Improving Health Care Waste Management in Nepal

Assessment of Present Status and A Strategic Framework and Action Plans

Ministry of Health

1. Introduction

1.1 Objectives: The objectives of this assessment is to know about the present status of health care waste management in Nepal, and to establish a strategic framework of action plans for improving the management of health care waste. It aims to present practical solutions for the improved health care waste management at the various types of health care facilities as well as presents examples of cost calculation for implementing such solutions. This assessment was carried out during the course of preparation of Nepal Health Sector Program - Implementation Plan in early 2003.

1.2. Background: Health Care Waste poses special risks compared to other kinds of waste due to its contents of infectious materials and other hazardous substances. The risks are not only connected to the handling of the waste - both inside and outside the health care facilities - but also the environmental risk connected to the treatment and disposal of the waste. The health care waste management issue is becoming critical in view of the growing amounts of health care risk waste and fast increasing HIV/AIDS incidence among certain groups, calling for increased attention to blood safety, disposal of needles and syringes and other infectious waste. In particular, health risks is obvious to the staff of health care facilities, to the patients and visitors, to workers collecting, transporting and treating the waste as well as to the society in general, thus requiring special efforts to ensure effective management of the Health Care Waste (HCW). His Majesty's Government of Nepal (HMGN), through the Ministry of Health (MOH), has prepared a Nepal Health Sector Program -Implementation Plan to implement the newly developed Health Sector Strategy which emphasizes to address key issues of : leveraging better value for the public health services; ensure access to quality health services particularly the Essential Health Care Services (EHCS) in a cost effective and efficient manner, and; increasing access to services outside the Essential Health Care Services (EHCS). Ministry of Health (MOH) had already drafted new Legislation to improve and strengthen the Health Care Waste Management at the health care facilities and was submitted to the Parliament for its approval. However, due to the present political situation, the legislation is yet to be approved. In general, it is observed that there is a growing awareness of the risks associated with health care waste resulting in a number of initiatives within the health care facilities as well as within through public and private organizations. Nepal Health Research Council in collaboration with MOH and WHO in support of the growing awareness and initiatives has developed National Health Care Waste Management guidelines and a Training Manual for Medical Professionals. However, a number of studies conducted by international organizations and national NGOs has documented that there are still a lot of shortcomings in regard to Health Care Waste Management. During the field visit by the assessment team it was observed that a few health care facilities have implemented comprehensive waste handling and management system, but at most of the health care facilities the waste management is still far from common international standard. In some cases the situation could be characterized as very unsatisfactory. The preparation of NHSP-IP presented an important opportunity to focus the dialogue on environmental aspects of the health services particularly on the health care waste management that led to development of this assessment study.

1.3 Scope and definitions: This study covers in principle all sources generating health care waste in Nepal, including large and small hospitals, and all kinds of health facilities primary health care

centres, health posts, sub-health posts including private nursing homes, and private & hospitals which are broadly listed below:

- Central general hospitals
- Teaching hospitals
- Governmental hospitals (army and police hospitals)
- Specialised hospitals (eye-, leprosy-, cancer hospitals etc.)
- Regional hospitals
- Sub regional hospitals
- Zonal hospitals
- District hospitals
- Primary Health Care Centres
- Health Posts
- Sub Health Posts
- PHC Outreach Clinics
- Private & teaching hospitals, and nursing homes.

The assessment was carried out for all kinds of health care waste (HCW) and is categorized in three distinct categories as Health Care General Waste (HCGW), Health Care Risk Waste (HCRW) and Health Care General and Liquid Waste. According to WHO guidelines can be divided into the following sub-categories:

- Infectious waste (general infectious waste, including e.g. bandages and cotton and paper tissue with blood)
- Pathological waste (including e.g. body parts, foetus and placentas)
- Sharps (including e.g. used injection needles, scalpels and ampoules)
- Pharmaceutical waste (including e.g. outdated and spilled medicines, vaccines)
- Genotoxic waste (including waste from cancer treatment)
- Chemical waste (including discarded solid and liquid chemicals from e.g. laboratories, insecticides)
- Waste with high content of heavy metals (including e.g. broken mercury thermometers, chemicals for developing x-ray photos)
- Pressurised containers
- Radioactive waste (including solid, liquid and gaseous waste that contains radioactive isotopes).

The action plan is proposed covering the period of : Short term for FY 2004/05, Medium term for 2005/06 to-2008/09 and long term for the period of 2009/10 to-2016/17

2. Available information on the Health Care facilities, staffing and health care waste in Nepal

2.1 Number and Distribution of Health care Facilities in Nepal:

According to the "Health Information Bulletin 2001" of the Ministry of Health, Policy, Planning and Foreign Aid Division there are 288 health care facilities with hospital beds in Nepal, having in total 1,140 beds (including 160 Primary Health Centres with 3 beds each).
There are 52 district hospitals each having 15 beds and three of the district hospitals have 25 beds. There are nine zonal hospitals with 50 beds. The remaining categories of health care facilities are larger hospitals of which some provide specialized services (eye, maternity, mental and cardiac army hospitals). In addition to this there are a large number of small health care facilities with no beds, however, they also generate health care waste. These facilities include 136 Primary Health Care centers, 711 Health Posts, 3 179 Sub Health Posts and 15 548 Outreach Clinics. Table 2.1 below summarizes the data on number of health care facilities classified by regions, districts and by sizes according to the following criteria:

- Small HCFs: < 25 beds
- Medium HCFs: 25-100 beds
- Large HCFs: > 100 beds.

Furthermore, the health care facilities are categorized for the later model categorization according to their location as: a) Relatively remote areas (Remote); b) densely populated areas (Dense); c) Larger towns and cities (City). Due to lack of information only the total number of beds for private teaching hospitals has been reported as 2285 beds assuming each of the private teaching hospitals has more or less similar number of beds. Table 1 presents the number of health facilities, beds by locations and by regions and districts.

Table 1: Number of Health Care Facilities (HCF), beds for various categories of Health Care Facilities in Nepal, by location, regions and districts, 2001.

Location	Small HCFs [1]			Medium HCFs [2]			Large HCFs [3]	
No. Of HCFs (beds)	Remote [4]	Dense [5]	City [6]	Remote [4]	Dense [5]	City [6]	Dense [5]	City [6]
Eastern Region								
Mechi	3 (45)			1 (50)				
Kaski	3 (45)	2 (30)				1 (87)	1 (140)	
Sagarmatha	5 (75)			1 (50)				
Central Region								
Janakpur	3 (45)			1 (25)	1 (25)		1 (100)	
Bagmati		3 (50)			1 (25)	2 (100)		5 (1199)
Narayani					3(100)		2 (243)	
Western Region								
Gandaki	4 (55)							1 (150)
Dhaulagiri	4 (60)							
Lumbini	7 (75)				1 (38)		1 (100)	
Mid Western Region								
Karnali	3 (45)							
Rapti		4 (60)						
Bheri		4 (60)			1 (70)			
Far Western Region								
Seti	3 (45)	2 (30)			1 (50)			
Mahakali	3 (45)				1 (50)			
Community Hosp.	1 (15)	1 (15)						
Other Govt. Hosp.	3 (18)	3 (27)						4 (328)
Gov. Teaching Hosp.							1 (100)	2 (1046)
Priv. Teaching Hosp.							2 (800)	3 (1200)
Non-Gov. HCFs	2 (27)			9 (385)			2 (210)	1 (100)
Eye Hospitals		5 (57)			7 (373)		3 (543)	
Primary Health Centres	60 (180)	50 (150)	50 (150)					
Total	**104 (775)**	**74 (479)**	**50 (150)**	**12 (510)**	**16 (731)**	**3 (187)**	**13 (2236)**	**16 (4023)**

Notes:

1. Small HFCs: < 25 beds
2. Medium HCFs: 25-100 beds
3. Large HCFs: > 100 beds
4. Relatively remote areas
5. Densely populated areas
6. Larger towns and cities.

Table 2 provides an overview of the staff employed at the level of public health care facilities in Nepal, including the volunteers working at the level of peripheral health facilities

Table 2: Number of staff and volunteers working in public health care facilities in Nepal

Staff group	No. of staff
Doctors	1 259
Nurses/ANM	6 216
Paramedics/Health assistants	5 295
Village health workers	4 015
MCHWs	3 190
Pharmacists	21
Pharmacy assistants	15
Ayurvedic physicians	391
Baidhya	347
Sub total of public health employees	**20, 749**
Volunteers	
Female Community Health Volunteers	53 999
Trained Traditional Birth Attendants	14 951
Sub total of volunteers	**68 950**
Grand Total	**89 699**

2.2 Surveys on Quantities of Health Care Waste:

A number of surveys have been conducted in the Kathmandu Valley to establish an estimate of the health care waste. Two of them include surveys of the quantities of health care waste (HCW) and health care risk waste (HCRW).

The first survey was conducted in 1997 and included measurements of the quantities of waste generated at 11 hospitals in the Kathmandu Valley. The average quantity of waste estimated for all 11 HCFs is shown in Table 3 below.

Table 3: Survey of health care waste quantities in Kathmandu Valley, 1997

Category of waste	Average amount of waste for all 11 health care facilities
Health care waste (HCW)	0.54 kg/patient/day (rounded figure)
Health care risk waste (HCRW)	0.16 kg/patient/day (rounded figure)

Another survey was conducted in 2001 by the Environment & Public Health Organization (ENPHO) for the Kathmandu Valley Mapping Program, Kathmandu Metropolitan City. It shows higher amount of HCW and HCRW than the earlier study of 1997 (see Table 4). It seems the ENPHO study has calculated with an occupancy rate of around 65% in average.

Table 4. Survey on health care waste quantities in Kathmandu Municipality, 2001

Category of waste	Average amount of waste for all health care facilities, 2001
Health care waste (HCW)	1.7 kg/person/day
Health care risk waste (HCRW	0.48 kg/person/day

The two surveys indicate an increase in the amounts of waste generated at the health care facilities in the valley, which corresponds very well with the increasing expansion of health care facilities in recent years. However, as the first survey probably also include smaller health care facilities, this is also part of the explanation for smaller amounts of waste. A recent survey in South Africa shows a quantity of HCRW at the same level as the ENPHO study, namely 0.6351 kg/patient/day (ref. Draft report "Health Care Waste (HCW) Generation and Characterization Study for Health and Treatment Facilities", prepared by Data Management & Statistical Analysis CC, January 2003).

2.3 Estimate of total quantity of HCRW in Nepal: If it is assumed that all health care facilities in Nepal (having beds) are generating approximately the same amounts of waste per patient per day as in ENPHO's survey, and that the occupancy rate is 65%, and that health post and sub health posts (not having beds) are generating 0.5 kg HCRW per day, and that outreach clinics are generating 0.1 kg HCRW per day, the total amounts of health care risk waste can be estimated as shown in Table 5 below.

Table 5: Estimated total amounts of health care risk waste generated by health care facilities in Nepal 2001.

	kg HCRW
Small HCFs, per day [1)]	456
Health Posts [2)], Sub HP [2)] & Outreach Clinics [3)], per day	1910
Medium HCFs, per day [1)]	1130
Large HCFs, per day [1)]	2034
Total, per day	**5 530**
Total, per year	**2 018 450**

Notes: 1) For HCF with beds: 0.5 kg/patient/day, 2) For Health Post and Sub HP: 0.5 kg/HCF/day
3) For Outreach clinics: 0.1 kg/HCF/day.

The estimate should be considered as indicative only, as there are many factors influencing on the amounts of waste, and there are considerable variation from HCF to HCF. In addition it also needs to be considered that it is seldom possible to have high quality segregation of waste for HCRW and HCGW. It is expected that some considerable portion of health care general waste is mixed with the health care risk waste, thereby generating larger amounts as health care risk waste.

3. Assessment of Present State of Health Care Waste Management

3.1 Findings from inspection during the assessment and from earlier studies: Following health care facilities were been visited with the purpose to assess the health care waste management practices:

- Bir Hospital (Nepal Central Hospital)
- Bhaktapur Hospital
- Kastjunje Sub Health post
- Thimi Health Post
- Maternity Hospital of Thapathali
- Om Hospital (new private hospital)
- Nepal Medical College, Teaching Hospital.

It is to be considered that in comparison to the large number of health care facilities in Nepal, the present assessment of the health facilities (visits made to a few health care facilities) can only provide a snap shot view of the present status of the health care waste management practice in Nepal. The impression of the health care waste management is made combined with series of in-depth interviews with related professionals with wide experience in the health sector as well as a detailed review of available reports on the subject and observation visit to a few health facilities. The findings are presented in various steps according to the path of health care waste as follows:

Step 1: Waste generation
Step 2: Waste segregation
Step 3: Containerisation
Step 4: Internal transport and storage
Step 5: External transport
Step 6: Treatment
Step 7: Disposal
Step 8: Wastewater
Others: Waste management plans, training and information.

For each Step the findings and observations are summarised in para marked with "A", followed by assessment of the risks associated with observed practices is included in para marked with "B". It should be emphasized that there is a large variations within the different categories of health care facilities.

