MINISTRY OF HEALTH AND FAMILY WELFARE

(MOHFW)

Environmental Assessment and Action Plan

For the Health, Population and Nutrition Sector Development Program (HPNSDP)

2011-2016

February, 2011

Government of the People's Republic of Bangladesh

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Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
BAEC	Bangladesh Atomic Energy Commission
BDT	Bangladeshi Taka
BAMWSP	Bangladesh Arsenic Mitigation and Water Supply Project
BOD	Biochemical Oxygen Demand
BUET	Bangladseh University of Engineer & Technology
CE	Combustion Efficiency
CIDA	Canadian International Development Assistance
CNO	Community Based Organization
COD	Chemical Oxygen Demand
DCC	Dhaka City Corporation
DFID	Department for International Development (UK)
DG	Director General
DGHS	Director General Health Services
DGFP	Director General Family Planning
DMCH	Dhaka Medical College Hospital
DoE	Department of Environment
DOHS	Director of Health Services
DPHE	Directorate of Public Health Engineering
DU	Dhaka University
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EOC	Emergency Obstructive Care
ESD	Essential Service Delivery
FP	Family Planning
FY	Financial Year
GOB	Government of Bangladesh
HCF	Health Care Facility
MWM-SG	Medical Waste Management – Service Group
HIV	Human Immune- deficiency Virus
HNP	Health, Nutrition and Population
HNPSP	Health, Nutrition and Population Sector Program

IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
IEC	Information, Education and Communication
LD	Line Director
LD – IHSM	Line Director, Improved Hospital Services Management
MCWC	Maternal & Child Welfare Centre
MOEH	Ministry of Environment and Forestry
MOHFW	Ministry of Health & Family Welfare
MOL	Ministry of Law
MOLGRD	Ministry of Local Government and Rural Development
MWM	Medical Waste Management
MW	Medical Waste
MWS	Medical Waste Strategy
NGO	Non-Government Organization
NICC	National Implementation Coordination Committee
NIPSOM	National Institute for Preventive and Social Medicine
OT	Operation Theatre
PIP	Program Implementation Plan
PRISM	Project in Agriculture, Rural Industry, Science and Medicine
THC	Thana Health Complex
ToT	Training of Trainees
UHC	Upazila Health Complex
UNICEF	United Nations Children's Emergency Fund
UP	Union Parishad
WHO	World Health Organization
WSP	Water and Sanitation Program

Preface

Any intervention involves some environmental impact and a number of such impacts have been identified to be associated with the Health, Population and Nutrition Sector Development Program (HPNSDP, 2011 to 2016). Medical Waste Management (MWM) is the most significant issue, although there are other important issues like supply of clean/pure water, provision of proper sanitation facility, occupational safety and infection control measures, use of hazardous insecticides/pesticides and construction related environmental issues.

The present report concentrates on review and mitigation of the potential impacts of MW disposal on environment and focuses on status of MWM in Bangladesh, in which some efforts have been initiated presently. This report reviews and updates the environment assessment and action plan for the health, nutrition and population sector program which had been prepared earlier (November, 2004).

An environmental Assessment and Action Plan was prepared for the HNP Sector Program (HNPSP), 2004. This report is an update of the 2004 EMP to identify the present status of medical waste management (MWM) in the country and other identified related environmental issues. The report also includes a gap analysis of the present MWM system and a framework for implementation of the updated strategy, including time line and a revised budget.

The report attempts at a fairly comprehensive look at the present level of environmental aspects of MWM in Bangladesh. The present statuses of MWM along with on-going developments have been reviewed including legislative and regulatory aspects and the gaps in the systems have been identified. They are broadly classified as inadequate adoption of legal provisions, insufficient institutional accountability, low level of awareness, inadequate capacity at facility level, resource constrains and lack of clarity on acceptable technical solution, although some developments are observed in the present scenario. The required strategy and its implementation including institutional and policy frameworks to tackle and improve these gaps have been proposed. A phased investment and operation plan for five years during the period FY10-11 to FY11-16 at an estimated cost of BDT 508.08 million (about US$ 7.21 million) for public HCF has been proposed. It will be implemented by the line directors of the DGHS and DGFP offices under MOHFW.

It has to be mentioned here that the valuable contributions provided by personnel of related organizations have enabled to prepare this report with the objectives of improved management of medical wastes for restoration of environment qualities in the country.

Summary

1. Introduction

Generation of Medical waste (MW) from health sector, due to its content of hazardous substances, creates adverse impact on human being and environment, if not managed properly. Efforts for improvement in managing MW has initiated in the country since the beginning of 2005. Various development activities have been undertaken MOHFW and related other Ministries/Organization/Agencies for proper MWM in the country, although many further efforts are required for implementation of country-wide MWM.

