

**Follow-up Study on Adoption of National Health Care Waste  
Management Guidelines at Health Care Institution at Kathmandu**

**Final Report**

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Mr. Kapur Poudel  
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## Executive Summary

Nepal Health Research Council (NHRC) with support of World Health Organization (WHO) has developed a “National Health Care Waste Management Guideline” in 2002, and circulated it in different Health Care Institutions. It has classified health care waste as waste that poses risk due to its contents of infectious materials and other hazardous substances compared to other kinds of waste. The guideline aims to develop effective health care waste management system in health care institutions and to expertise medical professionals in the health care waste management in Nepal and explains about different procedures for managing, handling and disposing of the health care waste generated in different health care institutions.

With the objective to monitor and evaluate Health care waste management practices, to recommend specific needs/modifications, and follow-up report on adoption of National Health Care Waste Management Guidelines at health care institution this study was conducted on five different health care institutions at Kathmandu.

The study respondents comprised of the health care waste management personnel (waste handlers, sweepers, and waste transporters), house keeping in-charge, matron, attending nurse at wards, medical director, and other experts who have been involved in the health care waste management in selected hospitals. It also focused on the different organization that take part on health care waste management such as Kathmandu Municipality City (KMC), Nepal Health Research Council (NHRC), Ministry of Local Development (MLD), Solid Waste Management and Resource Mobilization Centre (SWMRMC), World Health Organization (WHO), Ministry of Health and Population (MoHP), Department of Health Services (DHS).

Health-care waste (HCW) also called, as clinical waste is a reservoir of potentially harmful microorganisms, which can infect hospital patients, health-care workers and the general public. It comprises of 10 - 25 per cent of total Health Care Waste generated. Health care waste is considered hazardous as it contains items such as sharp objects (needles, razors, scalpels), pathological waste (disease causing waste), other potentially infectious waste, pharmaceutical waste, biological waste, and hazardous chemical waste where as the remaining of 75-90 percent of healthcare waste is classified as non-clinical or general waste, and contains items such as kitchen and office waste. Even though knowing such fact, improper handling of health care waste contaminates both infectious and non-infectious waste. Even though a variety of technologies have been developed for the storage, collection, treatment and disposal of health-care wastes, most of infectious medical wastes are disposed and treated haphazardly along with general waste in Kathmandu. Thus, healthcare workers, patients, waste handlers, waste pickers, and general public are exposed to health risks from infectious wastes (particularly sharps), chemicals and other special health care wastes. This in turn resulted in high risk factor to patients, health care workers and general public.

On monitoring and evaluation, Patan hospital and TUTH set a good example on waste minimization, Segregation, Labeling, Color Coding, Storage, Treatments and Disposal Practices among surveyed hospitals. Though each hospital has assigned colour-coding system for different types of waste, it has not been strictly practiced and lacks uniformity. Training in form of practical rather than verbal has led to decrease in overall rate of infection in all the cases. Illiteracy of the patients as well as visitors was found to be a profound factor, which has created difficulty in generating awareness among the visitors.

Improper disposal of health care waste has led to an increase in higher health risk to the public. To minimize such risks, infectious and hazardous waste produced should strictly be treated by hospitals themselves before final disposal to municipal containers. But due to lack of strong guidelines and policies, such process has not been practiced. Thus, the need of a central incinerator was felt which could eliminate such problems since the health care facilities are willing to pay for it. This opportunity can easily be utilized by the concerned authority and can launch the programme for proper disposal of health care waste efficiently. But the incinerator to be built should be of environmental standards for air emissions and treatment efficiency should be established. In case of unavailability of such incinerators, use of autoclave and microwave can be an alternative method. The method is cheaper, safer and simple which can become a good practice for smaller nursing homes and clinics. Use of special type of closed transportation devices can significantly reduce hazard to the public.

Municipality responsible for management of the health care waste is treating all types of health care waste as municipal waste and finally disposes it by land filling. Hospital also is equally responsible for mixing of infectious with general waste in municipal containers in few of the surveyed hospitals. Need of an alternate organization or authority was felt with active participation between different concerned government bodies in collaborative health care waste management, which could categorize health waste, segregate and dispose properly. Also it can be suggested that the same organization be involved in providing the containers for each waste to each health care institutions. Legislation concerning wastewater treatment and land filling was also lacking.

At present, Nepal has no rigorous laws or regulation, which is enforced in the field of health care waste. It was discovered that improved HCWM systems have only recently been introduced in a small number of health care institutions and private hospitals since the circulation of the guidelines. The study indicates that there is a need to improve the handling and disposal methods of hospital waste for almost all the available medical facilities along with final treatment. Public awareness through mass media, proper hygiene education to the scavengers, mandatory staff education in waste segregation, and legislation to regulate hospital waste management systems will change the traditional habits of different groups of people involved in this sector. Development of specific standards would bring out clarity and encourage private sector to engage in HCWM services. Addressing the shortcomings obtained from monitoring committee regarding health care waste was a key factor lacking which can be easily solved.

In conclusion, need of the institutional framework is felt, including needs identification, areas that need strengthening, and training for regulatory personnel at different levels of hospital management, hospital staff, and NGOs, if any, engaged in this activity. That is to conclude finally, though the hospitals in which the guideline is distributed has implemented the National Health Care Waste Management Guideline in some level, the level is not very satisfactory.

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### **List of abbreviation**

ADB	:	Asian Development Bank
AIDS	:	Acquired Immune Deficiency Syndrome
DHS	:	Department of Health Service
DWSS	:	Department of Waster Supply and Sewerage
EIA	:	Environmental Impact Assessment
EPA	:	Environmental Protection Act
EPC	:	Environmental Protection Council
ENPHO	:	Environmental and Publich Health Organization
GTZ	:	Technical Cooperation of Germany
HCF	:	Health Care Facility
HCI	:	Health Care Institution
HCW	:	Health Care Waste
HCWM	:	Health Care Waste Management
HIV	:	Human Immune Deficiency Virus
HMG	:	His Majesty of Government
IEE	:	Initial Environmental Examination
JUMA	:	Journal of Nepal Medical Association
KMC	:	Kathmandu Municipality City
KVMP	:	Kathmandu Valley Mapping Program
LMC	:	Lalitpur Sub Metropolitan City
MLD	:	Ministry of Local Devolvement
<b>MoEST</b>	:	<b>Ministry of Environment, Science and Technology</b>
MOHP	:	Ministry of Health and Population
MT	:	Metric Ton
NEPAP	:	Nepal Environmental Policy and Action Plan
NESS	:	Nepal Environmental and Scientific Studies
NDH	:	National Dental Hospital
NGO	:	Non-Government Organization

NHRC	:	Nepal Health Research Council
OHS	:	Occupational Health and Safety
PVC	:	Poly-VinylCarbonate
SWMRMC	:	Solid Waste management and Resource Mobilization Centre
TUTH	:	Tribhuvan University Teaching Hospital
UNICEF	:	United Nation International Children's Emergency Fund
WHO	:	World Health Organization

## **Chapter I**

### **Introduction**

#### **1.1 Introduction of the Study**

Nepal Health Research Council (NHRC) with support of World Health Organization (WHO) has developed a “National Health Care Waste Management Guideline” in 2002, and circulated it in different Health Care Institutions and has classified health care waste as waste that poses risk due to its contents of infectious materials and other hazardous substances compared to other kinds of waste. 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.

Realizing this need, NHRC has initially come up with "National Health Care Waste Management (HCWM) Guidelines" in May 2002 with support of WHO. The objective of this guideline is to develop effective health care waste management system in health care institutions and to expertise medical professionals in the health care waste management in Nepal. The guideline explains about different procedures for managing, handling and disposing of the health care waste generated in different health care institutions. So, realizing the problem, "National Health Care Waste Management Guidelines" were circulated to different hospital and a follow-up study was conducted in order to monitor and evaluate the implementation level of guideline for proper disposal of health care waste. So, a follow up study on Health care waste management guideline was realized, with initiation of NHRC and with support of WHO had started this work.

The work is being performed via use of different questionnaires; checklist and personal observation in selected health care institutions to the targeted population that already follow National HCWM guideline.

#### **1.2 Background of the Study**

Health-care waste (HCW) is a reservoir of potentially harmful microorganisms, which can infect hospital patients, health-care workers and the general public. Other potential infectious risks include the spread of, sometimes resistant, microorganisms from health-care establishments into the environment. These risks have so far been poorly investigated. Wastes and by-products can also cause injuries, for example radiation burns or sharps-inflicted injuries; poisoning and pollution, whether through the release of pharmaceutical products, in particular, antibiotics and cytotoxic drugs, through the waste water or by toxic elements or compounds such as mercury or dioxins.

The major sources of HCW are hospitals and other health-care establishments, laboratories and research centers, mortuary and autopsy centers, animal research and testing laboratories, blood banks and collection services, and nursing homes for the elderly.

Over the last decades, ever-increasing medical institutions and improper handling of medical wastes have posed a serious threat to the urban dwellers, especially in Kathmandu where the generation of medical wastes is very high. So far there is no separate mechanism for the treatment of medical waste. In reality, both the medical waste and general household waste are being finally treated together as municipal waste. The problem is exacerbating every day due to apathy of the concerned individuals and organizations.

Healthcare facilities have improved in Nepal over the last decade. The number of hospitals, private nursing homes, healthcare centers and health-posts has increased. Particularly in the urban

areas, many private nursing homes have been established. Although the healthcare institutions (HCI) provide healthcare services to the people, it generates solid waste, which is harmful to public health and environment due to its infectious and hazardous nature. Not only hospital or HCI but also healthcare at homes, mobile clinics, immunization centers, e t c... aids for HCW. Thus, produced healthcare wastes poses risks to public health and environment. Healthcare workers, patients, waste handlers, waste pickers, and general public are exposed to health risks from infectious wastes (particularly sharps), chemicals and other special health care wastes.

These wastes may increase environmental pollution and the spread of infectious diseases, including acquired immuno-deficiency syndrome (AIDS), hepatitis, tuberculosis, diphtheria, cholera, and many others. The concern is heightened by the newly emerging and re-emerging pathogens and for increased drug resistance among the re-emerging pathogens. Improper disposal of special healthcare waste, including dumping and uncontrolled burning, increase the risk of spreading infections and of exposure to toxic emissions from incomplete combustion.

A total of 75-90 percent of healthcare waste is classified as non-clinical or general waste, and contains items such as kitchen and office waste. This part of the waste presents no higher risk to the community than general municipal waste and is considered to be non-hazardous. The remaining 10 - 25 per cent is clinical waste, which could present a higher risk to the public, is consider hazardous as it contains items such as sharp objects (needles, razors, scalpels), pathological waste (disease causing waste), other potentially infectious waste, pharmaceutical waste, biological waste, and hazardous chemical waste.

A variety of technologies have been developed for the storage, collection, treatment and disposal of health-care wastes. Several types of treatment and disposal processes can be applied (incineration, micro waving, chemical treatment, melting etc.), with varying degrees of safety, cost and impact on the environment

Most of infectious medical wastes are disposed and treated haphazardly in Kathmandu. Some healthcare facilities dump their waste into the municipal containers, whereas some burn openly, or bury while other dispose along the riverbanks. Such mismanagement of infectious waste and irresponsibility of medical facilities can cause a major public and occupational health hazard, resulting in the spread of infectious disease like HIV/Aids and Hepatitis B.

Proper management of HCW can prevent cross infection and the spread of epidemics of infectious diseases. Unfortunately, this aspect is completely ignored in Kathmandu. In many cases, waste handling is left to lower-level workers who operate without any training, guidance, and supervision. Awareness and knowledge regarding the hazards of improper disposal of medical wastes is lacking at all levels.

### **1.3 Objectives of the Study**

1. To monitor and evaluate Health care waste management practices following National Health Care Waste Management (HCWM) Guidelines at Health Care Institutions.
2. To recommend specific needs/modifications that help to raise effectiveness in health care waste management works at Health Care institutions adopting national HCWM guidelines.
3. To recommend guidelines to strengthen the institutionalization of the process of national HCWM Guideline with Health Care Institutions.

### **1.4 Expected outcomes:**

1. Follow-up report on adoption of National Health Care Waste Management Guidelines at health care institution.
2. Workshop proceeding/report for sharing of information with different stakeholders and the public.

## **Chapter II**

### **Methodology**

This chapter gives the detail on the procedures of the study. Methodology comprises of a research design, rationale for the site selection, nature and source of data, sample size, techniques of data collection, data processing, analyzing and interpretation of the results. This study was conducted on different health care institutions at Kathmandu following waste management practices and the follow-up study on the level of adoption of NHRC health care waste management guideline at the selected institutions.

#### **2.1 Filed Study**

The information and knowledge of the health care waste was gathered from the literature review and overview of the existing health care waste management practices at the selected health care institutions (HCI) before visiting the selected hospitals. The secondary data was collected from the relevant literature, journals, and articles, published and unpublished reports. Listing out of the necessary data with intensive use of literature review was performed, and based on it the questionnaire, checklist was formed. Where as the primary data was generated from the filed interview, personal observation, and questionnaire and checklist survey.

#### **2.2 Units of Study Respondents**

The study respondents was comprised of the health care waste management personnel (waste handlers, sweepers, and waste transporters), house keeping in-charge, matron, attending nurse at wards, medical director, and other experts who have been involved in the health care waste management in selected hospitals.

#### **2.3 Sampling and Sample Size**

Five different hospitals that follow national HCWM guidelines were selected. The purpose of selecting those five hospitals was on the basis of them being into different category. The major difference that they fall into different category are as follows; Bir hospital being Government owned and managed, Om as private institution, Tribhuvan University Teaching Hospital (TUTH) as teaching hospital, Patan as being Missionary and Prasuti as maternity hospital to draw the major difference in health care management practices and processes. And also to illustrate the change and improvement that need to be followed. Apart from the five selected hospital the study was also focus on the different organization that take part on health care waste management such as Kathmandu Municipality City (KMC), Nepal Health Research Council (NHRC), Ministry of Local Development (MLD), Solid Waste Management and Resource Mobilization Center (SWMRMC), World Health Organization (WHO), Ministry of Health and Population (MoHP), Department of Health Services (DHS).

#### **2.4 Tools for Data Collection**

Both primary and secondary data was used and interpreted for this study. Primary Data was collected from study area and was collected from sample respondents, key informants, questionnaire, interviews and personal observations. The secondary data was collected from the literature review, journals, articles, published and unpublished reports etc. As regards to data collection method and techniques, semi-structured interview with target groups and personal

observations was used. Semi-structured interview would be prepared in such a way to elude information pertaining to the objective of the study. Personal observation helped us to get an understanding of the existing condition of the health care waste management, to triangulate and related information that was obtained through structure interviews. Semi structured questionnaire would mainly focus waste handlers and attending nurse at wards, house keeping in-charge, matron, medical director or hospitals management as shown in Annexes.

## **2.5 Method and Techniques for Data Analysis**

The collected data was processed and analyzed manually to draw a conclusion. Data was presented in tabular form and diagrammatic form as per necessary. There was different variables like collection, segregations, treatment and disposal of the medical waste and their relationship was analytically presented. All the primary data collected from questionnaires survey, information during field visits and interview with concern people was compiled and edited as separate tasks for final enumeration analysis. After analysis, these data was compared with base line information for discussion. Photographs were used to show existing condition of waste collection, segregation, treatment practices, as well as transportation and disposal system. Finally, the qualitative as well as quantitative analysis of data was conducted and the findings would be presented in a dissemination workshop.

## **2.6 Limitation of the Study**

Some institutions like private, government and other hospitals were not willing to respond to provide accurate required information regarding generation, handling, disposal and treatment system of medical waste. Even in some hospitals, they do not have the data of total waste generated per day.

Being a new concern very few information related to medical waste is available; hence it was very difficult to get data generated in different period of time. Concerned authority in concerned departments was not easily available during the study period.



## Chapter III

### Literature Review

Health care waste (HCW) includes all the waste that is infectious and non infectious in nature, generated by health care institution, research facilities and laboratories during diagnosis, treatment or immunization of human being or animals or in research activities. Health Care Waste poses risk due to its contents of infectious materials and other hazardous substances compared to other kinds of waste. 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.

HCW is a reservoir of potentially harmful microorganisms, which can infect hospital patients, health-care workers and the general public. Other potential infectious risks include the spread of, sometimes-resistant microorganisms from health-care establishments into the environment. These risks have so far been only poorly investigated. Wastes and by-products can also cause injuries, for example radiation burns or sharps-inflicted injuries; poisoning and pollution, whether through the release of pharmaceutical products like antibiotics and cytotoxic drugs or by toxic elements as mercury or dioxins. These may be generated from other health-care establishments, laboratories, research centers, mortuary and autopsy centers, animal research and testing laboratories, blood banks and collection services, and nursing homes for the elderly.