Step 1 A: Findings concerning waste generation:

The quantities are among others determined by:

- The health care services provided by the individual HCFs,
- The size of the HCF,
- The supply and share of disposable materials used,
- The degree of segregation.

Lack of initiatives to minimize quantities of waste or substitution of hazardous materials exist at the level of health care facilities. Only in few cases a proper waste segregation was noted takes place leading to less quantities of health care risk waste. In many of the health care facilities needles, syringes used for vaccination and surgical gloves are sterilized by steam sterilization apart from surgical equipment.

Step 1 B: Risks associated with waste generation:

The risks associated with waste generation practice of health care are primarily of financial and environmental nature. The present low rates for waste collection, however, does not encourage the health care facilities to make special efforts to minimize the volume of the waste. In addition, there is lack of regulation for particular hazardous materials such as mercury and other heavy metals, chlorinated compounds.

Step 2 A: Findings concerning waste segregation:

In general most of the health care facilities segregate sharp (needles) from other infectious waste and health care waste. However, the quality of the waste segregation varies a lot from HCF to HCF. This is obviously due to the following factors:

- Lack of awareness among nurses, assistant nurses and doctors
- Lack of training
- Lack of appropriately designed waste collection equipment
- Varying practices of the staffs

Staff in only very few health care facilities have received written information and training on waste segregation. At these facilities there seems to be a good understanding of the need of a waste segregation. These facilities also seem to be well supplied with waste collection containers and waste collection bags. A more thorough study of waste segregation appears from the ENPHO report. On most facilities the awareness is obviously low, resulting in hardly any segregation of the waste, meaning that most health care waste, risky waste as well as general waste, is collected together. The supply of waste collection equipment is often very few and not of always of an appropriate kind. No uniform system of color coding was applied. Some places use yellow to indicate infectious waste, other places use red, and some places are using cardboard boxes for collection of various categories of waste.

Step 2 B: Risk associated with waste segregation:

The primary risks associated with improper segregation of waste are of occupational health and safety nature, and in particular connected to the risk of infection if not properly segregated. In particular, if needles are mixed with domestic waste, this poses a special risk of needle prick injuries and infection as well as risk for HIV/AIDS.

Step 3 A: Findings concerning containerisation:

Sharps:
Most of the health care facilities visited had a metal sharps box for needles and syringes. However, none of the boxes those had a fitting for a padlock was actually locked. Some health care facilities use home made sharps boxes, made of old cardboard boxes, or plastic buckets with a cardboard lid.

General infectious waste:
General infectious waste was in most cases collected in plastic buckets, but very seldom it was seen that the buckets were lined with plastic bags and only few were covered with lids. In many cases the waste segregation was improper, because often lot of domestic waste was found in the buckets leveled for health care risk waste, and vice versa. lack of plastic lining require frequent cleaning of the containers and hence generation of waste water.

Pathological waste:
Pathological waste products from laboratory was found kept in open plastic bins in the sluice room, including placenta and brought to a central storage facility in the bins.

Domestic waste:
Domestic waste was in most cases collected in plastic buckets of varying quality.

Step 3 B: Risks associated with containerisation:

Sharps:
The metal sharps boxes appear to be of appropriate design. The use cardboard boxes as sharps containers can pose high risk of needle prick injuries.

General infectious waste:
The absence of lids and the lack of plastic linen increase the risk of spreading the infectious micro-organisms both during the transport of the waste and the cleaning of the containers.

Pathological waste:
The practice for containerization of the pathological poses just like for the general infectious waste can be of risk to spread the infectious organisms.

Domestic waste:
Domestic waste does not represent the same risk of infection the infectious waste. However, if it not collected daily, the organic matter may decompose and ferment, and hence create nuisance and reduce the cleanliness.

Step 4 A: Findings concerning internal transport and storage:

Collection frequency:
At most of the health care facilities the general infectious waste was collected once a day, and brought to the central storage facility. Pathological waste was often collected more than once a day and some times brought to special collection facilities directly. In most cases needles and syringes was not collected regularly and was brought to a place outside the building and burnt in either a drum or in an open fire. Domestic waste was usually collected once a day. Chemical waste that was not discharged via the drain was collected occasionally.

Internal transport:
At the larger hospitals the waste was collected in larger bins loaded on a trolley, but in most cases, the waste was transported by the sweepers (cleaners) to the central storage facility, either in plastic bags or in the waste collection bucket.

Intermediate storage:
No examples on intermediate storage rooms for either health care risk waste or health care general waste was seen at health care facilities visited. All waste was brought directly from waste collection buckets in the various departments to the central storage facility.

Central storage:
The central storage facilities consisted in most cases of open municipal containers. In most cases the general infectious waste was dropped in these container together with the domestic waste. The containers were placed in open air and in some cases in public places with access for both human beings and animals. In one hospital a central storage room was established with roof and a lockable gate, although much infectious waste was littered around the room, probably due to the fact that the waste was not containerised, but had to be loaded to a municipal truck with a shovel.

Step 4 B: Risks associated with internal transport and storage:

Collection frequency:
The collection frequency seems reasonable at most health care facilities, and seems not to imply any serious risk.

Internal transport:
Cases where the waste is transported manually imply a risk of infection to the sweepers in particular if they are not carrying the correct personal protective means such as heavy duty gloves, apron etc.

Intermediate storage:

The fact that there were no intermediate storage rooms and that much of the waste was carried manually means that the waste was transported over a long distance under not too safe conditions.

Central storage:
Most of the central storage facilities were open municipal containers where the general infectious waste was mixed with domestic waste. in some cases pathological waste was dropped in those containers. As the waste was drop unpacked directly from the buckets into the container there were free access to waste for human beings and animals. At several places waste was scattered around the containers, and in one case where the container was placed in a public area near the hospitals, dogs were seen walking around in the waste seeking food. These conditions naturally imply serious risk of spreading infectious materials both by wind, animals and human beings that probably will look for recyclable materials.

Step 5 A: Findings concerning external transport:

In all the cases observed the waste was collected by the municipal waste collection trucks, and brought through the city to the reloading facility, where it is dumped at an open place with concrete surface. Here scavengers are searching the waste for recyclable materials, before the waste is loaded on a truck for transport to the dumpsite at the riverbank. In cases where the unpacked infectious waste was stored in central storage room, the waste was loaded to the municipal truck with scowls.

Step 5 B: Risks associated with external transport:

- As the waste is transported in open containers/tipper trucks, infectious waste products may drop on the way, creating risk of infection as well as nuisance to the public.

- The scavengers picking recyclable materials are exposed to a serious infection risk in particular from the infectious waste and sharps but also from the domestic waste, warmer the weather higher the risk.

- The workers who load the waste to the trucks are likewise exposed to a serious risk of infection due the near contact with the waste and the dust and aerosols that may be released during the loading. Because the waste is loaded unpacked, some of the waste was found left on the ground.

Step 6 A: Findings concerning treatment: Many of the facilities visited were practicing burning of needles and syringes either:

- in open fires just outside the HCF's buildings or in the backyards or
- in metal bins just outside the buildings or on the roof of the HCF's buildings
- in a "low tech" incinerator made of bricks placed close to the HCF's buildings.

Some were burning the waste together with the cardboard boxes that the waste was collected in. Some of the larger HCFs have their own treatment facility (incinerators or autoclave) but only few were still in operation. Most of them were placed either close to the HCF's building or close to residential areas. The municipal incinerator that was installed 6 months ago had obtained a conditional permission from the Ministry of Population and Environment. But it was not used long because of the neighbors' objection to the use of incinerator due to heavy smoke arising

from the plant,. The municipality had enlarged the chimney of the incinerator in order to avoid further protests, but obvious this created problems for the incineration process.

Step 6 B: Risks associated with treatment:

In those cases where the waste are burnt in either open fire or in metal bins noxious gases generated (acidic gases, possibly dioxins and particulates), which both represent an environmental risk and a health risk, in particular for those living and working nearby. The few incinerators in operation are said to generate nuisance due to incorrect operation.
Pathological waste is in some cases disposed of separately, and in some cases buried (fetus, placentas, amputated limbs etc.).

Step 7 A: Findings concerning disposal:

Most of the general infectious waste generated at health care facilities in Kathmandu is dumped untreated at the river bank together with other types of wastes. The waste at the dumpsite is covered by soil. Usually the last dumped waste does not get covered during the first couple of days. Scavengers (including children) were picking recyclable materials from the uncovered waste at the dumpsite Animals were also seen picking waste at the Katmandu dumpsite. It is believed that the situation for other large cities in Nepal is likely to be the same, as most of the collected waste is placed at dumpsite. Furthermore there is a general tradition for dumping waste materials near the river side. For smaller health care facilities the waste may in many cases be buried in small pit near the health care facility.

Step 7 B: Risks associated with disposal:

The practice with uncovered health care waste risk imply an obvious serious risk for spreading infection via those numerous animals and the scavengers are easily exposed to infectious materials. The organic part of the waste will(when it decompose either under aerobic or anaerobic conditions, generate leachate that will flow down either to the ground water or to surface water. The leachate may in some cases kill the pathogen microorganisms. The location of dumpsite close to the rivers most probably means that leachate will flow into the river. However, as the waste is dumped so close to the river, there is a risk that the infectious waste gets flown into the river, when the water level rises, thereby spreading infectious waste with the river stream. There are no sanitary landfills in Nepal with no protection against ground water pollution too.

Step 8 A: Findings concerning wastewater:

Sources: Most of the larger health care facilities in Kathmandu are connected to the municipal sewerage system. Most of the liquid waste including toilet water as well as most liquid chemical waste is discharged to the system either via the toilets or via the drains. In some cases recycling of liquid chemical waste takes place, e.g. used fixation bath from the X-ray film development.

Treatment: One hospital has its own wastewater treatment plant and more are under way. However, there is not much experience within this field. Only parts of the wastewater from

Kathmandu are properly treated before discharge to the rivers around Kathmandu with the rivers heavily polluted. The discharge of wastewater from health care facilities in other areas of Nepal is supposed to a great extent to be discharged untreated to rivers. In some cases the wastewater is discharged to pit or other kinds of simple wastewater facilities.

Step 8 B: Risks associated with wastewater:

The risk of discharge of treated and untreated wastewater from health care facilities is in general not well documented. The rivers and the river banks around Kathmandu serve many purposes of waste pollution from sources of:

- Water is collected for various purposes in the households (due to problems with water supply in the city)
- Water is collected for small fields and gardens
- Clothes and other items are washed in the river
- Children are playing at the riverbank and some times also in the water
- Animals drink the water in the river
- The water is used to spread ashes from cremation of dead people.

Due to the traditional custom on use of river water for religious purpose, many people are exposed to the river water that possess many pathogen due to the above reasons.
Only few of the larger health care facilities had established what could be called a waste management plan, a systematic approach to handling of the waste. There is no regular training and information provided to the staff dealing with health care waste management. Lack of waste management plans, training programs and information will lead to inappropriate procedures for waste management, which may result in increased negative impact on the environment, occupational health and safety as well as the public health in general.

4. Assessment of Institutional and Legal Framework

4.1 Institutional framework:

4.1.1 The Ministry of Health and the Department of Health Services is responsible take care of the administrative, logistical and training activities in regard to health care. Besides there are other sectors who provide health services to their employee for example defence and police and the teaching hospitals under Ministry of Education. Expanding number of private sector health service providers and the private teaching hospitals are equally responsible to generate a large volume of health care waste.

In accordance to the United Nations conference on Environment held in June 1992 at Rio de Janeiro made a declaration of "principles on environment and development and an agenda for change" that acknowledged the dependence of human health on a healthy environment. Government of Nepal also prepared the Nepal Environment Policy and Action Plan (NEPAP)-1993 in pursuance of this Declaration.. NEPAP has identified major environmental problems facing the country and reviewed the consequences of these problems recommending set of policy guidelines and actions to address them. Nepal has introduced National Environmental Impact

Assessment (EIA) guidelines since 1993. As prescribed by the guideline require all concerned to assess the basic fundaments of biophysical, socio-economic impacts of the project and recommend measures to mitigate such impacts. The Ministry of Health has proposed an Act to formulate legal provisions on obligatory health care waste management for health care facilities that will serve as a prerequisite for obtaining a permit to operate a health care institution. This proposed legal requirement only covers for establishment of new health care institutions. However, according to MOH, it will be possible to include existing health care institutions allowing them to prepare and implement health care waste management actions after allowing a grace period. The law is yet to be approved by the parliament. The Ministry has in cooperation with WHO earlier held a "National Workshop on Hospital Waste Management" in December 1997. The Workshop recommended among others:

- Development of National guidelines
- Establishment of cooperative waste treatment facilities
- Development of a national training program
- Implementation of legislation for health care waste management.

