 1.7  | Infrastructure, buildings and support equipment for district level incineration facilities – O&M costs                            | 3,018,750                     | 52                  | 156,975,000              |
| 1.8  | Disposal area for incineration residues, District level – O&M costs (as for Pos. 1.4)   | 3,500,000                     | 52                  | 182,000,000              |
| 1.9  | Transport of HCRW from district stores to national facility (collection 4 times per year)   | 23,200,000                    | 1                   | 23,200,000               |
| 1.10   | Operation and maintenance of storage rooms within each HC   | 100,000                       | 2,278               | 227,800,000              |
| 1.11   | Transport of HCRW from all health centres within each district (collection once per week) – Estimated 50% of Pos. 3               | 11,600,000                    | 52                  | 603,200,000              |
| 1.12   | Containers + packaging materials, nationwide (10% of containers to be replaced annually sharps containers to be replenished 100%) |                               |                     | 0                        |
| <b>Sub-total:</b>                            |   |                               |                     | <b>1,479,175,000</b>     |
| <b>Contingencies (10%):</b>                  |   |                               |                     | <b>147,917,500</b>       |
| <b>Total estimated annual O&amp;M costs:</b> |   |                               |                     | <b>1,627,092,500</b>     |

Note: Unit costs: See Table 5.3

### Annual Costs within a 12 Years Planning Period

Phase 1 is assumed implemented in year 2005 and Phase 2 is assumed implemented over 3 years (2009, 2010 and 2011). Therefore, the total costs for establishment of the improved HCW management system will be divided several years.

It is assumed that treatment plants and other equipment (incinerators, vehicles, containers etc.) will have an economical lifetime of 5 years. After 5 years of operation, re-investments must be made for these facilities and equipment. Buildings and other infrastructure are assumed to last for more than 10 years. Therefore, no re-investments are assumed for these facilities within a 12 years financial planning period (2005 – 2016).

A detailed budget for the entire 12 years planning period is presented in Appendix 12. This budget is based on the assumption that all establishment and O&M costs within the planning period will be covered by average annual fee rates to be paid by the users (health facilities). At the end of the planning period, the accumulated cash flow will be zero, reflecting that all costs within the period have been covered by the fees.

### Financing Aspects

The Health Care system in Uganda is financed mainly by public means through central government's own resources, loans and donor contributions. Local governments' contributions are very limited. Financing of the investments for improved HCRWM will be mainly through public financing directly through loans or through donor funding. For recurrent costs funds will be transferred to the health units and/or health subdistricts/hospitals and payments for operation/payment for HCRWM services directly i.e. for the use of the national facility.

The polluter-pays-principle will be used for the private clinics, implying they will need to pay the full costs. For this to be possible the private operated health units need to be forced to use the system, through regulation by MOH and NEMA.

### Cost Recovery Aspects

Financing of the HCRWM is assumed to be through grants by central government, but a cost recovery scenario based on commercial interest rates is presented in appendix 12.3. The scenario presents the fees required for total cost recovery based on a commercial loan with interest of 15% and savings of 5%.

### Annual Budgets

The annual investment costs are presented in appendix 12.1 and summarised below.

**Table 5.5 Initial Annual Investment and Reinvestment Costs (mill. USHS per year)**

| Year | Initial Investments | Reinvestments |
|------|---------------------|---------------|
| 2004 | 550.0               | -             |
| 2005 | 5,461.5             | -             |
| 2006 | 330.0               | -             |
| 2007 | 660.0               | -             |

| Year | Initial Investments | Reinvestments |
|------|---------------------|---------------|
| 2008 | 660.0               | -             |
| 2009 | 7,991.5             | -             |
| 2010 | 7,434.9             | 2,472.8       |
| 2011 | 7,433.8             | -             |
| 2012 | 55.0                | -             |
| 2013 | 55.0                | -             |
| 2014 | 55.0                | 1,578.5       |
| 2015 | 55.0                | 3,769.7       |
| 2016 | 55.0                | 228.8         |

The Annual operation and maintenance costs are presented below.

