

Health Care Waste Management in Sri Lanka

CORDAID, 312/10085A



CORDAID Tsunami Reconstruction 1

Project Report

Authors: Dr. Hemanth, Dr. Prutvish, Dr. Gopinath, Dr. Kumar, Ivo Haenen, Valentin Post

Editors: Valentin Post, Ivo Haenen

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Cover photo: Photo of participants training health care waste Base Hospital, Hambantota April 2007, Sri Lanka

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TABLE OF CONTENTS

TABLE OF CONTENTS.....	1
LIST OF PHOTOS.....	3
LIST OF TABLES	3
LIST OF ACRONYMS.....	4
FOREWORD	5
ACKNOWLEDGEMENTS.....	6
CHAPTER 1 INTRODUCTION TO CORDAID SRI LANKA PROJECT AND THIS DOCUMENT	7
1.1 Background of the Project.....	7
1.2 Objective of this document & intended audience.....	7
1.3 Terminology	7
1.4 ISWM methodology for structure	8
1.5 Structure of this document	8
CHAPTER 2 HEALTH CARE WASTE MANAGEMENT	9
2.1 Why does health care waste require safe management?	9
2.2 Why health care waste management in Post-Tsunami reconstruction?	9
2.3 What constitutes health care waste management?.....	9
2.4 Key issues in health care waste management in the South.....	10
CHAPTER 3 PROJECT OBJECTIVES & OVERVIEW ACTIVITIES.....	12
3.1 A need for health care waste management in Post-Tsunami reconstruction ...	12
3.2 Project objectives.....	12
CHAPTER 4 INSTITUTIONAL AND LEGAL CONTEXT	14
4.1 Institutional Context	14
4.2 Legal Context.....	14
CHAPTER 5 ASSESSMENT OF WASTE MANAGEMENT SYSTEM IN FOUR HOSPITALS.....	17
5.1 Assessment of four health care waste management systems in Sri Lanka	17
5.2 Analysis of the health care waste management systems	23
5.3 Proposed Training Approach.....	25
CHAPTER 6 TRAINING OF TRAINERS (TOT).....	27
6.1 Training of hospital staff in Kalmunai and Hambantota.....	27

6.2	Assessment and training methodology	27
CHAPTER 7 STRENGTHENING TREATMENT FACILITY.....		32
7.1	Placenta Reactor.....	32
7.2	Sharp pits	33
7.3	Containers	34
CHAPTER 8 STRENGTHENING KEY INSTITUTIONS.....		35
8.1	Facilitating Network HCWM.....	35
8.2	Launch of the Health Care Waste Management Cell Sri Lanka.....	37
CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS.....		38
9.1	Conclusions	38
9.2	Recommendations to follow-up.....	38
9.3	Lessons learned.....	39
ANNEX 1	LOGICAL FRAMEWORK.....	41
ANNEX 2	SCHEMATIC OVERVIEW MEETINGS.....	42

LIST OF PHOTOS

Photo 1 Incinerator Ashroff Memorial Hospital, Kalmunai	20
Photo 2 Health care waste disposal at backyard Ashroff Memorial Hospital, Kalmunai	20
Photo 3 Health care waste segregation in Base Hospital, Kalmunai	21
Photo 4 Incinerator at Base Hospital, Kalmunai	21
Photo 5 Training participants in Hambantota	27
Photo 6 PAB reactor in India	33

LIST OF TABLES

Table 1 System elements in health care waste management.....	10
Table 2 Overview of project activities in Sri Lanka related to health care waste management.....	13
Table 3 Colour coding of health care waste in Sri Lanka	16
Table 4 Profile Castle Street Hospital for Women, Colombo	17
Table 5 Profile Hambantota Base Hospital, Hambantota	18
Table 6 Profile Ashroff Memorial Hospital, Kalmunai	19
Table 7 Profile Base Hospital, Kalmunai	21
Table 8 Summary observations field visit.....	23
Table 9 SWOT analysis of health care waste management systems.....	23
Table 10 Action Plan Ashroff Hospital Kalmunai	28
Table 11 Action Plan Base Hospital Kalmunai.....	28
Table 12 Action Plan Base Hospital Hambantota	29
Table 13 Action Plan Energy Forum on health care waste management.....	29
Table 14 Logical Framework for health care waste management	41
Table 15 Meetings with key institutions	42

LIST OF ACRONYMS

AGD	Assistant Government Division
AIDS	Acquired Immune Deficiency Syndrome
CEA	Central Environmental Authority
CTF	Common Treatment Facility
DDPHS	Deputy Director Provincial Health Services
DGHS	Director General Health Services
EPL	Environmental Protection License
ETP	Effluent Treatment Plant
GP	General Practitioners
HCWM Cell	Health Care Waste Management Cell
HIV	Human immunodeficiency virus
MOH	Medical Officer of Health
NEA	National Environment Act
OBG	Obstetrics Gynaecology
OR	Operation Room
PAB	Placenta Anaerobic Bio-Reactor
PHMW	Peripheral Health Mid Wives
PHO	Provincial Health Officer
PVC	Poly Vinyl Chloride
SOPs	Standard Operational Procedures
TCL	Tropical Chloride of Lime
ToT	Training of Trainers
UNOPS	United Nations Office for Project Services
WHO	World Health Organisation

FOREWORD

The project started as a response to the disaster that struck Sri Lanka on the 26th of December 2004. Based on a request to the Central Environment Authority an assessment was made of the solid waste situation caused by the Tsunami in the coastal zones of Sri Lanka. The first assessment – partially supported by CORDAID – resulted amongst others in debris management guidelines issued by the Central Environment Authority at the end of January 2005.

In the course of 2005 it became clear that many organisations at that time quite rightly focused on immediate relief efforts, but gave much less attention to longer term reconstruction efforts. Waste management systems - not very well functioning before the Tsunami - had collapsed. In relief efforts, waste management was seen as important to prevent outbreak of diseases, but few recognised its importance in reconstruction. And yet, at the same time there was a widely voiced demand for show-how projects as there was very little practical experience as to how things could be improved.

This is the background to the current project: as much as possible show how projects and initiatives are undertaken that target local needs, and at the same time are essential building blocks in reconstruction. As needs were high, a relatively large number of projects were identified by local counterparts. Therefore our aim is to assist counterparts with technically correct guidance that makes their interventions sustainable.

Waste management knowledge and expertise is conspicuously lacking in the country. Thus efforts are undertaken to share knowledge and disseminate whatever projects are implemented to a much wider audience. This is the background to this series of project reports.

The following areas are tackled and similar reports are available on each of these subjects: hospital waste water management; health care waste management; solid waste management; faecal sludge management; debris management and composting.

By no means these are the last words that can be said about any of these subjects. In the case of health care waste management, final disposal remains a critical issue. In the case of hospital waste water management, we believe to have made an appropriate design for a waste water treatment plant after a very elaborate consultative process with the client, but this plant still has to be built (for which CORDAID's assistance has been requested).

In the case of debris management, the delay between project conception and the final approval proved too long; by then most of the debris in Kalmunai had disappeared.

In Hambantota it was only those partially damaged buildings that were still standing that constituted 'debris', so it has become much more of a theoretical exercise than what we would have liked. Yet we do believe it is important to document what can be done with debris in case a next disaster strikes.

Solid waste management is very diverse, from plastic recycling (two projects) to landfill improvement, advocacy in solid waste management policy and strategy formulation, setting up an exchange mechanism (national platform), feasibility studies for gasification of waste (in these particular conditions it turned out to be not viable and thus it was not implemented) etc. Solutions for faecal sludge management are still a priority for organisations working with internally displaced persons in the Northern and Eastern Provinces of Sri Lanka (though from an environmental point of view we would suggest that it should cover the entire country) We believe we have managed to significantly improve an existing design for a faecal sludge treatment system. Yet till today, the UN agency that wishes to implement this together with the municipal council of Kalmunai is still struggling to implement it. In the case of Hambantota - as there is an existing site and additional VNG funds - the implementation of a different design will start just beyond the current project period.

All in all we are quite pleased that nearly all reconstruction efforts have become part of the main development agenda in Sri Lanka.

Valentin Post, December 2007

ACKNOWLEDGEMENTS

WASTE would like to acknowledge the support of Energy Forum (Asoka Abeygunawardene and Chinthaka Jayaratne in particular) for facilitating the logistics of the Health Care Waste Management Assessments and Training and for preparing reports. Gratitude also goes to Dr. Hemanth, for his support in the health care waste situation and training needs assessment, to Dr. D. Gopinath, Dr. Pruthvish and Dr. Kumar for providing the training on site, and for establishing valuable contacts to take the project to the next level, and for preparing the proceedings and reports.

Dr. Kumar is the Principle and Dean of MS Ramaiah Medical College, Bangalore and Group of Hospitals. Dr. Pruthvish is Professor of Community Medicine and Director Health Care Waste Management Cell, Department of Community Medicine, MS Ramaiah Medical College, Bangalore. Dr. Hemanth is Lecturer of Community Medicine, and coordinator Health Care Waste Management Cell, MS Ramaiah Medical College, Bangalore.

Additionally, Dr. Pruthvish and Dr. Gopinath assessed which of the Sri Lanka health care institutions would be most suitable and appropriate as counterpart organisation. Following their assessment Colombo Medical College which falls under the University of Colombo were recommended and joint training in health care waste management of medical staff in Hambantota Base Hospital resulted. Colombo Medical College has shown keen interest in curriculum development in health care waste management. As this is a longer term objective and it falls outside the project period of Tsunami reconstruction, WASTE has identified additional resources for the national curriculum development in health care waste management in Sri Lanka.

Also, I would like to acknowledge contribution of Mr. Malaka Dasanayaka Southern Province Coordinator Ministry of Health who extended much appreciated support during the entire project.

A final word of thanks to our friends from CORDAID (Ilse du Pied, Christine Fenenga, Gemma Claessen, Bernadette Hermans, Astrid van den Berg and Hans Scheen). All have been actively involved at one stage or the other from preparatory assistance, to project design and / or have been a continuous source of support during the entire implementation.

Valentin Post, December 2007

CHAPTER 1 INTRODUCTION TO CORDAID SRI LANKA PROJECT AND THIS DOCUMENT

1.1 Background of the Project

After the Tsunami struck Sri Lanka in December 2004, waste management systems virtually collapsed and waste was disposed of indiscriminately. The local authorities were faced with a post-tsunami situation which was beyond their resources. This resulted in unplanned coastal zone dumping practices, poor urban environment planning, substandard water management and sanitation practices and a general waste of resources.

The project “Rapid implementation of community based short and middle term measures to improve the functioning of solid waste management in Tsunami affected areas of Ampara and Hambantota districts” was approved by CORDAID on March 1st 2006.