#### **3.1 Health Care Waste and its Management in Different Regions**

According to the World Health Report 2002, unsafe injection practices and needle reuse in the South-East Asia Region are estimated to be responsible for a significant amount of the disease burden. The proportion of syringe reuse in the Region is very high as it is estimated to be from 30 to 75 per cent of all injections given, mainly among those given for therapeutic purposes. Regarding the problem, a pilot project to install locally-built small-scale, double chamber incinerators in Myanmar were also continued in 2002. Supported by WHO, a waste management committee was established with participants from the Ministry of Health, Ministry of Environment and representatives from various training institutes who devised an activity plan for a field trial of 15 incinerators. Technical assistance was provided to design the incinerator, to identify the location and the availability of construction material, to build prototypes and to train local engineers.

Thus, nearly all countries in the Region have guidelines but only three have passed legislation. Particular attention will be given to the management of infected sharps at primary health facilities. Some countries agreed to initiate assessment reports on health care waste management but only three have done it so far to develop and hold regular training courses.

*([www.whosea.org/meeting/rc/rc56/pdf/RC56-inf3.pdf](http://www.whosea.org/meeting/rc/rc56/pdf/RC56-inf3.pdf))*

WHO has collaborated with 18 countries in areas of technical assessment of solid waste problems and preparation for improvement plans at national and local level. These collaborative activities were targeted at medium and small-sized cities where technical expertise was most limited. Experience gained from these activities and additional applied studies led to the development of technical guidelines on information management for solid waste services; municipal solid waste management in Pacific island countries; and health care waste management in developing countries. It also cooperated with other international agencies (e.g. the ADB; the South Pacific Regional Environment Programme; the United Nations Environment Programme; the United

Nations Center for Regional Development; and the World Bank) in holding international seminars and developing technical guides. ([www.who.org.int](http://www.who.org.int) 2004sep2)

### **3.2 Medical Wastes and its Impact**

Health care waste is a by product of health care that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials. Poor management of health care waste exposes health care workers, waste handlers and the community of infections, toxic effects and injuries. It may also damage the environment. In addition, it creates opportunities for the collection of disposable medical equipment (particularly syringes, bottles e.t.c...), its re-sale and potential re-use without sterilization, which causes an important burden of disease worldwide.

Such mismanagement of HCW poses risks to public health and environment. Healthcare workers, patients, waste handlers, waste pickers, and general public are exposed to health risks from infectious wastes (particularly sharps), chemicals and other special health care wastes. Hence, such medical waste should be treated and handled separately because of its potentiality of causing infection and adverse effect.

While it is also the responsibility of the waste producer to dispose the waste safely thus safe management of HCW also needs to be supported and implemented by national and local authorities as well as health-care workers and waste workers.

The contribution and cooperation of a number of partners from various settings and sectors, including the health and the environment sector, the industry, research institutions and professional associations is needed to achieve safe and sustainable management of HCW worldwide.

Safe and sustainable management of HCW can be reached by developing, promoting and implementing good practices, safe and environment-friendly technologies, raising awareness, and promoting policy commitment and adequate regulations. ([www.healthcarewaste.org](http://www.healthcarewaste.org), 2004 19th Dec).

### **3.3 Health Care Waste Management Scenario**

#### **3.3.1 Global Scenario**

In middle and low income countries HCW generation is usually lower than in high-income countries. The report and figures available from developed countries indicates a range from 1-5 kg/bed/day with substantial inter country and inter specialty differences. High-income countries can generate up to 6 kg of hazardous waste per person per year. In the majority of low-income countries, the total health-care waste per person per year is anywhere from 0.5 to 3 kg (WHO). According to a WHO report, around 85% of the hospital wastes are actually non-hazardous, 10% are infective and the remaining 5% are non-infectious but poses hazard (Editorial 2003, *JNMA*).

Approximately 465,000 tons of bio-hazardous waste is generated by United States each year by 377,000 health care facilities. Hospitals, which comprise only 2% of the total number of generators, produce the greatest quantity (approx 77%) of the bio-hazardous waste among the different types of institution (Gibony, 1992). The average generation rate (kg/bed/day) of total hospital waste is about 4.5 in USA, 2.7 in Netherlands and 2.5 in France. However, the average hospital waste generation rates are in the range of 1-4.5 kg/bed/day in Latin American countries like Chile, Brazil Argentina and Venezuela (Monreal, 1991). The percentage of hazardous waste

is 5% in Denmark and 28% in USA. The indicated differences may be due to geographical location, living habits and standards, availability of different treatment facilities, and the ways in which solid wastes are categorized in different countries. (Sapkota K., 2003)

Worldwide, 8-16 million hepatitis B, 2.3 to 4.7 million hepatitis C and 80 000 to 160 000 HIV infections are estimated to occur yearly from re-use of syringe needles without sterilization (WHO, 1998). In developing countries, additional hazards occur from scavenging on waste disposal sites and manual sorting of the waste recuperated at the back doors of health-care establishments. These practices are common in many regions of the world. The waste handlers are at immediate risk of needle-stick injuries and other exposures to toxic or infectious materials.

In June 2000, six children were diagnosed with a mild form of smallpox (vaccinia virus) after having played with glass ampoules containing expired smallpox vaccine at a garbage dump in Vladivostok (Russia). Although the infections were not life threatening, the vaccine ampoules should have been treated before being discarded.

### **3.3.2 National Scenario**

A few studies on medical waste management have been carried out in past by various organizations like GTZ in 1987, DWSS/WHO in 1995, IIDS in 1997 and by KMC in 1999, ENPHO in 2000 and SEF in 2001.

In Kathmandu, it has been estimated that 20 to 40% of the total waste produced is hazardous in nature. A latest study by KMC indicates that there are approximately 3516 hospital beds in Kathmandu valley. With an average of 0.31 kg/person/day of infectious waste generation and a 70% occupancy rate, the amount of infectious medical waste produced by the health care institutions is calculated to be about 763-kg/ day. (Medical waste management a survey in Kathmandu valley, 2002)

Statistics reveal that 1,189 kilograms of infectious waste is generated in Kathmandu each day. However, this small fraction of infectious wastes contaminates the entire body of over 300 metric tons of solid wastes generated in Kathmandu every day since the hazardous wastes are disposed indiscriminately. (POST REPORT KATHMANDU, March 27)

The survey conducted by ENPHO indicates that most health care institutions are not following segregation practices strictly. Out of 36 health care institutions (public and private) surveyed 28% separate only sharps; 19.44% separate sharps; infectious and non-infectious; 8.33% separate the waste as infectious and non-infectious with separate collection of sharps and 44.44% do not segregate waste at all. As waste separation is critical in reducing the amount of hazardous waste, source separation of waste into at least three categories, infectious, non-infectious and sharps should be a priority. (ENPHO, 2004)

A report shows that in Kathmandu the daily production of healthcare waste is about one metric tone. This means only about 100-250 kg of such waste is special healthcare waste, which, if segregated, needs special attention and the rest can be handled like other domestic wastes. However, there is no separate management of special healthcare waste within the healthcare establishments. Most of the time, all healthcare wastes are mixed together. As a result, the general waste is also contaminated with infectious and hazardous waste. Finally, they dispose their untreated waste into the municipal container. At the municipal level, healthcare waste rarely receives special attention; rather, it is handled as part of the municipal waste stream. As a consequence, the total quantity of the municipal waste (around 200 MT/day) becomes contaminated with infectious and hazardous waste. (Adhikari. D.R, 2004)

With 0.1kg infectious medical waste generated per bed, the total generated garbage has been estimated at 1,500- 1,600 kg per day. Out of that, hazardous waste has been estimated at 29 per cent of the total garbage generation from the 70 private and government health care institutes. The total bed capacity is around 4,000.

The study also found that 23 per cent of the waste issuing out of hospital, clinics, nursing homes and pathological clinics contained virus of various diseases. Similarly, three per cent of the waste contained sharps and syringes. (Pathak P, 2003)

Dr Sushil Koirala of the National Dental Hospital (NDH) at a program on 'Hospital waste management in Kathmandu' organized on March 27 said, "If we mix infectious wastes with general wastes, all the wastes become infectious," He said that scores of medical institutions like medical colleges; nursing homes, private clinics and hospitals are disposing the medical wastes without segregating them. "We have the worst segregation system and concerned individuals and organizations are least seem bothered about its repercussions," he added. (POST REPORT KATHMANDU, March 27)

Facts and Figure:

- Infectious waste generation rate is 0.48-kg/ person/day
- Total waste generation rate is 1.7-kg/ person/day
- Total infectious waste in Kathmandu city is 1189 kg/day and in whole valley 1312 kg/day.
- It is expected that at the end of 2003, the infectious waste generation rate will increase by an amount of 81 kg/day.

Total numbers of beds are increasing with annual average growth rate of 5.38% and hence by the time of 2010, the total hospital beds will be 6593, which will result in more production of waste. (Suitable options for treatment and disposal of hazardous health care waste supported by WHO and implemented by NHRC.

Implementation of certain policies and practices and basic waste management principles can significantly reduce the wastes generated by healthcare establishments and research facilities such as source reduction, management and control measures at the hospital level and stock management of chemical and pharmaceutical products.

The lack of political wills to develop and implement a proper management system played a negative role in the management of health care wastes in the past. Recent directives of the Ministry of Health to the healthcare establishments on proper management of their healthcare waste are highly commendable. The decision of the ministry to establish a common incinerator for all the healthcare establishments is definitely a significant achievement. Now, it is important that the healthcare establishments will separate their special healthcare waste at source and bring it to the incinerator. We can expect that this will definitely lead to complete management of healthcare waste.

### **3.4 Classification of Health Care Waste**

As a means of evaluating problems on handling and disposal of medical waste that arises in relation to the diverse items of medical wastes, the classification systems in common use make assumption about the ultimate method of handling and disposal effective. Several classification systems are used for the characterization of different components of medical waste by different organization and some of them are discussed below:

### 3.4.1 WHO

From the total of wastes generated by health-care activities, almost 80% are general waste comparable to domestic waste. The remaining approximate 20% of wastes are considered hazardous materials that may be infectious, toxic or radioactive. The wastes and by-products cover a diverse range of materials, as the following list illustrates (percentages are approximate values):

- *Infectious wastes* -- cultures and stocks of infectious agents, wastes from infected patients, wastes contaminated with blood and its derivatives, discarded diagnostic samples, infected animals from laboratories, contaminated materials (swabs, bandages) and equipment (disposable medical devices etc.).
- *Anatomic* - recognizable body parts and animal carcasses.

Infectious and anatomic wastes together represent the majority of the hazardous waste, up to 15% of the total waste from health-care activities.

- *Sharps* -- syringes, disposable scalpel, blades, broken ampoules etc.

Sharps represent about 1% of the total waste from health-care activities. Throughout the world every year an estimated 12 000 million injections are administered. And not all needles and syringes are properly disposed of, generating a considerable risk for injury and infection and opportunities for re-use.

- *Chemicals* -- for example solvents and disinfectants; and
- *Pharmaceuticals* -- expired, unused, and contaminated; whether the drugs themselves (sometimes toxic and powerful chemicals) or their metabolites, vaccines and sera. Chemicals and pharmaceuticals amount to about 3% of waste from health-care activities.
- *Genotoxic waste* -- highly hazardous, mutagenic, teratogenic or carcinogenic, such as cytotoxic drugs used in cancer treatment and their metabolites; and
- *Radioactive matter*, such as glassware contaminated with radioactive diagnostic material or radio therapeutic materials;
- Wastes with high heavy metal content, such as broken mercury thermometers.

Genotoxic waste, radioactive matter and heavy metal content represent about 1% of the total waste from health-care activities. (WHO website)

### 3.4.2 NHRC

The waste management guidelines for the health care institution developed by Nepal Health Research Council (NHRC) has classified health care waste only in three categories and are as discussed below:

*Non-hazardous waste:* general waste includes paper, cardboard, metal containers, floor sweeping and kitchen waste. It doesn't need special treatment and storage facilities but it still needs to be collected separately from infectious waste. If separate collection of such waste is not practiced, it will not function as efficiently as desired.

*Hazardous waste or contaminated waste:* Hazardous wastes are waste with potential to cause hazard to health and life of human being. These includes cotton, gauze, soiled bandages, cotton used for dressing, blood bags, human and animal tissue body parts, chemicals, drugs, waste generated by cleaning spills of hazardous waste and any other soiled materials that has been used

for treatment. But it is to be noted that the containers for hazardous waste storage shall be colored yellow and marked: DANGER! HAZARDOUS WASTE”.

### **3.4.3 India**

According to the Indian rules, health care waste was segregated into ten different categories; these categories are as listed below;

*Human anatomical waste:* Human tissue, Organs, body parts.

*Animal waste:* Animals tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, discharge from hospitals, animals houses.

*Microbiology and biotechnology waste:* Waste from laboratory cultures, stocks or specimens of microorganism live to attenuated vaccines, human and animals cell cultures used in research and infectious agents from research and industrial laboratories, wastes from production of biological, toxins, dishes and devices used for transfer of cultures.

*Sharps:* Needles, syringes scalpels, blades, glass, etc. that may cause puncture and cuts, this includes both used and unused sharps.

*Discarded medicines and cytotoxic drugs:* Waste comprising of outdated contaminated and discarded medicines.

*Soiled waste:* Items contaminated with blood, and body fluid including cotton, dressing, soiled plaster casts, line beddings, and other material contaminated with blood.

*Solid waste:* Waste generated from disposable item other than the waste sharps such as tubing, catheters, and intravenous sets etc.

*Liquid waste:* Waste generated from laboratory including washing, cleaning house keeping and disinfecting activities.

*Incinerator ash:* Ash from incineration of any production of biological, chemicals used in disinfection, as insecticides, etc.

Meanwhile, a study conducted by Environment and Public Health Organization (ENPHO) for the KMC’s Kathmandu Valley Mapping Programme (KVMP) has recommended segregation of waste into general, hazardous and sharps at the point of generation. (Pathak P, 2003)

## **3.5 Medical Waste Management Practices**

### *3.5.1 Identification of Waste*

The most appropriate way of identifying the categories of medical waste is by sorting the waste into color-coded plastic bags or containers. For streamlining the process, waste could be classified and are stored in different colored bags. Color-coding varies from nation to nation. It is essential that this should be standardized at national level.

### *3.5.2 Segregation of Medical Waste*

The key to minimization and effective management of medical waste is segregation and identification of waste. Appropriate handling, treatment, and disposal of waste by type reduce costs and protect public health (Pruss et al, 1999).

The segregation of waste is most important as it allows special attention to be taken to manage the medical waste. Since the costs for safe treatment and disposal of hazardous infectious waste are typically more than 10 times higher than those of general waste. The suitable containers or bag holders should be placed in all locations where particular categories of waste may be generated and the containers should be removed when they are three-quarters full (Pruss et al., 1999).

It is vitally important to draw up a waste management strategy. Effective segregation at source is a key factor in the waste management strategy and it will enable hospital authorities to make economic savings in waste disposal costs (Moritz JM, 1995)

Meanwhile, a study conducted by Environment and Public Health Organization (ENPHO) for the KMC's Kathmandu Valley Mapping Programme (KVMP) has recommended segregation of waste into general, hazardous and sharps at the point of generation (Pathak P, 2003). Whereas the practice of the segregation of waste at the generation point was not found to be satisfactory in the context of Nepal except for the sharp wastes.

### *3.5.3 Collection of Waste*

Waste collection is the basic aspect for the effective management of health care waste, which should be followed in a systematic manner as per the outlined guidelines. So, Nursing and other clinical staff should ensure that waste bags are tightly closed or sealed when they are about three-quarters full. The Light-gauge bags can be closed by tying the neck, but heavier gauge bags probably require a plastic sealing tag of self-locking type. Sealed sharps containers should be placed in a labeled, yellow infectious health care waste bag before removal from the hospital ward or department. A routine programme for their collection should be established as part of the medical waste management plan. However, the frequency of collection should not be less than two times a day or more often as the needs of the facility units. The bags after the collection of wastes should be sealed and secured from unauthorized people prior to their collection by the porter (Coad, 1994). The porters should wear sensible protective clothing for hygiene during handling of the wastes and they are perfectly within their rights to refuse and remove the waste items liable to cause injury e.g. sharps etc. if found in the wrong bags or containers.

The ancillary workers in charge of waste collection should follow certain recommendations:

- Waste should be collected daily and transported to the designated central storage site.
- No bags should be removed unless they are labeled with their point of production and contents.
- The bags or containers should be replaced immediately with new ones.
- A supply of fresh collection bags or containers should be readily available at all locations where waste has been produced (Pruss et al., 1999).

### *3.5.4 Storage of Medical Waste*

A storage location for medical waste should be designed inside the health care institution establishment or research facility. Waste should be stored in the areas of generation for an interim period varying from 2-6 hours. Medical wastes collected in the various areas should be transported for treatment and disposal by the sanitation staff. The waste, in bags or containers, should be stored in separate areas, rooms or buildings of a size appropriate to the quantities of waste produced and the frequency of collection.