2. Objective

Present report concentrates on existing status of Medical Waste Management (MWM) in Bangladesh, potential trend situation, identification of gap, existing legislative/regulatory measure, potential improvement in MWM, its strategy and implementation procedures along with financial investment. It also includes some health care-related environmental issues like safe water supply to Health Care Facilities (HCFs), their sanitation facilities, use of hazardous insecticides for control of vectors, and management of HCF-construction wastes. The issue of, global warming, climate change and sea level rise has also been discussed in connection with MWM.

3. Present Situation of MWM

- Training and awareness building on MWM has been started in February, 2005 and it has been completed in all the Medical college hospitals and in 30 districts (out of total 64 districts) of the country;
- Officials of 34 districts and 108 upazila received training as trainers to orient MWM to other Health workers in 2009;
- Some of the health care facilities including both public and private (most of them in Dhaka, with some development in Khulna and Jessore)) follow the standardization for proper MWM, safeguarding the environment;
- Some NGOs (mainly PRISM, Bangladesh) have developed expertise for imparting training and for final transport and disposal (with cooperation from MOHFW and DCC) of MW;
- Construction of proper pits and supply of logistic required for improved MWM were done in 2008 for 133 upazila and in 2009 for 76 upazila;
- In emergency obstructive Care (EOC) service of MCWC locally made incinerators are used for burning of MW;
- In spite of all the above development efforts a major portion of HFC dump the non-segregated solid MW into the roadside City Corporation/Pourashava dustbins liquid MW in the drains/water bodies, which lead to contamination of soil, water (including ground water through leach ate), human health, affect bio-diversity and the environment as a whole.

4. Estimation on Quantity of MW

Assuming 1 kg/ total waste/ bed/ day and 23.5% infections and 1.5% sharps and 110% occupancy rate, the total generation of medical waste for a day of 2009 will be as follows:

Infectious waste = 22,486 kg

Sharps = 1,350 kg

General waste = 67,401 kg

Total MW = 89,945 kg

5. Projection of Future MW Generation

With the assumption 8% increase of no. of patience/year, 5% increase of MWM, there will be 3% net increase in generation of MW. The total annual generation of MW has been estimated to be 33,221 tons of which 8,208 tons to be hazardous in the year 2009. This amount will be increased to 39,668 tons and 9,801 tons of total MW and hazardous waste respectively by the year 2015.

6. Existing Regulatory Framework for MWM

Government (through Department of Environment) has declared Medical Waste (management and processing) Rule by November, 2008, which serves as the main existing complete code to be followed by all concerned agencies for proper disposal of MW and thus safeguard the environment. Onward efforts to follow the code have to be started for ensuring standard MWM in the country.

7. Potential Steps for Development of MWM and Environment

- Guideline specified by Government of Bangladesh for MWM should have to be established gradually with present standard of activities for restoring environmental. Standard.

- Action to be taken to gear up the awareness and training activities to complete nationwide task ASAP.

- All steps of waste collection, segregation interval transport, interval storage, external transport and final disposal to be done as per specification in DOE-declared regulation.

8. Potential Strategies for Improving MWM

- Enhancement of activities of National Implementation Co-ordination Committee (NICC) for nation-wide Implementation of MWM

- Building awareness and capacity building at all levels;

- Continuation of training and developing appropriate guidelines and manuals ;
- Creating accountability through appropriate legal/regulatory framework;
- Provision of logistics and manpower to be ensured for MWM activities;
- Enhance involvement of expert NGOs to supplement the activities of Government Organizations;
- Creation of more accountability of MOLGRD in capacity development of out-house facilities of MWM;
- Creation of appropriate institutional framework for implementation of MWM;
- Making targeted and phased investment;
- Follow the Government-declared code of MWM;
- Ensure adequate financial support for implementation of MWM activities.

9. Cost Estimate of MWM

According to an estimated cost for MWM of public HCFs of the country it would require BDT 508.08 million (about 7.21 million US$) for the period 2011-2016.

Environmental Assessment and Action plan for HPNSDP (2011-2016)

1. Introduction

1.1 Background

Environmental issues associated with the health sector creating adverse impact on environment vary widely in nature. Of them Medical Waste Management (MWM) is considered to be the most significant issue, although some other issues like Water supply, Sanitation, Handling and Use of hazardous insecticides/pesticides and issues associated with management of wastes during Construction of Health Care Facilities (HCFs) etc. also deserve due attention. Thus issues related to MWM as has been highlighted in the previously prepared Environmental assessment report as follows:

- MWM (solid, liquid and gas)
- Safe water supply
- Sanitation.
- Use of hazardous insecticides/pesticides
- Declaration of Environmental policy related to medical waste management and status of its implementation in the medical sectors.

The present effort will be to review present level of the management of Medical wastes in the light as stipulated in the previous Environmental assessment report and find out gaps and recommendation of mitigation measures accordingly.