The project team arranged interventions in the following thematic areas:

- ◆ Health care solid waste management (Report series 1);
- ◆ Faecal sludge management (Report series 2);
- ◆ Master Composting (Report series 3);
- ◆ Solid waste management: Policy and Strategy (Report series 4);
- ◆ Health care liquid waste management (Report series 5);
- ◆ Plastic recycling (Report series 6), and
- ◆ Debris management (Report series 7).

1.2 Objective of this document & intended audience

The project team felt a strong need to express and share the lessons learned from the project interventions. So the purpose of this document is to provide thematic and practical knowledge on improving solid waste management and sanitation systems in reconstruction efforts. However, we also see that this document has value in ‘ordinary’ development initiatives that aim to improve these environmental management aspects. Note that this document is not intended to be a guiding manual for safe health care waste management.

WASTE has prepared a similar document for each of the project interventions described in the first paragraph of this Chapter. The documents can be obtained electronically from the website www.waste.nl and waste.efsl.lk.¹

1.3 Terminology

This document uses the term 'health care waste' to refer to waste generated by health care institutions. 'Health care' is used instead of 'hospitals' as small health care units also generate waste and the treatment thereof is not much different from that of hospitals. There are various terms that cover similar contents: medical waste, clinical waste, hospital waste, infectious waste. Health care waste also includes ‘sharps’ (needles, scalpels and other medical instruments), and body parts.

¹ As of 31 December 2007

1.4 ISWM methodology for structure

In this document, the project team has opted to use the Integrated Sustainable Waste Management (ISWM) methodology to provide a structure for presenting, and analysing information.² The ISWM methodology is a tool that supports to describe and analyse any waste management system in a systematic way. The methodology describes three parts: identifying relevant stakeholders, waste system elements (generation, collection, transport, storage, treatment, disposal), and waste system aspects (technical, institutional/political, legal, environmental/health, socio-cultural, and financial/economic).

1.5 Structure of this document

This document is structured as follows:

Chapter 2 will briefly touch upon the risks associated with the management of waste in hospitals, and the need for safe health care waste management in general, and more specifically, in post-disaster or reconstruction areas. Also, it will broadly explain some relevant steps in health care waste management, based on the ISWM methodology.

Chapter 3 describes the project objectives and provides an overview of the activities that representatives of the project team carried out. Chapter 4 gives the institutional and legal context. Chapter 5 continues with observations made during the assessments of hospitals in Colombo, Hambantota and Kalmunai, and specifies the need for institutional training and final treatment options. Chapter 6 describes the outcomes of the training of trainers, and Chapter 7 describes the activities and outcomes of setting up a final treatment facility for Kalmunai. Chapter 8 gives an overview of the activities and outcomes of the institutional strengthening, in order to improve the chances of sustainability.

Chapter 9 gives a set of conclusions drawn from the experiences of the training and institutional strengthening, and advises on the follow-up.

² The ISWM Methodology has been developed by WASTE. The Manual 'Putting ISWM into Practice' can be obtained from the WASTE website at <http://www.waste.nl/content/download/561/4346/file/ISWM%20ass%20eng%20screen.pdf>

CHAPTER 2 HEALTH CARE WASTE MANAGEMENT

2.1 Why does health care waste require safe management?

The disposal of waste originating from health care establishments is likely to have effect on the health and human well being, the environment (air, water, soil, animals, plants, and land), issues relating to the public security and order. Nevertheless experience has proven that waste originating from health care establishments, when properly managed, generally poses no greater risks than other waste. This applies to the disposal of biomedical and infectious waste as well.

The safe management of health care waste is essential for community and environmental health. It is also important that, irrespective of technologies used for treatment and disposal, the standards for the protection of the environment and human health are uniform for all health care establishments. This in turn ensures a more viable and efficient health sector. However, it should be noted that in many countries national authorities, in addition to the health industry, is an active participant in health care, either providing services or paying for them. Additionally, the lack of resources and experience in developing standards may be significant factors affecting the capacity to treat biomedical and healthcare waste.

Introduction of improved solutions for the segregation of waste at the source, within health care facilities can result in reduced amounts of waste requiring special treatment, and therefore in reduced waste treatment costs. In addition, new technologies have become available to disinfect and treat biomedical and healthcare waste so that they can finally be managed safely.

2.2 Why health care waste management in Post-Tsunami reconstruction?

The Tsunami literally swept away the lives of thousands of people living in Sri Lanka. But in addition, it paralysed the waste management infrastructure that was already facing challenges in safe waste management. Moreover, the victims and injured people further stressed the capability to manage health care waste safely.

Safe health care waste management is always a must-have, and the Tsunami further stressed this essential need. When reconstructing (waste management) infrastructure in densely populated areas, health care waste management therefore deserves its fair share of attention.

Risks associated with improper health care waste management are considered high, in terms of environment, but also in terms of occupational health. It not only concerns those directly dealing with health care waste– that is all hospital staff and patients – but also informal waste pickers that roam waste disposal sites for recyclables, and who could catch an infection or be cut by sharp waste items.

2.3 What constitutes health care waste management?

The project focuses specifically on improving health care waste management in hospitals in Sri Lanka. Health care waste, in theory, travels among the same **elements** of the waste management system as household waste management. This means that, at a certain stage, specific substances ‘become’ waste. This is referred to as **generation**. When someone

disposes waste, there should be a receptacle for the specific waste for **storage**. Usually there is a need to get the waste away from the location of generation – **collection** is then a next step, together with **transport** to get the waste, in its transport container, to a secondary storage place, or directly to a **treatment** place where the waste can be processed so that it poses no risk to people and environment. This is a very basic explanation of how health care waste should move from generation to treatment.

When managing hospital waste, it is important to consider each of these steps. Table 1 provides a list of important aspects.

Table 1 System elements in health care waste management

Waste system element	Relevant steps in safe health care waste management
Generation	<ul style="list-style-type: none"> ◆ Identification and classification of waste material ◆ Segregation at the source based on categories: <ul style="list-style-type: none"> ○ Sharps (medical needles and other surgical instruments) ○ Infected waste (biomedical, from surgery, nursery, cleaning) ○ General waste (food scraps, paper, plastics) ◆ Disinfection of areas that have been in contact with waste materials (including hands of staff)
Collection	<ul style="list-style-type: none"> ◆ Handling and storage based on colour coding, in disinfected receptacles
Storage in hospital	<ul style="list-style-type: none"> ◆ Separate storage facility ◆ Documenting and monitoring of quantities of waste ◆ Packaging and labelling
Transport	<ul style="list-style-type: none"> ◆ Monitoring of transport
Storage	<ul style="list-style-type: none"> ◆ Separate storage facility ◆ Documenting and monitoring of quantities of waste
Treatment /disposal	<ul style="list-style-type: none"> ◆ Appropriate treatment of infected waste: <ul style="list-style-type: none"> ○ Sharps to a sharp-pit, incineration (not to the municipal landfill!) ○ Infected waste (incineration, bio-reactor, deep burial, other) (not to the municipal landfill) ○ General waste (recycling, composting, municipal landfill)

The success of health care waste management system elements depends on a committed and educated staff, that fully understands the relevance each of the steps.

2.4 Key issues in health care waste management in the South

This section briefly describes some of the key issues in health care waste management. The section is structured based the ISWM aspects.

2.4.1 Health and environmental issues

Exposure to health care waste poses a risk to a broad range of people, directly and indirectly. Directly it includes hospital staff, including medical, paramedical and waste handlers working

in these health care institutions; patients and their attendees of these health care institutions; indirectly, when mismanaged, health care waste can affect waste pickers that roam the waste disposal sites, and the public in general, when health care waste comes in contact with the water table or water streams.

Sharps waste, although produced in small quantities, can be highly infectious and because of its ability to cut tissue, risk of infection is high when sharps are not safely stored, collected, transported and disposed or processed. The World Health Organisation (WHO, 1997) has estimated that 32% of all new infections of Hepatitis B, 40% of Hepatitis C and 5% of HIV are due to injections with contaminated syringes. Injuries from sharp waste which is not disinfected have the potential to transmit HIV and Hepatitis B to health care professionals and to people handling them like waste handlers and rag pickers.

2.4.2 Technical issues

Usually, problems emerge with safe health care waste management when some of the waste system elements are disregarded. In order for the system to work effectively all system steps need to be in place – this is true for all waste management systems. An infamous example of mismanagement of hospital waste is that waste is segregated at the point of generation but later on it is added to the hospital's general waste, and all hospital waste ends up at a municipal disposal site.

2.4.3 Institutional issues

Internally, responsibilities should be clear for all staff involved, and all staff should know the consequences of mismanagement of health care waste. At the same time, issues of health care waste management should be included in educational courses, to ensure that newly trained staff are aware of the reasons for safe health care waste management.

2.4.4 Legal issues

It is important that politicians recognise the relevance of separating hazardous waste streams from ordinary, household and commercial waste streams, and set legal standards for treatment thereof.

2.4.5 Financial issues

It is often claimed that equipment for safe treatment of health care waste comes at a price. While not denying that various treatment systems require substantial investments, there are also lower-cost treatment options for hospitals that operate with marginal budgets. Also, sharing of treatment options is often necessary for cost-effectiveness.

2.4.6 Socio-cultural issues

Lastly, the socio-cultural aspects of waste in general, and health care waste specifically, can have a large effect on the system. It could be the case that certain groups of people refuse to handle (hospital) waste, or that there are cultural issues with incineration of body parts in a closed environment.

CHAPTER 3 PROJECT OBJECTIVES & OVERVIEW ACTIVITIES

3.1 A need for health care waste management in Post-Tsunami reconstruction

3.1.1 *Why health care waste management in post-Tsunami reconstruction?*

Immediately after the Tsunami hit the island of Sri Lanka, the affected communities were first in need of safe shelter, medical care, food provisions, and all other basic needs necessary for survival. After the immediate needs were (partially) satisfied, reconstruction activities began, in the form of repair or rebuilding infrastructure such as roads, housing, and supporting communities with livelihoods. Rebuilding waste management and sanitation infrastructure was frequently overlooked in the rebuilding process, despite the common understanding that safe management of both is very important for human health, and for environment in general.

Safe hospital or health care waste management should also be part of reconstruction, as the effects of these materials on human health and environment can be very serious – as this document has portrayed in Chapter 2. Health care waste is especially believed to be dangerous, and this is not different from other waste streams, if disposed uncontrolled in an area that show the combined effects of high groundwater tables, high population density, and a socio-economic profile where informal dump and waste picking is daily practice.

At the same time, the daily practice of health care waste management should leave as little risk possible to those who are directly related to it – medical staff, but also patients.