Ministry of Health during the process of preparation of the Health Sector Strategy - an Agenda for change has drafted a "Logistic Management Strategy" which among is one out of seven objectives has mentioned addressing the health care waste management related issue. The objective of this activity is to "Improve quality and safety of health services by establishing clear, functional policies and systems for physical asset and waste management". The target is outlined as " during the period of the 10th Five-Year Plan, LMD will work with Physical Asset Management Project (PAMP) of GTZ Health sector Support Program to develop and implement a plan for safe management of bio-medical waste". It further mentions that such a plan will include procedures and guidelines for all health facilities, training for health facility staff, provision of necessary equipment and supplies (incinerators, burn boxes), and feasible plans for monitoring and supervision of the disposal process. The strategic actions needed to accomplish these outputs include:

- Implement waste management systems at all levels in collaboration with DDCs,
- Procure and distribute equipment and commodities for waste disposal
- Supervise and monitor waste management system operation.

The first and third strategic actions are discussed separately in the "Physical Assets Management Working Group work plan." And PAMP is developing concept for appropriate comprehensive health care waste management systems for health care facilities, in particular with focus on district hospitals. Recently, PAMP has published a report on Hospital waste Management – Situation analysis and concept for improvement. This report includes proposals for a comprehensive waste management system for all health care waste, including chemical waste and wastewater, for a district hospital. PAMP has estimated the cost of such a full system will be approximately 600 000 Nepali rupees.

4.1.2 Ministry of Local Development: It is the responsibility of the Ministry of Local Development to plan for and to provide landfills for disposal of waste. The Ministry has planned for a new landfill for Kathmandu for the last 10 years without any decision made. Ministry of

Local Development has proposed for a new landfill 32 km from the city on which Municipality has objected due to the high cost for transportation. The Municipality has proposed a landfill about 6 km from the city.

4.1.3 Municipality of Kathmandu: The Municipality of Kathmandu decided in 2000 - through its Kathmandu Valley Mapping Programme – to conduct a survey on the generation of health care waste in Kathmandu, and to submit an environmental impact assessment (EIA) for a treatment plant. The survey and the EIA was carried out by ENPHO. The survey showed that approximately 20-40% of the HCW is HCRW. The report also mentions that about 4000 hospital beds in Kathmandu generate approx. 1500 kg HCRW/day. The municipality plant received an incinerator made in India made, manufactured by Haht (collaborating with a German company) with support from the European Union Development Aid. Municipality was granted a conditional operation permit from the Ministry of Population and Environment to operate the incinerator that was installed in November 2002. However, the plant has not been put into operation, because of complains from the neighbours. The municipality is considering outsourcing the operation of the plant to private company. There is still no decision of a new landfill. By now all the waste collected in the city - domestic as well as the hazardous waste - is dump at the river bank of the Bagmati River in the South Western part of the city.

4.1.4 Nepal Health Research Council: Nepal Health Research Council in cooperation with WHO published the following documents to address the health care waste management and related issues. National Health Care Waste Management Guidelines", Nepal Health Research Council and WHO, May 2002. The two first publications are directly related to health care waste management. The third deals with assessment of health impact of the various polluting activities including handling, treatment and disposal of health care waste.

- "Training Manual for Medical Professionals", Nepal Health Research Council and WHO, May 2002.
- "National Environmental Health Impact Assessment Guidelines – For Project Development"
- National Health Care Waste Management Guidelines, Nepal Health Research Council and WHO, May 2002.

4.1.5 Royal Nepal Academy of Science and Technology (RONAST): RONAST has established an Environmental Laboratory and has conducted some air pollution and water quality monitoring. It is not involved in any activities directed towards health care waste management. Its priority areas are:
Biotechnology
Natural products
Environment and alternative energy
High altitude science
Science & technology policy.

4.1.6 World Health Organisation: WHO has developed manuals and other materials for improving health care waste management, as well as assisted to hold workshops and conferences. In Nepal WHO in cooperation with the Ministry of Health organised a workshop

on health care waste management in 1997and has assisted to the Nepal Health Research Council in preparing their guidelines and training manual.

4.1.7 Environment & Public Health Organisation: Environment & Public Health Organisation (ENPHO) is an autonomous NGO, non-profit scientific organisation, established in 1990, to assist the Government, INGOs, NGOs and other social and private institutions and universities. ENPHO objectives are:

To conduct research on public health, water, waste water, soil, air and sound pollution and its associated adverse impact
To disseminate the research findings and enhance public awareness
Conduct training on environment and health & sanitation
To develop and promote appropriate technologies.

4.1.8 Save the Environment Foundation: Save the Environment Foundation (SEF) is a non-governmental environmental organisation establish in 1994 by nine women. The aim of SEF is to finds solutions to the growing pollution in Kathmandu and the resulting negative effects on health. SEF has among others conducted a study on the health care waste management on a number of hospitals in the Kathmandu Valley, and has donated needle destructors to selected hospitals.

4.1.9 Health Care Facilities: A number of health care facilities has on their own initiative implemented and experimented with different ways of collecting and treating health care risk waste. Only a few examples will be mentioned here:

- Bir Hospital has developed and installed new waste collection containers (metal sharps boxes and plastic buckets) in yellow and with clear instructions on which waste fractions that should be dropped in the containers

- Teaching Hospital in Kathmandu has - with the assistance of JICA – installed a new incinerator for health care risk waste that is supplied with some kind of flue gas cleaning.

- Om Hospital, which is a new private hospital, has implemented a comprehensive waste collection system, and developed internal codes of practice as well as information materials. The hospital is furthermore considering installation of own wastewater treatment facilities.

4.2 Legislation: There exist legislation concerning EIA, the Environmental Protection Act and the Environmental Protection Regulation (1996-1997), which includes procedure for EIA (Environmental Impact Assessment) and IEE (Initial Environmental Examination). Small plants and activities have to apply for IEE, while larger plants, industries and activities have to apply for EIA.. EIA has to be submitted to Ministry of Industry (MOI) that forwards it to MOPE. IEE has to be submitted to MOI if it regards industrial activities, or to the Ministry of Agriculture if it regards agricultural activities. The IEE is not forwarded to the MOPE. According to the Environmental Protection Regulation the following activities with relation to HCWM require an EIA:

- Hazardous waste treatment plants, no matter how much waste is treated.
- Land filling of hazardous waste, no matter how much waste is land filled.
- Handling and disposal of radioactive waste.
- Health Care Facilities with more than 25 beds.

Needs in institutional and legislative activities in order to improve health care waste management in Nepal: Based on the above assessment of the present state of the institutional and legislative framework the needs for improvement for health care waste management can be summarized as indicated below:

Institutional needs:

- Capacity building in all involved public authorities, in particular the major players the Ministry of Health and the Ministry of Population and Environment.
- Coordination between stakeholders (establish a coordinating body, chaired by Ministry of Health, with representatives from all major stakeholders)
- Commitment of the hospital management for higher priority of health care waste management
- Training and information at the health care facilities as well as the other institutions involved in waste management
- Monitoring of the HCWM at HCFs and in the following steps (transport, treatment and disposal)
- Data for general planning purposes at national level.

Needs for regulation:

- Implement regulation on Waste Management Plans for health care facilities
- Supporting measures: guidelines/minimum requirements for internal handling of health care waste at health care facilities
- Occupational health and safety (enforcement of existing regulation)
- Establish environmental standards for air emissions and treatment efficiency
- Legislation concerning land filling
- Legislation concerning wastewater treatment.

5. Strategic Framework and Action Plans for improved HCWM in Nepal:

5.1 Strategic Framework: It describes overall elements of a strategic plan for improving the health care waste management in Nepal, including:

- Formulation of a vision
- Policy options
- Ways to strengthen the institutional framework
- Need for legislation

- Description of technical options
- Calculation of cost of implementing the Strategy
- Need for training and information
- Action plans
- Financial implications
- A programme for monitoring the progress.

5.2 Vision of the Strategy:

The Vision of this Strategy, which represents the overall and final goal for the health care waste management, is proposed as below.

Vision of the Strategy for Health Care Waste Management in Nepal

The **Vision** of the Nepal's Health Care Waste Management Strategy is to facilitate the establishment of an

- Environmentally sustainable,
- occupationally healthy and safe,
- financially viable,
- institutionally feasible
- technically appropriate
- operationally practical comprehensive and
- integrated "cradle-to-grave"

management system for health care waste management covering all health care facilities, addressing the short, medium and long term needs.

The Vision implies that the Government of Nepal should strive at developing the health care waste management to meet the **high environmental standards**, and at the same time ensuring that the health care waste management is environmental sustainable. At the same time it should be assured that the health risk of the staff of the health care facilities are reduced to lowest possible level, and at least meeting the international standards for **occupational health and safety**. Likewise, the health care waste management should be handled and disposed of in such a manner that it does not affects the **public health**, which implies that the handling of the waste should not add health risks to the patients and visitors at health care facilities, as well as neighbours, scavengers at dump and land fill sites and others.

The Vision implies that the Government of Nepal should strive at developing the health care waste management to meet the **high environmental standards**, and at the same time ensuring that the health care waste management is environmental sustainable. At the same time it should be assured that the health risk of the staff of the health care facilities are reduced to lowest

possible level, and at least meeting the international standards for **occupational health and safety**. Likewise, the health care waste management should be handled and disposed of in such a manner that it does not affects the **public health**, which implies that the handling of the waste should not add health risks to the patients and visitors at health care facilities, as well as neighbours, scavengers at dump and land fill sites and others.

The development of the health care waste management will naturally, have to take place within the framework of the financial resources that are allocated for the purpose. However, the Government should currently consider increasing the available resources to ensure that health care waste management is constantly developed towards the above goals. The organisation of the work to implement improved health care waste management systems should be include the development of the **institutional** framework as well as capacity building to ensure the most efficient achievement of the goals. This would include considerations of the allocation of competences and responsibilities as well as ensuring appropriate education, training and information of all involved staff and ensuring that there currently is a due balance between the tasks and the skills of the employees.

It should ensure that the health care waste management is based on **appropriate technology** that are designed to local needs and conditions, and that it is affordable and easy to maintain, and at the same time representing an improvement of the present state.

Furthermore, it should be ensured that the technology, procedures etc. that are introduced are **operationally practical** meaning that it easy to operate and that they fit to the skills of the staff and the skills of the staff is upgraded to the necessary level.

Finally, it should be ensured that the development of the health care waste management is done in an integrated way, meaning that there is a due balance between the various components of the system to avoid bottle necks and waste of resources as well as ensuring that the environmental problems are not just moved from one phase to another.

5.3 Policy options: As it appears from the above formulation of the various elements of the Vision the implementation of an improved health care waste management will have to be based on selection between different options and at the same time ensure progress as well as due balance between the various elements, requiring political decisions. This section includes proposals for policies that should be adopted in the further development of the health care waste management in Nepal.

Proposed policies to be applied for the future improvement of Health Care Waste Management in Nepal:

Centralized versus decentralized implementation of improved HCWM:

- Initially initiatives taken by a central institution (e.g. MOH) is necessary to ensure common standards for internal HCWM as well as environmental regulation.
- The actual implementation will take place at the individual HCFs, except that central institutions may make procurement of some equipment.

- Later on more responsibilities should be allocated to local institutions.

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

Regulation:

- Urgent need for legislation and other regulation (detailed guidelines) that establishes common standards for waste segregation, transport, treatment and disposal.

Technology:

- Waste collection: Medium standard (simple but efficient) waste collection containers, trolley etc. should be applied at all health care facilities
- Treatment: 1) Central treatment plants of medium technology should be introduced in densely populated areas and cities, however, located away from residential areas, and 2) individual treatment equipment of "low technology" should be introduced at smaller facilities.
- Final disposal: 1) For densely populated areas and cities minimum requirements for sanitary land filling should be applied. 2) In remote areas minimum requirements for burial pits should be applied.

Financing:

- Adopt duty-of-care as well as polluter-pay-principle for the whole life cycle of the health care waste especially for private HCFs.

Implementation:

- Outside larger cities: Start with information activities, development of guidelines and implement training programs, together with distribution of equipment
- Within larger cities: Establish central treatment plants and establish transport systems. Upgrade internal collection systems.

5.4 Institutional Strengthening

This section will include proposals for institutional strengthening for improving the health care waste management, including proposals for:

5.3.1 Strengthening institutional framework and capacity building: This section includes proposals for institutional strengthening in the following central organisations:

- Ministry of Health
- Health care facilities
- Ministry of Population and Environment.

Ministry of Health: The Ministry of Health has the overall responsibility for the health sector management and should as such also have the overall responsibility for health care waste management and coordination with local bodies, private sector and the NGOs participating at the level of health care facilities. A considerable number of institutions and other stakeholders are involved in the health care waste management at various levels. With the overall responsibility the MOH shall furthermore, take the initiative to clarify and strengthen the institutional framework as well as coordinate the various activities to improve the health care waste management.