1.2 Objectives

The objective of this report is evaluate the present status of disposal of MW, to delineate the key environmental issues in the medical sector, detail the legislative measures taken by the Government of Bangladseh, provide an update of status of MWM implementation, including measures proposed and undertaken by Departments of Health Services (DGHS and DGFP) and Environment (DoE), compliance with legal requirements and formulation of Action Plan for MWM based on identified gaps.

Other Healthcare environmental issues like safe water supply, sanitation, handling of hazardous insecticides for control of vector borne diseases and management of construction wastes, global warming and climate change have also been integrated in this report for improved health environment.

1.3 Structure of the Report

The structure of the report follows the previously formulated report with some modification as required shown in the following table:

Table-1.1
Structure of Report (Chapter wise issue/ Focus)

Chapters	Issue/ Focus
Chapter-1	• Introduction to the Report
Chapter-2	• Environmental Issues in the Medical Waste Sector. • Brief outline of the Hospital Related Environmental Management Issues • MW Management • Safe Water Supply • Climate Change, Global Warming and Medical Waste Management.
Chapter-3	• Review of Present Scenario of Medical Waste Management in Bangladesh • Present Practice of MWM • Description of Health Sector • Situation of MW Generation and its Trend
Chapter-4	• Status of Implementation of MWM and Enactment of New MWM Rule
Chapter-5	• Improving MW Management in Bangladesh • Strategy and Action Plan for Improving MW Management; • Policy Framework
Chapter-6	• Implementation of the MW Management Strategy • Proposed Institutional Framework. • Training & Capacity Building • The MWM Action Plan • Cost Estimate • Monitoring of the Implementation
Chapter-7	• Recommendations

1.4 Sources of Information

Information used in this report are mainly from the following reports along with others:

a) Environmental Assessment and Action plan for the HNP Sector Program (2005-2010)
b) Health, Population and Nutrition Sector Program (PIP), June, 2011
c) Medical Waste Regulation (Management and Processing), DoE, 2008.
d) Health Population & Nutrition Sector Strategic Plan, 2011-2016
e) Health Bulletin, 2009, MIS, DGHS.
f) Health Bulletin, 2010, MIS, DGHS
g) Survey Report, Hospital Waste Management in Dhaka City
h) Some national and international publications related to MWM and environment.

2.0 Environmental Issues in the Medical Waste Sector

2.1 Brief Outline of the Hospital Related Environmental Management Issues

Environmental health is the measurement, evaluation and control of factors within our environment that have an effect on the health and well-being of the population. Occupational health is that aspect of environmental health that concerns itself with the interaction between workplace and the health of the workers.

Hospitals are large, organizationally complex, system driven institutions employing large number of workers from different professional streams. They are also potentially hazardous workplaces and expose their workers to a wide range of physical, chemical, biological, agronomical and psychological hazards. Thus environmental health issues' relating to personal safety and protection of its workers and the community is a very important concern for hospitals. Hospitals play an integral role in community protection through wider Public Health issues including injury and illness prevention, health surveillance and disease notification, and disaster management.

In addition, over their core business of acute health care for in-patients, hospitals are also concerned for the safety and protection of in-patients related to nosocomial infection control, evacuation plans for internal emergencies, food preparation, and handling by the hospital kitchen. Finally, hospitals are also concerned with environment protection through their waste management strategy, with particular attention to collection and disposal of the contaminated waste.

Discussion of environmental health issues relating to hospitals can be divided into 4 parts –

(1) Patient protection,
(2) Population (community) protection,
(3) Personnel (staff) protection, and
(4) Environment protection.

2.1.1 Patient Protection

Minimizing adverse outcomes of health care for inpatients is of prime importance to hospitals and a major focus of quality assurance activities. A very significant indicator of quality care is the nosocomial infection rate.

The hospital's infection control should be concerned with the prevention, surveillance and control of nosocomial infections. There should be written guidelines outlining the principles,

strategy, policy and procedures for infection control in the hospitals, on which all staff should be familiar with. Regular feedback on surveillance of nosocomial infection rates will help motivate staff to remain vigilant. Following steps are required for patients' protection:

- Maintenance of patient safety in bed, during mobilization, toilet aids etc;
- Evacuation plans for internal emergencies including fire, explosion, bomb threat, earth quake, flood etc.;
- Food safety, including maintaining standard during food storage, handling and preparation.

2.1.2 Population (community) Protection

Health Surveillance

The hospital's role in health surveillance is limited to notifiable disease. Laboratory confirmed diagnosis is notified to the public health unit within. Early notification of a provisional clinical diagnosis of certain notifiable disease is encouraged, particularly those of public health significance, such as Dengue fever and meningococcal disease, which allows early mobilization of resources for contact tracing and other public health measures to contain outbreak.