3.2 Project objectives

The project objectives are to:

- ◆ review health care waste management data related to the Tsunami in Sri Lanka, particularly in the identified districts/ project areas;
- ◆ analyse the health care waste management situation in Sri Lanka;
- ◆ identify training needs for sound and effective health care waste management, at different levels;
- ◆ prepare the health care waste management training programme;
- ◆ deliver the health care waste management training programme;
- ◆ identify and implement options for final disposal (biogas and others) in a consultative manner

3.2.1 *SMART objectives and results*

The Logical Framework of this specific intervention (see Annex 1) formulates the following:

Overall Objective:

- ◆ In target areas, safe management and disposal of medical and sanitation waste, focus on increased amounts of waste due to the Tsunami.

The overall result is:

- ◆ There is an improvement compared to the assessment data survey in the health, and environment status in project areas of Ampara and Hambantota districts by June 2007 directly benefiting 10,000 people and indirectly 20,000 people.

Annex 1 provides the Logical Framework of the project, related to hospital and health care waste management.

3.2.2 Overview of activities

This document is mainly based on information from the field. Table 2 gives a broad impression of important moments and activities of the project.

Table 2 Overview of project activities in Sri Lanka related to health care waste management

Time	Activity	Carried out by
March 2006	◆ Cordaid approves project proposal prepared by WASTE – start of project	
Oct - Nov 2006	<ul style="list-style-type: none"> ◆ Situation analysis – coordination with key institutions ◆ Training Needs Assessment of four hospitals in Sri Lanka ◆ Training programme delivered to Ashroff Hospital, Kalmunai, and Base Hospital, Kalmunai 	Dr. T Hemanth
December 2006	<ul style="list-style-type: none"> ◆ Training programme delivered to Base Hospital, Kalmunai and Ashroff Memorial Hospital, Kalmunai ◆ Identify suitable local counterpart organisations ◆ Examine opportunities of setting up a Health Care Waste Management Cell in Sri Lanka 	Dr. D. Gopinath Dr. S. Prutvish
April 2007	<ul style="list-style-type: none"> ◆ Training programme delivered to Base Hospital, Hambantota (jointly with Colombo Medical College) ◆ Strengthening institutional network ◆ Examine opportunities of setting up a Health Care Waste Management Cell in Sri Lanka ◆ Examine opportunities for a common treatment facility 	Dr. D. Gopinath Dr. S. Prutvish
July 2007	◆ Testing of materials of Ramaiah Medical College in a small scale health care facility in Sri Lanka by Colombo Medical College	Dr. Nalaka
October 2007	◆ Review of outcome training programme Ashroff Hospital and Base Hospital Kalmunai, and Base Hospital, Hambantota	Dr. S. Kumar Dr. S. Prutvish
December 2007	◆ Close of the project	

CHAPTER 4 INSTITUTIONAL AND LEGAL CONTEXT

4.1 Institutional Context

The health care service system can be divided in government and private hospitals. Governmental hospitals serve around 95% of the Sri Lankan population, and the private sector serves the other 5% (Gopinath and Prutvish 2007).

4.1.1 Governmental health care service

The governmental service system in Sri Lanka is divided in to curative services and preventive services.

Curative services

For curative services, the government has established **peripheral units** (PU's) in each village. Additionally, there are **District Hospitals**, of which there are 5 to 8 in each district in Sri Lanka, depending on district size and population. Furthermore, there are **Base Hospitals**, which act as referral units with Medical, Surgical, Paediatrics and Obstetrics and Gynaecology specialties. In each district there is one **General Hospital** with specialties like ENT/Ophthalmology, Dermatology, Radiology apart from Medical, Surgical/Paediatrics and OBG. In each province there are **Provincial Hospitals** (8 in total), and there is one **National Hospital** in Colombo, which has all the specialties, and super specialties, which is the apex referral centre in the health system. There are also **Teaching Hospitals**, which are attached to the Medical Colleges. Health care is provided free of cost to all the people including the super specialty services.

Preventive services

For preventive services there is one Medical Officer of Health (MOH) in each Assistant Government Division (AGD), which caters for a population of every 60,000 people. Each Medical Officer of Health is supported by Peripheral Health Mid Wives (PHMW) and Public Health Inspectors. They are responsible for the Mother and Child Health programme and for the Food Hygiene and Sanitation respectively. In each district there is Deputy Director Provincial Health officer (DDPHS) and for each province there is Provincial Health Officer (PHO) and at the top of this hierarchy is Director General of Health Services (DGHS).

4.1.2 Private health care service sector

The medical private sector in Sri Lanka consists of a few hospitals, private general practitioners, laboratories, blood banks, and dental clinics. Private hospitals serve roughly 5% of the population. The number of private medical services is relatively small in Sri Lanka, and these services are predominantly located in Colombo and the other larger cities like Kandy and Galle.

4.2 Legal Context

Regulating the management of health care waste started relatively late in the country. The government carried out a survey on health care waste management in government hospitals in early 2001, and a National Action Plan has been recommended for health care waste management in the country. The survey proposed installation of incinerators or autoclaves in hospitals of Colombo and to have final disposal equipment at other strategic locations to facilitate the waste management of smaller hospitals. Health care waste was divided into three

categories by the survey mission: non-risk (general) waste, general biomedical waste, and sharps.

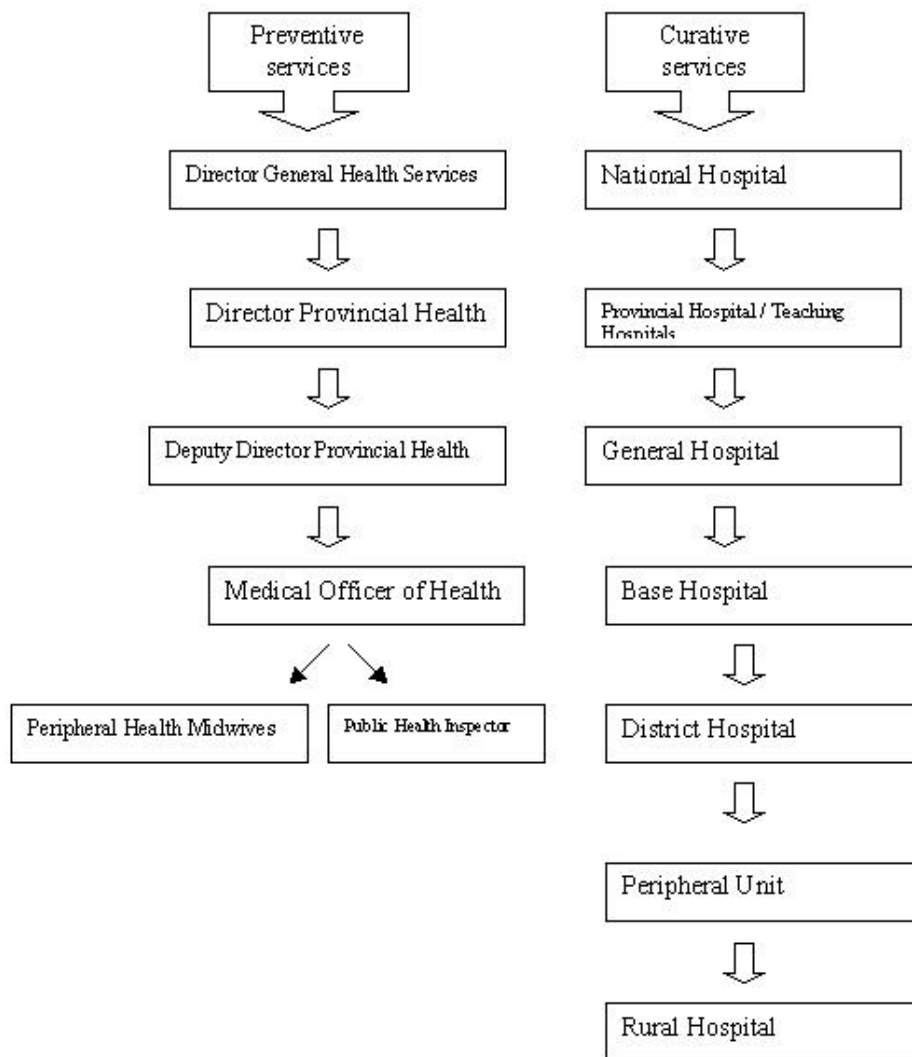


Figure 1 Overview of institutional framework of preventive and curative health care delivery service systems in Sri Lanka

4.2.1 Legislation and regulation

The National Environment Act (NEA) No. 47 of 1980 with its amendments Nos. 56 of 1988 and 53 of 2000 are the basic legal documents that regulate the management of hazardous waste in Sri Lanka. Waste generated by health care facilities is categorised as hazardous waste. The guidelines for managing health care waste have been reviewed and approved during a workshop held at Ministry of Health in October 2001.

The guidelines encourage the health providers to use the most appropriate technology to manage waste but has not very clearly specified the exact facility for the type of health care and for the category of waste. The NEA has not specified medical institutions and the

production of health care waste as an activity requiring an Environmental Protection License (EPL) from the Central Environmental Authority (CEA).

The Government of Sri Lanka is consolidating the current legislation to produce a regulatory document related to the management and disposal of health care waste providing clear definitions and characterization of health care waste. The document will, among others: assign duties and responsibilities to health care providers; describe segregation, packaging, labelling, collection, storage and transportation of waste in medical institutions; select and list authorized treatment and disposal technologies and facilities; and prescribe licensing for health care institutions. Additionally, the Government of Sri Lanka is planning to develop and set up regular monitoring procedures at the provincial and district levels.

4.2.2 *National colour code*

To implement a uniform system of segregation throughout the country, the Ministry of Health has developed a National colour code for health care waste, dated March 2006. The National colour code has been circulated to all the government health care institutions. The national colour code identifies 7 specific categories.

Table 3 Colour coding of health care waste in Sri Lanka

Colour	Category	Contents
Yellow	Infectuous	Cultures or stocks from microbiology, tissues from surgeries/autopsies, material or equipment in contact with blood or body fluids soiled linen, dialysis equipments such as tubing and filters.
Yellow with red stripes	Sharp waste	Sharps, needles and IV sets contaminated with body fluids
Black	General waste	General or municipal waste that is uncontaminated
Green	Biodegradable waste	Garden, kitchen and food waste
Red	Glass waste	Uncontaminated drink bottles, water bottles
Blue	Paper waste	Paper, cardboard and office stationary
Orange	Plastic waste	Uncontaminated plastic medicine bottles, saline bottles without IV sets, plastic bags

CHAPTER 5 ASSESSMENT OF WASTE MANAGEMENT SYSTEM IN FOUR HOSPITALS

5.1 Assessment of four health care waste management systems in Sri Lanka

WASTE, based in the Netherlands, and Energy Forum, based in Sri Lanka, contacted the Health Care Waste Management Cell, Bangalore, India (HCWM Cell) to conduct a situation analysis and training needs assessment of health care waste management in hospitals of Tsunami affected districts, and, based on this report, to carry out a training programme to various stakeholders. WASTE contracted Dr. T. Hemanth, Lecturer at the HCWM Cell to conduct a study visit to four selected hospitals. A first study visit took place from 29 October to 9 November 2006. Observations and conclusions represented in this section are largely drawn up from this study visit.