A first step will be to establish a coordination body, a Coordinating Committee for Health care Waste Management, where all relevant stakeholders are represented. The Committee could be chaired by the DOHS, and LMD will execute the role of secretariat. Furthermore, PAMP could

conduct the technical activities such as investigations and survey, or coordinate such activities. Among the other members that should be represented in the Committee are proposed as:

- Ministry of Health, Planning Division for coordinating policy, planning decision facilitation
- Ministry of Population and Environment (responsible for setting environmental standards at the national level)
- Ministry of Local Development (responsible for planning of landfills and mobilizing DDCs)
- Ministry of Labor (responsible for occupational health and safety)
- Association of private health care facilities (that represent a considerable part of the health care sector)
- Associations of health care staff (doctors and, para-professional Associations)
- Association of Municipalities and,
- Kathmandu Municipality at the central level
- Representative of private sector

A second step will be to ensure a clear allocation of the responsibilities and the resources for the health care waste management within the ministry. The Logistic Management Division (LMD), under the Department of Health Services, has been given the responsibility to take the initiative to improve the health care waste management by including the aspect of health care waste management in its "Logistic Management Strategy,and the Nepal Health Sector Program - Implementation Plan" Marg 22, 2059 (February 5, 2003). The LMD has implemented a project, Physical Assets Management Project (PAMP), that among others are investigating various means to improve the health
care waste management.

Tasks to be considered by the Coordinating Committee for HCWM:

- Ensure a clear definition of health care waste categories and sources of health care waste
- Regulation on the requirement for Health Care Waste Management Plans (HCWMP) as part for health care services delivery (MOH has already proposed such regulation, but it is yet to be approved by parliament).
- Conduct surveys of the of the amounts of healthcare waste generated, its handling, treatment and its disposal all over the country
- Prepare detailed guidelines for health care waste management in Nepali and possibly in other languages, and publish and distribute them
- Develop information and training materials in Nepali and if needed in other languages, as well as publish and distribute it
- Prepare documents for code of practice for health care waste management at various types of health care facilities
- Prepare documents for waste management plans for various types of health care facilities
- Investigate the options for collection and disposal of HCW through its full lifecycle (including equipment for collection, transport, storage, treatment etc. of the waste)
- Carry out feasibility studies to determined which ways and means that are the most appropriate and cost-efficient ones

- Establish policies for which levels of environmental and occupational health and safety standards that should be achieved
- Develop financial mechanisms, according to the polluter-pay-principle, for health care waste management.
- Develop indicators for monitoring the improvement of health care waste management.

It is equally important that the LMD is given the necessary resources and authority to take the leading role in the work, including additional manpower and funds for conducting the various studies and investigations.

A third step could be to investigate in more details what is needed to improve the health care waste management, e.g. in accordance to the Strategy. At the level of Health care facilities: In many of the hospitals and other health care facilities a firmer and clearer organisation is needed to improve the health care waste management. This can be done in many ways and will be different from HCF to HCF, among others because of the different sizes of the HCFs.

A proposal for organizing the health care waste management is described below for a large HCF. For smaller HCFs the organization must be less complicated, but it is still important that the responsibilities for the various activities are clearly defined. First of all, it is proposed to establish a Waste Management Unit unit, given the responsibilities for most of the health care waste management. The Waste Management Unit should have the following responsibilities:

- Internal collection and transport of all kinds of waste generated at the various departments and wards.
- Central storage
- Procurement and distribution of waste collection equipment and materials (waste collection containers and bags) to all units and wards
- Treatment of the HCRW, if the HCF has its own treatment facility
- External transport of the HCRW if the HFC itself is responsible for sending the waste to a central treatment facility
- Keeping record on the amounts of waste generated, divided on various categories
- Maintenance of transport equipment and treatment facility
- Current monitoring of waste segregation and collection procedures as well as information to the hospital staff to ensure proper waste segregation.

The Waste Management unit will be headed by Metron or the administrative officer as appropriate depending upon the staffing level of the hospital with delegation of function of overall waste Management. S/he will refer and report to the hospital director or the technical director. In order to ensure the necessary coordination between the various units of the hospital units and to ensure a current discussion of the options to develop the health care waste management it is advised to establish a Waste Management Committee, in the respective hospitals which could include the following representatives:

- Waste Management Coordinator who will be heading the Waste Management functions Metron or Administrative officer who coordinates with Hospital Director
- A nursing staff who represent the nurses and other paramedical staff and the staff group responsible for cleaning and e waste segregation

- Laboratory section representative
- Wards representative
- Pharmacy representative
- Operation theature in-charge
- Emergency/casualty section in- Head of Procurement who has the responsibility for procurement of equipment and materials, among others the procurement of equipment and materials for health care waste management
- X-ray unit or nuclear imaging section in-charge for a safe disposal of radioactive waste.
- Post mortem unit in-charge

There is an urgent need for training and providing information to the staff in various aspects of health care waste management. Proposal for training of the various staff groups in different aspects of health care waste management is described below. The training is proposed as both on-the-job-training ("O") and training at classroom training courses ("C"). The need for information materials is as well indicated ("I"). It should be emphasized that the proposed training program only reflects the need for introductory training. Refreshing training should be incorporated in the current operation of the health care facility.

Table 6. Training needs – proposal for training

Topics	Waste Management Unit (WMU)	Responsible at department level	Nurses, ass. nurses & workers	Doctors
Waste Management				
Definition of health care waste categories	C	C	O	C
Health & environmental impacts	C	C	O	C
Organization of HCWM	C	C	O	C
Procedures for HCWM (Code of Practice)	C	C	O	C/I
Instructions concerning segregation	C	C/O	O/I	C
Instructions concerning storage	C/O	C	I	C
Instruction concerning treatment	C/O	C	I	C
Instructions concerning external transport	C/O	C		C
Auditing of HCWM	C	C		C
Legislative aspects of HCWM	C	C		C
Infection Control				
Sources of infection hazards	C	C	O	C
Principle for infection control	C	C	O	C
Personal hygiene	C/O	C/O	O	

Notes: C: Class room training, :On the job training and information, I: Information materials
Reference: Guidelines on Safe Management of Health Care Waste, Egyptian Environmental Affairs Agency/Ministry of Health and Population/DANIDA/RAMBOLL, Cairo 2000.

Ministry of Population and Environment: The environmental arm of the Ministry of Population and Environment has only been in function for a few years, and there is a need of strengthening the capacity of the Environment division of the Ministry for issuing and enforcing new environmental legislation.

5.3.2 Need for regulation: With regard to environmental regulation in relation to health care waste management the Government needs to prepare the regulation that is proposed as: regulation that specify the roles and responsibilities of the regional and local authorities with regard to carry out and to monitor the various activities within health care waste management; Development of environmental standards for treatment and discharge of wastewater, Air emissions from HCRW treatment plants; establishment of landfills and dumpsites and for enforcement of legislation. In particular there is a need to decide on the permissible level of emission from treatment plants that is urgently needed. Without clear standards the health care facilities and the local authorities or private operators those interested in investing in treatment facilities may not know what is required. The table below summarizes standards established in a number of other countries/regions, which can be used for MOPE's proposal for Nepali standards.

Table 7.: Standards for air emissions from incinerator plants for health care risk waste implemented in different countries.

	South Africa	European Union	USA	India	Vietnam
	1965	Dec. 2000	Sept. 1997	June 1996	1999
Units	mg/Nm^3	mg/Nm^3	mg/Nm^3 S/M/L	ppm v (unless others indicated) S/M/L	mg/Nm^3
Type of pollutant					
Particulate Matter/dust	180	10	53/26/26	115/69/n.a.	100
CO	-	50	36	44/40/n.a.	100
TOC	-	10	-	-	
Dioxin/furan (nanogram) TEQ	0.2	0.1	1.76/0.46/0.46	125 ng/Nm^3 total CCD/CCF or 2.3 ng TEQ/Nm^3	1
HCl	30	10	17	100 or 93% reduction	100
HF	-	1	-	-	2
SO_2/SO_x	25	50	112	55	300
NO_x	-	200	366	250	350
NH_3	-	10	-	-	
Pb, (same for Cr, Be, Ar, As, Sb, Ba, Ag, Co, Cu, Mn, Sn, V, Ni)	0.5	0.05	0.92/0.05/0.05	Lead only: 1.2 mg/Nm^3 or 70% reduction	2
Cd (same for Tl)	0.05	0.05	0.12/0.03/0.03	0.16 mg/Nm^3 or 65% reduction	1
Hg	0.05	0.05	0.42	0.55 mg/Nm^3 or 85% reduction	0.5

Notes: *) S/M/L: Small (<200lb/h)/Medium/Large facilities (>500lb/h). Limits recalculated to same standard conditions
Ref. Cond.: 11% O_2, 273 Kelvin, 101.3 kPa, **) S/M/L: Small (< 91 kg/h)/Medium (91-227 kg/h)/Large (>227 kg/h)(For abbreviations, see the list in the beginning of the report).

6. Technical Options and Cost Estimates

6.1 This section has proposed practical options for improving the health care waste management at the various types of health care facilities. It starts with presentation of three models for the different types of health care facilities, which will serve as a basis for the further calculation of cost implications. Then follows more detailed descriptions of the different elements of the models, following the various steps of the waste flow (waste minimization, segregation, internal transportation, treatment and final disposal). Where relevant each of these step are divided into three categories of health care facilities (small, medium and large HCFs).
The proposed solution should be considered as another step on the way to the above formulated vision only, as the proposed practical solution will not meet the high environmental standards adopted in industrialized countries. However, the proposed solution represents a practical

solution for solving urgent occupational health and safety hazards as well as environmental problems. Hopefully, they will serve as a basis for further development of the health care waste management.

Integrated Waste management models: The three models represent the following types of health care facilities and their location:

Model 1: Small and medium sized HCFs in remote areas
Model 2 Small and medium sized HCFs in densely populated rural areas
Model 3: Small, medium and large sized HCFs in cities.

Model 1: Small and medium sized HCFs in remote areas: This model describes the technologies that are proposed to improve the health care waste management at the small and medium sized health care facilities in remote areas, or areas where access is difficult or time consuming. It is presumed that the health care facilities can be supplied with the necessary materials and equipment for waste collection and treatment, but that it will lead to high cost and infection risk to establish centralized treatment facilities. Based on the overview of health care facilities it is assumed that there are about 104 of small facilities and 12 medium sized facilities in remote areas in Nepal. The small facilities have a total of 775 beds and produce 387,5 kg of HCRW per day. The medium facilities have 510 beds and produce 255 kg of HCRW per day. As there are relatively few places, where the non-hazardous waste generated in these facilities can be landfilled/dumped it is assumed that all the HCW is treated together, which gives a total amount to be treated waste on 1 285 kg per day, in average 11 kg HCW per facility per day.

It should be emphasized that this figure most probably is higher than the actual generation of waste in this category of health care facilities. However, it has been decided all way through to conduct conservative calculations, meaning that figures in the upper end of intervals have been chosen for the calculations. The figures on quantities of waste will, however, not influence much on the cost calculations, as all the small health care facilities will have to be supplied with a certain minimum of equipment no matter how small quantities of waste they may generate. In Model 1 it is proposed to use the same equipment and procedures for waste segregation and collection as for the other models, which include yellow plastic buckets with lid and plastic liner for collection of general infectious waste, yellow steel boxes with plastic liner for sharps and black plastic buckets with lid and black plastic liner for domestic waste. In most cases small sized waste collection equipment are sufficient (small waste collection buckets and small sharps containers). For the most of the small health care facilities in this category three sets are sufficient. It is proposed to supply the medium sized health care facilities with five small and 3 large waste collection buckets as well as five small and 2 large sharps containers each.

For internal transport the medium sized HCFs should be supplied with one trolley and they should have three intermediate and one central storage room. It is furthermore proposed that the buckets with general infectious waste and domestic waste are emptied and treated everyday, while the sharps box is emptied and treated once every week. With regard to treatment it is proposed to use "low tech" burners for the small health care facilities, e.g. used oil drums, designed after simple principles. These treatment facilities will need charcoal or kerosene to burn the waste. In most cases small oil bins should be sufficient, as only very limited amounts of

waste will be generated and treated per day. The medium sized health care facilities should be supplied with brick incinerators. The treatment facilities should be fences and placed as far as possible from the health care facility, residential areas and fields, because the smoke is noxious. The ashes should be dumped in a pit and covered with soil when needed, preferably within the fenced area. The wastewater from the small health care facilities is supposed to be led to a "low tech" cesspool, and not to the river. The wastewater from the medium sized health care facilities are supposed to be treated in "low tech" biological treatment plants, and the treated wastewater is afterwards led to a cesspool. Cesspools should be located away from drinking and irrigation water wells. The supply of equipment to the different categories of health care facilities appears from table 7 below. The equipment proposed is described in further detail in section 7.

Model 2 Small and medium sized HCFs in densely populated rural areas: This model describes the technologies that are proposed to improve the health care waste management at the smaller, medium and large sized health care facilities in densely populated rural areas, where the access to the different facilities is relative good. Hence, it will be relatively easy both to supply the health care facilities with the necessary equipment and materials for health care waste management, and it will furthermore be relatively easy to transport waste to central treatment facilities. The possibilities of applying mobile treatment facilities that can moved around to the health care facilities, instead of moving the waste to a central treatment facility, is discussed below. Based on the overview of health care facilities in section 2.1 it is assumed that there are about 74 small health care facilities with 479 beds, 16 medium sized HCFs with 731 beds and 13 large HCFs with 2 236 beds in this model. The health care facilities are supposed to generate a total of 1 723 kg HCRW per day. The size of health care facilities varies a lot in this model, as it includes both sub health post with no or only one bed, as well as district/regional hospitals that may have up to 200 beds. It is furthermore assumed that dumpsites/landfills are available in those villages where the health care facilities are placed, which means that there is no need to treat the domestic waste together with the infectious waste.