2.1.3 Disaster Management and Hospital Preparation in Emergency

Hospitals have a major role in disaster management, where disasters result in multiple casualties. The procedures for mobilization of resources to (i) receive and triage (ii) assess, resuscitate and stabilize (iii) provide definitive care for and facilitate inter hospital-transfer of patients should be clearly documented in the hospital's external disaster plan.

The Hospital Disaster Committee is responsible for preparedness and planning of the hospital for management of multiple casualties, and should regularly review and rehearse with mock exercises. The committee shall also ensure the adequacy of back-up power and water supplies to the hospital following the impact of natural disaster.

It ensures planning, design, development, conduct, evaluation, after action, training and exercise conducted in hospitals and preparedness of planning partners.

The hospitals external disaster plan forms part of the functional Regional Health disaster plan, which in turn forms the medical sub-plan of the comprehensive District Counter Disaster Plan.

The hospital's ability to respond to emergency would depend on, to a large extent on system's pre-event preparedness planning, which relates to practice to train staff on their roles and responsibilities in responding during occurrence/ need.

For an effective preparedness exercise all level staff should participate and the senior level staff should play the key role for leadership support. For any such exercise the participants need to be organized into major functional areas (e.g. emergency operation center, administration section, infection control, clinical support services etc.)

Sometimes hospitals may also collapse, which is serious incident. All types of preparation like salvation of patients, doctors, nurses, medical staff, logistics, equipment, setting up field hospitals/ substitute medical facility with immediate effects have to be done, which require huge preparation, include training and other support supply, which need prior planning and management.

2.1.4 Personnel (staff) Protection – Physical Hazards

(a) Protection from Radiation Exposure

There is a wide range of radiation hazards related to medical imaging (x-ray, nuclear scans utilizing radioactive isotopes) and radiation oncology which utilizes ionizing radiation from variety of sources to treat a range of malignant tumors. These sources include (i) sealed sources containing radioactive materials, such as isotopes of radium, cobalt and strontium and (ii) linear accelerators emitting short wave length gamma waves.

The various hospital compliance required with relevant codes of practice, standards, statutes and guidelines are as follows:

- Appropriate training, certification and credentialing of users;
- Demonstrated implementation of safety precautions related to storage, use and shielding of non-target personnel;
- Regular inspection, maintenance and certification of the equipment by the appropriate authority; and
- Monitoring the radiation exposure of staff using the equipment.

  (Present situation on Nuclear Safety and Radiation Control in Bangladesh has been attached in annexure - D)

(b) Protection from Chemical Hazards

Toxic chemicals in use in the hospitals include:

- Industrial cleaners used by contracted cleaning staff;
- Chemical sterilizers, in particular gluteraldehyde used for the sterilization of endoscopes and other equipment that cannot steam sterilized;
- Tissue preservatives, such as formaldehyde used to store and preserve body tissue prior to histopathology;
- Chemical reagents used in the hospital pathology laboratory;
- Cytotoxic drugs requiring preparation prior to parenteral administration to cancer patients;
- Processing chemicals for x-ray film development;
- Anesthetic gases in the Operating Theatre.

The hierarchy of principles for controlling chemical hazards should be well documented and utilized within hospitals (as follows):

- Elimination (use an alternative process or strategy e.g. disposables);
- Substitution (use of least toxic chemicals that will do the job);
- Isolation (keep the relevant chemical in one isolated area, if possible);

- Enclosure (e.g. gluteraldehyde fume cupboard, preparation of enclosure for cytotoxics, close circuit anesthetic machines with scavenging of exhaust gases);
- Ventilation (X-ray processors);
- Personal protection (gloves, goggles, plastic gowns etc. where appropriate);
- Personal hygiene (hand washing after use);
- General cleanliness (clean up spills, appropriate storage etc.);

Relevant staff should have appropriate training and education in the use of any of these chemicals, also should be informed of the dangers of associated risk.

(c) Protection from Biological Hazards

Management of biological hazards should be comprehensively covered by the policies and procedures developed and monitored by the respective authority. There are 3 important modes of disease transmission from patients to staff; they are,

(1) Air-borne and droplet aerosol exposure – include viral upper respiratory tract infection, measles and TB. Preventive measure include (i) keeping distance(>1m) from frontal coughing as much as possible (ii) wash hands after every patient contact and especially avoid rubbing eyes before washing (iii) high filtration face masks (where applicable) and (iv) isolate inpatients in a negative air pressure room.

(2) Skin contact exposure – include *staphylococcus aureus* and *Varicella*. Prevention requires protective gown and gloves.

(3) Exposure to infectious fluids via broken skin, eyes, mucous membrane and parenteral exposure – includes hepatitis B, hepatitis C and HIV from all body fluids except sweat, as well as gastroenteritis and hepatitis A from fecal fluid. Preventive measures include universal precautions (glove, gown, goggle and mask), and appropriate management of sharps, spills and contaminated waste.