This chapter will first describe the situation of four hospitals; one in Colombo, one in Hambantota (South Sri Lanka), and two in Kalmunai (East Sri Lanka). It then briefly describes the status of the legal framework regarding health care waste management in Sri Lanka. The chapter then continues with a SWOT analysis, and a gap analysis of institutional / capacities of each of the hospitals. The gap analysis provides the structure for the follow-up training.

5.1.1 Castle Street Hospital for Women, Colombo (Hospital 1)

Table 4 Profile Castle Street Hospital for Women, Colombo

Hospital characteristic	Number
Beds:	150
Average bed occupancy:	100%
Average deliveries per month:	1000
Number of Doctors:	120
Number of nursing staff:	170
Number of other supporting staff:	30

At Castle Street Hospital, the waste is being segregated at source at all points of generation. The colour coding is practiced according to the recent circular issued by the Ministry of Health. However syringes and needles are not being separated, and they are dumped in the same container without being subjected to disinfection. The broken ampoules and vials are segregated into a separated container and intact glass items are stored in another container, and reused after washing.

Used cotton swabs and bandages are being disposed separately in a yellow container. The food waste, scrap paper and the like, are collected in a black coloured container. The hospital is using plastic bins as containers, which are lined by the appropriately coloured plastic liners. Some containers do not fit the standards: lids do not provide full coverage, or the containers can not be moved by foot, and sometimes the container materials are porous. Syringe and needles are collected in cardboard boxes, also with the appropriate red stripe lining. The waste is collected twice a day, and the containers are not washed.

The hospital has a centralized injury register which records all the injuries reported. Zidovidine is used as post-exposure prophylaxis for those who had needle stick injuries from a suspected case of HIV/AIDS. The staff uses Tropical Chloride of Lime (TCL) as a

disinfectant to clean accidental spills of blood or body fluids by adding 30 grams of TCL to 1 litre of water. The area of the spill is flooded with the disinfectant and immediately wiped with clean cotton gauze and disposed into a yellow container.

The staff use gloves during the procedure of drawing blood but waste handlers hardly use any protective gears while handling waste. The hospital does not have an in-house laundry; they give it to an outside agency. Linen contaminated with body fluids is immersed into a container containing TCL solution and later sent to the laundry.

The waste is transported in an open push trolley to the final treatment site, which is a short distance away from the main building but closer to the staff quarters. There is a waste storage area within the hospital premises at a further distance, the final storage areas are coloured according to the colour codes being practiced in the hospital and the waste is stored accordingly before being disposed. This area has got easy access to all and only the area storing human anatomical parts is properly secured preventing access to animals and birds.

Syringes with intact needles which are not first disinfected and broken ampoules and vials are burnt in a masonry structure after adding sodium chloride and TCL powder, and kerosene for fuel. The remains of this process are dumped into a rectangular concrete pit, measuring approximately 6 x 5 x 6 feet which was built one year ago and it is already full. Placentas are dumped into another rectangular pit for digestion by maggots, measuring approximately 4 x 6 x 8 feet, there are three pits of same dimension side by side which are used one after the other. These are built 4 years ago and have not been emptied since, and are covered. Recyclable plastics are stored in an area which is easily accessible and handed over to the recycler without prior disinfection. Cotton swabs and bandages are handed over to the local municipal authorities for dumping along with the other general municipal solid waste. Human anatomical parts and dead foetuses are collected by a local coffin contractor who apparently either cremates them or buries them in a coffin but this has not been monitored so far.

5.1.2 *Hambantota Base Hospital, Hambantota (Hospital 2)*

Table 5 Profile Hambantota Base Hospital, Hambantota

Hospital characteristic	Number
Beds:	300
Average bed occupancy:	100%
Average deliveries per month:	500
Number of Doctors:	160
Number of nursing staff:	175
Number of other supporting staff:	127

Hambantota is situated in the southern province of Sri Lanka. It was one of the worst affected areas during the recent Tsunami. It is a major referral hospital for this district. It has all the major specialties like Medicine, Surgery, OBG, and Paediatrics.

The hospital has an infection control committee, which meets once a month. The committee consists of the Medical Superintendent, Paediatrician, ward in-charge, and the Infection control nurse. The infection control nurse and another nursing staff have undergone training in the area of infection control from the National Hospital, Colombo. In the training, apart from infection control activities they have also been trained in waste segregation and colour coding. The hospital - even though it does not have a disinfection policy of its own – is

following the guidelines given in the infection control manual issued to all the infection control nurses who have undergone training in Colombo.

Waste is segregated into municipal solid waste (food waste, food packaging), clinical waste (cotton swabs, dressing materials, used bandages, plastic covers of the syringes), waste sharps (used syringe with intact needles, broken ampoules), intact glassware, plastic medicine bottles, placentas and dead foetuses and human anatomical parts. The practice of segregation is incomplete, especially with respect to sharps and clinical waste.

The containers, made from plastic, are open most of the times. Because the plastic is porous it is not possible to wash them. The containers are usually lined by the appropriate colour coded liners. Cardboard boxes are used to contain the waste sharps with a top opening without any colour coding. These dustbins are emptied twice a day and the waste handlers from the points of generation to the final treatment site carry them manually.

Even though the hospital purchased a single chambered incinerator 5 years ago, the incinerator has not been put to use so far due to lack of trained staff to operate it. The final disposal site is a short distance away from the main building of the hospital at the rear. The waste sharps and the clinical waste are incinerated in a metal drum with a top opening to put the waste in, and a side opening at the bottom to clear the ash. The remaining ashes are buried next to the incinerator. The placentas and the dead foetuses collected from the labour room are dumped into a concrete pit without a vent. The human anatomical parts from the Operation Room (OR) are buried as and when received, along with the ash, three feet deep into the ground.

The plastic waste is sold to a collector for Rs. 20/- a Kg and he in turn washes it and sells it to a plastic recycler in Colombo for Rs. 60/- a kg.

The hospital does not have a laundry. Before the hospital sends the linen to an outside laundry, the linen is immersed in a TCL solution for half an hour. The leftover samples of body fluids from the laboratory are mixed with the TCL solution for half an hour and then discarded into the drain. The culture plates are washed and reused.

The unused X-ray films are sold to a person who extracts silver. Some locals collect films to prepare as a screen for drums (musical instrument). The liquid from the developing and processing unit is disposed of into the drains.

5.1.3 *Ashroff Memorial Hospital, Kalmunai (Hospital 3)*

Table 6 Profile Ashroff Memorial Hospital, Kalmunai

Hospital characteristic	Number
Beds:	200
Average bed occupancy:	100%
Average deliveries per month:	500
Number of Doctors:	100
Number of nursing staff:	125
Number of other supporting staff:	62

Ashroff Memorial hospital in Kalmunai is situated in the eastern province in one of the worst Tsunami affected areas. Kalmunai is a main business centre, dominated by Tamil and Muslim population. Ashroff Memorial hospital caters mainly to the Muslim population of the area.

The hospital has very poor segregation practices. The waste is segregated into waste sharps in a cardboard box with no colour coding and, as in the other hospitals, with all the sharp items in the same box including glass sharp, needles and syringes, and rest of the waste is collected in a plastic container with a black liner.

The hospital staff uses minimal protective devices and the waste is carried manually to the final disposal site. At the back of the hospital all the waste is dumped and gets mixed with the general solid waste. The urban municipal council collects the waste once in two days and sometimes once in three days.

Placentas, infected cotton swabs, bandages, plastic IV bottles are dumped along with the general waste to be carried by the urban municipal council. This place is not secure; cattle were seen grazing through the covers and sometimes dogs and cats are also seen picking at this waste. Waste sharps, as in other hospitals, are burnt in a cylindrical metal drum and the ash is buried next to it (see Photo 1 and Photo 2).



Photo 1 Incinerator Ashroff Memorial Hospital, Kalmunai



Photo 2 Health care waste disposal at backyard Ashroff Memorial Hospital, Kalmunai

In the laboratory, staff was neither seen wearing gloves nor any other protective devices while handling body fluids. The leftover blood or body fluid samples are mixed with 1% hypochlorite solution and allowed to stand for half an hour and later disposed of into the drain. The sample bottles are washed, dried, autoclaved and reused.

In case of a liquid spill the area is flooded with 1% hypochlorite solution and cleaned with a cloth and put in a bin which ultimately goes along with the general solid waste.

In the dental unit there is only one container and all the waste goes into it. Mercury spills are cleaned with a cotton cloth and sent for burning.

The hospital has an infection control committee with a Paediatrician as a chairperson assisted by two infection control nursing officers; meetings are held once in two months with waste management as one of the agenda items. The two infection control nursing officers are trained in the aspects of infection control at National Hospital Colombo for 1 month; they have failed in their attempts to train the other staff in the area of waste management and infection control because of poor attendance.

The committee has completed a targeted surveillance in ICU for a period of 1 month and found that the hospital-acquired infection rate is 10%.

Even though the committee maintains the injury register, the response is poor according to the infection control nursing officers. They suspect injury numbers to be high because waste handlers, while carrying waste bags, receive needle stick injuries quite often in their legs, and only 15% of staff are immunized against Hepatitis B.

The hospital is commissioning a wastewater treatment plant (with the support of Merlin, an international NGO) that is going to become operational very soon. Currently the wastewater is drained into a nearby lake, which the local public uses for washing and fishing.

5.1.4 Base Hospital, Kalmunai (Hospital 4)

Table 7 Profile Base Hospital, Kalmunai

Hospital characteristic	Number
Beds:	250
Average bed occupancy:	100%
Average deliveries per month:	Not available
Number of Doctors:	55
Number of nursing staff:	112
Number of other supporting staff:	69

Kalmunai Base hospital is one of the oldest hospitals in the country.



Photo 3 Health care waste segregation in Base Hospital, Kalmunai



Photo 4 Incinerator at Base Hospital, Kalmunai

The hospital has an infection control committee and two trained infection control nursing officers who monitor, implement the infection control activities in the hospital, and train the staff, including the doctors.

Segregation practices use the four colour codes black, green, yellow and blue and card board boxes to segregate the waste sharps (see Photo 3). The segregation needs further strengthening. The bins are not closed but labels have been put on the bins indicating the type of waste in the container. The International NGO Merlin has supplied bins for many locations in the hospital. The bins are emptied twice a day but placentas are transported to the final

disposal site as and when produced. The waste is usually carried manually to the final disposal site.