In Model 2 it is proposed use the same equipment and procedures for waste segregation and collection as for the other models, which include yellow plastic buckets with lid and plastic liner for general infectious waste, yellow steel boxes with plastic liner for sharps and black plastic buckets with lid and black plastic liner for domestic waste.

The small and medium sized health care facilities will be equipped with the same devices as in model 1, expect that the medium sized health care facilities will not be equipped with own treatment facility, but will have to bring their HCRW to the large health care facilities that will be equipped with medium tech incinerators. With regard to waste collection equipment the large facilities will in average be equipped with: 20 small and 12 large waste collection bucket, 20 small and 6 large sharps boxes, four trolley for internal transport, 12 intermediate and one central storage room. Furthermore, there will be one pick up for every second large health care facility to take care of the waste collection and transport from medium sized and large health care facilities to the treatment facilities that are placed at the large health care facilities. These treatment facilities will need diesel oil and electricity for operation. The treatment facilities should be placed in a building and located as far as possible from the health care facility, residential areas and fields, because the smoke may create nuisance and to a certain degree be noxious. The ashes should be dumped at landfill or if not available at a dumpsite. It is proposed

that the buckets with general infectious waste are emptied and transported to the central treatment facility everyday, while the sharps box is emptied and treated once every week.

The wastewater from the small health care facilities is supposed to be led to a "low tech" cesspool, and not to the river. The wastewater from the medium and large sized health care facilities are supposed to be treated in "low tech" biological treatment plants, and the treated wastewater is afterwards led to a cesspool. Cesspools should be located away from drinking and irrigation waste wells. Model 2 is illustrated in Box 7.2 below. The supply of equipment to the different categories of health care facilities appears from table 7.

Model 3: Small, medium and large sized HCFs in cities:This model describes the technologies that are proposed to improve the health care waste management at the small, medium and large sized health care facilities in cities, where the access to the different facilities is good.
Hence, it is easy both to supply the health care facilities with the necessary equipment and materials for health care waste management, and likewise it is relatively easy to transport waste to central treatment facilities. Based on the overview of health care facilities above in section 2 it is assumed that there are 3 cities in Nepal that have both small, medium and large sized health care facilities so closely located in densely populated cities that flue gas cleaning will be required (Kathmandu, Pohkara and Chitwan). The small health care facilities include 50 public health clinics, private and specialised clinic. The Medium sized health care facilities include 3 specialized clinics and smaller hospitals. The large facilities include 16 central and specialized hospitals as well as police and army hospitals. They have a total of 4 360 beds. The health care facilities in this model is supposed to generate 2 180 kg of HCRW per day. The amount of waste generated at the different health care facilities varies a lot due to the different sizes and services of the healthcare facilities in this model. It is assumed that dumpsites/landfills are available for these cities, which means that there is no need to treat the domestic waste together with the infectious waste.

In Model 3 it is proposed use the same equipment and procedures for waste segregation and collection as for the other models, which include yellow plastic buckets with lid and plastic liner for general infectious waste, yellow steel boxes with plastic liner for sharps and black plastic buckets with lid and black plastic liner domestic waste.

For the smaller health care facilities three sets of waste collection equipment are sufficient, while for the medium sized health care facilities it is proposed to equip them in average with: 6 small and 4 large waste collection bucket, 6 small and 3 large sharps boxes, two trolleys for internal transport, four intermediate and one central storage room. The large health care facilities are proposed to be equipped in average with: 24 small and 16 large waste collection bucket, 24 small and 12 large sharps boxes, eight trolleys for internal transport, 16 intermediate and one central storage room. Furthermore, there will be one pick up for every fifth large health care facility to take care of the waste collection and transport from medium sized and large health care facilities to the treatment facilities that are placed at the medium sized and large health care facilities. It is furthermore proposed that the buckets with general infectious waste and domestic waste are emptied and transported to the central treatment facility everyday, while the sharps box is emptied and treated once every week.

It is proposed to equip each of the three medium sized health care facilities with "medium tech incinerators", while every fifth of the large health care facilities should be equipped with "medium tech" to "advanced tech" treatment facilities, e.g. dual chamber incinerators with efficient fuel injection, ventilation and temperature control, see below under section 7. These treatment facilities will need diesel oil and electricity for operation. The treatment facilities should be placed in buildings and located as far as possible from the health care facility, residential areas and fields, because the smoke may create nuisance and to a certain degree be noxious. The ashes should be dumped at landfills or if not available, at a dumpsites.

The wastewater from the small health care facilities is supposed to be led to the municipal sewerage system. The wastewater from the medium and large sized health care facilities are supposed to be treated in "low tech" biological treatment plants, and the treated wastewater is afterwards led to the municipal system. The supply of equipment to the different categories of health care facilities appears from table 7.

6.2 Technical Options: Waste minimization: Seen from a life cycle perspective the waste minimisation initiatives represent the first technical options to be considered, as it is directed toward the first step in the waste cycle, the waste generation. In the following examples on the waste minimisation are divided into the categories:

- Waste avoidance
- Green procurement
- Reuse
- Recycling.

Waste Avoidance: The primary objective is to prevent waste from being generated. Some examples of actions aimed at avoiding the generation of waste is presented below:

Refraining from generating waste through disposal of materials unless it is unavoidable, provided that the health and safety of people are not put at risk; limiting the use of disposable items through increased use of reusable items, once again on condition that it will not create an increased health risk to patients. In connection with health care waste management a proper segregation of the waste in health care risk waste and health care general waste is also a kind of waste avoidance or minimization as the a proper segregation will result in smaller amounts of waste that require special treatment.

Green procurement is a process of intentional selection of products during the purchase process that will not only assist in generating less waste, but that will also ensure that waste being generated, can be treated and / or disposed of in an environmentally sound manner. Green procurement can be achieved by purchasing:

Products with only the minimum required amount of packaging;
Reusable products or products that are recyclable, whilst being non-infectious;
Plastic bags, containers or similar items to be incinerated, that is made of Polypropylene (PP), alternatively of Polyethylene (PE), or any other plastic material that can be demonstrated to

produce minimum emissions if incinerated. PVC may only be used where it cannot reasonably be substituted by other plastic material for medical or technical reasons;
Plastic, paper, cardboard or other materials that do not contain dyes or colouring agents that contain heavy metals, chlorinated or other halogenated compounds, and shall be of such a nature that minimum pollution is caused when incinerated or disposed of;
Disposable receptacles that are designed with a view to minimising the wastage of materials without compromising on the strength of the containers, thus avoiding excessive disposal of paper, cardboard, plastic, metal etc.

Reuse: The use of reusable products rather than disposable products is to be encouraged as far as possible, provided that it will not create a risk of infection when reused. In some instances the products may be reused for the same purpose initially intended for, although in other instances the product may be reused for an application completely different from its initially intended use.
Products can be reused in a number of ways, provided that the health of staff or patients is not put at risk due to the risk of infection, for example by:
Making use of reusable linen;
Making use of reusable theatre outfits;
Purchasing products that are packed in reusable containers;
Reusing the containers used for the supply of chemicals, for the containerisation and offsite transport of the products when used (waste);
Reusing packaging materials for alternative purposes.

Recycling: The recycling of waste materials is yet another way of reducing the waste stream. Materials like glass, paper, cardboard, plastic, metal etc. should therefore be recycled where financially viable and practically possible, provided however that it would not in any way create any risk of infection. Should HCRW have been treated with non-thermal technologies to the point where it is classified as non-hazardous for disposal at general waste disposal sites, such materials may be recycled if it is considered to be economically viable and aesthetically acceptable.Waste avoidance and waste reuse is preferred over waste recycling, as the latter will not only require additional energy consumption, but it is also likely to result in some form of pollution during its processing or by the disposable residues.

a. Waste collection equipment and storage facilities: There are manifold options for waste collection equipment. In these models it is decided to apply equipment that is already in use at some health care facilities in Nepal. For general infectious waste it is proposed to use a yellow plastic bucket with lid and with text indication which kinds of waste that should be dropped in it. Furthermore, the bucket is marked with the international symbol for bio hazardous waste. See Box 7. The bucket should be available in both a small (10 litre) and a large bucket (20 liter). For sharps it is proposed to apply a yellow metal box with text indication which kinds of waste that should be dropped in it as well as the international symbol for bio hazardous waste. Lastly, it is proposed to use a plastic liner, a yellow plastic bag with "wings" to collect the waste from the buckets/boxes to the internal transport device, and in order to reduce the frequency of cleaning. It should be emphasized that tying of the bags should be done great precautions.

6.3 Waste collection equipment, storage and transportation: There are manifold options for equipment. In these models it is decided to apply equipment that is already in use at some health care facilities in Nepal and equipment for internal waste transport a wheelie bin and including a trolley seen use in Bir hospital in Kathmandu. For general infectious waste it is proposed to use a yellow plastic bucket with lid and with text indication which kinds of waste that should be dropped in it. Furthermore, the bucket should be marked with the international symbol for bio hazardous waste. The bucket can be made available in both a small (10 liter) and a large bucket (20 liter). For sharps it is proposed to apply a yellow metal box with text indication which kinds of waste that should be dropped in it as well as the international symbol for bio hazardous waste. And, it is proposed to use a plastic liner, a yellow plastic bag to collect the waste from the buckets/boxes to the internal transport device, and in order to reduce the frequency of cleaning. It should be emphasized that tying of the bags should be done great precautions.

In regard to personal protection front for waste handlers responsible for internal waste collection should be supplied with including heavy duty gloves, apron, boots and possibly a mask to cover nose and mouth.

About storage of waste there should be a on a central collection or storage room with a concrete platform and with a drain connected to the municipal sewerage system or its own wastewater treatment plant. There exists one such facility in Bhaktapur Hospital which was not in practice during site visit. Furthermore the opening of the collection room needs to be fenced to keep away insects and birds but at the same time it has to be ventilated. It needs to be locked and the surrounding has to be kept clean.

For transportation of waste from the health care facilities to a central treatment plant it is proposed to use a pick-up where the loading compartment is designed according to the international standards for transport of bio hazardous waste.The vehicles are not supposed to transport heavy load, maximum around 100 kg, so there is no need for expensive vehicles with big motors.

6.4 Treatment of Health Care Waste: Within treatment there are many different technologies, as well as many different technological levels, capacities and prices. The list below shows the range of technologies available:

- Combustion Technologies, i.e. thermal treatment/combustion technologies:
  - Incineration which includes: excess air, controlled air, rotary kiln and fluidized bed
  - *Plasma Arc* and
  - *Pyrolysis*

- Sterilization/Disinfections Technologies,
  - Steam sterilization, e.g. Autoclaving
  - Chemical sterilization, e.g. with chlorine, glutaraldehyde
  - Gas sterilization, e.g. with ethylene oxide, formaldehyde
  - Dry heat sterilization, e.g. oil heated screw feed technology
  - Electro-thermal deactivation,
  - Microbe sterilization,
  - *Irradiation sterilization*
    - *Cobalt-60 gamma rays*

- *Ultra violet*
  Electron beam sterilization

This assessment report does not include a comprehensive discussion of the various options, because many of the options will not be relevant in Nepal at the moment, mainly due to the limited financial resources and the technological capacity. It has clearly been stated from many of the stakeholders during the draft report discussion workshop that it will not be realistic to apply costly and advanced technology. Hence, it is decided to concentrate the proposals and the cost calculations on various options for incinerators. Apart from incinerators the only realistic treatment option is supposed to be steam sterilization. However, as this is not applied as a waste treatment method in Nepal it is not included in the further considerations. As mentioned under the definition of models in the earlier section it is proposed to apply a "low tech" and "low cost" solution for treatment of HCRW at the small and remote health care facilities. An example of such a "treatment facility" consists of an emptied oil drum, modified for the use as a burning chamber. The bottom is removed, and metal screen are used below to keep the waste inside, and the screen above is used to prevent ashes from flying away. The drum is placed on some brick over a pit to make room for either firewood or charcoal charcoal. The "incinerator" should be placed under a shelter to protect against rain and should be fenced in order to keep away animals and unauthorized person.