If acute exposure to a biological hazard does occur, staff members need to be aware of relevant policies and procedures for appropriate management of the exposure. This will include;

- Appropriate washing for mouth, eye or skin exposure;
- First aid for penetrating sharp injury
- Prophylaxis for high risk exposure;
- Testing of the source, if possible;
- Testing and follow up of the exposed staff
- Reporting of the incident.

A shortened copy of a Biological Waste Management Plan has been attached in Appendix-E, which can be piloted in some MCH/HCF in our country with the cooperation of all concerned agencies as a test case.

2.1.5 Environmental Protection

Waste Management Issues

In an increasingly cost conscious world concerned with the long term environmental effects of pollution there is an increasing expectation that producers of hazardous products should be responsible for them "*from cradle to grave"*, that is from their production to safe disposal.

Also in a world of limited and diminishing resources there is increasing pressure for waste minimization and recycling despite the cost involved. This has led to the introduction of waste management principles – reduce, reuse, recycle, treat and dispose. Clinical (biomedical) waste disposal gives rise to some special issues in relation to infectious material, hazardous chemicals and drugs and body parts for which a standardized system approach should be adopted.

The major components of medical waste management includes:

- Proper waste collection and segregation at source – use of standardized color-coded bins for different wastes;
- Waste streams - general, contaminated, cytotoxic/pharmaceuticals, body parts;
- Storage and transport - cold storage for contaminated waste and body parts, transport in safe and leak proof containers;
- Waste treatment – sterilization of contaminated waste (steam autoclave), incineration of cytotoxics, pharmaceuticals and body parts in incinerator meeting relevant standards and statues.

The hospitals (specially the large-sized) have the opportunity to take a proactive role in the community by:

- Increasing commitment to quality assurance activities to maximize patient protection against adverse outcome;
- Promoting environmental health by support for waste reduction, reuse and recycling; use of energy efficient, environment-friendly building; and greener and organic gardens.

2.2 Medical Waste Management (MWM)

Medical activities safeguard the health of the community but their functioning results in the production of wide varieties of wastes.

MW which is also referred as clinical waste has to be handled and disposed in a proper manner to eliminate the possibility of injury or infection and safeguarding the environment as a whole. The impacts associated with improper MWM can damage the environment and affect public heath directly and indirectly.

Medical wastes contain both general wastes (app. 75-80 per cent) and infectious wastes (app. 20-25 per cent). MW constitutes a public health hazard, if not managed properly. Although majority of the MW is no more dangerous than household/municipal waste, the hazardous waste, if exposed to the people or environment in an untreated form, pose various kinds of danger. Thus, the main concern relates to the portion of MW that are defined as hazardous. In particular, MW poses a special health risk to the staff of HCFs, to the patients and visitors, to workers collecting, transporting and treating the waste and to the society and environment in general. Thus, there is a need of special effort for proper management of MW by the concerned authorities.

According to WHO medical wastes have been categorized as follows:

- Infectious: Materials containing pathogen in sufficient quantities, that if exposed can cause diseases.
- Sharps: Disposable needles, syringes, saw, blades, broken glasses, nails or any other item that could cause a cut.
- Pharmaceuticals: Drugs and chemicals that return from wards, spilled, out-dated, contaminated or are no longer required.
- Radioactive: Solids, liquids and gaseous wastes contaminated with radioactive substances used in diagnosis and treatment of diseases (e.g. toxic goiter).
- Others: Wastes from office, kitchen, room including bed linen, utensils, paper etc.

While the adoption of disposable sharps provides safety to health workers reducing risk from needle pricks and sharp-cuts it has caused sudden increase of the MW production and it has also created problem of plastic waste and the repacking and resale of MW such as improperly treated contaminated syringes, needles and other recyclable items used for treatment which can result in community exposure to infection such as HIV/AIDS, sepsis, hepatitis and multi-drug resistant bacteria. Proper MWM helps control of hospital acquired infections (nosocomial diseases), and negative long-term health effects like cancer, from the environmental release of toxic substances e.g. dioxin, mercury and others.

The issue of MWM is becoming important gradually as the amounts of hazardous/ infected waste is increasing with fast spreading of blood- infected HIV/AIDS incidence among certain groups of population. It has necessitated more attention to blood safety, disposal of needles, syringes and other infectious wastes.

Since Bangladesh is susceptible to frequent flooding, waste from HCFs can easily be spread with water and can cause regular outbreak of water-borne diseases like diarrheal disease during and after flooding, mainly caused by improper management of medical waste.

The present scenario of MWM in Bangladesh has improved considerably, although many more development still to be done on the issue.

MWM is an issue associated with all kinds of medical facilities including health care related laboratories, academies and research institutions etc. as spread all over the country. Since medical services are regular activities, the MWM has to be continued.