The recommendations for the storage facilities for health care waste:

- The storage area should have an impermeable, hard standing floor with good drainage; it should be easy to clean and disinfect.
- The storage area should afford easy access for staff in charge of handling the waste.
- There should be a water supply for cleaning purposes.
- It should be possible to lock the store to prevent access by unauthorized persons.
- There should be protection from the sun.
- Easy access for waste collection vehicles is essential.
- There should be good lighting and at least passive ventilation.
- A supply of cleaning equipment, protective clothing, and waste bags or containers should be located conveniently close to the storage area.
- The storage area should not be situated in the proximity of fresh food stores or food preparation areas.

Unless a refrigerated storage room is available, storage times for medical waste should not exceed the following: Temperate climate; 72 hours in winter, 48 hours in summer: Warm climate; 48 hours during the cool season, 24 hours during the hot season.

Cytotoxic waste should be stored separately from other health care waste in a designated secure location. Radioactive waste should be stored in containers that prevent dispersion, behind lead shielding. Waste that is to be stored during radioactive decay should be labeled with the tape of radionuclide, the date and details of required storage conditions.

### *3.5.5 On-site Transport*

The transports system depends on the amount of waste generated, existing management techniques, their acceptance and the facility's ability to meet new capital and operational and maintenance cost. Medical waste should be transported within the hospital to other purpose and meet the following specification.

- Easy to load and unload
- No sharp edges that could damage bags/containers during loading and unloading
- East to clean

The vehicles for the on-site transport of waste should be cleaned disinfected daily with appropriate disinfections. All waste bag seals should be in place and intact at the end of transportation of medical waste (Pruss et,al., 1999).

## **3.6 Treatments and Disposal of Medical/Infectious Waste**

### *3.6.1 Incineration*

Nearly 20-30 per cent of the garbage, which flows out of hospitals, is hazardous and thus should be incinerated at around 900 degrees centigrade. But the "Incinerators being used by various hospitals and nursing homes are not environment-friendly. Problem is the incinerators in use don't



reach up to the desired temperature," said Rajesh Manandhar, a Kathmandu Metropolitan City (KMC) official.

*Mainly three types of incinerators are being used:*

Double-chambered pyloric incinerator where waste is combusted to a residue of ashes at a temperature ranging between 800-900°C and the gases are burned in the post combustion chamber at 900-1200°C. And a Single chamber incinerator has one chamber with a static grill where waste is burned by adding some fuel. Operating temperature reaches up to 400°C resulting in significant reduction in weight and volume reduction of waste.

Rotary Kiln with a rotating oven and post-combustion chamber with operating temperature of 1200-1600°C is most suitable for treatment of chemical, infectious and pathological waste.

### *3.6.2 Chemical Disinfections*

Disinfections are defined as the "process by which most of the pathogenic microorganisms are destroyed from any inanimate body, surface or material". This method is used primarily to treat sharps, cultures and stocks, pathological waste, and fluid animal waste. Common chemicals used for disinfections are Methylated spirits, Glutaraldehyde (Cidex), Bleaching powder, Sodium hypochlorite etc.

### *3.6.3 Steam Sterilization/Autoclave*

Autoclave is a low heat thermal process, which is designed to bring steam into direct contact with the waste in a controlled manner for a sufficient duration to disinfect the waste. Proper temperature, pressure and holding time (121 °C at 15 lbs for 30-60 minutes) correlation are matched, in order to achieve desired level of sterilization. (WHO, suitable option)

### *3.6.4 Hydroclave*

It applies steam (which is stored in a double wall/jacket) as an indirect heat source, allowing total dehydration of the waste at 132 °C and 36 psi and also the waste is internally agitated and fragmented to attain a high sterilization level of all components and particles-sharp, PVC pathological waste, etc, (WHO, 1998)

### *3.6.5 Microwave*

A technology in which, microorganism are destroyed by microwaves with frequency of about 2450 MHz and a wavelength of 12.24 cm. working principal includes water containing waste is heated up in the microwave chamber killing infectious agents present in the waste.

### *3.6.6 Encapsulation*

This is a method for treatment and containment of waste, which is safer for deposition in municipal landfill. It is used primarily to treat and disposed the sharps, pharmaceutical and chemical waste. Encapsulation involves placement of the treated waste in a polymer matrix such cement, which will solidify into solid material. Encapsulated medical/infectious waste is typically disposed of in a sanitary landfill. (NHRC, 2002).

### *3.6.7 Thermal Inactivation*

It is used primarily to treat cultures and stocks, pathological waste, and fluid animals waste. Generally used for liquid medical/infectious waste, thermal inactivation is a treatment method that uses heat to reduce infectious agents in waste. Successful treatment relies on the waste being

exposed to a minimum temperature for a minimum period to ensure destruction of all pathogens. The treated and cooled liquid waste is normally discharge to the sanitary sewer (NHRC, 2002).

### *3.6.8 Sanitary Landfill*

Where approved by the waste water treatment plant owner/operator and the installation Civil Engineering Environmental Flight, may be suitable as a disposal or treatment method for untreated bulk blood and blood products, treated animals waste fluids and fluids resulting from chemical disinfections, (NHRC, 2002).

### *3.6.9 Burial Pit*

In the absence of a special treatment facility, burial of medical waste in a pit within the hospital premises or landfill can be regarded as an acceptable measure to reduce environmental and public health risks. It is a special type small pit of 1-2m depth that could be prepared to receive waste only and filled to a depth of 1-1.5m. After each waste load, the waste should be covered with a soil layer 10-15cm deep.

## **3.7 Waste minimization**

Significant reduction of the waste generated in health-care establishments and research facilities may be encouraged by the implementation of certain policies and practices, including the following:

- **Source reduction:** measures such as purchasing restrictions to ensure the selection of methods or supplies that are less wasteful or generate less hazardous waste.
- **Recyclable products:** use of materials that may be recycled, either on-site or off-site.
- **Good management and control practices:** apply particularly to the purchase and use of chemicals and pharmaceuticals.
- **Waste segregation:** Careful segregation (separation) of waste matter into different categories helps to minimize the quantities of hazardous waste. Small amounts of chemical or pharmaceutical waste can be disposed of easily and relatively cheaply, whereas disposing of larger amounts requires costly and specialized treatment, which underlines the importance of waste minimization. Waste minimization usually benefits the waste producer: costs for both the purchase of goods and for waste treatment and disposal are reduced and the liabilities associated with the disposal of hazardous waste are lessened. All health-service employees have a role to play in this process and should therefore be trained in waste minimization and the management of hazardous materials. This is particularly important for the staff of departments that generate large quantities of hazardous waste. Suppliers of chemicals and pharmaceuticals can also become responsible partners in waste minimization programmes. The health service can encourage this by ordering only from suppliers who provide rapid delivery of small orders, who accept the return of unopened stock, and who offer off-site waste management facilities for hazardous wastes. Reducing the toxicity of waste is also beneficial, by reducing the problems associated with its treatment or disposal. For example, the Supply Officer could investigate the possibilities of purchasing PVC-free plastics that may be recycled or of goods supplied without unnecessary packaging.
- **Safe reuse and recycling:** Medical and other equipment used in a health-care establishment may be reused provided that it is designed for the purpose and will

withstand the sterilization process. Reusable items may include certain sharps, such as scalpels and hypodermic needles, syringes, glass bottles and containers, etc. After use, these should be collected separately from non-reusable items, carefully washed (particularly in the case of hypodermic needles, in which infectious droplets could be trapped), and may then be sterilized. Although reuse of hypodermic needles is not recommended, it may be necessary in establishments that cannot afford disposable syringes and needles. Plastic syringes and catheters should not be thermally or chemically sterilized; they should be discarded. Long-term radionuclides conditioned as pins, needles, or seeds and used for radiotherapy may be reused after sterilization.

### **3.8 Occupational Health and Safety**

Health care waste management is a major problem in Nepal. Health care waste presents occupational health risks to those who generate, package, store, transport, treat and dispose of it. It also presents environmental and public health risk through inappropriate treatment and/or disposal, and can contribute to the spread of infections (Editorial 2003, *JNMA*)

The management of waste presents a number of potential hazards to employees requiring the appropriate measures of risk identification, risk assessment and risk control.

The implementation of strict waste segregation practices, monitoring of their performance by different authorities, good hygiene practices, including use of protective equipment and clothing, as well as proper vaccination programmes especially for waste handlers will have positive impact on the occupational health and safety aspect of the waste handler. (NHRC, 2002 Guideline).

### **3.9 Monitoring and Enforcing Instruments**

Regular monitoring must be performed in each institution with regard to health care waste management (NHRC, 2002). It provides:

- Feedback to the state of affairs in the various stages of health care waste management.
- Information on the areas of weakness

Monitoring is the measure of success or failure of the waste management system and also provides timely inputs for progressive improvement of health care waste management system. Baseline, Compliance and Impact monitoring are the monitoring mechanisms that need to be enforced for the progressive improvement and sustainability of the health care waste management system.

#### **Baseline Monitoring**

Baseline monitoring monitors the changes in baseline environment conditions. Parameters should be monitored to examine changes in baseline environmental conditions are:

- Waste handling and management practices at health care institutions
- Present practices of waste handling in institutions
- Air and water quality at treatment facility, or at landfill site

#### **Compliance Monitoring**

Compliance monitoring ensures that all the parties concerned in the health care waste management system follow the provisions of guidelines or rules. Compliance monitoring should be done during construction of treatment unit/facilities and during the operation of entire operation.

During construction it is important to check that the right kind of equipment is being bought and installed in a proper way. During operation it is important to ensure that hazardous waste is being handled properly and the equipment is being operated as per the instruction of the manufacturer. Both the institution and the operator of the waste management system should be monitored. The following parameters should be monitored:

#### **At the source of waste generation**

- Preparation of waste management plan by health care institution
- Training to all employee
- Follow up of occupational health and safety requirements
- Waste segregation in all areas of health care institutions
- System for transportation of hazardous waste within health care institutions
- Collection scheduled

#### **At common treatment facility**

- Use of waste treatment equipment as per required specification
- Construction of waste treatment facility as per specifications
- Operation of all waste treatment facilities as per the instruction of the equipment manufacturer
- Restricted access to treatment facilities

#### **Impact monitoring**

Impact monitoring identifies any positive or negative changes that have been brought by the established health care waste management system. Parameters should be monitored to evaluate the impact of health care waste management system are:

- Opinion of patient and visitors
- Opinion of workers in health care institution
- Opinion of health care institution
- Inventory of waste handler
- Payment by health care institutions to service provide

### **3.10 Review of Acts Regarding HCWM**

#### ***Related Policies and Legislation for Health Care Waste Management in Nepal***

Unlike many western countries, In Nepal there are no special policies and legislation or guidelines related to wastes from health care institution. In Nepal, very few government policies and acts are targeted to health care waste. Till 1996, it has been felt that there were no specific national policies on the waste as such.

National Conservation Strategy, 1998 Nepal's first environmental policy mentions that HMG will develop and implement policy and legislation related to pollution including treatment and handling of waste and the Constitution of Kingdom of Nepal 1990, required the state to prioritize prevention against environmental degradation from development activities.

Nepal Environmental Policy and Action Plan (NEPAP) are not focused on issues of Health care waste management (EPC, 1993). The 8<sup>th</sup> Five Year Plan (1992-1997) does not specifically mention any plan regarding health care waste management. It however, emphasis on the

investigation on causes for air, water, land related pollution through on-the spot observation and manage mitigation plans.

The main national level policies related to waste management are the 9<sup>th</sup> Five Year Plan (1997-2002), Nepal Environmental Policy & Action Plan and The Solid Waste Management National Policy.

Nepal Environmental Policy & Action Plan does not address the issue of waste management. The 9<sup>th</sup> Five Year Plan didn't specifically mention any thing about health care waste management but includes the following statement related to solid waste management.

- Make legal provisions for mobilizing NGOs, private sector effectively in the filed of waste management.
- Setting of norms and standards in this field of waste management and its strict implementation in every municipality.
- Recycling will be promoted by motivating people engaged in recycling business.

Although these statements are impressive there are no plans and programmes to implement them.

In 1996, the government prepared the Solid Waste Management National Policy, which has the following objectives:

- To make solid waste management simple and effective.
- To minimize environmental pollution and adverse effect on public health caused by solid waste.
- To mobilize solid waste as a resource
- To privatize solid waste management
- To obtain public support by increasing public awareness on waste management.

Rule 3, annex-2 of the Environmental Protection Act, 1997 states that an EIA is necessary prior to the development of any health care facility with 25 or more beds. Safe disposal of Health Care waste is also made mandatory for this category of health care facility.

Under the National Health Care technology Strategy of Second Health Plan (1997-2017), functional guidelines to manage medical waste at all levels, including private sector has been envisioned.

Although the National Policy was a good start on the part of the government to address the issue of waste management, with lack on emphasis on health care waste it had not been followed up with plan and programmes. As a result, the policy has not yet been implemented. The main policies, legislation and regulations related Acts in Nepal are reviewed in the section below.

### *Municipality Act, 2048*

The municipality act was promulgated with the main aim of strengthening institutional and decentralizing development activates by making the municipalities responsible for the economic, social and cultural development. Section 15, sub section1 of the act makes all municipalities responsible for various local level activities, including the following;

- Protect water bodies such as rivers, pond and wells.

- Conserve environment and cultural heritage.
- Public health and social development
- Clean special areas as designated by the municipalities.
- Remove hazardous substance
- Collect and dispose of municipal solid waste

Sub-section 2 of Section 15 mentions that municipalities may implement activities related to cleaning of cities and collection and disposal of waste. Therefore the act is not clear in case of metropolitan areas (only in Kathmandu), Section 63 of the acts state that the municipal corporation is responsible for solid waste management and sanitation as well as it can issue directives to any polluting institutions to stop polluting activities. Kathmandu Municipal Corporation has not been able to implement this provision effectively.

Additionally the section 23 of the act mention that the municipalities shall hold programmes which will conserve the environment. The municipality act does not address the ways or procedural for the health care waste management.

The Municipality Act has also authorized municipalities to collect fees for cleaning services (Section 47 sub-section 2) but this is not practiced because the concern authorities has not come with a pricing mechanism.

#### *Solid Waste Management and Resource Mobilization Act, 2044*

The Act was promulgated with the objective to manage waste, mobilize resource and prevent public health from pollution from waste. Section 2, sub-section 2.1.1 of the Act designates responsibilities of waste management and resource mobilization to Solid Waste Management and Resource Mobilization Center. Accordingly to Section 3, sub-section 3.1.1, scope of work, duties and responsibilities of this center are summarized as follows:

- The center can seek the assistance of related municipality to build physical facility for managing waste.
- Designate area and containers for disposal of waste.
- Make provision for transferring and proper (pollution free) disposal of collected waste.
- Produce briquettes, compost and energy from waste.
- Make provisions to collect recyclable materials from waste.
- Conduct research activities to manage and mobilize waste.
- Provide technical assistance, training, public awareness to individuals institutions and the general publics.

#### *Solid Waste Management Policy 2053*

This policy has been necessary to address the problem of increasing waste as a result of population density, urbanization and industrialization. The main objectives can be summarized as follows; Section3, subsection 3.1-3.11 states that the policy will involve NGO sector in cleanup programs, process waste to recycle and use it as resource, make waste management a self

sustaining operation, private waste management phase wise and introduce program to reduce waste.

#### *The Industrial Enterprises Act, 1992*

The industrial policy 1992 is a main government policy and legislation regarding industrial development. Utilization of resources is the one of the main objective of the Policy. This Act provides that industrial license is required if it is related with defense, public health and environment. Section 11 clearly provides that license or registration certificate shall contain provisions regarding concessions, exceptions, facilities that will be given to enterprise and prescribed conditions to be fulfilled by them.

Section 13 also provides that the industrial promotion board establishment under the Act can direct the industries to make arrangements for controlling environmental pollution. Similarly, section 25 (2) empowers HMG to punish those who don't comply with the conditions mentioned in the license or registration certificate.

#### *The Town Development Act, 1988*

Clause 9 of this Act empowers the Town Development Committee to regulate control or prohibit any act or activity that has an adverse effect on public health or the aesthetic of the town, or in any way pollutes the environment. It also contains penalty provisions in the form of fines for the violation of the Act.

#### *The Local Self-Governance Act, 1999*

The Local Self-Governance Act, 1999 makes local authorities have full responsibilities of solid waste management and can impose fine on organizations and individuals for improper disposal. The Act does not require the local governments to manage hazardous waste but empowers them to fine anyone up to Rs.15, 000.00 for haphazard dumping of solid waste.

### **3.11 Steps towards Improvement**

Improper disposal of sharp waste needs development of cost effective methods that are applicable at a small scale. (Janjua NZ, 2003)

#### *The need for planning*

Formulation of objectives and planning for their achievement are important for improving health-care waste management at the national, regional, and local level. Planning requires the definition of a strategy that will facilitate careful implementation of the necessary measures and the appropriate allocation of resources according to the identified priorities. This is important for the motivation of authorities, health-care workers, and the public, and for defining further actions that may be needed. Surveys on the generation of waste will be the basis for identifying opportunities and setting targets for waste minimization, reuse and recycling, and cost reduction. A national programme of sound health-care waste management is achievable through an action plan.