The drum-incinerator is from an environmental point of view the poorest solution. Hence, it is important to management the incineration process as perfect as possible, and locating the drum so far as possible from places where the smoke can give nuisance to neighbors or others.
A somewhat more advanced solution is a brick incinerator that can be designed in many different ways. It represents a relatively cheap solution, and if the incineration process is managed well, it can reduce the air emissions considerably and it can ensure a relatively efficient treatment of the waste, so that the infection risk is minimized to a minimum. Brick incinerators are already found at some health care facilities in Nepal. As there are no flue gas cleaning system the location of the incinerators has to be considered carefully. It is proposed to apply such incinerators at the medium sized health care facilities in remote and densely populated areas of Nepal, and in the densely populated areas, they should serve as central incinerators for smaller facilities in the vicinity.
Physical Assets Management Project (PAMP) has with the assistance of GTZ has developed a new design of a high temperature (more than 900 dg C) brick incinerator.

Recently, the Municipality of Kathmandu has installed a "medium tech" incinerator, made in India. It is a dual chamber incinerator, with supporting burner. It is said to be able to meet the Indian emission standards for incinerators for health care risk waste. It is proposed to apply the Indian made incinerators at the larger health care facilities in the densely populated areas as central treatment facilities that should also serve smaller facilities in the area. At the Teaching Hospital in Kathmandu a Japanese made incinerator has been installed. It is a "medium to advanced tech" dual chamber incinerator with some flue gas cleaning. It is proposed to apply three of such incinerators in Nepal (Model 3), located in the three cities with most large hospitals (Kathmandu, Pokhara and Chitwan). Although, the incinerators is equipped with some flue gas cleaning it should be considered to locate them outside the densely populated areas of the cities, if it is logistically appropriate.

In some of the larger hospitals it may be appropriate to use needle destructors which small electric devices that can be placed on the nurse trolleys. They destruct the needles and thereby reduce the risk needle prick injuries. Needle destructor has already been introduced at certain departments at a number of the larger hospitals in Nepal.

6.5 Health Care Waste disposal: All health care risk waste should be treated – even if only a "low tech" incinerator is available. Through a carefully managed incineration process good results with regard to disinfection can be achieved. However, if treatment is not possible the health care risk waste should be buried in a dumpsite. Treated waste also require disposal, and here the burial pit can also be used. Rain will generate leachate from the burial that can harm ground water resources. Therefore the pit should preferably be located near a river so that the leachate may flow towards the river instead of the groundwater.

6.6 Other logistics needs for Health Care Waste Management: There are different ways for physical location of the treatment facilities as well as the necessary logistics to ensure the most efficient use of treatment capacity. In consideration of the present existence of larger hospitals there obviously are concentrations of hospitals beds and thereby health care risk waste in the Kathmandu (including Lalitpur and Bakhtabur), Pokhara, Chitwan and in some Southern part of the country, along the main highway. Especially in the first three cities there seem to be obvious reason for proposing central mutual treatment facilities where a number of health care facilities e a potential to share the costs of one treatment facility. In principle there are two alternative ways of establishing mutual treatment plant, either:

A **mobile treatment plant** that are moved around to health care facilities for treatment of the waste at their location, or
A **central treatment plant** where the waste from the health care facilities are brought for treatment.

The advantage of the mobile plant (if it is an incinerator) is that pollution from it will be spread over a larger area compared to similar stationary plant, thereby creating fewer nuisances to neighbours. The disadvantages are that they will be more expensive, both in terms of investment and running costs.

However the first time investment will be larger, because the plant need to be more compact, and a truck is needed for transporting the plant. The running costs are higher, because the maintenance of the mobile plants and the truck. Furthermore, more fuel will be needed for transporting of a heavy plant and a truck than a small pickup that will be needed for a stationary plant. In addition to this small pickups will be able to reach more health care facilities than a large truck in areas where the access roads are not so well paved. The disadvantage of the stationary plant is that is will load the same area with its emission all the time. Therefore, it is very important to assess the physical location of the stationary incinerator plants. Preferably, the should be located sufficiently far away from residential areas, the health care facilities and field producing human food.

As stationary plants most likely represent more cost-effective solutions the following calculations will be based on such technology. However, when detailed feasibility studies are

conducted for supplying treatment capacity to the densely populated areas in Nepal the mobile solutions should still be taken into consideration. Similarly, other treatment technologies than incineration should be taken into consideration.

Supply and distribution of equipment and materials: Another logistic question that should be taken into consideration is the distribution of equipment for all the health care facilities. It may be appropriate to develop a supply and distribution network with Logistic Management Division within the Ministry of Health as a focal point for such a network.

6.7. Cost estimate for Health Care Waste Management: Cost Calculations: For the purpose of the cost calculation the cost assumption shown in table 8 and 9 are applied for the three models described in the earlier section of the report. Table 10-12 indicates cost estimates for each model 1 , 2 and 3.

Table 8: Cost assumptions for waste collection and transport.

Item	Unit price NRP	Remarks
Yellow plastic waste bucket with lid, small	300	Estimate, based on information from Dr. Sushil Koirala (30 litre w. lid: 190 NRS)
Yellow plastic waste bucket with lid, large	500	Estimate, based on information from S. Koirala (50 litre w. lid: 365 NRS)
Yellow plastic bag, normal thickness	1	Ref. Bir Hospital
Yellow plastic bag, heavy duty	3	Estimate
Red plastic bag, heavy duty, large (for pathologic waste)	7	Ref. Bir Hospital
Yellow sharps box, metal, improved model, small size	300	Estimate, based on information from Bir Hospital
Yellow sharps box, metal, improved model, large size	500	Estimate, based on information from Bir Hospital
Trolley for internal transport	5 000	Estimate based on information from supplier
Intermediate storage rooms	20 000	Estimate. Redesign of existing room at hospital
Central storage room	50 000	Estimate. Brick house with metal roof. Placed on concrete foundation.
Car for external waste transportation	600 000	Chinese pickup (550 000 NRS), modified (estimate 50 000 NPS)
Petrol, per litre	56	Current price, March 2003: 18.5 NRS/l

Table 9: Cost assumptions for waste treatment.

Item	Unit price NRS	Remarks
Sharps destructor, Indian made	7 500	Estimated life: 5 years
"Low tech" charcoal/kerosene burner, small bin	100	Estimated life: 2 years Shelter + fence
"Low tech" charcoal/kerosene burner, large bin	300	Estimated life: 3 years Shelter + fence
Brick incinerator	55 000	Estimated life: 10 years Maintenance: 10% pa. Shelter + fence (brick works i.c. labour 40 NRS/m^3)
Medium tech incinerator, Indian made	2.5 million	Information: Kathmandu municipality Estimated life: 10 years. Maintenance: 10% pa. Building + fence
Medium tech incinerator with particle sampler, Japanese made	25 million	Estimated life: 15 years. Maintenance: 10% pa. Building + fence
Charcoal, per kg	20	Current price, March 2003: 400 NRS/20-25 kg
Kerosene, per litre	26	Current price, MS/l
Diesel oil, per litre	45	Current price, March 2003: 26.5 NRS/l
Wastewater treatment plant	200 000	Estimate, based on PAM Project– one third of total cost for total waste management system at HCF.

Furthermore, it is assumed that the capital cost and the maintenance make up 10% of the investments per year.

Table 10: Cost calculation Model 1, in NRS

Item	Unit price NRS	Equip-ment per small HCF w. beds	Equip-ment per small HCF, with no beds	Equip-ment per medium HCF	Materials per small HCF per year	Materials per small HCF, no beds	Materials per medium HCF per year
Waste bucket, small	300	3	1	5			
Waste bucket, large	500			3			
Plastic bag, normal	1				1095	52	2555
Plastic bag, heavy duty	3				104		364
Red plastic bag	7						104
Sharps box, small	300	2	1	5			
Sharps box, large	500			2			
Trolley, internal transport	5 000			1			
Intermediate storage	20, 000			3			
Central storage room	50, 000			1			
Car, external transport	600, 000						
Petrol, per litre	56						
Sharps destructor	7 500						
"Low tech" burner, small	100		1				
"Low tech" burner, large	300	1					
Brick incinerator	55, 000			1			
Medium incinerator	2.5 m.						
Medium/adv. incinerator	25 m						
Charcoal, per kg	20				1095	520	
Kerosene, per litre	26						1825
Diesel oil, per litre	45						
Wastewater treatment plant	200, 000			1			
Average invest per HCF		**1 800**		**375 500**			
Annual running costs					**23 307**	**1 092**	**51 825**
Capital cost, 10%					**180**	**100**	**37 550**
Annual cost per HCF					**11 487**	**1 192**	**89 375**
Annual cost all HCF					**2 442 648**	**17 880 000**	**1 072 500**
Total annual cost, Model 1	**21, 395 148**						

Table 11: Cost calculation Model 2, in NRS

Item	Unit price NRS	Equip-ment per small HCF	Equip-ment per medium HCF	Equipment per large HCF	Materials per small HCF per year	Materials per medium HCF per year	Materials per large HCF per year
Waste bucket, small	300	3	5	20			
Waste bucket, large	500		3	12			
Plastic bag, normal	1				1095	2555	11680
Plastic bag, heavy duty	3				104	364	1352
Red plastic bag	7					104	416
Sharps box, small	300	2	5	20			
Sharps box, large	500		2	6			
Trolley, internal transport	5 000		1	4			
Intermediate storage	20, 000		3	12			
Central storage room	50, 000		1	1			
Car, external transport	600, 000			0,5			
Petrol, per litre	56						72000
Sharps destructor	7 500						
"Low tech" burner, large	300	1					
Brick incinerator	55, 000						
Medium incinerator	2.5 m.			1			
Medium/adv. incinerator	25 m.						
Charcoal, per kg	20				1095		
Kerosene, per litre	26					1825	
Diesel oil, per litre	45						3650
Wastewater treatment plant	200, 000		1	1			
Average invest per HCF		**1 800**	**320 500**	**3 331 000**			
Annual running costs					**23 307**	**4 740**	**283 698**
Capital cost, 10%					**180**	**32 050**	**333 100**
Annual cost per HCF					**23 487**	**36 790**	**616 798**
Annual cost all HCF					**1 738 038**	**588 640**	**8 081 374**
Total annual cost, Model 2	**10, 345, 052**						

Table 12: Cost calculation Model 3, in NRS

Item	Unit price NRS	Equip-ment per small HCF	Equipment per medium HCF	Equipment per large HCF	Materials per small HCF per year	Materials per medium HCF per year	Materials per large HCF per year
Waste bucket, small	300	3	6	24			
Waste bucket, large	500		4	16			
Plastic bag, normal	1				1095	2955	11680
Plastic bag, heavy duty	3				104	364	1352
Red plastic bag	7					104	416
Sharps box, small	300	2	6	24			
Sharps box, large	500		3	12			
Trolley, internal transport	5 000		2	8			
Intermediate storage	20, 000		4	16			
Central storage room	50, 000		1	1			
Car, external transport	600, 000			0,2			
Petrol, per litre	56						3650
Sharps destructor	7 500						
"Low tech" burner, large	300	1					
Brick incinerator	55, 000						
Medium incinerator	2.5 m.		1				
Medium/adv. incinerator	25 m.			0,2			
Charcoal, per kg	20				1095		
Kerosene, per litre	26						
Diesel oil, per litre	45					3650	3650
Wastewater treatment plant	200, 000		1	1			
Average invest per HCF		**1 800**	**2 847 100**	**5 758 400**			
Annual running costs					**23 307**	**8 390**	**387 298**
Capital cost, 10%					**180**	**284 710**	**575 840**
Annual cost per HCF					**23 487**	**293 100**	**963 138**
Annual cost all HCF					**1 174 350**	**879 300**	**15 410 208**
Total annual cost, Model 3	**17, 463, 858**						

The total annual costs of implementing all three models, covering all health care facilities in Nepal is summarised in table 7.6 below.

Table 13: Total annual cost, all models, Nepal

	NRS	Kg HCRW /year	Average cost per kg, NRS/kg
Total annual cost, NRP, Model 1	**21 395 148**	**234 512**	**91**
Total annual cost, NRP, Model 2	**10 345 052**	**632 180**	**16**
Total annual cost, NRP, Model 3	**17 463 858**	**1 169 643**	**15**
Total annual cost, NRP, all models	**49 204 058**	**2 036 335**	**24**

As it appears there are some variations in the cost of implementing the various models. In particular, the cost per kg is much higher for Model 1 than for the two other models. The high price of implementing Model 1 is due to the fact that it is relatively costly to supply with a minimum of equipment to the many small health care facilities in remote areas so that they are able to handle the waste individually, than for larger health care facilities in densely populated areas, where they can work together on transport and treatment. As it, furthermore, appear from the table the average cost per kg in the two other models are at the same level, although Model 3 is supplied with relative costly treatment facilities. This is due to large quantity of waste that is handled in that model. Compared to the annual public health expenditures on NRS 5-6 billion, the cost of this strategy for improved health care waste management will make up about 1% of the public health budget. If the three models are found costly, the incinerators in Model 3 can be replaced by other less environmentally friendly incinerators.