Not many staff use protective devices during the procedures and only 40% of the staff is immunized against Hepatitis B. Most of the practices in the hospital are according to the infection control manual given to all trained infection control-nursing officers by the government.

The final disposal site is short distance away from the main building. There is a single chambered incinerator installed by the International NGO World Vision (see Photo 4). The place is used as a intermediate storage area before the urban council collects the general solid waste and the non infected plastic like IV sets, saline bottles, urine bags etc. The waste sharps and the clinical waste are burnt in the incinerator and the ash is dumped into a concrete pit next to the incinerator. It is a rectangular concrete pit measuring approximately 2 x 2.5 x 4.5m and closed. There are two such structures: currently one is being used while the other is empty. The stack of the incinerator is about 4.5 m high and coconut shells and husk are used as fuel, the area is covered with a fence. It is a small scale incinerator.

The empty vials and other bottles, which are intact, are sold to a collector with the labels intact. Currently, the biggest problem faced by the institution is the disposal of wastewater.

5.1.5 General observations for the four hospitals

Based on the observation of the individual hospitals, Dr. Hemanth made the following general observations, based on the waste system elements:

Segregation & Storage:

All hospitals follow guidelines on colour coding for segregation of health care waste provided by Ministry of Health and Nutrition. Also, all hospital practice some waste segregation at source, although storage practices are unsafe in some cases. Municipal solid waste is sometimes mixed with infected waste, and sometimes even biological waste parts, such as dead foetuses. In addition, there are waste storage areas within the hospital premises in all the hospitals except the Ashroff Memorial hospital, at a distance from the main building, where waste is stored before being disposed.

Transport

The in-house transportation of waste to the final treatment site is mostly done manually, by carrying the waste. The risk for waste handlers receiving accidental sharp injuries during this routine is high.

Treatment & Disposal

Most health care waste is burnt after collection. All hospitals are depending on a municipal authority for collection of general waste (food wastes, other waste materials). Collection does not happen frequently. Some waste materials are sold or handed over to a recycler, but without prior disinfection of the waste.

In addition to general observations of the waste system, the trainers made the observations that:

- ◆ Some hospital staff has been trained on safe health care waste management, but the quality was not perceived high, and attitude and morale to deal with the issue were low.
- ◆ All hospitals studied do not practice immunization programmes for staff.

- ◆ All hospitals are maintaining an injury registers to record all the sharp injuries, but except for Castle Street Hospital, none of the hospitals have a protocol that prescribes follow-up action.

Table 8 summarizes the observations made by Dr. Hemanth.

Table 8 Summary observations field visit

Variables	Hospital 1, Colombo	Hospital 2, Hambantota	Hospital 3, Kalmunai	Hospital 4, Kalmunai
Segregation of waste	++	++	+	++
Containers	++	++	+	+++
Disinfection of waste	-	-	-	-
Management of spills	+++	++	+	++
Personal protective devices	+++	++	+	++
Management of soiled linen	+	+	+	+
Transportation of waste	++	+	+	+
Final treatment of waste	+	+	+	+
Training on health care waste	+++	++	+	++
Activities of Infection control committee	+++	++	+	++
Injury reporting & Injury register	+++	++	+	++
Immunization	+++	++	+	++

(Subjective impression of the author after direct site visit) – Absent, + Average, ++ Good, +++ Very Good

5.2 Analysis of the health care waste management systems

The training needs analysis, and the SWOT analysis, identified several institutional issues. Table 9 presents the results from the SWOT analysis, the conclusions from the training need analysis are presented in the following section on institutional issues.

Table 9 SWOT analysis of health care waste management systems

Strengths	Weaknesses
<ul style="list-style-type: none"> ◆ Awareness among many health care staff. ◆ Commitment of Ministry of Health. ◆ Availability of funds from international agencies. ◆ Segregation is happening to some extent in many hospitals. ◆ Commitment of few medical superintendents. ◆ General cleanliness is good. ◆ Majority of the hospitals are under government sector. ◆ Government is ready to explore building partnerships with private sector. 	<ul style="list-style-type: none"> ◆ Lack of training among staff. ◆ Final treatment options are currently limited. ◆ No legislation or act for enforcement. ◆ Private sector hospitals are not involved. ◆ Absence of regular monitoring mechanisms.
Opportunities	Threats
<ul style="list-style-type: none"> ◆ Presence of trained infection control nursing officer in the hospitals. ◆ Monitoring activities being carried out by the infection control nursing officers. ◆ Presence of link nurses in few hospitals that will be assisting infection control nursing officer. ◆ Regular ongoing training for minor staff / 	<ul style="list-style-type: none"> ◆ Attitude of the staff

<p>attendees.</p> <ul style="list-style-type: none"> ◆ Presence of international NGO, Merlin who are already working in this area. ◆ Availability of some final treatment facilities. ◆ Two hospitals have waste water treatment plants (one under construction, another under repair). ◆ Presence of a ready manual on infection control. ◆ Presence of national colour coding guidelines 	
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5.2.1 System issues

Treatment options unsafe

The SWOT analysis shows that, looking at the waste system elements, the treatment options are posing serious risks. The commonly employed technology for the treatment of health care waste in the four hospitals is burning. The remaining ashes are buried. In this process, dioxins and furans are released due to burning of plastic waste that contains Poly Vinyl Chloride (PVC), increasing the risk of cancer among staff living in quarters near these sites. The temperature of the incineration process is too low, causing incomplete burning. The ash and remains are buried at a depth that allows animals to excavate the waste materials. On the other hand, when items are buried at a greater depth, it increases the chances of water pollution when contacting the water table.

5.2.2 Institutional issues

Knowledge & skills often lacking

There is a set of basic information that all categories of health care workers should know about health care waste management. This seems to be lacking among many of the health care workers in the hospitals studied. Basic knowledge should include, among others: identification and classification of types of hospital waste, the hazards of mismanagement, segregation of waste into various categories, the advantages of segregation. Due to lack of (basic) knowledge, there is a clear lack of carrying out essential tasks in many areas of health care waste management. These tasks would include, among others, cleaning and disinfection of spills, preparing a disinfecting bleach solution, maintaining an injury register.

Responsibilities unclear

The responsibility of health care waste management and infection control lies in the hands of infection control nursing officers. Often this responsibility of monitoring is not being shared by doctors, adversely affecting the implementation of systems especially when these infection control officers are monitoring the activities of doctors.

For effective health care waste management it is essential that health care workers hold positive attitudes towards care of the environment, occupational health and safety, and teamwork. All these are lacking among all the categories of health care professionals in the hospitals studied, which could be partially explained by the fact that responsibilities are often unclear. Infection control and health care waste management responsibilities are given to the infection control nursing officers, which might cause the other staff to disregard the issue.

Additionally, waste management is not institutionalized in a waste management committee or hospital policies (HIV control, sharp waste, occupational health).

5.2.3 Legal issues

Policy framework in process

Policies, guidelines, procedures and codes of practice are essential to support any health care waste management system. At the time of writing this document, a national policy for health care waste management is still in process of being drafted by the Sri Lankan government. A draft National policy on health care waste management was ready in 2001 but it still awaits input of all concerned stakeholders. In March 2006, the national government released a national colour coding system for the segregation of hospital waste. Implementation of this code needs strengthening.

5.3 Proposed Training Approach

The content of the proposed training approach has an institutional part and a technical part.

1. Institutional: Training on the roles and responsibilities of each staff member of the hospital on waste management, and relevance of safe health care waste management.
2. Technical: Instructions, relevant for the target group, on the application of waste management practices.

5.3.1 Develop institutional memory

It is important that one specific person or entity receives responsibility for documenting the training methodology and its contents. Dr. Gopinath and Dr. Prutvish advised to give this responsibility to the infection control-nursing officer. This will support the infection control-nursing officer to train other groups separately at a later stage. Other groups can be either existing infection control nursing officers, link nurses for each ward to carry out continuous training on a day to day basis in their wards, representatives from Merlin, faculties from the department of Community Medicine from various Medical colleges.

5.3.2 Content of the training

Medical Doctors and Nursing staff have to be trained in all the three domains of cognitive, psychomotor and affective to develop attitude among the staff for safe management of health care waste and to be good role models. The proposed contents is:

1. Importance of health care waste management – quantity, characterization and hazards;
2. Existing legislations, policy guidelines;
3. Roles and responsibilities of all health care providers;
4. Segregation at the source;
5. Proper containment of waste;
6. Sharps management;
7. Occupational safety, use of personal protective equipment and practice of universal precautions;
8. Disinfection of waste before disposal;
9. Options for final treatment;
10. Record keeping – Monitoring of the system.

5.3.3 Target group

Paramedical staff like lab technicians, apart from gaining the above knowledge, should be trained in the area of management of blood and body fluid spills, use of personal protective devices, use of bio safety guidelines.

Housekeeping staff and waste handlers, apart from gaining the above knowledge, should be trained in precautions to be taken while handling waste, transportation methods, methods to deal with cleaning spills, use of personal protective devices, preparation of disinfectant solutions, documentation and recording of health care waste, and introduction of needle stick injury surveillance.

CHAPTER 6 TRAINING OF TRAINERS (TOT)

6.1 Training of hospital staff in Kalmunai and Hambantota

To follow-up the assessment of the four hospitals, the project team planned two 3-day trainings, for Base Hospital, Kalmunai, Ashroff Hospital, Kalmunai, and Base Hospital, Hambantota. Energy Forum facilitated the logistical part, while Dr. D. Gopinath and Dr. S.Pruthvish, Chairperson, and Director, of the HCWM Cell, provided the training.

6.2 Assessment and training methodology

6.2.1 Selection of the participants

For the training of the Ashroff Hospital staff, the project team first selected representatives of different functional units. In Base Hospital, the team of trainers selected the members of Infection control committee for the training. In Hambantota, the participants were mostly nursing staff, and other support staff from the blood bank, Labour Room and laboratory.

6.2.2 Training language

The trainers provided the training in English for Doctors and the training was translated in Sinhalese, and/or Tamil for nursing staff, paramedical staff and minor staff in the respective regions.

6.2.3 Training programme

Day 1: Assessment and formulation of the SWOT analysis

First, the trainers request the participants to fill in a questionnaire that provides a situation analysis. The questionnaire, developed by the Health Care Waste Management Cell, covers the waste system elements from collection (segregation practiced?, waste disinfected before disposal? Is staff using protective gear?), storage (containment measures), transport, and treatment (how are different waste streams treated?). The participants are divided in four groups, and receive some time to exchange information with staff (nurses, doctors, support staff) and to make observations.