2.3 Safe Water Supply

In Municipality areas hand tube wells (HTWs) are the main source of drinking water and while in city areas piped water (combination of surface and ground water) is the source of supplying water. In rural areas the primary source of drinking water was surface water, including reserve ponds only, where no other activities like bathing (human and bovine), washing were allowed. However, given the numerous outbreaks of cholera epidemics Government promoted the installation of HTWs.

2.3.1 Arsenic Contamination of Drinking Water

Since the detection of arsenic contamination in 1993 and subsequent testing of ground water samples, it has been recognized that the ground water of almost 249 upazila of 61 districts are contaminated with arsenic[1]. Presently about 80 million people of the country are at the risk of arsenic-contamination. Arsenic is highly toxic and can cause skin cancer, kidney and liver failure, respiratory problems and in extreme cases, death.

In addition to arsenic, excessive iron, manganese content and salinity also poise problems to drinking water in some areas. There are a number of programs underway to manage, treat and mitigate arsenic contamination of ground water.

Given the high risk of contaminated ground water, supply of safe water to HCFs needs special planning and management system.

According to Health Bulletin, 2010 the first human cases of arsenic contamination was detected in 1994 by the Department of Occupational and Environmental Health (OEH) of the National Institute of Preventive and Social Medicine (NIPSOM). The National Arsenic Program of the DGHS is carrying out detection of arsenic patients in the country. The number of such patients was 23 in 1996, which rose to 38,320 in 2009, which has further risen to 56,758 by December, 2010. Division-wise distribution of the latest situation is given in the following table:

Table-2.1: Distribution of arsenic patients by Division of Bangladesh

Chittagong	Khulna	Dhaka	Rajshahi	Barisal	Rangpur	Sylhet	Total
27,811	11,340	9,337	5,500	1,308	1.015	447	56,758

Various initiatives for arsenic related health problem have been undertaken since 1994 including survey, formation of steering committee, Secretary's committee and expert committee. National policy for arsenic mitigation and its implementation plan and implementation committee were formed in 2004.

Arsenic program targets include community awareness raising, capacity building on arsenic mitigation, arsenicosis patient searching, identification and management, awareness raising

[1] *According to survey in 1999-2000 conducted in 61 districts with cooperation of DFID, where as many as 3500 water samples were tested.*

on alternative source of water, research and development and coordination with GO and NGO.

Awareness raising include adverse effects of arsenic contamination, alternative water source, treatment arsenic patients and on non-communicable properties of arsenicosis.

According to Dr. AKM Jafar Ullah, DPM Arsenic & NCD. DGHS, Arsenic programme of DGHS look into the above issues (effect of arsenic on human health and their remedy mainly) related to arsenic contamination of drinking water and DPHE is involved in the investigation on extent of arsenic contamination of drinking water of the country discharging from different aquifers through hand tube wells and steps for its possible solution mainly. Thus, these two organizations are involved in total potential solution of Arsenic menace of the country, although various NGOs also work for the issue under their umbrella and there exists some coordination between DGHS and DPHE on it.

> *Under the circumstances, it may be proposed here, that all the existing working forces combating the arsenic problem of the country, to work under 'one umbrella' consisting of representations of concerned Ministries/organizations (like MOHFW, MOLGRD, MOEF, MOL NGOs etc.), that would provide better scope for proper addressing the severe national problem with integrated force on national basis.*

2.4 Sanitation

In the national context Government of Bangladesh has set target of achieving 100% sanitation by 2010 and has taken up a multi-year program on total sanitation starting from October, 2003.

2.4.1 HCF Sanitation

Some of the established HCFs lack proper sanitation facility. These HCFs discharges toilet wastes to surrounding water bodies, land areas and also pollute air. The improper/poor sanitation systems get worsen by the poor maintenance systems. It contributes enormously to the outbreak of various diseases like malaria, diarrhea, dysentery and upper respiratory tract infection etc.

Away from the disposal problem general maintenance standard (specially in respect of cleanliness) of almost all the existing toilet facilities are quite poor and need further attention. It has to be remembered that patients are more easily susceptible to various diseases than the general people and thus the sanitation arrangement of HCFs should maintain high level of cleanliness and infection-free status.

Thus emphasis should be given on environmental hygiene and cleanliness by improving the sanitation facilities which would reduce the tendency of spread of diseases in the HCFs.

2.5 Use of Hazardous Insecticides/ Pesticides

Different types of insecticide are generally used for prevention of vector borne diseases. But improper handling and use of such substances poses health risk to both general public and persons handling such substances.

Higher concentrations of insecticides, if spread in the air, is likely to cause health problem of the people of the area.

The adverse impact may affect the following stakeholders:

- Health staff who handle the poisonous substances as main part of their job.

- General public of the affected area, who are exposed to such substances (including air pollution).
- Non-pathogenic microbes, surface water, plant/trees etc. of the area.