7.Action Plans: The Strategy includes three action plans that cover the following periods:

- Short term: 2004/05 - Phase one
- Medium term: 2005/09 - Phase two
- Long term: 2009/17 - Phase three

7.1 Phase one for the period of 2004/05: One of the most cost-effective ways to improve the health care waste management is to training and inform those staff members that will be directly involved in the waste management (professional and para-professional medical staff, technicians and sweepers). However before starting training there is a need to develop detailed and clear guidelines and to translate them into at least Nepali. Furthermore, there is a need to prepare information material for the different staff groups. The efforts need to be coordinated in a forum,

where all stakeholders are represented, why this will be first step to accomplish. The coordinating body should as some of its first activities ensure that a training program is established and that the complicated technical matters like the choice of treatment technology is addressed, e.g. through feasibility studies, so that sufficient treatment capacity can be established as soon as possible. Parallel with these activities it is important that the Ministry of Population & Environment and the Ministry of local development is preparing the legal basis for environmental requirements for treatment plants and for establishing land fill sites. Furthermore, a monitoring program should be established and started in order to monitor the development of the action plans right from the beginning.

7.2 Phase two for the period of 2005/09: The training activities at the health care facilities can be started within the second phase. However, it must be expected that it will take some years to for the training program to be implemented in its full. It is furthermore important that the collection equipment is installed at the same time as training takes place, so this will also be started up in this phase. Although treatment capacity is urgently needed, it is not realistic, neither from a technical nor a financial point of view, to expect installation of central treatment plants to start before 2005, the second phase. Furthermore, the installation of treatment facilities will have to await clarification from the Ministry of Population & Environment. It must be expected that it will take at least three years before there is a reasonable coverage of treatment capacity.

7.3 Phase three two for the period of 2009/17: In case the new health care waste management systems are fully implemented in the previous phases the activities of this phase will include refreshing training and monitoring, as well as plans for developing and improving the health care waste management to higher standards.

Table 14 below indicates the major activities that need to be carried out during the action plan period.

Table 14 below indicates the major activities that need to be carried out during the action plan period

Table 14: Major activities within the Action Plans

Phases	**Phase 1**		**Phase 2**			**Phase 3**				
Years	**2004**	**2005**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012 -2017**
Ministry of Health										
Establish Coordinating Committee										
Prepare detailed guidelines										
Prepare training and inf. materials										
Prepare training program										
Feasibility study on treatment										
Procure equipment										
Distribute equipment										
Prepare Plans for following years										
Health Care Facilities										
Conduct training courses										
Install equipment										
Install central incinerators										
Others										
MOPE: Environmental standards										
Municipalities provide landfills										
Monitoring										
Overall strategies & plans										
Second Long Term Health Plan										
Nepal Health Sector Program Implementation Plan Period										

8. Monitoring of Health Care Waste Management Actions:

It is important to include means to monitor the implementation of the HCWM and to monitor the achievements, which hopefully will result in improved health care waste management, which should lead to:

- Reduced impact on the environment
- Improved occupational health and safety
- Improved public health.

Firstly, a number of milestone and indicators should be established so that there is a common agreement on how improvements should be determined. Milestones can be the various activities within the Action Plans, and a success criteria can be the timely and successfully implementation of an activity. Indicators can be physical as well as non-physical parameters that can be measured.
Survey of the present state can be based by this assessment but it needs to be carried out by the level of each health facility. The next element of the Monitoring Program can be regular/periodical audits where independent parties are investigating which milestones that have been reach and measured the various indicators. A list of indicators as suggested below should be determined. For each audit the present state - determined by the indicators – is compared with previous states the comparison will show that improvements are achieved. The lists of indicators that can be used to determine the progress of the different activities to improve the health care waste management are divided as indicators for:

- West management
- Occupational health and safety
- Environmental impact
- Cost of waste management.

Indicators for Waste management:

Quantity of waste: divided on various fractions (HCGW and HCRW). The quantity of waste is an important parameter in health care waste management. However, it is important that the weight of the various fractions – HCRW and HCGW – are measured and compared. An improved waste segregation should result in IS to determine if it contains infectious materials.
Visual inspection of domestic waste fraction to determine if it contains infectious materials: It is important to combine this with visual investigation of the HCGW to ensure that the staff is not so eager to reduce the quantities of HCRW that they drop infectious materials in the HCGW fraction.

Consumption of equipment and materials (e.g. waste collection bags) to determine the state of the health care waste management system is to measure the number of waste collection equipment distributed at the health care facility and e.g. the number waste collection bags used. But although it is a sensible indicator a high use of waste collection bags not necessarily leads to

a more efficient waste collection; it may just as well indicate "wasteful" use of waste collection bags. However, in the beginning where the use of waste

Indicators for occupational health and safety:

Number of needle prick injuries: The number of needle prick injuries indicates how well informed staff is in handling used needles. It also indicates how well the health care facility is supplied with appropriately designed equipment to handle the sharps, e.g. sharps containers

Number of staff trained in proper waste management: Another indicator is the number of staff trained in proper waste segregation.

Indicators to measure environmental impact: MOH can get this information from RONAST which can play a central role in establishing the environmental monitoring program.

Emission parameters from incinerators (particulate matter/dust, HCl, SO_2, NO_x, Pb, Cd and Hg)
Parameters for quality of the incineration process (organic matter in ashes)
Selected parameters in the wastewater (infectious micro organisms).

Indicators for economic use: It is a measure to increase the awareness and to ensure the most cost-effective ways of health care waste management is to keep an eye to the annual expenditures for this service. This could be done through registration of the annual cost for healthcare waste management at the different health care facilities.

Annual allocation and expenditure of Health Care Waste Management by level of health facilities.

Annex 1

List of Reference

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IX. "Hospital Waste Management – A Case Study in Kathmandu, Patan, Bharatpur and Pokhara", prepared by Chanda Rana, project director and Madan Mala, project advisor, Save the Environment Foundation.

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XI. "Nepal Health Sector Strategy – An Agenda for Change", The World Bank, June 2002.

XII. "Nepal: Public and Private Partnership in Health sector" National Workshop on "Private Investment in Health sector: Opportunities and Challenges", October 14-15, 2001, by Tirtha Rana, The World Bank.

XIII. "Hospital waste Management – Situation analysis and concept for improvement with sustainable HC design set" Jayendra Bhatta and Karl Mock, HSSP/Physical Assets Management Project/GTZ, 2002.

XIV. "Guidelines on Safe Management of Health Care Waste", Egyptian Environmental Affairs Agency/ Ministry of Health and Population/ DANIDA/ RAMBOLL, Cairo 2000.

Annex 2:

Health Care Waste Management – Draft Report Discussion Workshop Report

Date	:	March 5, 2003
Venue	:	National Health Training Centre/Department of Health Services, Teku, Kathmandu, Nepal
Participants	:	As per the attendance logbook attached

Brief summary of the proceedings:

1. After the Chairperson, Dr. Sarla Malla, Acting Director General (Actg. DG)/ Department of Health Services (DOHS) called the Workshop to order, Mrs. Guna Laxmi Sharma, Acting Director, Logistic Management Division (LMD)/DOHS welcomed all the participants and wished the Workshop success.

2. Dr. Tirtha Rana, Senior Health Specialist of The World Bank (Country Office in Nepal) and the official responsible for the current study on "Health Care Waste Management in Nepal", followed with a presentation on the study's purpose and objectives for the wider benefit of the workshop participants.

The objectives were defined as: a) to prepare a comprehensive report detailing an assessment of the current status of Health Care Waste disposal and related environmental aspects, and b) to make recommendations for putting in place effective policy/strategy/institutional framework and waste management system.

3. Next presentation was made by Dr. Sushil Koirala, Executive Director, National Dental Hospital (NDH), Kathmandu, who spoke on the current experience for implementing Health Care Waste Management in Nepal. He described the actual situation and elaborated on the efforts being taken by different institutions at present based on the NDH-carried out survey on 'Medical Waste Management in Kathmandu Valley' covering a number of Health Care Institutions (HCI) run by the government, private parties and the NGOs. A brief summary is as follows:

- Hospital waste is mixed with household waste in municipal containers and the health hazard that such practice could cause is not appreciated neither by the health institutions nor by the Municipality nor by the general public,
- The situation (with the mixing of hospital waste with household waste) is worse especially in areas where the hospitals or the private nursing homes are located,
- A large majority of the HCIs admit that they have no disposal system and use the municipality containers for the purpose. In some cases the incineration facilities had to be closed down due to strong public protest,
- Most HCIs are willing to bear extra cost for safe disposal of their waste,

- The legal and regulatory frameworks either do not exist or are not known to the majority of the HCI officials, and
- Some private HCIs have, on their own, taken initiative to install a disposal system and also to train their staff on handling the hospital waste.

4. Next, Mr. Niels J. Busch, the consultant made an elaborate presentation on 'how to improve Health Care Waste (HCW) Management in Nepal – different options and cost implications' based on the present study that he has carried out. He focused his presentation along the following outline: present state-findings, basic data, vision of strategy, policies, technical options, model descriptions, cost calculation and action plan.

Summary of Comments/Discussions:

5.

- Each country has its specificity in dealing with domestic and other waste. To ensure that the options proposed in the report for waste disposal and management are more acceptable, the cultural dimensions need to be very carefully weighed and considered.
- The proposal to develop financial mechanisms according to the 'polluter-pay-principle' is a great idea but it may not work. The HCIs and the general public have been used to the provision of free services for the waste disposal by the public or municipal authorities, whereas the suggested principle implies that the waste disposal and treatment become the responsibility of the HCIs themselves.
- In the above context, the public relation to waste management through contracting to private parties may become a better alternative. Each HCI will pay for the waste generated and the Ministry of Health (or a relevant government authority) shall have the responsibility for the monitoring and supervision of the disposal and treatment.
- As regards to the suggestion on technology option the feasibility of using mobile incinerators need to be seriously considered. The advantage of this option is that not all HCIs need to install (rather expensive) incinerators and the general public living close to the HCIs may have less objection to incineration since it will be only once in a while operation.
- On the different models presented it may be desirable to separate HCIs in small towns and at local community level.

6. Mr. Salil Devkota, Director, Scientific Centre for Environmental Consulting, raised some questions about the source of data presented in the study, whether any field visit outside of Kathmandu valley was undertaken and how the cost calculations were made. The average cost calculated at NRs. 19/kg of the health care risk waste (HCRW) is quite high. A private contractor operating in Biratnagar (major town outside of Kathmandu valley) is offering its services for NRs. 8/kg and there are no takers.

It was admitted that the study has been concentrated only in Kathmandu valley and the data used are from the survey carried out by ENPHO (Environment and Public Health Organization, a Kathmandu-based NGO) in Kathmandu valley. The annual quantity of waste generated has been arrived at by using the earlier figures of the waste generated at 0.1 kg/bed/day (based on the results of an earlier study carried out by NDH in 11 HCIs) and

considering also the increase in number of HCIs in major cities like Kathmandu and Pokhara. The figures on the quantity of waste are realistic since quite often it is difficult to separate between domestic waste and HCRW. The cost at NRs. 19/kg may also seem high because it includes the investment cost (eg. collection cost and cost of equipment).

It was further suggested that while calculating the costs it may be desirable to use the willingness to pay criteria. This may be appropriate because most HCIs have expressed their willingness to pay but are not clear on how much they would like to pay.

7. Mr. Amir Khati from DPHO Kathmandu drew the attention to the fact that the cost for HCW management in most government HCIs is higher than the budget available for the health care services that they are supposed to deliver. In such a situation who is to support the HCIs towards these costs? The situation in privately-run HCIs could be quite different because they are in a better situation to absorb the costs for the HCW management. Moreover, it is also important to make cost calculations for each type of treatment required for different kinds of waste.

The point raised was acknowledged as a valid one but the proposed 'polluter-pay-principle' was reiterated as a possible way out. It was also brought to the notice that the earlier survey carried out by NDH, Kathmandu has concluded that there is no need for a separate budget for HCW management: an additional 2.3% of the total health care budget is sufficient to deal with it. What seems to be more important is the change in the attitude of health personnel working in HCIs. NDH, Kathmandu and other privately-run HCIs are already working towards it.

8. Dr. Shrestha from Om Hospital (a privately-run HCI) enquired whether the study has looked into the question of liquid waste and whether some simple cost-effective solutions could be suggested. Om Hospital has received a quote to the amount of NRs. 2 million for the installation of a total system there, which it finds to be rather costly.

The consultant confirmed that the wastewater aspect has not been looked into although it is a very important aspect in overall waste management.

Mr. Mingma from ENPHO informed that ENPHO has developed a so-called 'Narkat plant', which is used to treat waste water. Such plants are being installed at present in two HCIs (Dhulikhel Hospital and Sushma Koirala Memorial Trust hospital) and one private boarding school (Malpi School). He extended invitation to the participants to contact ENPHO for further information.

Mr. Mock from GTZ (German Technical Support Agency) also emphasized the need to tackle the problem of wastewater pollution since the untreated wastewater from laboratories is discharged directly into rivers and water bodies thus polluting the water supply sources.

Mr. Jayandra working for the Physical Asset Management (PAM) within the DOHS supported by GTZ informed the workshop participants about a simple low-cost (NRs. 0.6 million) plant developed for wastewater treatment under this project. This plant is to be installed on a trial basis at Dhading Hospital and based upon the results there a similar plant is proposed to be installed for the Public Health Laboratory within the DOHS premises.