**Table 5.6 Annual Operation and Maintenance Costs (mill. USHS per year)**

| Year | Phase 1 - Initial Implementation | Phase 2 - Nationwide Implementation |
|------|----------------------------------|-------------------------------------|
| 2004 | -                                | -                                   |
| 2005 | -                                | -                                   |
| 2006 | 501.2                            | -                                   |
| 2007 | 501.2                            | -                                   |
| 2008 | 501.2                            | -                                   |
| 2009 | 501.2                            | -                                   |
| 2010 | 501.2                            | 485.1                               |
| 2011 | 501.2                            | 969.3                               |
| 2012 | 501.2                            | 1,455.5                             |
| 2013 | 501.2                            | 1,455.5                             |
| 2014 | 501.2                            | 1,455.5                             |
| 2015 | 501.2                            | 1,455.5                             |
| 2016 | 501.2                            | 1,455.5                             |

## EDUCATION AND TRAINING ASPECTS

The main areas of focus for education and training aspects (Human Resource Development) to overcome the present weaknesses and be able to improve HCRWM in Uganda with the proposed institutional changes include:

- ③ Development of guidelines for HCRWM, by level for dissemination and use by all health facilities. The guidelines will be prepared in the next stage of this study.
- ③ Contracts management: The proposal is to privatise some of the functions of operating the HCRWM system and this requires staff of Ministry of Health, District Directorates of Health, District and Regional Hospitals, Health Subdistricts and Health Units to be able to draw up contracts on HCRWM, tender and supervise the

contractors. The private sector in Uganda is developing and also requires support in managing contracts (tendering, carrying out contracts etc).

- ③ Capital Investments Planning: The public and the private sector will require support in planning for future investments in HCRWM.
- ③ Information management: In order to improve on planning and supervision staff will be trained in monitoring and evaluation.
- ③ Environmental management: Health Care wastes have to be managed in an environmentally sustainable way and health care staff will receive training in environmental assessment and environmental management procedures.

The main strategy to be used for human resource development is on the job training. Other strategies will be seminars, workshops and short training courses and exchange visits. During the development of guidelines for HCRM a detailed task analysis and training needs analysis will be carried out and training programmes detailed.

Training will be carried by Trainers of Trainers (TOTs), who will be identified from health training institutions and among the core staff involved in HCRWM.

For a HCRWM system to be established and to succeed, the key factor is commitment from the Health Care authorities concerned as well as local authorities and communities using the services as well as those living in close proximity to the health care facilities and wastes disposal sites. This means that it can only be established where the local health authorities including statutory committees and local community has recognised the need for it, and is prepared to fully support it. Alongside the capacity building and training of wastes handlers and health care staff there will be a public awareness campaign on improved HCRWM using social marketing techniques through the media and other channels like posters.

It is assumed the Institutional Strengthening and human resource development will be carried out through Consultancy Technical Assistance support. Costs for technical assistance are included in appendix 12.

## LIST OF REFERENCES

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- /19/ Preparation of National Health-Care Waste management Plans in Sub-Saharan Countries, Guidance Manual, Secretariat of Basel Convention and World Health Organization
- /20/ Basel Convention Technical Guidelines on Incineration on Land, UNEP, November 2002

## **Appendix 1**

### **Equipment and material for separate collection and intermediate storage of HCW**



## **Appendix 2**

### **Conceptual designs of storage facilities**



## **Appendix 3**

### **Trolleys / pushcarts for on-site transport**



# **Appendix 4**

## **Vehicles for off-site transport**



## **Appendix 5**

### **Layout / conceptual design of National Level HCRW Incineration Facility**



## **Appendix 6**

### **Draft specifications for the National Level HCRW Incineration Plant**



## **Appendix 7**

### **Layout of brick incineration facility at district level**



## **Appendix 8**

### **Design and specifications for brick incinerators at district level**



## **Appendix 9**

### **Conceptual design of residue disposal site**



## **Appendix 10**

### **Site selection criteria for HCRW incinerators and disposal sites**



# **Appendix 11**

## **Draft Implementation Plan**



## **Appendix 12**

### **Budgets on Investments and Annual Costs for the Phased Implementation**