Current practice of handling such chemicals in the HCFs need also to be reviewed whether adequate precaution is taken. If not, revised arrangement to be adopted for safe handling of the chemicals

Training of the people involved in handling the poisonous chemicals, will enhance awareness among them to ensure safer/proper handling. Supply of required logistics along with close monitoring would also help in improving the situation.

2.6 Construction Waste Management

Constructions of HCFs (along with maintenance activities) involve various activities resulting degradation of environment in many ways. They involve various steps like

- Clearing of area,
- Excavation of site and disposal of earth,
- Disposal of construction materials,
- Accommodations of labour including their food preparation, water supply, provision of sanitation etc. also include production of wastes which require proper disposal.

Disposal of all these activities produced during construction activities have to be done in environment-friendly manner.

Unless Proper construction management practices are followed, construction activities can cause serious environmental pollution, ecological degradation along with health and safety concern to the workers and public health of the vicinity.

An environmental guideline during construction (containing technical, social and financial aspects) has to be provided to the construction agency during signing of contract, which has to be complied by the contractor, that needs to be monitored during construction for ensuring environmental protection.

2.7 Climate Change, Global Warming and Medical Waste Management

Human beings are exposed to climate change through changes weather patterns (temperature, precipitation, sea-level rise and frequent events). Global warming would enhance calamities like floods, weather disasters, heat waves, deaths, droughts, fire etc.

Climate change would cause various effects on people's health like malnutrition, increased death, diseases and injury due to extreme weather events, increased burden of diarrhoeal diseases, increased frequencies of cardio-respiratory diseases due to concentration of ground level ozone in urban areas related to climate change and it is also associated with increased hospital admission of pneumonia, chronic obstructive pulmonary disease, asthma, allergic rhinitis and other respiratory diseases and premature mortality. Although climate change would reduce exposure to cold effect, but the negative effects

The negative effects of climate change would be mostly on the low-income population, already experiencing large burden of diseases.

There is likelihood that climate change caused by global warming may change the type and quantities of medical waste generated from medical sector. Proper management of potentially produced heath care waste may require revised planning and management.

The major potential fields of development to face possible fields of climate change are as follows:

- Capacity building to face the situation with required logistic;
- Awareness building and training of manpower for increasing efficiency;
- Energy conservancy and energy efficient building and other logistic;
- Efficient and trained manpower.

For new hospital building arrangement for solar panel /alternate renewable energy sources applicable/ feasible in Bangladesh should be thought of.

For the purpose the areas identified potentially to be affected by climate change (comparatively low-elevated coastal areas in the southern belt of the country) should get preference and plan to be prepared accordingly.

Same type of preparation also to be taken for any other natural catastrophe (like earth quake/flood, poor construction, old building collapse etc.).

2.8 Summary of Qualitative Assessment

Various drives have been undertaken in a large number of HCFs in the country for MWM, being coordinated by MOHFW, who has undertaken active role along with other related ministries and organizations, although many efforts have to be diverted on the issue in both quantitative and qualitative dimensions. The MWM has to be extended to the new areas, where it is yet to be started and at the time drive for ensuring qualitative attainment of MWM has also to be initiated following the related environmental code as declared by DoE.

3. Review of Present Scenario of MWM in Bangladesh

This chapter includes an overview of the medical sectors in the whole of the country and an estimate of the quantities of medical waste generated and required to be managed properly.

3.1 Present Practice of MWM

Medical waste poses serious threats to environmental health, which creates concern for environmental protection. The problem is growing with the increasing number of HCFs (hospitals, clinics and diagnostic laboratories) in Bangladesh as per the public demand which has further increased by the introduction disposable medical practices.

According to World Development Report 1992 (The World Bank, 1992) “Protection of environment is an essential part of development, without adequate environmental protection, development is undermined.”

Management of Medical Waste, in Bangladesh, has although entered development arena, several efforts to be diverted to attain it. At present, although there are some HCFs who

follow the codes of MWM, some follow MWM partly and many are yet to adopt/follow any code related to WM. The lapses are found in all the stages, collection, segregation, storing, treatment and final disposal of MWM.

Mixed with ordinary waste the medical waste, the entire municipal waste creates a great public health hazard. The liquid and the solid MW containing hazardous materials are simply dumped into the nearest drain and garbage heap respectively, where they are prone to contaminate the rag-pickers. It is observed in some HCF that the cleaners (*ayahs*), who are responsible for cleaning and segregation of medical waste, resale various used items like syringe, needle, saline bag, blood bag, test tube etc. In many occasions the infectious wastes are not separated from the non-infectious/ domestic waste.

It is also observed that some HCFs discharge the liquid pharmaceuticals and chemical wastes into general sewer/drain without any treatment, which pollute the water bodies around in terms of BOD, COD, TSS, Faecal coliform and Total coliform content above tolerable limits.