9. Ms. Sudha from the Urban Development through Local Efforts (UDLE)/GTZ enquired a bout the execution part of the action plan proposed in the study.

It was reported that the Logistic Management Division (LMD)/MOH has been designated as the unit to take initiative to coordinate all the agencies to be represented in the proposed Coordinating Committee for HCW Management, since it has included the HWC management in their strategy.

Mr. Bista, who is the 'focal point' for the National Health Sector Program –Implementation Plan (NHSP-IP) in the MOH informed the participants that His Majesty's Government of Nepal (HMG/N) has started including costs for HCW management in overall costs for health care facilities right from the sub-health post level to central hospital level.

10. Ms. Agatha Pratt from UNICEF, Kathmandu stressed the importance and the need to share information as widely as possible since it seems much work has been done and is being done by different agencies on waste management. But she emphasized on the need to work towards ensuring behavioural changes through training to health care personnel at all levels.

11. Ms. Guna Laxmi Sharma from DOHS emphasized the need to get the message on proper HCW management down to the lowest, i.e. sweepers, level. To support her point she described a real life situation from the country's biggest and oldest hospital (Bir Hospital in Kathmandu). Nurses give injection to the patients, the used syringes are thrown to a bucket and so are the other waste into the same bucket, the sweepers collect the waste from the bucket and separate the used syringes, these syringes are cleaned and then sold to small time traders. What happens after that is not known but the situation is frightening.

She therefore felt that training programmes need to be imparted to health personnel at all levels focusing on raising awareness and the development of training materials which can be easily understood by the staff at the lowest level. She also felt that there need to be much wider representation in the proposed Coordinating Committee for HCWM.

The issue raised was recognized as a complicated issue, which is caused primarily by the lack of awareness. There is, therefore, a need to look into what happens beyond the HCIs on the matter of waste disposal. One way suggested to deal with it was to explain about the social costs to the people. In other words to explain in easy terms how the risk and hazard to the health of common people are increased if the waste is not properly disposed and treated.

12. Dr. Malla, Chairperson of the workshop, narrated her own experience in the Public Health Laboratory on the disposal of waste from there. To prevent the used syringes from being sold again, the needles are autoclaved and then stored in a plastic bags. Other waste are disinfected first and then stored in plastic bags. These waste are then given to a private contractor who is paid NRs. 1,000/month for its collection from the Laboratory. What happens afterwards to the disposed waste is not known. She did acknowledge however that budget for waste disposal is a problem even though the amount involved is small: there is no separate code in the budget from which to spend.

She did expect the situation to improve in the Laboratory once GTZ constructs the treatment plant it has promised to build once the pilot plant in Dhading Hospital proves to be working.

13. Dr. Malla, closing the workshop, made her remarks that:

* The study report will be seriously considered by HMG/N,
* Recommendations on the low-cost burners are appreciated, and
* The MOH will take the initiative to implement the proposed action plan.

Annex: 3

Health Care Waste Minimization - Examples of Green Procurement, Waste Reduction, Reuse and Recycling Activities

(Some of the following examples may be commonly applied in Nepal)

Green procurement (purchasing practices)

- Substitute heavy metals containing product (e.g. substitute mercury thermometers with electronic thermometer where appropriate, substitute heavy metal containing metal products, equipment and batteries (lead, cadmium, chromium and mercury));
- Substitute PVC containing products if the treatment method is incineration. PVC may only be used, where it cannot reasonably be substituted by other plastic materials for medical or technical reasons. Look for products made of other materials with same characteristics, e.g. plastic bags, containers or similar items that is made of Polypropylene (PP), Polyethylene (PE), or any other plastic material that can be demonstrated to produce minimum emissions if incinerated;
- Products with only the minimum required amount of packaging;
- Reusable products or products that are recyclable, whilst being non-infectious;
- Plastic, paper, cardboard or other materials that do not contain dyes or coloring agents that contain heavy metals, chlorinated or other halogenated compounds, and shall be of such a nature that minimum pollution is caused when incinerated or disposed of;
- Disposable receptacles that are designed with a view to minimizing the wastage of materials without compromising on the strength of the containers, thus avoiding excessive disposal of paper, cardboard, plastic, metal etc.
- Purchase materials and products with recycled content, where appropriate (e.g. office paper, envelopes, toilet tissue, paper towels) and look for Environmental Labels. Work with purchasing committees to determine which products may be suitable.
- Work with suppliers to have oversized packaging materials minimised, and in general returned or recycled.
- Work with suppliers to have packaging materials returned or recycled.
- Use building construction products with recycled content materials (e.g. drywall, asphalt).
- Use environmentally responsible vehicles and maintenance products (e.g. propane as fuels, refined oils, retreated tires, recycled antifreeze)
- Purchase durable equipment, furnishings and supplies.
- Use energy-saving devices (refrigerators, air conditioning, pumps, etc.

Waste reduction

- Use two-sided photocopying.
- Use electronic mail (i.e. personal computers or phone messages, where available).
- Buy in bulk (e.g. food and drink containers in the cafeteria and soaps and detergents in housekeeping).
- Avoid products with excess packaging and work with suppliers to reduce it.
- Reroute publications such as magazines, newspapers and journals.
- Circulate memos or documents.

- Use bulletin boards for posting announcements.
- Single space texts.
- Use two-way envelopes for billing.
- Make sure staff understand how to use equipment to reduce wastage.
- Use the reduction feature on your copier to fit more than one paper per page.
- Use permanent tape dispensers, not disposable ones.
- Use refillable pens instead of disposable ones.
- Install energy efficient appliances (e.g. lighting, pumps, air conditioning, refrigerators, etc.).
- Consider central heating systems instead of electric heating, to save energy, pollution and money.
- Turn off lights and office equipment when not in use.
- Use incinerators that meet the newest emission standards and have and energy recovery system.
- Use computer fax software to send facsimiles without making hard copies.
- Use non-solvent liquid scintillation cocktails in laboratories.
- Use less hazardous radioactive materials where appropriate.
- Develop micro-testing procedures to reduce chemical usage.
- Make sure biomedical waste is properly segregated from general waste to reduce disposal costs and increase materials for recycling.
- Explore opportunities to reduce formalin usage in sample analysis by replacing with cold, physiological saline solutions where appropriate.
- Substitute formalin solutions with commercially available, less toxic cleaning solutions in dialysis machines.

Recycling

- Newspapers and telephone books (not contaminated) can be given to farmers or humane societies as bedding.
- Recycle used towels and rags to rag recyclers (after thorough cleaning).
- Use plain paper fax machines; these are recyclable and the messages will not fade.
- Recycle the following items in "blue box" programs, where available:
  - Saline bottles
  - glass bottles from juice bottles or baby formula,
  - juice and food material containers,
  - newspapers and
  - plastic containers (e.g. pop containers or other types where appropriate).
- Recycle cardboard with commercial recycler or through your supplier.
- Recycle pallets with commercial recycler or through you supplier.
- Include pickup of containers as part of the supplier's role in your contract.
- Work with suppliers to help them design workable packages that are recyclable.
- Pool local business together who recycle material and contract for the services of the same recycler to reduce pickup costs.
- When purchasing products, ensure that all packages can be returned to supplier or recycled at your facility.
- Use a distribution network to recycle materials back to a central location for better material marketing.
- Explore waste recycling options for food waste either as:
  - animal feed either directly or through a commercial processor and as
  - composting or vermiculture and use compost at your facility in landscaping.
- Contract a shredding company that recycles your shredded paper.

- Involve ambulatory patients in waste minimisation programs (e.g. psychiatric and geriatric patients in composting projects).
- For large waste generators, explore processing equipment such as balers or compactors for recyclable materials.
- Locate markets for recyclable materials which are generated in sufficient quantities, such as:
  - office paper,
  - cardboard,
  - plastics,
  - solvents (xylenes, toluene, CFCs),
  - oils (vegetable and hydraulic) and
  - construction and demolition materials such as drywalls, asphalt, concrete, wood.
- Install silver recovery units for photo processing wastewaters.
- Evaluate opportunities for anaesthetic gas recycling.

Reuse

- Donate used publications to doctors' offices, nursing homes or the local library.
- Reuse worn cloth diapers and towels as rags.
- Reuse scrap paper for notepads and draft copies.
- Reuse old envelopes by applying labels (with non-solvent glues) on top of old addresses.
- Use reusable diapers, incontinence and underpants where appropriate.
- Use reusable urine trays.
- Use reusable drapes and gowns where appropriate.

Annex 4:

Terms of Reference

Assessment of Nepal Health Care Waste Management

1. Terms of Reference

Background: His Majesty's Government of Nepal (HMGN), through the Ministry of Health (MOH), has decided to prepare a five-year health sector program. In the past, the MOH has not taken sufficient account of the environmental aspects in its projects. There is a large hospital sub-sector in the public and private sectors but the health care waste disposal is not satisfactory and is potentially hazardous to the health of communities living around the waste disposal sites. The country needs to develop a national policy on health care waste management as well as an integrated health care waste management system. These issues need to be discussed with the HMGN at length, but very little concrete and well-documented information is available on the subject. The issue is becoming critical in view of the fast increasing HIV/AIDS incidence among certain groups, calling for increased attention to blood safety, disposal of needles and syringes, and medical waste management. MOH's decision to prepare the Nepal Health Sector Program - Implementation Plan presents an important opportunity to focus stakeholders' dialogue on environmental aspects of that program. To use this opportunity effectively, it is proposed to conduct an environment assessment of the health sector, particularly of the health care l waste management. A short-term international consultant will be recruited for four weeks. She/he will undertake an assessment of the health care waste management in Nepal and related environmental aspects, identify weaknesses in the system, and recommend actions to put in place an effective medical waste management policy and system.

Scope of Work: The consultant will review the current health care waste management including current policy, strategy and waste disposal systems. This will also include a review of the National Environment Policy of the Ministry of Population and Environment and the MOH's under-preparation medical waste disposal policy. She/he will make field visits focusing on disposal of health care waste products, sharps (needles, syringes etc.), and other waste. The output from this part of the work will be comprehensive information on and an analysis of the current system. The consultant will then make recommendations on an effective policy, legislation, strategy and system for medical waste disposal for Nepal.

Deliverable: The consultant will deliver a comprehensive report detailing an assessment of the current status of health care waste disposal and related environmental aspects and recommendations for putting in place effective policy/strategy/institutional framework and waste management system.

2. Specific Tasks:

The consultant will perform the following specific tasks to feed into the overall task:

(i) Assess Policy and Legal Framework for health care Waste Management in Nepal

Identify and assess policy and legislation for health care waste management, in particular the national environment policy of the Ministry of Population and Environment and the Environment

Act of 1998 of HMGN, reviewing definitions and standards, and comparing these with international standards;

(ii) Assess health care Waste Management

a. ***Review current practices for management of blood, blood products, sharps and other waste at hospitals:***

This should include:

1. Geographical distribution of hospitals (locations by center, region and district, with identification on a map);
2. Quantitative assessment of health care waste products, sharps and other medical waste that results from hospitals at different levels (total quantities, and estimation of waste types);
3. Waste segregation practices within hospitals (are sharps, needles, hazardous wastes, radioactive waste, infectious wastes, blood, and domestic waste segregated?), are color coordinated separate containers used ?;
4. Waste handling (waste storage and transfer) practices, need for colored containers, secure spaces, loading systems; and
5. Transportation methods, treatment and disposal practices within and outside hospitals of blood, blood products, sharps and other medical waste.
6. Pollution prevention at hospitals and plans, if any, to reduce health care wastes, especially those that are hazardous; and actions, if any, to replace hazardous with less hazardous materials such as replacing mercury based products with digital and electronic technology;
7. Assessment of awareness of waste related hazards among all levels of hospital and clinical staff; waste management practices and techniques, discipline in waste handling, and related training at different levels.

b. ***Assess risks associated with the current waste management practices:***

This should include:

1. Risks within health care facilities (to health workers) during handling, transfer, storage and treatment, especially of blood and sharps;
2. Risks outside health care facilities during transportation as well as during treatment and disposal, especially to municipal workers and scavengers; and
3. Risks to general public, for example, from incineration air emissions, or from water discharge.

(iii) Assess Monitoring Framework for Medical Waste Management

- Identify and assess capacity of regulatory institutions (at the central, regional and district levels) for medical waste;
- Identify and assess of NGO or civil society organizations that may participate in medical waste monitoring.

(iv) Recommendations:

Based on the above analysis, the consultant will frame recommendations for improvement in health care waste management across the board from policy to implementation; these will include recommendations on:

i) The policy/strategy framework;

ii) The legal framework including specifying areas where strengthening of the legal framework is necessary for effective health waste management.

iii) The institutional framework including needs identification, areas that need strengthening, and training for regulatory personnel at different levels of health facilities, management, health workers, and NGOs, if any, engaged in this activity.

Duration: The task will require a consultant for 4 weeks. The final report will need to be delivered within 10 weeks of the start of the assessment.