### **National plans for health-care waste management**

#### *Purpose of a national management plan*

A national management plan will permit health-care waste management options to be optimized on a national scale. A national survey of healthcare waste will provide the relevant agency with a basis for identifying 35 actions on a district, regional, and national basis, taking into account

conditions, needs, and possibilities at each level. An appropriate, safe, and cost-effective strategy will be concerned principally with treatment, recycling, transport, and disposal options.

*Action plan for the development of a national programme*

A national programme of sound health-care waste management can be developed through a seven-step action plan. The seven steps and their suggested time frame are described in more detail in the following paragraphs.

Step 1. Establish policy commitment and responsibility for health-care waste management

Step 2. Conduct a national survey of health-care waste practices

Step 3. Develop national guidelines

Step 4. Develop a policy on regional and cooperative methods of health-care waste treatment

Step 5. Legislation: regulations and standards for health-care waste Management

Step 6. Institute a national training programme

Step 7. Review the national health-care waste management programme after implementation

Improvements in health-care waste management rely on the following key elements:

- Build-up of a comprehensive system, addressing responsibilities, resource allocation, handling and disposal. This is a long-term process, sustained by gradual improvements;
- Awareness raising and training about risks related to health-care waste as well as safe and sound practices;
- Selection of safe and environmentally friendly management options, to protect people from hazards when collecting, handling, storing, transporting, treating or disposing of waste.

Government commitment and support is needed to reach an overall and long-term improvement of the situation, although immediate action can be taken locally. (WHO)



## Chapter IV

### Monitoring and Evaluation of Current Health Care Waste Management Practices

Visit to all these five health care Institution has presented different scenario on health care waste. The data obtained from the observation was tabulated and then evaluated according to the health care waste management guideline. According to our objective, monitoring and evaluation of health care waste management processes has been done as follows:

#### 4.1 Waste Minimization:

**Table 4.1: Monitoring of Waste Minimization Practices at Surveyed Hospital**

Hospital	Waste Minimization			
	Avoidance	Reduction	Re-Use	Recycling
<b>Om</b>	Absent	Present	Present	Absent
<b>Bir</b>	Absent	Absent	Present	Absent
<b>Patan</b>	Present	Present	Present	Absent
<b>TUTH</b>	Absent	Present	Present	Absent
<b>Prasuti</b>	Absent	Absent	Present	Absent

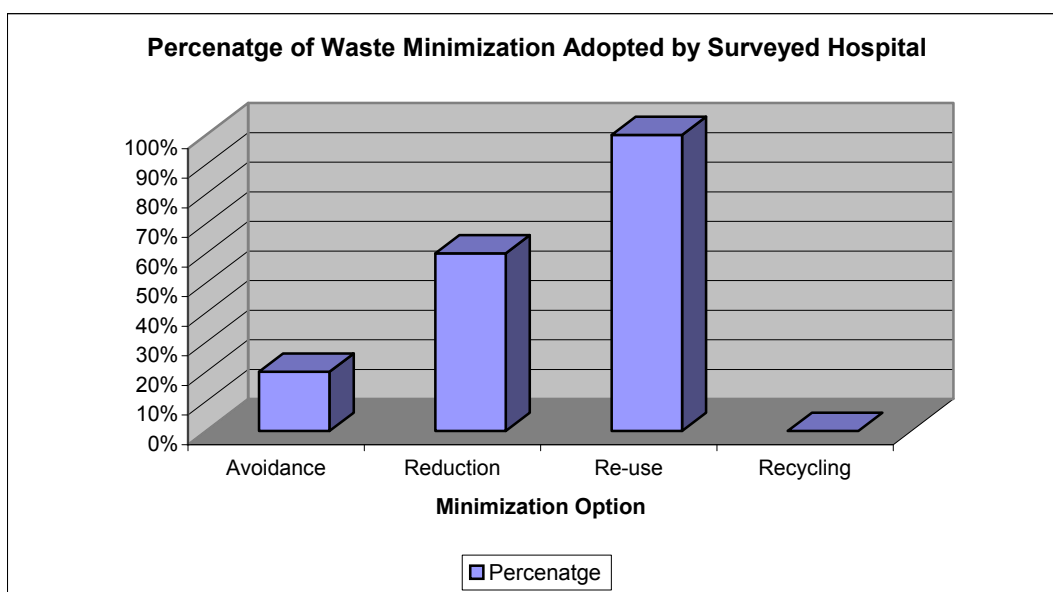


Figure 4.1: Evaluation of Waste Minimization Adopted by Surveyed Hospital

In our observation we found that Patan Hospital has practiced waste minimization policy seriously and has set an example for all the hospitals. Reduction in form of low weight waste generation like use of plastic bottles for glass bottles was seen in all hospitals, where as use of reusable syringe instead of recyclable syringe was seen in only Patan hospital. Reuse of gloves after autoclave as seen in all the hospitals is also a step seen towards adoption of waste minimization. Apart from gloves, reuse of syringe (Pic 1) was seen in only Patan Hospital. Even though, recycling policy has not been adapted by any hospitals, they have effectively separated the saline bottles and other plastics to promote recycling. Even though it is known that such recycling can have immediate cost reductions and increasing benefits in the future, there is no such recycling plant available so far.



Pic 1: Waste Minimization Policy Adapted Patan Hospital



Pic 2: Waste Minimization Policy Adapted at TUTH

#### 4.2 Waste Segregation:

Segregation of waste and its proper storage can be a step toward reduction in secondary infections like hospital-acquired infections. Segregation of syringe followed by its disinfections by the use of chemical disinfectant at the segregation unit prevents spread of any infections lead by blood stained or immunized syringes. Proper segregation of infectious waste from general waste can significantly reduce the working load of incinerators. Incinerator requires higher temperature for operation, which is quite expensive therefore; general waste should be segregated from other type of waste properly and can be disposed as municipal waste. Segregation of waste, use of color container for those segregated waste, their storage time in such container are illustrated in the following Table 4.2.

**Table 4.2: Monitoring of Waste Segregation**

SN	Hospital	Segregation place	Segregation container			Storage time	
			Sharps	Infectious	General	Sharps	Infectious/ Non
1	Bir	Operating Room	Metallic (Yellow)	Plastic (Red)	Not Specific	5 Days	24hrs
2	Om	Operating Room	Cardboard	Plastic (Red) Buckets/bags	Plastic (Blue) Buckets /Bags	7 Days	24 hrs
3	TUTH	Operating Room/store area	Metallic	Plastic (Red) Buckets /bags	Plastic (Blue) Buckets /Bags	6 Days	24 hrs
4	Patan	Dirty Room	Plastic	Plastic (Red) Buckets /Bag	Plastic (Green) Buttocks/Bags	5 Days	24 hrs
5	Prasuti	Toilet	Metallic	Plastic Buckets	Plastic Buckets	7 Days	24 hrs

Segregation was present in the operating room or on other specified room in all the hospitals visited (Pic 3 and 4). Especially the sharps were segregated in all the HCI's we visited so far and have assigned a different container for it but for the other waste, no such strict procedures were

implied. Containers of one color adjacent to another color labeling were frequently observed condition throughout our study period. Even though storage time of infectious and non-infectious waste was only twenty-four hours, in comparison the sharps were stored for a very long period. The evaluation of existing waste segregation practices at surveyed hospitals illustrated at the Table 4.3.

**Table 4.3: Existing Waste Segregation Practices at Surveyed Hospitals**

<b>Hospital</b>	<b>Segregation Place</b>	<b>Segregating Container</b>
<b>Bir</b>	Poor	Moderate
<b>Om</b>	Moderate	Excellent
<b>TUTH</b>	Excellent	Excellent
<b>Patan</b>	Excellent	Excellent
<b>Prasuti</b>	Poor	Good



Pic 3: Segregation Place at TUTH



Pic 4: Segregation Place with Colored Container at Patan

### 4.3 Containers Use and Container Specification:

On the process of collection of different types of medical waste, different types and number of containers are used at hospital wards for the segregation of waste at point source. On our survey it was seen that, most of the medical wastes were collected in plastic bins before final disposal from each generated point. Considering the present practices, it is essential to figure out the type and number of container that is being used at different wards at point source; the level of waste stored in each container before disposal from point source; the frequency of collection and disposal to final disposal site in each day; and the means of transport of such collected waste to the final disposal area from point source. The following Table 4.4 illustrates the number of containers used to show the effectiveness of collection practice, duration of collection and storage of such collection waste at source point, level of waste in each container used, and the transport mechanism to final disposal.

**Table 4.4: Monitoring of handling and Transport of Waste**

SN	Hospital	No of Containers	Level of waste	Frequency of collection	Transport device
1	Bir	18 in 9 Wards = 2 containers	100%	2 Time in 12 hrs	Open bucket
2	Om	21 in 5 wards = 3 Containers	75%	3 Time in 12 hrs	Open bucket
3	TUTH	5 Containers	75%	1 Time in 24 hrs	Open bucket
4	Patan	7 Containers	75%	1 Time in 24 hrs	Close bucket
5	Prasuti	3 Containers	90%	2 Time in 24 hrs	Open bucket

**Table 4.5: Conditions of Handling and Transport of Waste:**

Hospital	Handling of Waste	Transport of Waste
Om	Excellent	Good
Bir	Moderate	Poor
Patan	Excellent	Excellent
TUTH	Excellent	Moderate
Prasuti	Moderate	Poor

House keeping department present in the hospital were responsible for collection of waste from each ward followed by its transportation. Excellent handling of waste with closed mode of transportation in Patan gives a proper management scenario present in the hospital. The open devices used during the transportation process poses serious health hazard to the patients. With the use of closed transportation device the problem can easily be solved even in Bir and Prasuti hospitals Where as full level of waste during the transportation gets spilled in the floor leading to other complicated hospital acquired infections even though such spill management was done with the use of available disinfections. Different hospitals has different schedule for their waste disposal, but it would be proper if the time should be scheduled according to the bed capacity of the hospital. The problem can easily be managed with the active participation of management.

#### 4.4 Labeling of Waste:

**Table 4.6: Efficiency of Labeling of Waste**

Hospital	Labeling of Waste			
	Excellent	Good	Moderate	Poor
Om		✓		
Bir				✓
Patan	✓			
TUTH	✓			
Prasuti			✓	

Note: Categorization done on the basis of proper labeling of container and its practices.

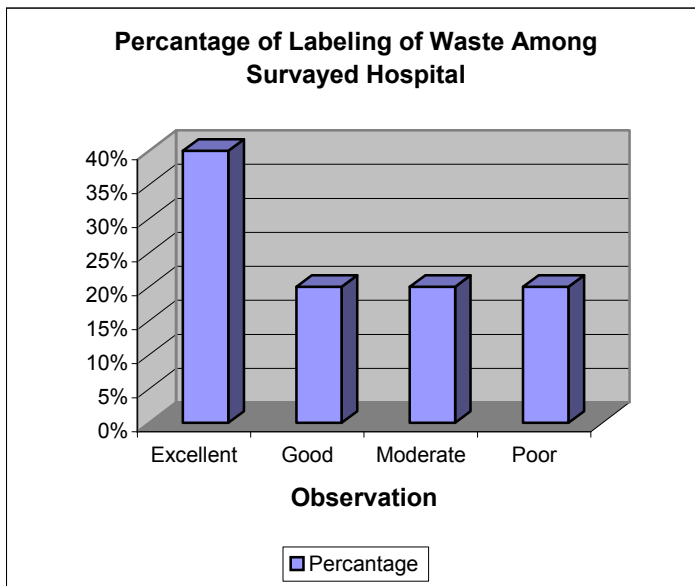


Figure 4.2: Evaluation of Labeling of Waste Among Surveyed Hospital



Pic 5: Improper Use of Waste Container at Bir

Improper waste segregation followed by miss labeling was frequently observed condition among hospitals. Proper labeling leading to proper waste segregation in wards as seen in Patan and TUTH can also be adopted by other hospitals which would help in effective segregation. In some hospitals like Prasuti misleading labeling for the color of the buckets (Pic 6) was seen where as miss use of labeled bucket was observed in Bir Hospital (Pic 5). In our view, we found Patan and TUTH to be hospitals, which has excellently handled waste.



Pic 6: Misleading Labeling of Containers at Prasuti



#### 4.5 Color Coding:

The color-coding system or use of different types/color of container for different type of waste is essential. Color identification is one of the most important functions of waste separation for effective function of segregation system of medical waste. Among the surveyed healthcare institution, the majority of HCIs are not following NHRC color-coding system; they have been collecting haphazardly in the different color-coded plastic bins. In context, different types of color were being used for different types of waste by different HCIs as per their convenient. The following Table 4.7 illustrates the color container used by different health care institution surveyed.

**Table 4.7: Use of Color code/container by HCF's**

SN	Hospital	Color Coding and Labeling			
		Hazardous	Non-Hazardous	General	Sharps
1	Bir	Red/ Positive	NS	Blue/ Positive	Yellow tin/Positive
2	Om	Red/ Negative	Green/ Negative	Blue / Negative	Cardboard/Negative
3	TUTH	Red / Positive	Green/	Blue/	Red tin / Positive
4	Patan	Red/ Positive	Blue/ Positive	Green/ positive	White box/positive
5	Prasuti	Red/ Positive	NS	Blue/ Positive	Paper/ Tin box/ Positive

Though each hospital they have assigned color-coding system for different types of waste, this color-coding system has not been strictly practiced. Out of five HCI's surveyed only three HCI's has been following the color-coding mechanism strictly, which comprises about 60% of the HCI's. If made the color universal, it would be easier for the HCI's to work along with 100% of full participation. But during our survey it was realized that, there are no strong guidelines and policies to use standard color-coded bins or container for handling and storage of hazardous waste in all the HCIs to show the uniformity.

Labeling is another important system of waste separation. It should be clearly labeled after segregation of medical waste by writing information on the waste containers. The information should indicate the type of waste, date of collection, time and treatment method for effectiveness.



Pic 7: Different Colored Container Use at TUTH



Pic 8: Improper Color Coding at Prasuti

#### 4.6 Storage of Health Care Waste:

**Table 4.8: Present Scenario of Storage of Waste at Surveyed HCI's**

Hospital	Storage of Waste		Storage Area	
	Proper	Improper	Secured	Unsecured
Om		✓		✓
Bir		✓		✓
Patan	✓		✓	
TUTH	✓		✓	
Prasuti		✓		✓

Note: Secured- Closed/Isolated Unsecured- Open/Public reach

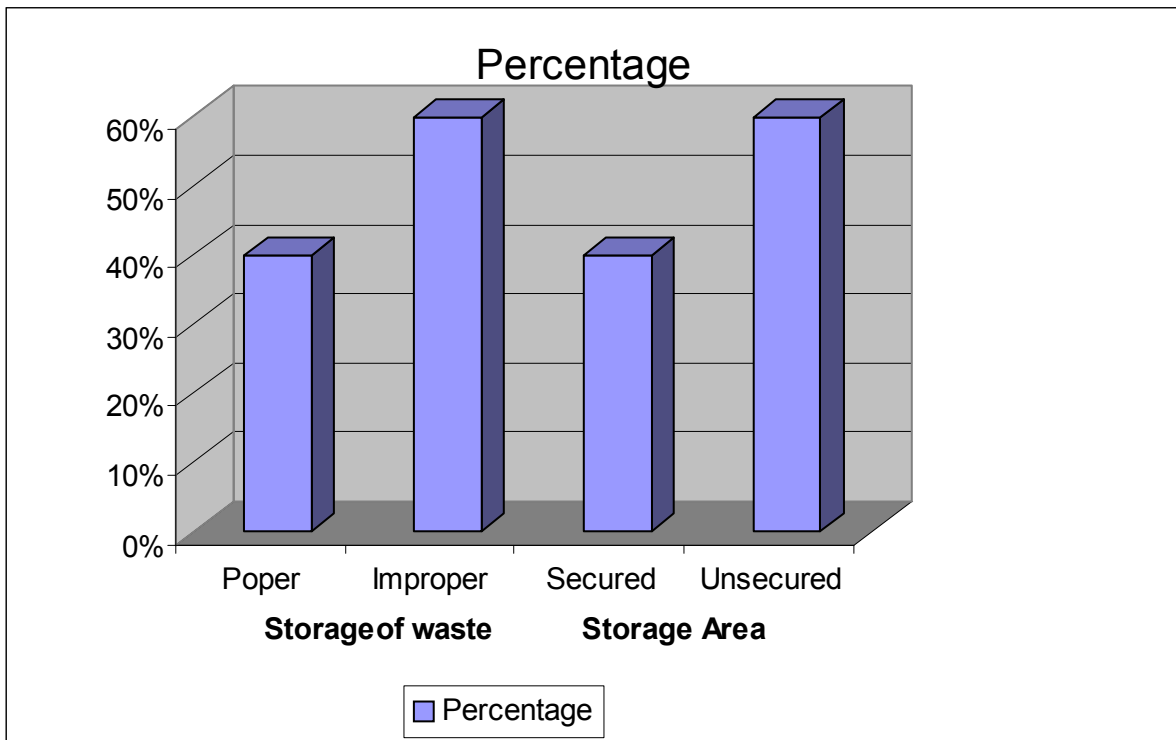


Figure 4.3: Evaluation of Storage of Waste

TUTH has the most separate, secured area for the storage of waste (Pic 12), where as Patan has storage area at the back of hospital (Pic 11). But Om, Bir and Prasuti hospital has open, insecure and improper area for the storage of waste. During our observation, waste stored in unsecured area of Om (Pic 10) has a blood spillage condition from a body part in a plastic bag (Pic 14). Similarly the open storage area of Bir as well as Prasuti (Pic 9, 13 respectively) has a negative effect like foul smelling conditions and aerosol spread of infectious diseases leading to higher risk rate due to higher exposure. Individuals with lower immunity, exposed to such situations can be even detrimental. These have affected commuters and community in the vicinity.