Photo 5 Training participants in Hambantota

Based on the questionnaire, one training participant presents the findings to the entire group. The trainers act as moderators, and request the group to make a SWOT analysis.

Day 2: Discussion of solutions

On the second day, the group continues discussing the SWOT analysis, and identifying practical solutions.

Day 3: Formulation action plan

On the third and final day the trainees formulate an action plan to improve health care waste management practices on site. The action plan describes activities, and provides a time-frame. Management members joined throughout the training sessions in both hospitals, and reacted on the Action Plan Developed.

6.2.4 Training output

Table 10, Table 11, and Table 12 provide the action plans of Base and Ashroff Hospital Kalmunai, and Base Hospital Hambantota. In addition, the group discussed the role of Energy Forum, as facilitator of the health care waste management process (see Table 13).

Table 10 Action Plan Ashroff Hospital Kalmunai

Area in need of improvement	Activity
Skills	Training all staff: waste handlers, nursing staff, and Doctors (3 months)
Segregation	Improve segregation, introduce colour codes (6 months)
Treatment	<ul style="list-style-type: none"> ◆ Incineration: Link up with facilities of Base Hospital Kalmunai (3 months) ◆ Construct sharp pit, Aerobic composting (6 months) ◆ Common Treatment Facility (CTF): contribute, participate, develop, in cooperation with the Red Cross
Tracking, monitoring, supervision	Based on methodology organised by Energy Forum, developed by Merlin (INGO), 7 NGOs active in health care waste management, and based on training (throughout the year)
Advocacy & Research	<ul style="list-style-type: none"> ◆ Participate in research and advocacy in the neighbourhood ◆ Field test use of sharp pit, Aerobic composting
Information dissemination	<ul style="list-style-type: none"> ◆ Field testing of Information, Education and Motivation (IEM) materials

Table 11 Action Plan Base Hospital Kalmunai

Area in need of improvement	Activity
Skills	Training all staff: waste handlers, nursing staff, and Doctors (3 months)
Segregation	Improve segregation, introduce colour codes (6 months)
Treatment	<ul style="list-style-type: none"> ◆ Incineration: Increase height of chimney of Incinerator (1 month) ◆ Construct sharp pit, Aerobic composting (6 months) ◆ Common Treatment Facility (CTF): contribute, participate, develop, in cooperation with the Red Cross
Tracking, monitoring, supervision	Based on methodology organised by Energy Forum, developed by Merlin, 7 NGOs active in health care waste management, and based on training (throughout the year)
Advocacy & Research	<ul style="list-style-type: none"> ◆ Participate in research and advocacy in the neighbourhood ◆ Field test use of sharp pit, Aerobic composting
Information dissemination	<ul style="list-style-type: none"> ◆ Field testing of Information, Education and Motivation (IEM) materials

Table 12 Action Plan Base Hospital Hambantota

Area in need of improvement	Activity
Skills	Further training all categories of staff, especially on <ul style="list-style-type: none"> ◆ Spill management of liquid waste ◆ Liquid waste management <p>Staff will continue to segregate based on colour coding system.</p>
Treatment	Director will explore possibilities for a Common Treatment Facility at Base Hospital Hambantota. The director takes action towards making Base Hospital a model for the region. Director will explore possibilities to recycle plastic and other materials, and will explore possibilities for storing recyclables temporarily, as permission of government is needed. Hospital management is planning to use a Hydroclave for decontamination of the plastic waste materials, before shredding. Opportunity for integrating HCWM with general waste
Tracking, monitoring, supervision	No specific action mentioned
Advocacy & Research	No specific action mentioned
Information dissemination	The Director will follow-up to the Health Care Waste Management Cell, established in Colombo. Staff will continue to use the training manual on health care waste management, as disseminated in October 2007.

Table 13 Action Plan Energy Forum on health care waste management

Area in need of improvement	Activity
Skills	<ul style="list-style-type: none"> ◆ Facilitate training in Base Hospital, Hambanthota (2 months) ◆ Facilitate translation of training materials, support training expenditure (6 months)
Segregation	Facilitate supply of plastic colour coded bins to three hospitals (6 months)
Treatment	<ul style="list-style-type: none"> ◆ Provide technical information on incinerator and other technologies (throughout the year) ◆ Support visit of hospital staff to best practice areas (throughout the year) ◆ Provide inputs to French red cross and Sri Lankan Red Cross on Common Treatment Facility (CTF)
Tracking, monitoring, supervision	◆ Provide technical input for Monitoring and Evaluation, by linking with Merlyn, 7 NGOs working on Solid waste Management, and by participation in Bangalore training
Advocacy & Research	<ul style="list-style-type: none"> ◆ Explore support from Waste Netherlands, Hospital Managements, Government ◆ Develop collaboration with University of Moratuwa, Dept. of Environment, one of the Medical Colleges, hold National workshop on HCWM and Infection Control in 2008 January in collaboration with Waste, Netherlands
Information organisation and dissemination	<ul style="list-style-type: none"> ◆ Develop & disseminate news letter in collaboration with HCWM Cell (6 months) ◆ Start IGNOU study centre (6 months), start HCWM and IC Cell (1 Year) ◆ Develop Information, Education and Motivation (IEM) materials - posters, flip charts, hand book, DVD, News letter on IC and HCWM ◆ Develop library and Information Centre

6.2.5 Training outcomes & follow-up

In April 2007, the trainers visited Base Hospital in Hambantota, Base Hospital in Kalmunai, and Ashroff Hospital in Kalmunai, to evaluate the outcome of the training.

Base Hospital, Hambantota

The trainers learned from observations and interaction with the hospital Director, officers in charge of health care waste management and Infection control, and the trainees that:

- ◆ 150 staff persons have received a one day orientation course, in about 19 batches;
- ◆ Hospital management is planning to give training to an additional 112 Doctors and nurses, and 150 support staff;
- ◆ Safe final treatment options are not available, including a sharp pit for syringes and glass fractions;
- ◆ Segregation based on colour coding is in place.

Energy Forum proposes to follow up by:

- ◆ Designing and constructing waste sharp pits
- ◆ Providing additional training of 112 nurses
- ◆ Facilitating the process of training the support staff, by trained nurses.
- ◆ Maintaining contacts with the hospital to provide and receive support to other initiatives in this project.

Base Hospital, Kalmunai

From conversations with the director, senior doctors and other staff, the trainers commented the following:

- ◆ The staff showed a positive attitude towards the training on health care waste management
- ◆ The hospital segregates waste based on colour coding;
- ◆ The hospital maintains an injury register (injuries related to contact with waste and in work) transportation of waste within health care settings
- ◆ The staff who received training in December 2006 have trained an additional 70 staff.
- ◆ Despite advice of Dr. Prutvish and Dr. Hemanth, the management did not take measures to increase the height of the incinerator chimney. It should be noted here that increasing height would only serve as a temporary improvement of the treatment option – the incinerator is small and does not meet health and environmental standards.
- ◆ Supply of disinfectants needs to be improved.
- ◆ The Director of the hospital is open for communication on a Common Treatment Facility (CTF), although the Director fears the risk of ‘civil disturbances’ when health care waste is managed outside the hospitals premises.
- ◆ Although there has been a significant staff turnover, health care waste management had not deteriorated.

The trainers advice to be followed up by:

- ◆ Utilising the willingness of the Director to convene a CTF consultation round.
- ◆ Considering the CTF issue in the monthly meeting of hospital Directors at national level
- ◆ Construction of a waste sharp pit
- ◆ Printing of IEM Materials. Protocols, etc.

Ashroff Hospital, Kalmunai

The trainers made the observations that:

- ◆ The hospital appears more clean and better organized;
- ◆ The Director and staff expressed commitment towards developing a better health care waste management system;
- ◆ Some areas still need improvement, especially spill management;

- ◆ The hospital is in need of collection equipment, notably bins and wheel barrows;
- ◆ The hospital management expressed that staff needs additional training on health care waste management;
- ◆ An effluent treatment plant is under construction with the support of Merlin and will be commissioned during the next two months.

Ashroff Hospital will follow up the observations by:

- ◆ preparing a proposal to Energy Forum for support of bins, wheel barrows, personal protective equipment, house keeping materials, sharp design;
- ◆ developing Standard Operational Procedures (SOPs) and conducting in-house training of all staff including doctors;
- ◆ developing a plan to cover drainage at the back, and to organise the required storage facility for hospital waste.
- ◆ Continue to show support towards setting up a Common Treatment Facility (CTF).

CHAPTER 7 STRENGTHENING TREATMENT FACILITY

7.1 Placenta Reactor

A PAB Reactor (Placenta Anaerobic Bio-Reactor) is a safe final treatment option for some part of the hazardous waste generated in hospitals. It is developed in Cochin, India as response to the fact that medical wastes from hospitals is no longer collected by the Cochin municipal solid waste company. The reason behind their refusal is that medical waste contains about 10% hazardous waste and this can and typically will infect the entire waste stream and render all of it hazardous.

Traditionally two options exist for safe disposal of human anatomical wastes, organs and body parts. These are incineration and deep burial. Incineration is for many reasons not really suitable, due to the material itself (wet organic matter), high capital cost of installations and other maintenance costs.

Deep burial in the coastal belt of Cochin in conditions similar to Kalmunai with a high ground water table is not suitable, as contamination of ground water is almost a certainty. In addition, the natural deep burial process takes a very long time for the degradation of the body parts on account of the delay in developing appropriate micro-organisms for degradation.

Thus a simple technology needed to be developed to deal with this hazardous waste from hospitals. The reactor is designed for the disposal of placentas. It can be modified and used also for other anatomical wastes like organs and body parts without bones. Thus, it is a multipurpose facility, indispensable for both small and large hospitals for easy disposal of anatomical waste.

The process adopted in the PAB Reactor is an upgraded natural degradation³ process. The first part of the bio-degradation process is hydrolysis of the biomass into liquid. Thus, the reactor has been designed to carry out the liquefaction of the solid mass effectively and quickly. Once the biological process gets stabilized, the reactor will convert the organic matter into carbon dioxide, hydrogen and energy with very biomass. During the process, gas will be generated. Appropriate vent pipes are provided for disposal of the gases generated.

The final part of the process is the stabilization of the degraded liquid and liquidized fine sludge. In the Reactor, both supernatant liquid and the liquidized fine sludge formed in the Reactor are sent to the wastewater stream for further treatment in the Effluent Treatment Plant (ETP). The conditions within the Reactor will not allow many pathogens to survive for long periods.