Pic 9: Open Storage Area at Back side of the Bir Hospital with Public



Pic 10: Store Area at Hospital with Public Reach



Pic 11: Store, Segregation and Incinerating Place of Patan



Pic 12: Final Segregation and Storage Place at TUTH



Pic 13: Store Area with Municipal Container at Prasuti



Pic 14: Blood spillage condition from a body part in a plastic bag



#### 4.7 Treatments and Disposal of Waste:

**Table 4.9: Monitoring of Treatment and Disposal of Waste at HCI's**

Hospital	Types of Waste						
	Infectious	Pathological	Sharps	Pharmaceutical	Cytotoxic	Chemicals	Radioactive
Om	CD/A/DS	SL/DS	DI/SL	SL	SL	DS	SL
Bir	SL	SL	DI/SL	SL	SL	DS	DS
Patan	BI/CD/A	BI/A/SB	BI/SB	OM	DS	DS	DS
TUTH	I/CD/A	I/CD/A	I/SB	SL	SL	DS	DS
Prasuti	SB/SL	SL	DI/SL	SL	SL	DS	DS

Note:

DI: Drum Incinerator

BI: Brick Incinerator

I: Incinerator

A: Autoclave

SL: Sanitary Landfill

OM: Other Methods

CD: Chemical Disinfection

SB: Safe Burial on hospital premises

DS: Discharge to Sewer

Several methods are used for health care waste treatment, depending on the type of waste material on various hospitals. In context of our country, incinerator was found to be the most efficient way for the proper hospital waste treatment. Complain of the release of dioxins furans etc from the use of non-standard incinerator can be eliminated with the construction of incinerator with required standard. Direct discharge of liquid medical waste in sewage as seen in most of the surveyed hospitals can have different negative impacts to public health.



Pic15: Drum Incinerator at Om Hospital



Pic 16: Brick Incinerator at Patan



Pic 17: Incinerators at TUTH



Pic 18: Landfilling on Balkhu

#### 4.8 Occupational Health and Safety:

During handling of waste, precautions are the most important thing for waste handler and have to be followed as per the guideline. Since there is always possibility of risk to health by contaminated needles and other broken glass. Those groups of people involved in waste handling are vulnerable and also in high risk to transmission of infectious diseases like AIDS, hepatitis and other communicable diseases. Use of personal protective equipments can significantly reduce risk of infection; this section tries to highlight the availability and usages of safety measures and equipments by the waste handlers during their work period in surveyed hospitals. The following Table 4.10 and Figure 4.4 illustrate the availability and usage of such safety measures.

**Table 4.10: Available safety measures for handling of waste among waste handlers**

SN	Hospital	Gloves		Mask		Apron		Trousers		Boots	
		sample	used	sample	Used	sample	used	sample	used	sample	used
1	Gov (Bir)	6	5	6	3	6	1	6	6	6	0
2	(Om)	6	6	6	6	6	6	6	6	6	0
3	TUTH	6	6	6	5	6	1	6	6	6	1
4	Patan	6	6	6	1	6	5	6	6	6	0
5	Prasuti	6	4	6	1	6	3	6	6	6	0

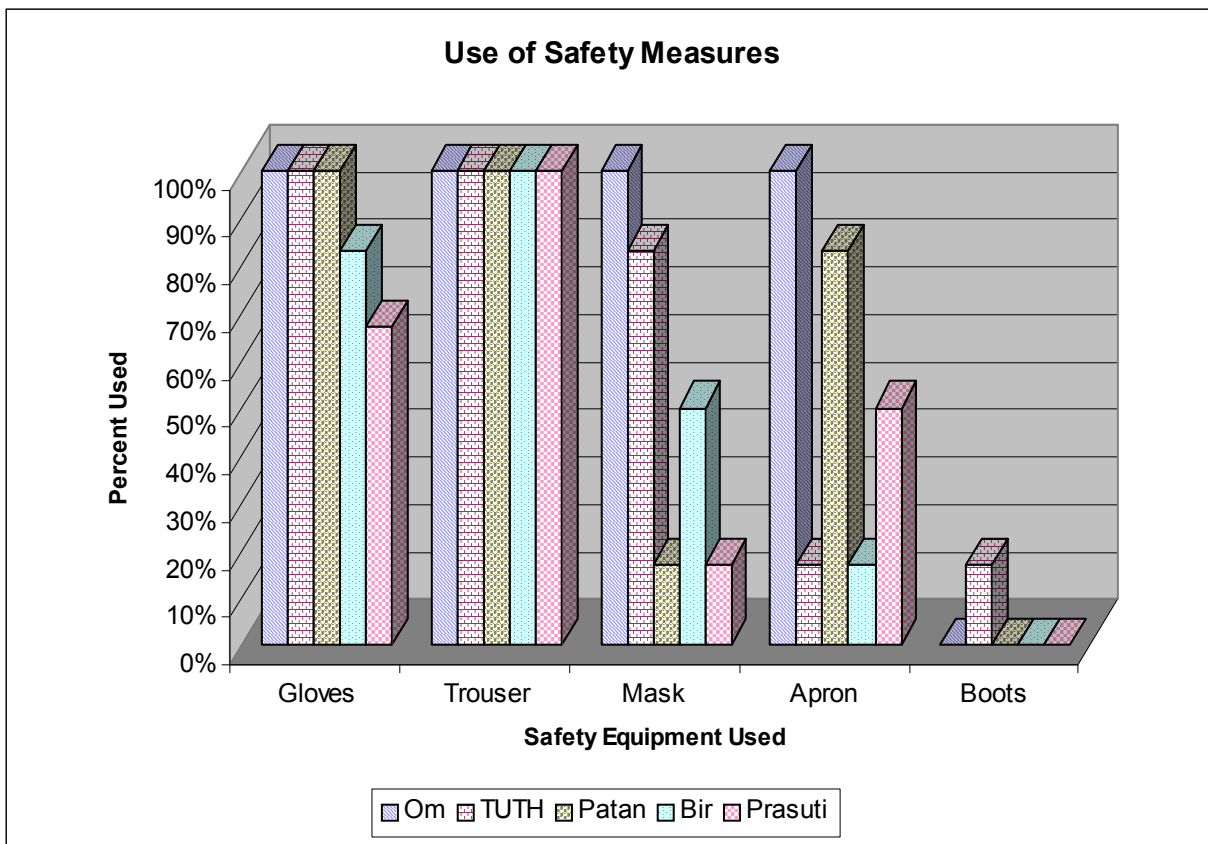


Figure 4.4: Percentage of Use of Safety Measures among Waste Handlers.

**Table 4.11: Condition of Usage of Safety Measures among Hospitals**

Hospital	Use of Safety Measures
Om	Excellent
TUTH	Excellent
Patan	Good
Bir	Moderate
Prasuti	Moderate

Most of the waste handlers were female and thus they were wearing cotton saree instead of trouser during their working hours. But additional use of safety measures like mask and apron was observed in only few workers. Where as, almost all the workers were using gloves during the waste handling periods.

In present study, the data shows that Om hospital, TUTH as well as Patan Hoapital has been conscious of those safety measures (Pic 19, pic 20) and its usage among their waste handling staffs.



Pic 19: Use of Safety Measures during work TUTH



Pic 20: Use of Safety Measures during handling in Patan Hospital

#### 4.8.1 Occupational Safety Practices used:

Improper handling and storage of Hospital waste can lead to a number of complications like needle stick injuries leading to general or chronic infections. This rate of Infection can be decreased with the use of different vaccines as well as it also depends on education and the personal hygiene of waste handlers. These variables are in turn dependent on level of education as well as vaccination given. The section including Table 4.12 and Figure 4.5 here tries to find the correlation between these variables.

**Table 4.12: Occupational Safety among waste handlers**

SN	Hospital	Education	Infection	Injury	Vaccination
1	Bir	Illiterate	3/6	5/6	4/6
2	Om	Illiterate	2/6	5/6	2/6
3	TUTH	Illiterate	5/6	4/6	5/6
4	Patan	Illiterate	2/6	2/6	6/6
5	Prasuti	Illiterate	2/6	2/6	3/6

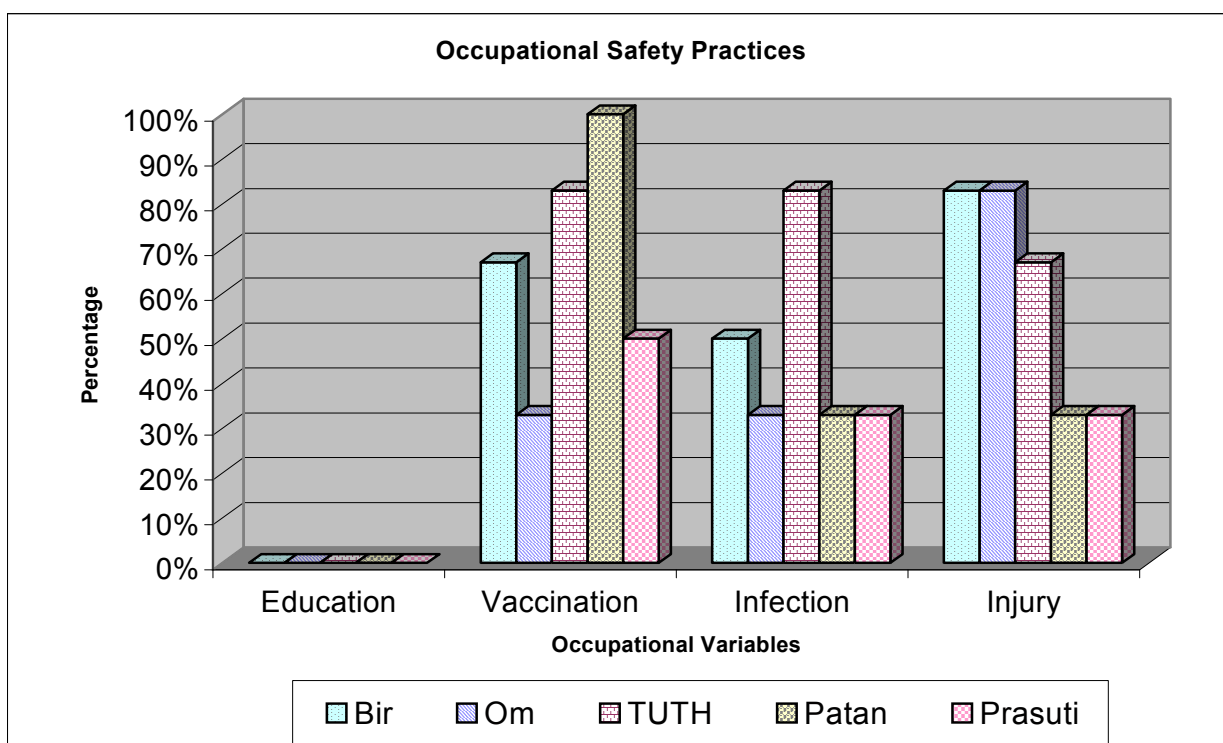


Figure 4.5: Awareness of Occupational health Safety Practices

A common situation noted among the hospital was illiteracy among the waste handlers. This in turn might have led to higher infection and injury rate. Needle stick injury was a major type of injury found other than cuts from scalpel and broken ampoules. Skin allergy was frequently heard complaint, which might have been due to inappropriate use of available disinfectant. Even though vaccination was given by almost all HCI's to their workers, some staff from a hospital also had a complaint of providing insufficient amount of vaccine dose required. The vaccines most commonly given were Hepatitis and tetanus Vaccine. But apart from other hospitals, Patan hospital has given polio, typhoid, meningitis and Diphtheria in addition, for their working staffs.

### Occupational health and safety:

Almost in each and every step during the handling of hospital waste from generation to disposal has significant occupational health risk to health workers involved as well as to the environmental risks. For avoidance of such risks, proper way for the handling of waste can significantly reduce rate of infection by lowering the risk rate, cost required as well as occupational health and safety. Hence, this following figure 4.6 is the flow chart addressing the Occupational health and Safety with impact to Environment and Health at different stages of waste management.

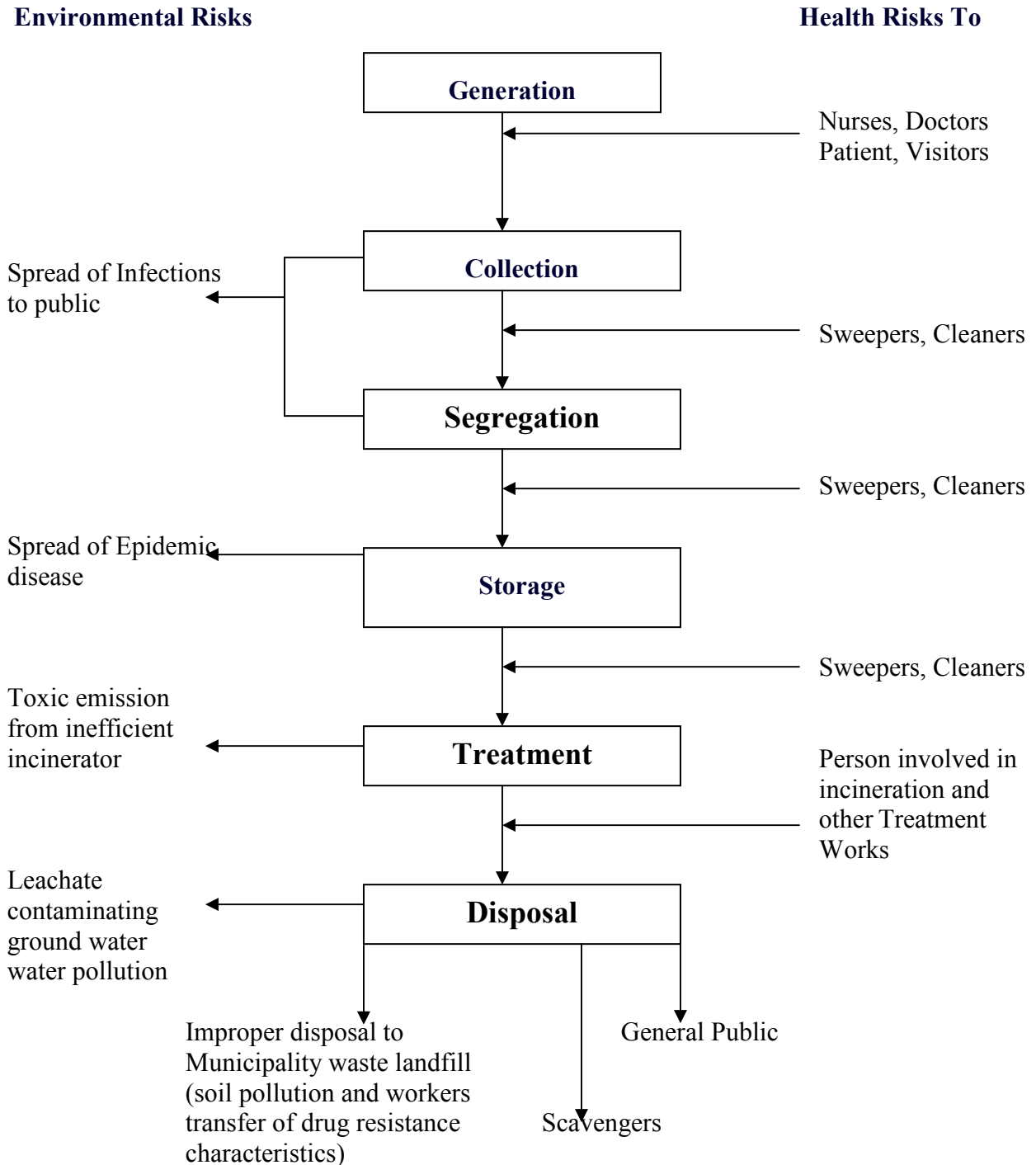


Fig 4.6: Flowchart of Occupational health and Safety with Risks to Environment and Health

#### 4.9 Training Regarding Health Care Waste Management:

Every staff should be trained in his/her responsibilities with regard to achieving good waste management in their area. Improper handling and storage of Hospital waste can lead to a number of complications, mismanagement and hazard to personal hygiene. Hence, training is essential for administrative staffs and waste handlers for the protection and safety of their own health. Training in the form of verbal and practical class was conducted in all the hospitals. Verbal means of training is simply the instruction and briefing by the seniors and older staffs to the new comers or staffs. Whereas the practical training means the workshop, meeting or orientation by the head of department to concerned staffs of one to two hour's duration. The section including Table 4.13 and Figure 4.7 here represents the types of training given to the waste handles and their personal Hygiene.