The working model of the PAB Reactor has a standardized 150 litre capacity. Per day this will handle three placentas and other human anatomical parts originating from hospitals of

³ In nature, the first phase is the development of microbes suitable for anaerobic degradation. This takes considerable time. Appropriate microbe consortium (inoculums) should contain a consortium of obligate and facultative anaerobic bacteria. These inoculums are developed in the laboratory. The process of degradation of the organic matter is to be initiated by administering developed inoculums into the reactor. The enrichment and stabilization of the microbial culture is necessary for the proper and continuous functioning of the Reactor. This process will take approximately 7 – 10 days. Once the Reactor gets stabilized, the working of the Reactor will be a natural process without any substantial additional support.

around 100 bed capacity. The Reactor can even be located inside hospital rooms (next to operation theatres/labour rooms or at any convenient place). If the hospital is large, more Reactors located at different places will be more convenient. This will enable easy loading of the Reactors reducing the difficulties with storage and transport of the anatomical parts.

The operation and maintenance of the Reactor is effortless and simple. The important precautions are:

- ◆ maintaining the water level in the reactor;
- ◆ not upsetting the biological process by overloading;
- ◆ periodical reduction of sludge accumulation (not complete removal) by letting out of the sludge (once every 3 months) by opening the bottom valve;
- ◆ maintaining the minimum water level marked on the reactor;
- ◆ keeping the lid always closed;
- ◆ avoiding to feed the reactor with plastics and other non-degradable materials.

If the Reactor is functioning regularly no further addition of the inoculums will be necessary. But, if the Reactor is not in operation for some time, the microbial consortium will be lost and further addition of the inoculums will be necessary for initiating the biological process again

During the assessment four hospitals in Cochin, India were visited that have installed the PAB reactor. Discussions were held with staff, both from the managerial side as well as with those actually feeding the reactors. In three of the four cases no operational problems were reported, whereas in the fourth case, there had been no births (and thus no placentas) for over a month.



Photo 6 PAB reactor in India

Following the assessment and subsequent discussions with Kalmunai Base Hospital it was decided to place the placenta reactors inside the Kalmunai Base Hospital. A Letter of Credit to this effect was issued by WASTE to the Indian supplier in September 2007 and final installation of the reactors is to take place by the end of December 2007.

7.2 Sharp pits

Segregated sharp waste should be disposed safely and expeditiously. Sharp waste should not be kept a long time at the outside nor should it be exposed to the general public. In Ashroff

the practice was to burn sharps in open drums. Thus the following method is implemented in Ashroff Memorial Hospital and Base Hospital, Kalmunai to safely dispose the sharp wastes.

Sharps are segregated at the source. Until November 2007 carton boxes were used for collection. In December 2007 these were changed to yellow pedal operated bins. The segregated sharps, after applying approved precautionary measures, are sent to the lined pits.⁴ A basic drawing of a sharp pit is given below. Typically in conditions as applicable in Kalmunai with high ground water table the pit is having a concrete liner with a small opening to allow dropping the sharps inside. Chemicals may be added such as Tropical Chloride of Lime or Sodium Chloride (salt) to accelerate erosion of the sharps.

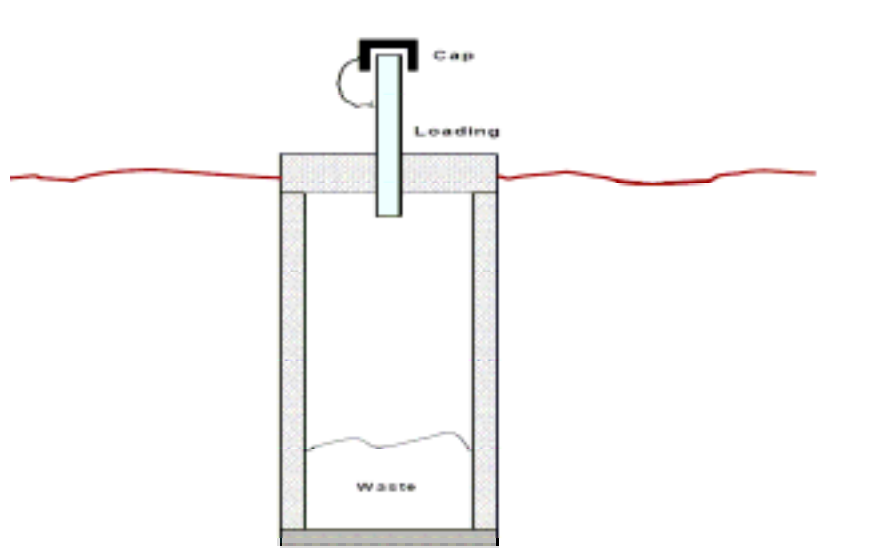


Figure 2 Cross-sectional view of secured disposal pit for sharps⁵

So in order to provide an environmentally sound alternative to the hazardous practice of burning, sharp pits are introduced in the project. Sharp pits are used in several countries that do not yet have a final solution for sharp disposal.

The final disposal routes follow the collection of sharps that are segregated at the source using yellow colour sharp bins that have been provided to the wards in Ashroff Memorial.

Also in the case of Kalmunai Base Hospital sharp pits are now used. These were originally pits that were constructed to dispose of the ash from the incinerator, but after stopping this so-called incinerator from operating, the pits have now been converted into sharp pits.

7.3 Containers

The final collection system in Ashroff Memorial Hospital is modified to allow for separate storage of different types of waste. Segregated plastics will be collected regularly by the plastic recycling unit established in Kalmunai under the same project.

⁴ These lined pits are old septic tanks that were used earlier by the hospital for partial wastewater treatment. After the new wastewater treatment plant came into operation, the septic tanks were no longer used. Senior medical staff themselves suggested to convert these septic tanks into sharp pits.

⁵ Management of Solid Health-Care Waste at Primary Health-Care Centres - A Decision-Making Guide- World Health Organization, Geneva, 2005 whqlibdoc.who.int/publications/2005/9241592745.pdf p. 43

CHAPTER 8 STRENGTHENING KEY INSTITUTIONS

In addition to training hospital staff, and improving treatment options for health care waste, the project representatives from Ramaiah Medical College established contacts with key stakeholders in Sri Lanka. Annex 2 presents a table that summarizes the stakeholders and the meeting topics of the first mission to Sri Lanka.

8.1 Facilitating Network HCWM

Private Sector Involvement

In the area of solid waste management, there are already Public-Private Partnerships. Experience from India shows that the private sector is more involved in setting up a common treatment facility for health care waste, as it has an incentive to create a business opportunity from health care waste. Although the role of the government and private sector in the health care system are different in Sri Lanka, with the Government playing a major role, the potential role of the private sector should be examined.

College of General Practitioners, Sri Lanka

Dr. Kumar and Dr. Prutvish organised a meeting with the College of General Practitioners, Sri Lanka. In this meeting, the Doctors emphasized that, although General Practitioners (GPs) each produce small amounts of health care waste, when volumes are combined, GPs potentially produce more health care waste than the total waste volume produced by hospitals in the country. The involvement of the College of GPs in setting up a more sustainable health care waste management system is therefore highly needed.

The Doctors advised the College to:

- ◆ Ensure the educational fundamentals for appropriate segregation, disinfection, decontamination and other necessary steps in the practice.
- ◆ Organise treatment and disposal of health care waste as a network activity to ensure an economic and efficient mechanism.

The GP forum unanimously agreed that their responsibility as first level physicians must be to establish sound health care waste management practices, to explore networking, and consider a common treatment facility. Most of the GPs present at the meeting indicated that they would be willing to share the cost of a CTF .

A quick resolution was made to form an advisory committee with a firm commitment that they would move ahead and not wait for Governmental agencies to provide facilities.

The Doctors proposed the following follow-up:

- ◆ Energy Forum to make an appointment with Dr. Sharath and to strengthen the private sector that has come forward to network and explore possibilities of a common treatment facility (CTF) in Colombo.
- ◆ HCWM Cell to visit Kelaniya University, Ragam to discuss about impact on the health professional curriculum.

Community Medicine Faculty, Colombo University

Dr. Kumar, Dr. Prutvish and Mr. Chinthaka (Energy Forum) arranged an appointment with Dr. Sreenika, Dean of Community Medicine Faculty, and Dr. Nalika, about setting up a

Health Care Waste Management Cell (HCWM Cell) in Sri Lanka. A Health Care Waste Management Cell in Sri Lanka could further support making the issue of health care waste management part of university curricula.

The appointment confirmed the interest of the Community Medicine Faculty in this initiative. Furthermore, the Dean will examine the proposal to set up a Health Care Waste Management Cell with the Ministry of Health and the Ministry of Environment, which, as proposed will be members in the steering committee, together with the World Health Organisation (WHO).

The focus of the HCWM Cell would be to strengthen awareness on the need for a Common Treatment Facility (CTF), to network, and to provide training on the subject, and to monitor the process of improving health care waste management in the country.

Additionally, it was suggested to approach, motivate and ensure participation of the medical core of armed services in HCWM programmes. The protocols and discipline of armed forces will help in rapid implementation, as experienced in India.

The group also raised the challenge of the control of the HCWM Cell – the Ministry of Health Care and Nutrition and the Ministry of Environment.

Medical Education Cell of Medical Faculty, Colombo University

Dr. Kumar, Dr. Prutvish and Mr. Chinthaka held a meeting with Professor. L. Mendis and Dr. I. Karunathilake on further incorporating aspects of health care waste management in the Health Professional Curriculum. Additionally, the group discussed the proposed symposium on Health care waste management, as scheduled by the Sri Lankan Medical Association for 18 – 22 March, 2008.

It was unanimously agreed that HCWM and Infection control should not be included at one level only, but should be included as part of teaching and training at multiple levels during the clinical training.

Dr. Gopinath and Dr. Pruthvish were invited to the symposium as resource persons.

Merlin International

Merlin International, an international consultancy group, has supported 14 hospitals in the East of Sri Lanka (Batticaloa and Kalmunai), by providing training on health care waste, and by developing effluent treatment plants. Merlin International will withdraw its support to the area, including construction work by June 2008. Dr. Kumar and Dr. Prutvish met with Mrs. Vasantha Vadivelu, project coordinator of Merlin International.

A new project officer will join from end October. UNOPS is interested in CTF Development.

Synergising with other HCWM initiatives in Sri Lanka

The World Bank is supporting three hospitals in the south of Sri Lanka. Dr. Kumar and Dr. Prutvish established contact with the hospitals and discussed potential coordination / follow-up action for health care waste management training.

8.2 Launch of the Health Care Waste Management Cell Sri Lanka

The Colombo University, the College of General Practitioners and the Ministry of Health Care and Nutrition, are each very much interested in managing the HCWM Cell. Dr. Kumar and Dr. Prutvish argue that governmental agencies often face scientific and ethical challenges during implementation. Therefore, the Doctors argue, the HCWM Cell will be better off if it is not pressurized by the Government. The Doctors advise that the University is best suited to be in charge of a HCWM Cell, for the following reasons:

1. The University maintains high academic standards which will be constantly updated;
2. The University is less likely to yield to pressure when it comes to quality in monitoring the performance of the HCWM Cell;
3. The University is well placed to set up a model institution which could be a showcase to all groups of institutions.