**Table 4.13: Awareness of HCW practices among waste handlers**

SN	Hospital	Training		Personal Hygiene
		Verbal	Practical	
1	Bir	6/6	4/6	5/6
2	Om	6/6	2/6	6/6
3	TUTH	6/6	2/6	6/6
4	Patan	6/6	6/6	6/6
5	Prasuti	6/6	2/6	6/6

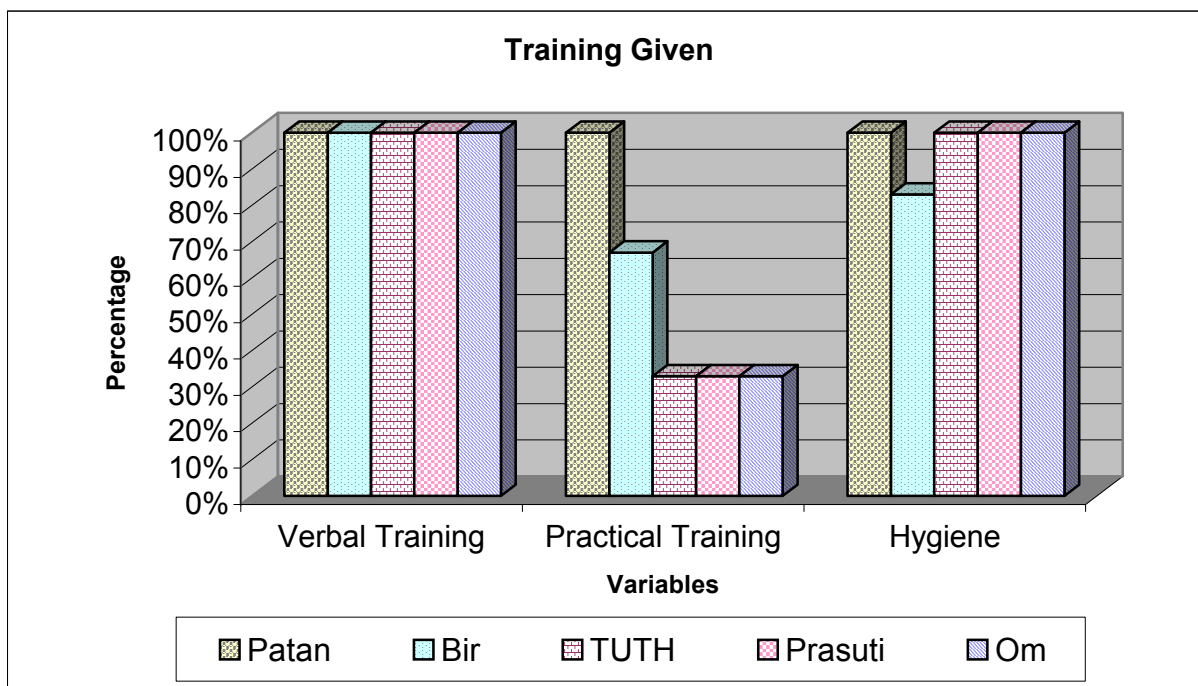


Figure 4.7: Percentage of Training program with Personal Hygiene.

Training either in form of verbal or practical was provided to all the waste handlers by their HCI's. Good efficiency for proper handling of waste among the waste handlers attending practical training, It was noticeable that almost all the workers were conscious about their personal hygiene.



## Chapter V

### **Needs/Modification that helps to raise Effectiveness in Health Care Waste Management Works**

Recommendation on specific needs to raise effectiveness in HCW management works adopting national HCWM guidelines are as follows:

- There seems to be a certain criteria for the disposal of infectious, general and hazardous waste. Where as, waste like cytotoxic, radioactive and pharmaceutical waste and its disposal methods are not clearly defined in national HCWM Guideline.
- Use of auto clave and microwave can be cheaper, safer and simple alternative method for disinfections of infectious waste before disposal for smaller nursing homes and clinics, regarding the unavailability of any incinerators.
- Color-coding system in order to enhance the management system should be made universal at each and every HCI's.
- Frequency of collection of waste generated should directly correlate with amount of waste generated per day / bed capacity.
- Providing clothes and required equipments needed during the handling of waste can motivate health workers toward their works along with required occupational health and safety for them.
- Regular orientation of waste management to the patients and visitors during the time of admission would be beneficiary for the segregation process of the waste.
- There is a need for monitoring of the HCWM at HCFs in different process like, collection, segregation, transportation, treatment and disposal.
- Establish environmental standards for air emissions and treatment efficiency.
- Establish legislation concerning wastewater treatment.
- Literate instead of illiterate health care workers would aid to effective waste handling or formulation of this guideline in native language would be beneficiary.
- Each and every HCI's should try to treat infectious and hazardous waste produce by themselves on their own as per outlined on the guideline instead of just dumping or disposing it into the municipal container.
- Central incinerator for the final disposal of health care waste was realized since all the health care institutions were willing to pay for any other alternate method of proper health care waste disposal. This opportunity can easily be utilized by the concerned authority and can launch the programme for proper disposal of health care waste efficiently.
- Successful implementation of health care waste management training and awareness programs should be provided to all waste handlers in order to minimize health hazard by using safety measures.
- Lack of proper coordination between hospital and municipality authorities should be abolished regarding collection, transportation, and disposal of segregated waste.

- Municipality should use special type of vehicle for the transportation of different type of segregated medical waste.
- Need for training and information sharing at the health care facilities as well as the other institutions involved in waste management.
- There should be a commitment among the hospital management for higher priority of health care waste management.



## Hospital Waste Management

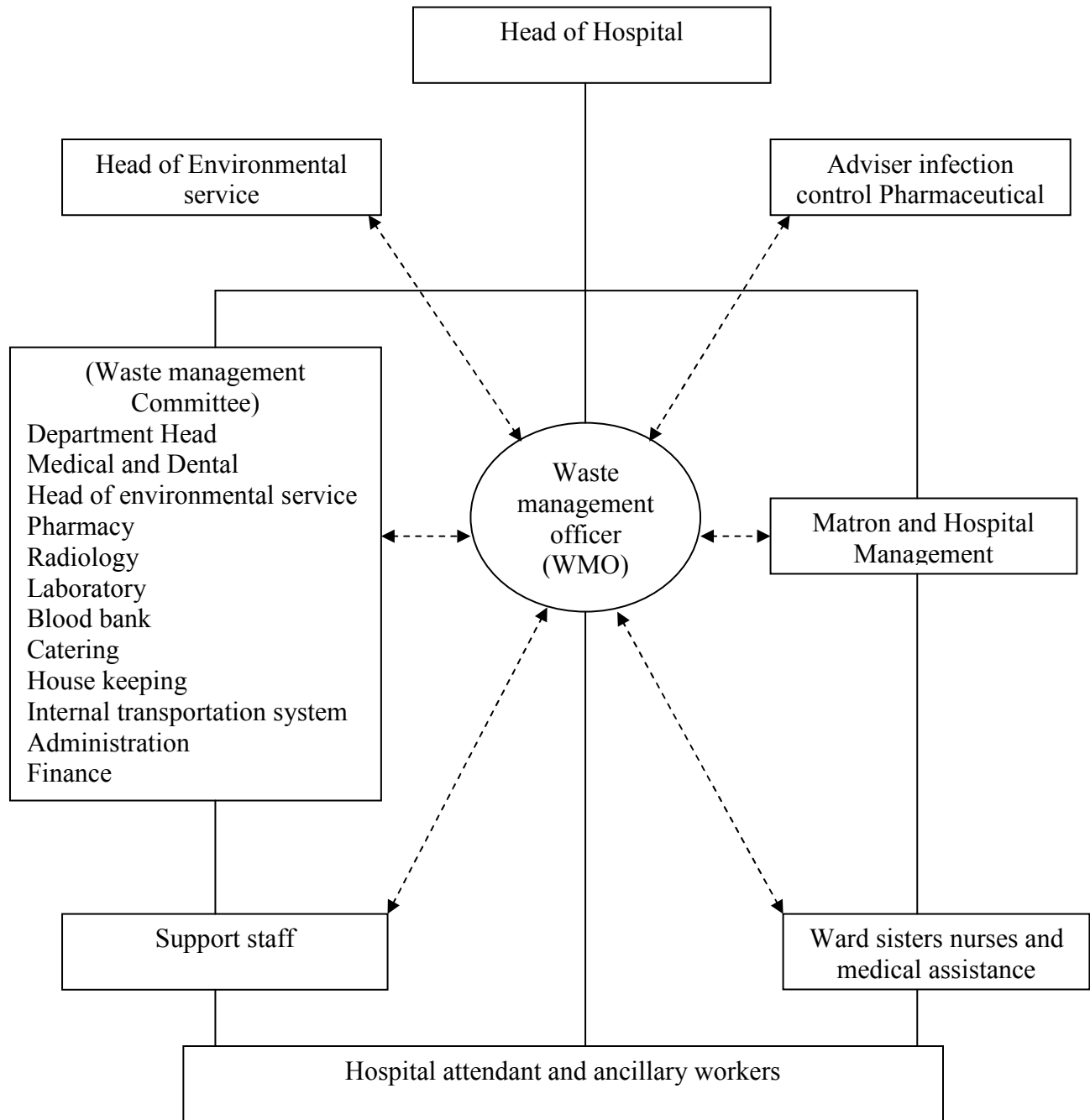
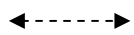


Fig 4.8: Needs/modification to raise effectiveness on HCW works at Institutions



Liaison Paths



Line management paths

## **Head of Hospital**

The Head of Hospital is responsible for the following tasks:

- Forming a waste management team to develop a written waste management plan for the hospital. The plan should clearly define the duties and responsibilities of all members of staff, both clinical and non-clinical, in respect of the handling of health-care waste, and establish lines of accountability.
- Designating a Waste Management Officer (WMO) to supervise and coordinate the waste management plan. The Head of Hospital retains overall responsibility for ensuring that health-care and other wastes are disposed of in accordance with national guidelines.
- Ensuring that monitoring procedures are incorporated in the plan. The efficiency and effectiveness of the disposal system should be monitored so that the system can be updated and improved when necessary.
- Ensuring adequate training for key staff members and designating the staff responsible for coordinating and implementing training courses.

## **Waste Management Officer (WMO)**

The WMO is responsible for the day-to-day operation and monitoring of the waste management system. It is therefore essential that he or she has direct access to all members of the hospital staff (see Fig. 4.8). The WMO is directly responsible to the Head of Hospital. He or she should liaise with the Infection Control Officer, the Chief Pharmacist, and the Radiation Officer in order to become familiar with the correct procedures for handling and disposing of pathological, pharmaceutical, chemical, and radioactive wastes.

*In the area of waste collection, the WMO should:*

- Control internal collection of waste containers and their transport to the central waste storage facility of the hospital on a daily basis;
- Liaise with the Supplies Department to ensure that an appropriate range of bags and containers for health-care waste, protective clothing, and collection trolleys are available at all times;

*Concerning waste storage, the WMO should:*

- Ensure the correct use of the central storage facility for health-care waste, which should be kept locked but should always be accessible to authorized hospital staff;
- Prevent all unsupervised dumping of waste containers on the hospital grounds.

*To supervise collection and disposal of the waste, the WMO should:*

- Coordinate and monitor all waste disposal operations;
- Monitor methods of transportation of wastes both on- and off-site and ensure that wastes collected from the hospital are transported by an appropriate vehicle to the designated treatment and disposal site;
- Ensure that waste is not stored for longer than specified in the guidelines and that the transport organization (which may be the local authority or a private contractor) collects the waste with the required frequency.

*For staff training and information, the WMO should:*

- Liaise with the Matron (or Senior Nursing Officer) and the Hospital Manager to ensure that the nursing staff and medical assistants are aware of their own responsibilities for segregation and storage of waste and that the responsibilities of hospital attendants and ancillary staff are limited to the handling and transport of sealed waste bags and containers;
- Liaise with Department Heads to ensure that all doctors and other qualified clinical staff are aware of their own responsibilities regarding segregation and storage of waste and that the responsibilities of hospital attendants and ancillary staff are limited to the handling and transport of sealed bags and containers;

*For incident management and control the WMO should:*

- Ensure that written emergency procedures are available, that they are in place at all times, and that personnel are aware of the action to be taken in the event of an emergency;
- Investigate and review any reported incidents concerning the handling of health-care waste.

### **Department Heads**

Department Heads are responsible for the segregation, storage, and disposal of waste generated in their departments. They should

- Ensure that all doctors, nurses, and clinical and non-clinical professional staff in their departments are aware of the segregation and storage procedures and that all personnel comply with the highest standards;
- Continuously liaise with the WMO to monitor working practices for failures or mistakes;
- Ensure that key staff members in their departments are given training in waste segregation and disposal procedures;

### **Matron and Hospital Manager**

The Matron (or Senior Nursing Officer) and the Hospital Manager are responsible for training nursing staff, medical assistants, hospital attendants, and ancillary staff in the correct procedures for segregation, storage, transport, and disposal of waste. They should therefore:

- Liaise with the WMO and the advisers (Infection Control Officer, Chief Pharmacist, and Radiation Officer) to maintain the highest standards;
- Participate in staff introduction to, and continuous training in, the handling and disposal of health-care waste;
- Liaise with Department Heads to ensure coordination of training activities, other waste management issues specific to particular departments, etc.

### **Infection Control Officer**

The Infection Control Officer should liaise with the WMO on a continuous basis and provide advice concerning the control of infection and the standards of the waste disposal system. His or her duties are to:

- Identify training requirements according to staff grade and occupation;
- organize and supervise staff training courses on safe waste management;

- It should Liaise with the Department Heads, Matron, and the Hospital Manager to coordinate the training procedural. The Infection Control Officer also has overall responsibility for chemical disinfection, sound management of chemical stores, and chemical waste minimization.

### **Chief Pharmacist**

The Chief Pharmacist is responsible for the sound management of pharmaceutical stores and for pharmaceutical waste minimization. His or her duties are to:

- Liaise with Department Heads, the WMO, the Matron, and the Hospital Manager, giving advice, in accordance with the national policy and guidelines, on the appropriate procedures for pharmaceutical waste disposal;
- Coordinate continuous monitoring of procedures for the disposal of pharmaceutical waste;
- Ensure that personnel involved in pharmaceutical waste handling and disposal receive adequate training. The Chief Pharmacist also has the special responsibility of ensuring the safe utilization of genotoxic products and the safe management of genotoxic waste.

**Current Situation and Involvement of Different Institution for HCW Management Scenario**

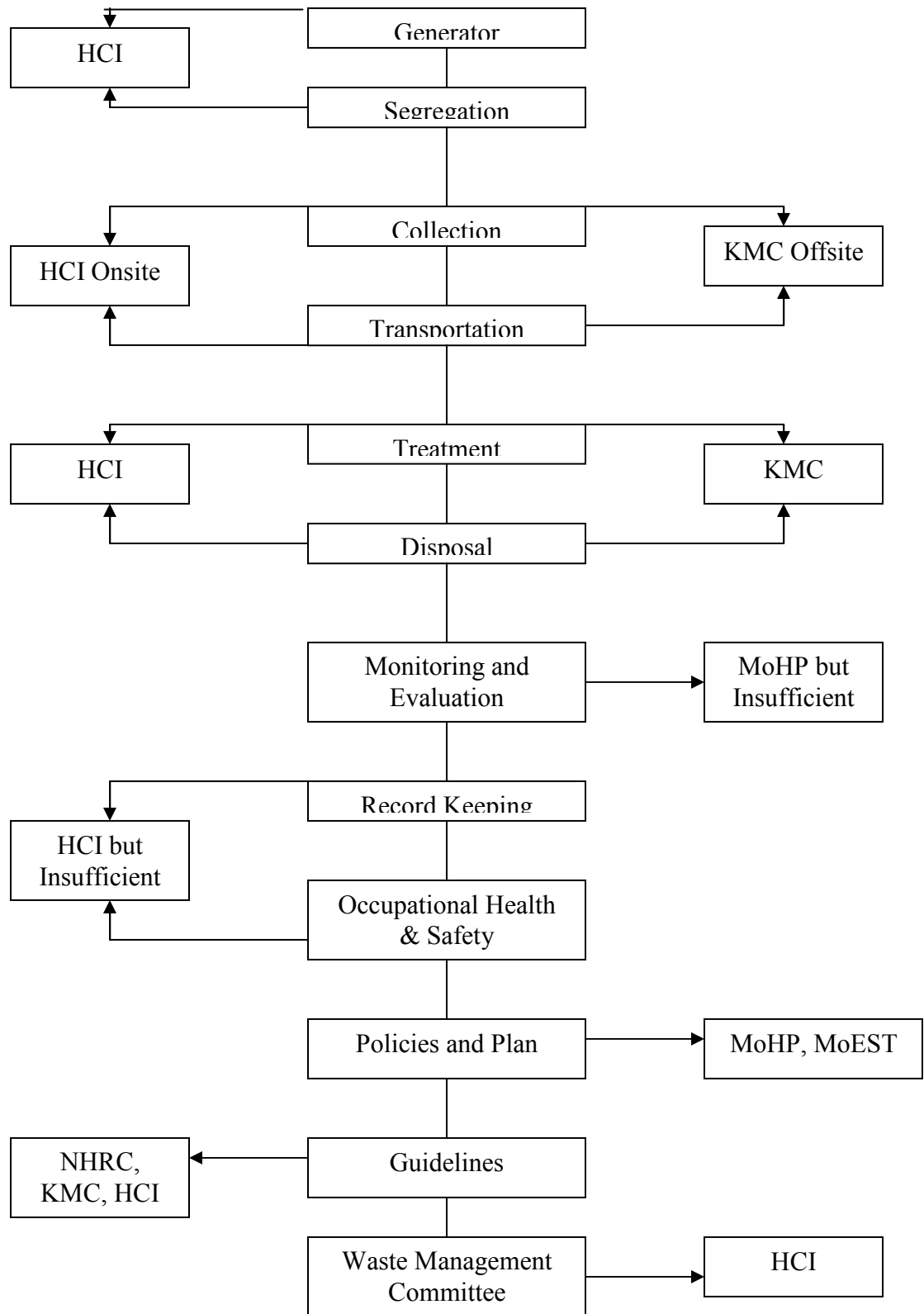


Fig 5.2: Current Situation and Involvement of Different Institution for HCW Management

The above flow chat 5.2 tries to show the current and ongoing situation and the involvement of different organization in the different step of waste management hierarchy. From this figure, it seems that most of the health care waste management process from waste generation till disposal is done only by HCI's and Municipality. Instead of involvement of ongoing such institution for waste management process, there is the felt as well as possibility of involvement of more concerned organization in collaborative manner to enhance and sustain HCW management. The following figure 5.3 tries to show and recommend the different institution that can be institutionalized for effective HCW management inside and outside the HCI's premises.

**Recommended Institutionalization on HCW management**

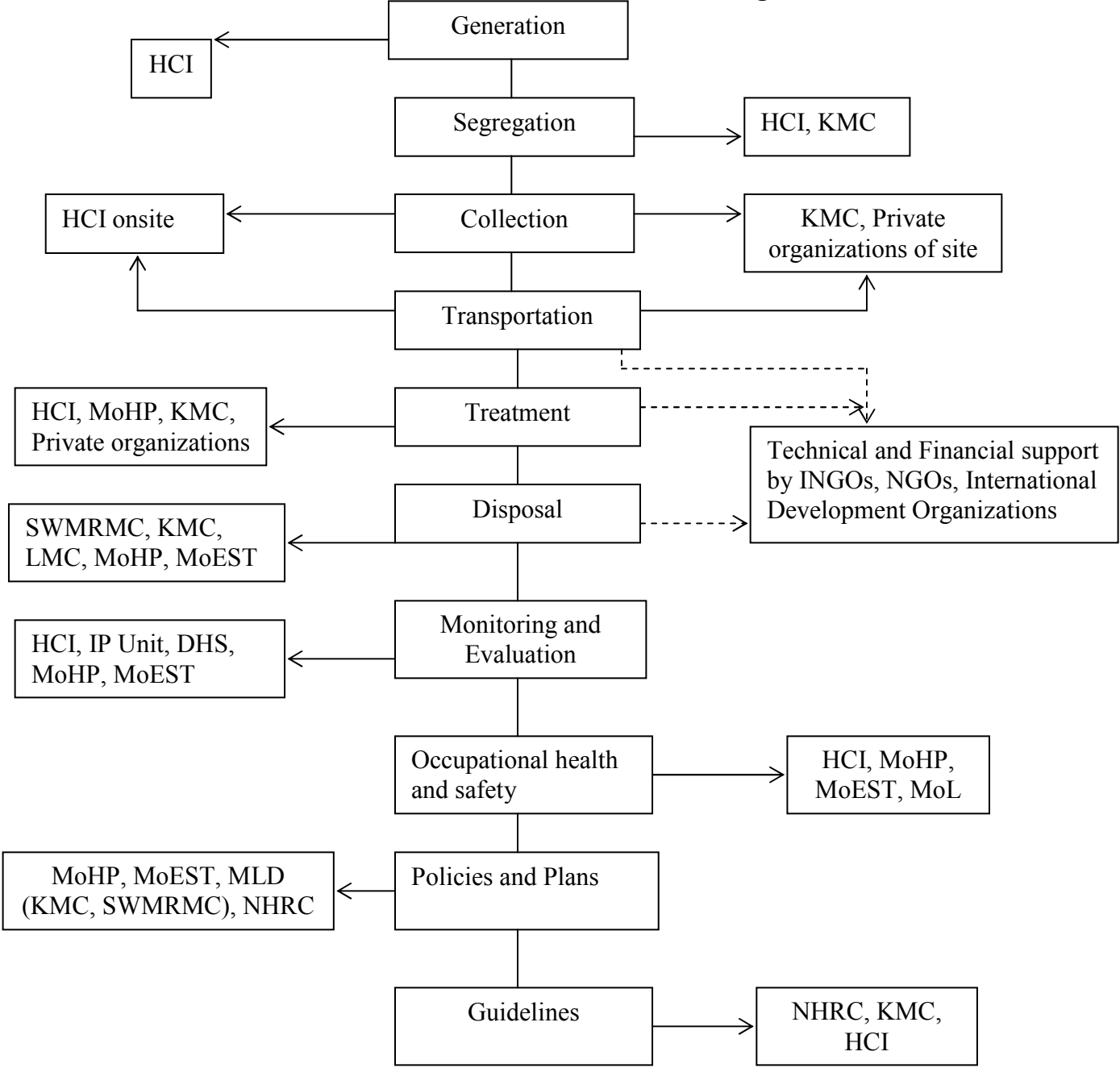


Fig 5.3: Recommended involvement of different institutions for HCW management

### Flow Chart Illustrating to strengthen the use of Guideline at Health Care Institutions

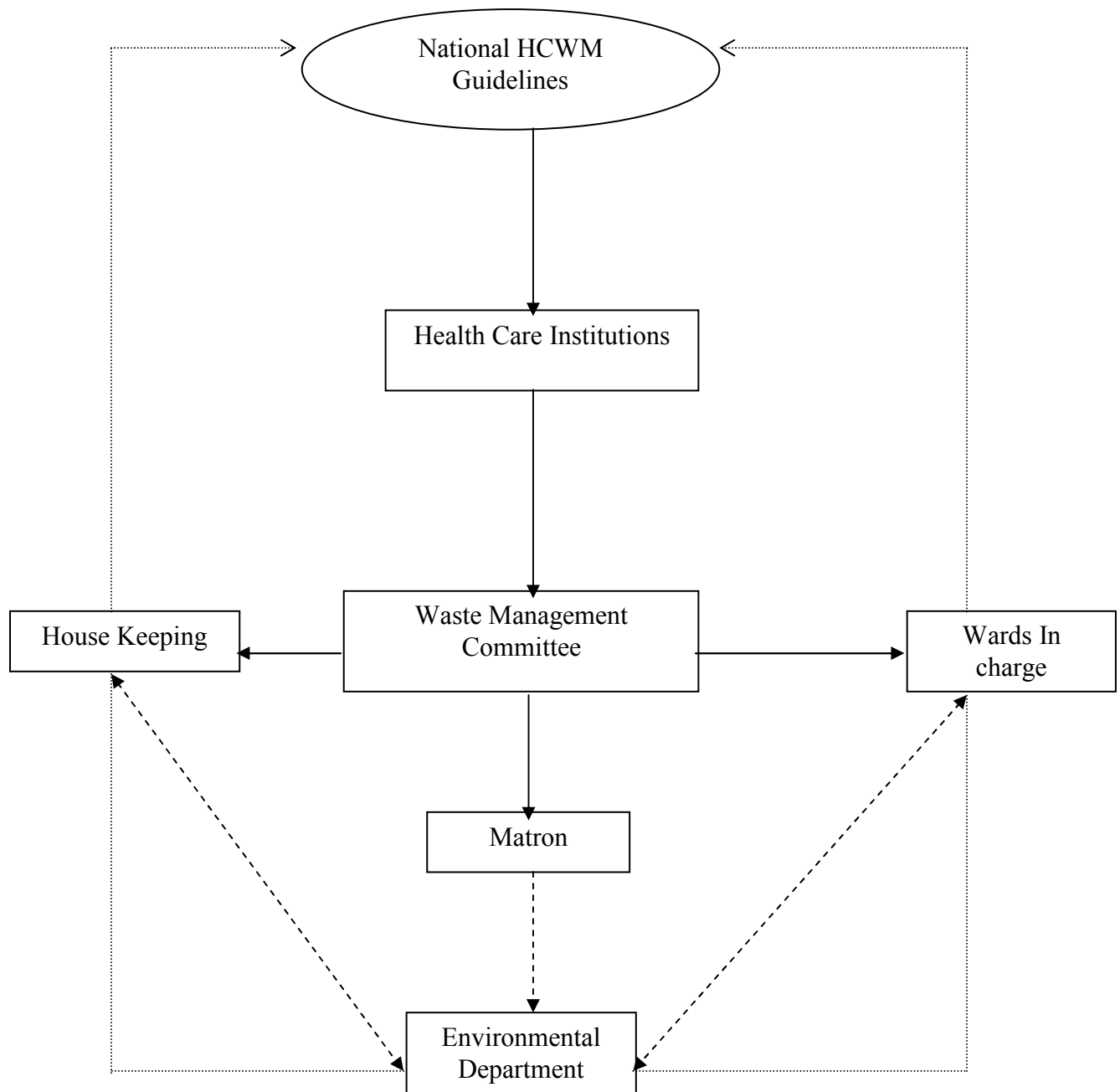


Fig 5.4: Flow chat of strengthening the use of Guideline at Health Care Institutions

The above formulated chart clearly shows the steps to be taken to strengthen the use of guideline at health care institutions; waste management committee should enforce the ward in charge, house keeping, matron or other concerned authority like infection prevention units for implementation of health care waste management guideline from the preliminary level and there should always be a mutual coordination between them. It seems that every HCI should established an Environmental Department responsible for routine monitoring and follow-up activities by member of ward in charge, house keeping, matron and infection prevention units regarding HCW management. Then report it to the waste management committee for action.

# Recommendation to Strengthen the Institutionalization of Different Institution on the Process of HCW Management

## Institutional Framework of HCW Management

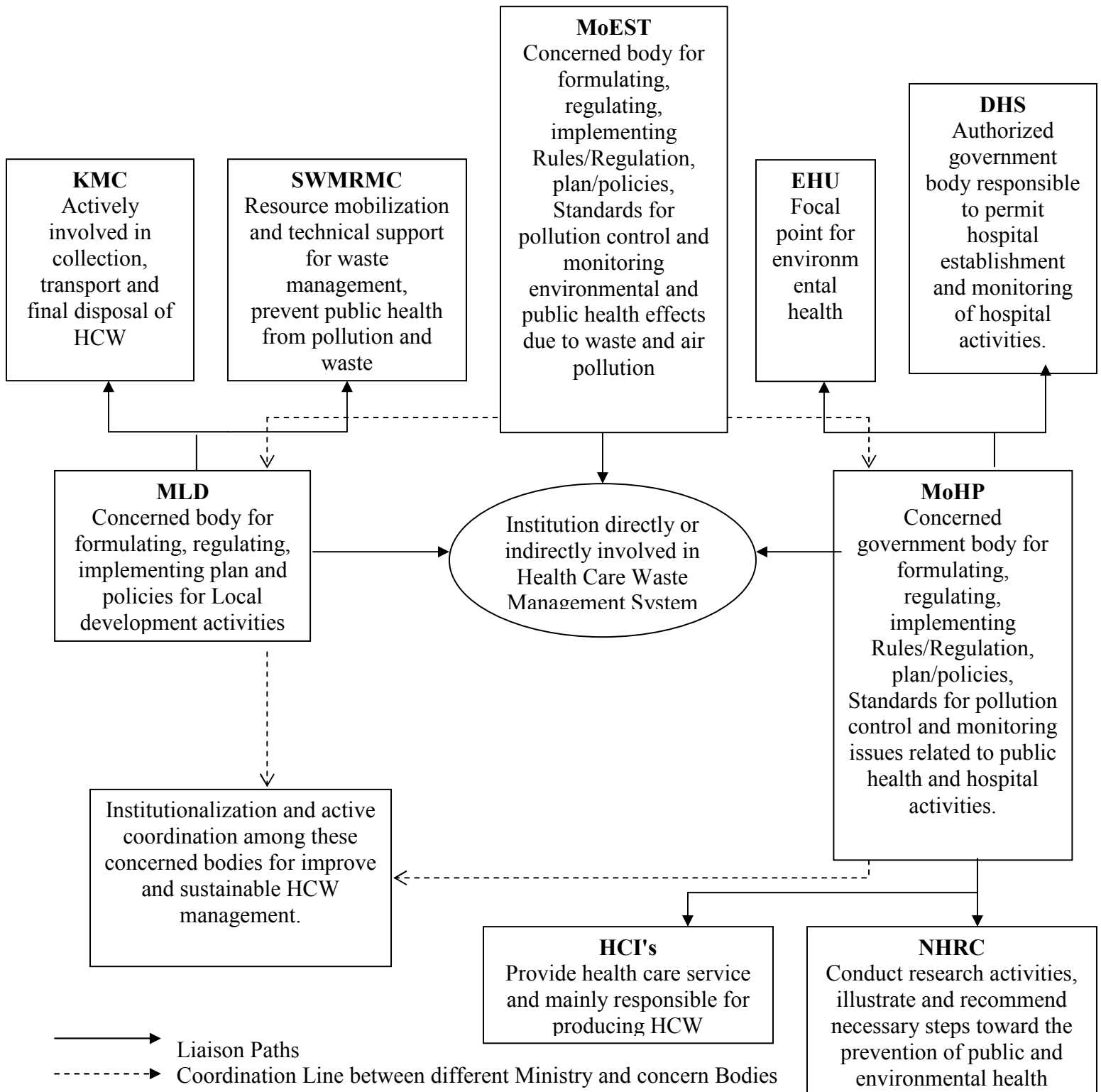


Fig 5.5: Path illustrating Institutionalization and active coordination between concerned agencies



Institutions described in this flow chart have been directly or indirectly involved in health care waste management. These institutes are working on the same issue individually and the level of co-ordination among them seems to be very low. Thus in our view, it would be better and easy to work if the specified duties and responsibilities given to specified institution under a single central authority. Figure 4.11 tries to explain that involvement of a single organization is not sufficient for systematic, appropriate and sustainable way of waste management generated health care services.

### **Views of different government bodies directly related to Health Care Waste Management.**

Regarding the concept of institutionalization of NHCWM guidelines from NHRC, different views and ideas were obtained. Our visit was concentrated on different government bodies like Department of Health Services, Ministry of Health and Population, Solid Waste Management and Resource Mobilization Center, Kathmandu Municipality Commission, Nepal health Research council and World health organization.

Talking about DHS, it is the authorized government body responsible to permit hospital establishment and to provide all the requirements. Even though they are responsible for the routine monitoring of hospital activities, they lack on addressing the shortcomings obtained. Since they explained that they are not the focal point for the effective health care waste management; they just work under Ministry of Health. Where as Immunization center, which operates under DSH has its own policies regarding the waste.

Similarly, According to MOHP, monitoring of health care waste management is essential and the process has been active but not sufficient. Especially due to political instability, one body cannot independently perform such type of work in effective manner. According to Dr. Saroj Rajendra except NHRC guideline, no such guidelines have been developed. She further insists that, MOH playing a role as a good facilitator/ coordinator in effective implementation of NHCW guideline there is the need of MOHP initiation rather than NHRC initiation to make the guideline mandatory. According to her, with MOEST first steering committee meeting was completed where as the second meeting is in process regarding institutionalization and mandatory on NHCWM guideline. Thus, from MOHP level, concerned institutions were given the guideline for health care waste, which they have already started working on.

Visiting another government body responsible for health care waste management, Mr. Surya Man Shakya, Chief of solid Waste Management and Resource Mobilization Center, explains the need of proposed level of coordination between the concerned institutions and clearly defined role and responsibilities. Since municipality is mainly responsible for the management of the health care waste, it is treating all type of health care waste as the municipality waste and finally disposes it by land filling. Where as, as per Environment Protection Act 1996, there should be a separate system in which, special provision like separate collection, transportation, and disposal system is required for sound HCW management. Such type of initiation is possible by making aware of environmental implication of different types of waste in the municipalities. He further explains that there should be a formulation of stepwise work plan for all types of waste. He added that after management of municipal waste in regular basis, solid Waste Management and Resource Mobilization Center has planed to address medical and industrial waste in effective way respectively.