If the management of the HCWM Cell is entrusted to the University, it is necessary for the University to show that they 'practice what they preach'. University owned hospitals need to ensure that doctors, nurses and support staff provide best practice examples.

University being a academic body, IEM material development and -outreach activity will be better through the staff's professional qualities. This advantage does not exist with private sector. With Government, new staff need to be recruited which will add to the project cost.

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

9.1.1 *Conclusions on the Training of Trainers (ToT)*

The training provided to the staff of Base Hospital, Ashroff Hospital in December 2006, and Base Hospital, Hambantota in April 2007, have motivated the staff and management to strengthen health care waste management in the respective hospitals. Specific improvements were achieved in the areas of:

- ◆ **Segregation:** all hospitals use the colour code for segregation of health care waste;
- ◆ **Waste handling:** hospital staff uses personal protective equipment, and the hospital have set guidelines for transportation of waste within health care settings;
- ◆ **Documentation:** all hospitals are maintaining a waste management register and injury register.

An area that is still in need of improvement is spill management.

9.1.2 *Conclusion on institutional strengthening*

There is a strong commitment from key institutions to improve health care waste management in Sri Lanka, through improving technical (treatment) systems, and through incorporating the relevance of proper health care waste management in the health care educational system.

Institutional Network

In the course of the project, representatives of the Ramaiah Medical College, Bangalore, supported the process through active communication with various key actors that have a stake in improving health care waste management. These include: educational institutions, (colleges, universities), governmental institutions, hospitals, consultancy firms, and (at least) one international financing institution.

Health Care Waste Management Cell

The initiative to launch a Health Care Waste Management Cell in Sri Lanka has received an over-interest. Several institutions have shown interest in managing the Cell, including Colombo University, the Ministry of Health and Nutrition, and the College of General Practitioners. Dr. Kumar and Dr. Prutvish argue that Colombo University is best suited for this task, because of its academic nature. The project team expects that the HCWM Cell will be launched early 2008.

Private Sector Involvement

The private sector, and specifically the General Practitioners Association, has shown interest to be involved in health care waste management.

9.2 Recommendations to follow-up

9.2.1 *Follow-up to training hospital staff*

Further training of hospital staff is needed. In Kalmunai, this can be carried out by the staff that received training from Ramaiah Medical College. Hospitals in Hambantota other than the

Base Hospital, have not yet received training. The project team recommends to address this through joint action of the HCWM Cell, in coordination with the World Bank project.

9.2.2 Follow-up to institutional strengthening

Private Sector Involvement

The enthusiasm initiated in the private sector needs to be capitalized by constant projections of their role as key player in HCWM system development. Their will, sound finances, lack of red tape-ism and protocols should be exploited to ensure early establishment of CTF under their banner. This will surely serve as a catalyst to major hospitals and Government Agencies to catch up with them.

Knowledge sharing

Knowledge sharing on health care waste management could be done through the universities and related study centres. In addition, it is proposed to develop a newsletter on HCWM and Infection control in Sri Lanka for use of both private sector and government sector.

Meeting on legislation & monitoring, Common Treatment Facility

In order to streamline capacity strengthening initiatives, the project team proposes that Energy Forum organises a national meeting on the subject of health care waste management on 7 April 2008 at the Colombo University. Relevant participants include the Ministry of Health, Ministry of Environment, Central Environment Authority, the Sri Lankan Medical Association, the College of General Practitioners, the Association of Independent Medical Practitioners, the WHO, the World Bank, the UNOPS, UNDP, UNEP, the Red Cross, and NGOs.

The proposed focus of the meeting is:

- ◆ advocacy for formulation and creation of legislation and a monitoring mechanism set up for implementation;
- ◆ inviting collaboration for setting up a Common Treatment Facility: selecting potential locations and developing guidelines.

The project team proposes to organise a meeting with similar stakeholders in the Ampara District, with a focus on establishing a Common Treatment Facility for health care waste in the area. In addition to the stakeholders mentioned above, Merlin International, plastic recyclers, and civic bodies, will be invited to participate. This meeting will be convened beyond the project period, most likely January 2008.

9.3 Lessons learned

- ◆ Because of the risks associated with hospital waste, in terms of environmental risks, and (occupational) health risks, safe health care waste management is very important not only in reconstruction or post-disaster activities, but in development initiatives in general.
- ◆ Attitude of hospital staff – ranging from nurses, cleaning crews, doctors – in dealing with this issue is essential. It is important that educational institutions, such as universities and nursing schools adopt health care waste management in their curriculum. Field visits and trainings have showed wide differences in motivation to deal with hospital waste.
- ◆ Waste management inside hospitals has to be targeted at the most appropriate level. This has proved to be the level of the nursing staff and not the doctors level (though their support and commitment is crucial).

- ◆ In order to get the commitment from senior staff in hospitals the facilitators or trainers should ideally be medical doctors themselves.
- ◆ Educational institutions have shown moderate to high interest in supporting health care waste management initiatives. This is not only true on national level, but even on international level (India).
- ◆ Final disposal remains a critical issue in Sri Lanka but due to this project several options are now available and a project concept has been prepared for a common treatment facility for Ampara District.

ANNEX 1 LOGICAL FRAMEWORK

Logical Framework:

Table 14 Logical Framework for health care waste management

Objective In target areas, safe management and disposal of medical and sanitation waste, focus on increased amount of waste due to the Tsunami .	
Result	Activities
2.2 Amount of solid waste generated by 3 hospitals and IDP, labelled as hazardous will have been reduced by at least 75% reducing spread of contagious diseases from dumpsites.	2.2.1 MoUs 2.2.2 Site visits of hospital staff 2.2.3 Health care waste management assessment 2.2.4 ISWM training waste management 2.2.5 Main stakeholders implementing health care waste management including needle ash burners 2.2.6. Solidarity (NGO) sustainable implementation of medical waste segregation in IDP camp. 2.2.7 Improved medical waste systems in at least two local 45 authorities using TOT and above demonstration sites. 2.2.8 Capacity built in dealing with Tsunami (or other disaster) related medical waste systems improved
2.4 Hazardous waste of at least one hospital (Hambantota) will be safely disposed minimizing risk of catching contagious disease for about 5,000 people.	2.4.1. Feasibility (technical, socio-economical, operational) of different options 2.4.2. Construction of and training for most appropriate option (subsequent to 2.2.2, 2.2.3, 2.2.4, 2.2.5) – after segregation in collaboration with crematorium facility Tangalle, burning using proper fuel (Kalmunai)
2.5 Urban dwellers and supporting institutions have increased their capacity in integrated sustainable health care waste management	2.5.1 Exposure visits 2.5.2 Providing trainings in health care waste management

ANNEX 2 SCHEMATIC OVERVIEW MEETINGS

Table 15 Meetings with key institutions

Institution	Name & Function	Outcome of meeting/correspondence/communication
Department of Environment, Government of Sri Lanka	Dr. Shanmugaraja, Director	Telephone conversation with Dr Prutvish: <ul style="list-style-type: none"> ◆ The Government of Sri Lanka is committed to taking steps towards improving health care waste management ◆ University of Moratuwa (South) will set up Programme Study Centre, together with Indira Gandhi National Open University, New Delhi on health care waste management ◆ Government is considering sending a group of trainees to Bangalore, India, for advanced training on health care waste management.
World Health Organisation (WHO), Sri Lanka	Dr. Supriya, National Professional Office	<ul style="list-style-type: none"> ◆ Confirmed support towards Sri Lankan Government in health care waste management: support in setting up study centres, training in Bangalore.
Faculty of Medicine and Com Med Faculty at University of Peradenia, Kandy	(no name available), Dean	<ul style="list-style-type: none"> ◆ The faculty will discuss the possibilities of supporting Energy Forum in health care waste management initiatives (interest level 5 out of 10).
Faculty of Medicine and Com Med Faculty at Medical College – University of Ruhana, Galle:	(no name available), Dean	<ul style="list-style-type: none"> ◆ Com Med Faculty will discuss with all faculties and will get back to Energy Forum their concurrence to collaborate (interest level 7 out of 10).
Faculty of Medicine and Com Med Faculty at Medical College – University of Colombo, Galle	(no name available), Dean	<ul style="list-style-type: none"> ◆ The Dean expressed interest to be involved in the training of Hambantota Hospitals (interest level 9 out of 10) ◆ The faculty will discuss their interest internally and communicate to Energy Forum
Consultant in Medical education, Former Dean, Medical College, Colombo and Former Director of Post Graduate Medical studies, University of Colombo	Dr.Lalitha Mendis, Consultant	Planned follow-up: <ul style="list-style-type: none"> ◆ Dr. Mendis will visit HCWM Cell, Bangalore during end January 2007 to attend an International Conference on Medical Education. ◆ Energy Forum will plan to meet Dr. Mendis in February 2007 to discuss 1) advocacy and networking for common treatment facilities for HCWM in select locations; 2) influencing and strengthening curriculum in health professional education – doctors, nurses, dental surgeons, etc, 3) supporting possible workshop at National level for faculty of Medical, Dental and Nursing Colleges.
Castle Street Hospital, Colombo	Director	As Castle Street is found to be a best-practice, the director suggested: <ul style="list-style-type: none"> ◆ Director and his deputy can be observers and resource persons for Hambantota training. ◆ For Trainings around Colombo, Castle Street Hospital could function as a demonstration site. ◆ 5S Principles used in 20 hospitals have scope and potential for use across the primary health care system
Family Practitioner's Association, Colombo	Dr.Preethiraja Gunawardane, President	Follow-up planned <ul style="list-style-type: none"> ◆ Support a workshop for general practitioner's – half a day in Colombo during visit to Sri Lanka in March 2007 ◆ Prepare an article for the Newsletter of the College of General Practitioners to be the contribution from HCWM Cell and Energy forum.

Merlin International	Ms. Vasantha Vadivelu, senior nursing officer	<ul style="list-style-type: none"> ◆ Merlin has shown commitment by supporting trainings in Kalmunai, supplying materials, and through development of use of Spill kit for the disinfection of liquid spills
International Federation of Red Cross (IFRC)	Mr. Bob Laget, consultant, and Mr. Parakrama Rayasinghe, Consultant	<ul style="list-style-type: none"> ◆ IFRC is planning to set up a pilot project for a common treatment facility for health care waste in Ampara District (Kalmunai) ◆ There is potential for collaboration in this effort for Energy Forum and WASTE, Netherlands. The consultants feel that this is worth negotiating.