Similarly, Mr. Rajesh Manandhar, senior engineer of the Kathmandu Municipality environmental division agrees with above facts and supports the idea for the need of central waste treatment facilities like incineration facility. Thus, he said that, Kathmandu metropolitan city is lobbying for establishment of Central Level Medical Waste Management System and it also initiated a pilot project of HCW incinerator of 450kg per day capacity at Teku but due to local opposition it has to stop. Need of appropriate laws to penalize those who dispose the medical waste have also been felt.

During our visit to Ministry of Population and Environment at present Ministry of Environment, Science and Technology, Mr. Pant, senior officer of MOPE explained that, Nepal has signed the BASSAL Convention on Management of Hazardous and toxic waste thus the law is automatically implemented here, but since there are no appropriate rules and regulations formulated after the assignment, it has not been addressed properly from the ministry level.

NHRC, the major responsible council involved in the health care waste management though has launched different programmes for its management, alone it cannot make the guideline mandatory. It needs a support of MOHP for the process. Even though NHRC has acted as a first, to formulate such guideline and stimulate other concerned bodies, to make concrete decision, it lacks such authority. Presenting the view of NHRC, it explains the need of publishing the guideline even in Nepali language, which can make the guideline easier to understand from both technical and non-technical persons throughout the country. It further explains the need of EIA and IEE before establishment of any hospitals, which has been outlined even in environment protection act. Since most hospitals located in urban area are with less space for HCWM on their own, municipality should act on lead with centralized treatment system in co-ordination with HCI. Further it explained the need of municipality to focus on HCW apart from municipal solid waste. And added MoHP should make the guideline mandatory and should monitor and evaluate regularly in HCIs. A positive attitude toward the guideline is that, MoHP have made action plans to develop HCWM system in all HCIs and to operationalize the HCWM guideline.

Mr. Sharad Adhikari NOO/EHP/WHO explains the need of strong coordination between WHO, municipality, MOH and MOLD regarding the treatment of Health care waste in effective manner along with institutionalization of it. He further added that, even after the generation of National Health Care Management Guideline, its implementation has been poor and thus the need of a national task force may be needed to make an effective HCWM system at municipal levels of the country. According to him, after the implementation of NHCWM guideline a good change in selected health care institutions was observed but the practice is not enough. For the NHCWM implementation, WHO can make the guideline available to all the levels and it can also help or organize training at various levels.

From all the interviewees, lack of co-ordination between government bodies was described as a major cause leading to mismanagement of health care waste.

## Chapter VI

### **Recommendations to Strengthen the Institutionalization of National Guideline HCWM Guideline**

- The concerned ministry should first of all make this HCWM Guidelines mandatory and give enough authority in order to act effectively at HCI's.
- Every HCI's should treat this national HCWM Guideline as the authorized and valuable document and follow it with full strength on their HCI regarding health care management process effectively.
- There should be a formulation of a committee responsible for the waste generated in the concerned ministry and particular hospital.
- Government should formulate strong policies and legislation to enhance effective management of hazardous medical waste and such policies and legislation should be enforced by the Ministry of Health.
- The concerned authority should enforce the compliance mechanism along with polluters pay principle on each health care institution.
- Fine for improper disposal and management of medical waste from ministry level is beneficiary.
- There should be a formation of environmental department at each health care institution for the regular monitoring, follow-up and to guide proper and systematic health care waste management by the institution itself.
- Regular awareness program should be launched from ministry level to the hospitals personals so that the basic health care waste management system and practices would be uniform at all health care institutions.
- Regular monitoring and supervision from the management level would help keep guard of their responsibilities to the health care workers along with appropriate way of waste management as per the rules outlined in the guideline.
- The legal framework including specific areas requires strengthening of the legal framework necessary for effective medical waste management.
- Need of the institutional framework is felt, including needs identification, areas that need strengthening, and training for regulatory personnel at different levels of hospital management, hospital staff, and NGOs, if any, engaged in this activity.
- Need of active participation between different concerned government bodies in collaborative health care waste management.
- Need of active participation of MoEST on plan and policies formulation for the standardization of incinerator in health care waste management sector.
- Need for capacity building in all involved public authorities, in particular the major players the Ministry of Health and the Ministry of Population and Environment.
- Need for permanent coordination between stakeholders (establish coordinating body, chaired by Ministry of Health, with representatives from all major stakeholders).

- Need for data for general planning purposes at national level.
- Implement regulation on Waste Management Plans for health care facilities.
- Legislation concerning land filling.
- Consequences of post medical waste disposal should be considered effectively while selecting the landfill site which may led to improper Leachate, human and animal scavenging.

## **Chapter VII**

### **Situational Analysis and its Report**

As per guideline every health care institution should provide personal protective equipment to all the workers in order to minimize risk of infection and injury during collection and handling of waste. Also the employees are to comply with health care waste management policies, procedure and instructions given for the protection of their own health and safety of the others. The study revealed that usages of protective equipments during the handling of waste and the rate of vaccination given to the workers have greatly reduced the rate of infection. But rather than use of surgical gloves as seen in most hospitals during handling of waste, utility gloves are recommended. But use of surgical gloves during virex preparation would be a better choice, which would eliminate the risk of direct contamination of virex solution to skin.

If a person is not willing, the hospital management cannot expect him or her to do it properly. Training in form of practical rather than verbal has led to decrease in overall rate of infection in all the cases except in one hospital the injury rate has increased which might have been due to negligence in workers part, since most of the workers were illiterate. Even though apron has been assigned to workers at the beginning, management did not replace worn-out and torn aprons. High Pressure of patient in the hospital in turn has also led to realization of low staffing leading to problems in management of the health care waste generated in hospital. Also illiteracy of the patients as well as visitors was found to be a profound factor, which has created difficulty in generating awareness among the visitors.

Immunization center working under DHS has its own policy, that is the waste generated specially the sharps like syringe which are auto disposable are disposed by burning it in a special safety box in which the syringe are collected. The box was provided by UNICEF and has been used since 2001 in campaign only. But from 2005 it has been regularly used in routine immunization programme.

Visiting the environmental section of Lalitpur municipality, it came to know that they have constructed the incinerator especially for sharps and syringe collected from routine immunization center and clinics with water scrubber for its treatment. The service has started since last two years from the municipality level, which can be, consider as the positive approach toward the management of health care waste. Taking about KMC in this context, already established incinerator at Teku for the treatment of such Health Care waste is not functioning.

While in interaction with Kathmandu Municipality it came to know that the final disposal and treatment of Health care waste collected from various Health care institutions is dumped at Balkhu dumping site along with the municipal waste. On visit to the Balkhu dumping site, various types of medical waste were found scattered throughout the dumping site as in photograph 35/36. It is to be noted that the workers involved in this waste management, scrap collector and scavenger were carelessly working in the area. This situation cause leaching of waste to river water leading to water born diseases, needle stick injuring leading to blood born diseases and other communicable diseases. Thus, the segregation done by hospitals in certain level has gone to waste. Negative impact due to improper coordination between the hospital authority and municipality regarding mixing up of the general waste with hospital waste during collection, transportation and disposal has worsened the situation.

This study reveals that in an average only about 15 per cent hazardous portion of total wastes from hospitals require special attention for their proper disposal. The remaining portion of wastes can be easily disposed off in to the municipal dustbins if they are carefully segregated. Thus a few changes in material procurement process in hospitals, mandatory staff education in waste segregation, proper hygiene education to the scavengers, treatment of selected hazardous materials, and such other few efforts can get healthcare establishments off the list of major hazardous materials to be disposed off to the municipal dust bins. Once these are properly segregated, the hazardous portion can be treated by different treatment options (e.g. chemical disinfection, autoclaving, micro waving, incineration, etc.).

Apart from this there is a need of central incinerator for the final disposal of health care waste. It was realized that all the health care institutions were willing to pay for any other alternate method of proper health care waste disposal. This opportunity can easily be utilized by the concerned authority and can launch the programme for proper disposal of health care waste efficiently.

## Chapter VIII

### Discussion

Hospital waste management is one of the most neglected parts of the managerial process in Nepal. Neither the government nor hospital authorities pay proper attention to this matter. Unhygienic waste disposal by many hospitals, clinics and healthcare centers in Kathmandu are posed serious health hazard to the city dwellers in general and to the people living within and in the vicinity of the hospitals in particular. Almost all of these hospitals are disposing every kind of wastes (hazardous, non-hazardous, infections, sharps etc.) in nearby municipal dustbins without any pretreatment whatsoever. An unhealthy and hazardous environment exists in and around these hospitals, affecting patients, hospitals staff and other people. Scavengers who collect waste from dustbins are at risk from sharps, pharmaceuticals and chemicals and from direct contact with infectious materials. Also, recycling of infectious objects may pose serious health hazard to their users. Liquid hospitals wastes are disposed directly to the municipal sewer system in most of the hospitals in Kathmandu city. Chemicals used in hospitals are a potential source of water pollution. Direct disposal of feces and urine of infectious patients in municipal sewer system may cause outbreak of epidemic diseases.

Supervision leads to consciousness and it can highlight requirements as well as need for the training. Therefore need of practical training for the waste handling staff has been felt in surveyed hospitals. Also the supervision of the supervisors is felt necessary. Attending nurse and house keeping in charge verify monitoring in regular manner, which seemed insufficient during the survey period in some hospitals. Complaint of mismanagement to upper level from attending nurse and attendants has not been beneficiary. There was no response from higher level nor any supervision or regular monitoring mechanism active resulting in lack of motivation among workers to work as per procedures. Since, monitoring is the measure of success or failure of the waste management system if done regularly the result will be good.

Virex, a disinfectant used in cleaning floors and instruments seems to be giving problems like respiratory distress and also complaint of chest pain among some workers. The problems might have been arisen due to lack of awareness in use of mask. Or even in some cases, they explained that they had no time to use gloves due to low staffing. Carelessness during laboratory work without the use of gloves was also observed in one of the hospitals during our visit period. Similarly, even though the needle destroyer was assigned in Bir hospital, it was either non-functional or difficult to perform. Low staffing with such time consuming work had created a problem during the operational condition of the machine.

Even though, personal hygiene and awareness has been found in profound level, use of toilet, as kitchen seems to be an example of carelessness or mismanagement in one of the hospital visited during our survey period. This might have been a cause for decrease health status among some workers from occupational health and safety point of view. Disposal of infectious waste in open at the heart of city as in photograph 4 can lead to serious hazard and can be a cause of epidemic spread of diseases. Thus proper disinfection of the infectious waste before disposal would be a safer method even in those conditions where proper disposal or incineration should be available. In comparison to other hospitals surveyed, Prasuti hospital have developed a constructed drainage system for the final disposal of placenta, that carries the disposed placenta into the underground concrete pits and which undergoes self-decomposition which is quite hygienic, safe and scientific.

But improper disposal of placenta and blood could be observed in back of the hospital along with open drain system. This proves lack of awareness among waste handlers and lack of proper monitoring from management level.

Even though house keeping was in charge of proper health care waste management in TUTH and have developed a separate unit for the collection of waste, but it was not so safe and mixing of waste during collection and transportation process was observed as in photograph 15. Where as in each ward they have four different color buckets for different category of waste as in photograph 14 but all kinds of waste could be seen in all buckets. During our interaction with the staffs it has been found that the resulting condition has been due to the negligence and carelessness among visitors and patients even after hospital briefing during admission procedure. Orientation to the visitors during admission procedure has led to proper management of waste in comparison to those not orientated. As a result waste segregated in ward some how, again under go segregation process in storage area as in photograph 16 which seems to be waste of time and resource as well as unhygienic for workers who are involved in the segregation process as it might be highly infectious. After segregation, they try to minimize the hazardous waste and manage the waste by incineration and the remaining general waste goes to the municipal container. Two functional incinerators operate in two types of waste i.e. one with lower operating temperature for hazardous waste and higher operating temperature for sharps like needles. But the consciousness among doctors has been found to be lacking in some wards.

Patan hospital being a district level hospital was found to have developed their own prepared guidelines since 2048, which has been followed up before the implementation and circulation of this NHCWM Guidelines. For this procedure they seems to have separated approx 25% of the annual budget for HCWM, which has been properly done with the help of trained manpower with efficient and active monitoring mechanism almost daily conducted by Infection Prevention Unit. Collection, storage, and disposal of waste and its categorization have been done strictly according to their guideline. Apart from these, waste minimization policy was also found to be adapted followed by reduction and reuse of materials in regular bases as in. If followed by other hospitals, by-products produced during burning of such products can be reduced in profound manner. The only operational problem of HCW management felt in this hospital was need of high temperature incinerator for proper final treatment of HCW effectively, due to lower operating temperature of the incinerator in use as in. This locally built incinerator seemed to have insufficient stack height leading to releases of fumes containing higher carbon particle, dioxins, and gases along with low heat temperature as in photograph 16, which might not meet the international standard. Low vent leads the spread of gases in lower atmosphere affecting health directly. It was also noticed that needles were burnt in lower temperature, which was not sufficiently disinfected and sterilized. There seemed to have insufficient space for the final disposal of biopsies and autopsies, as well as broken ampoules buried with in hospital premises since 2048 BC.

Even though pair of gloves was provided in regular basis, re-use by manual washing seemed improper and explains insufficiency of gloves. It is inappropriate to re-use gloves by manual washing after such extreme use. Apart from these two problems Patan hospital seems to have done well; they strictly follow their guideline and throw only non-infectious waste to the municipal waste container as in photograph 9. They categorize waste in wider range then the NHCWM guideline and have become an example for all hospital who neglect on these issues.



## **Chapter IX**

### **Conclusion**

Through this investigation, it has been quite evident that a satisfactory hospital waste management system in several hospitals is severely lacking. At present, Nepal has no rigorous laws or regulation, which is enforced in the field of health care waste. The waste is generally dumped together in a public place such as the hospital surroundings, roadside, and riverside or municipality container. Many doctors and nurses are found careless about what constitutes as medical waste could have if they are not properly dump on right container on ward while on their service period. Health care workers have only a basic understanding of health care and do not perceive handling or disposal of medial waste as a hazardous work. Some staff members interviewed was complaining various kinds of infectious diseases such as viral infection, typhoid, skin disease/allergy, diarrhea, dysentery e.t.c during their working period. It was discovered that improved HCWM systems have only recently been introduced in a small number of health care institution and private hospitals since the circulation of the guidelines. The study indicates that there is a need to improve the handling and disposal methods of hospital waste for almost all the available medical facilities along with final treatment. Public awareness through mass media, proper hygiene education to the scavengers, mandatory staff education in waste segregation, and legislation to regulate hospital waste management systems will change the traditional habits of different groups of people involved in this sector.

As HCW poses risks to both people and environment, it requires proper collection, treatment and disposal. The level of proper management among other factors depends upon the type of technology applied. Review of HCWM across the several health care institutions in Kathmandu city reveals that none of the HCFs follow proper HCWM. Investment in HCWM is normally seen as increased expenditure with no returns. Hence the HCFs do not make investments in improving HCWM. Therefore, there is a need to make HCWM mandatory in all HCFs by regulation. Further, in the absence of specific standards, the HCFs may choose to implement the least cost option, which may not address the concerns risks to people and environment. Specific standards can also help assess the HCWM performance. In the absence of specific standards, HCFs and private HCWM service providers are expected to be reluctant in making any investment in equipment and technology with the apprehension that such invest may turn out to be bad investments in case higher standards are prescribed by the regulation later. Development of specific standards would bring out clarity and encourage private sector to engage in HCWM services.

With regard to environmental regulation in relation to health care waste management the Government should consider to prepare the regulation and enforce it with regular monitoring.

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**ANNEX-II**  
**PHOTOGRAPHS**



**Photo 1: Blooded/used Syringe Container at Bir Hospital Laboratory**



**Photo 2: Dumping of used Syringe on the Floor instead of Waste Container**





**Photo 3: Spillage of wastewater at back of the Bir hospital**



**Photo 4: Open Storage Area at Back side of the Bir Hospital with Public**



**Photo 5: Municipal Container At Om**



**Photo 6: Body Parts on the Plastic bags on the Municipal Container at Om**





**Photo 7: Syringe ready to Burn at Patan**



**Photo 8: Box Use for Collection of Needles and Sharps at Patan**





**Photo 9: Example of a Good Waste Segregation at Patan**



**Photo 10: Different Types of Waste at Municipal Container at Prasuti**





**Photo 11: Unsafe Waste Segregation Practices Adapted at Prasuti**



**Photo 12: Use of Dalo as Waste Collection Container at Prasuti**



**Photo 13: Representation for Collection of Different type of Waste at TUTH**



**Photo 14: Segregation Place at TUTH**





**Photo 15: Collection & Transportation of Waste to Storage Area at TUTH**



**Photo 16: Final Segregation and Storage Place at TUTH**



**Photo 17: Use of label and Warning to Infectious Area at TUTH**



**Photo 18: Incinerating of the Infectious Waste at TUTH**





**Photo 19: Used Syringe at Landfill side on Balkhu**



**Photo 20: Safety Box Use for disposal of Syringe, Sharps by EPA**



**Photo 21: Incinerator at Lalitpur Municipality Medical Waste**