These are the extreme examples of poor MWM. On the other hand it is certain that MWM is developing in Bangladesh. Training is being imparted, awareness is progressing, several efforts for improved MWM are underway mainly from MOHFW along with other concerned Ministries/Organizations/Agencies.

In Bangladesh the most mentionable progress in MWM is the formation of National Implementation Committee (NICC) that took place on 26.8.2007 by the active effort of MOHFW, where representation from different ministries and organizations took place and various related issues related to collection and proper management of MW up to final disposal were discussed and required steps were taken in meeting and many subsequent meetings were held for various development on the issues.

Declaration of Code for MWM by the Government of Bangladesh (on 5th November, 2008) is also a remarkable progress in this connection.

It can also be mentioned here that a private HCF, Medinova undertakes the services of a western organization, working in Bangladesh, for collecting and managing their MW.

According to DGHS, at present level (by the end of 2010) all the public HCFs and registered private HCFs in the Dhaka city follow the procedures of MWM, which is a major development.

The information/data available from various HCFs on management of health care waste is not adequate and proper in the country, which is like many other developing countries. It can be said that there is an urgent need for raising awareness and education on medical waste issues. In this situation, initiative must be taken to regulate and control the threats of hazardous hospital waste.

However, some HCFs, mostly private, have been found to collect their in-house waste systematically. In Dhaka medical college hospitals, the largest HCF in the country MWM has improved a lot in the in-house waste collection and segregation, which has been introduced 9-10 months back (from early 2010), although they have many limitations, like shortage of man-power and lack of monitoring mainly. Holy Family Hospital has also been found to manage the MW properly, although they have some limitations which need further development.

Another mentionable progress in MWM in the country is activities of NGO PRISM (Project in Agriculture, Rural Industries, Science and Medicine), who is now working for MWM in association with DCC and with assistance from MOHFW and financial assistance from WSP and CIDA. The NGOs Waste-Concern and Prodipon are also playing some roles in MWM in the country.

Discussion with various stakeholders of MWM has been carried out and the information availed from discussion with different MWM agencies, (Text part of discussion are attached in annexure) data/ information from various survey findings and progress of medical waste management at Upazila level HCFs the present situation of MWM can be summarized as follows:

Table-3.1
Present Situation on MWM and Action Needed

Sl. No.	Issues of MWM	Observation	Action needed
1.	Awareness and motivation on MWM	The MWM training of the staffs of HCFs have to be completed ASAP through an integrated national program maintaining its qualitative standard. Lack of awareness among the HCF professionals (in most cases) affecting understanding of proper MWM and its severe adverse impact on environment.	• Need further active steps for enhancement of awareness and motivation; • National Implementation of Coordination Committee (NICC) to make proper arrangement for taking action for proper conduct/ monitoring of MWM in individual HCF; • Some steps for general awareness of local elite about severity of MW may also be thought of.
2.	Use of specific color coded bin	Few HCFs have introduced use of specific color bins for segregation of MW at source, most of them in Dhaka and no uniformity in using specific colored bins in most of the HCFs	• These HCFs also need close monitoring for which a cell to be organized at HCF level; • All HCFs need to be made aware to use the specific colored bins for specific waste as prescribed by DoE regulation.

Sl. No.	Issues of MWM	Observation	Action needed
3.	Segregation of HCF waste at source	The practice has been introduced through training and supply of required equipment in few HCFs, e.g. In DMCH segregation at source has been started about 9-10 months before, but still there exist some lacking, like all the wards do not maintain 4 nos. bins for segregation. In some wards (CCU, ICU and post-operative) maintained by nurses the quality of segregation is quite satisfactory. But for other wards, segregation done by sweepers need further monitoring and quality control.	• Imparting training and building awareness is the most important per-requisite for segregation at source; • Need strict monitoring of proper segregation; • Require increase of manpower to carry out the activities properly.
4.	Management of sharps	Some cut off the nozzle of needle from syringe, some do not.	• Need training and monitoring to stop reuse of needle and syringe to protect from infection. • Ensure cut off nozzle of needle from syringe. Need supply of equipment and monitoring.
5.	Intermediate storage	Lack of availability/ use of secured intermediate storage facility for MW.	• Facility for intermediate storage to be ensured; • Awareness training to be imparted and monitoring to be ensured.
6.	Internal transport	Trolleys are not used regularly for transport of MW to outside containers.	Require proper monitoring.
7.	Occupational health and safety measures for workers.	Adoption of security/protective measure taken by sweepers on very few occasions..	• To ensure use of protective measures by health workers during MWM activities.
8.	Transport and ultimate disposal of MW	Non-segregated MW directly dumped to public container; Segregated MW waste is dumped in closed pits at hospital premise; Segregated wastes are dumped in open pit for burning (burning is incomplete in most cases);	• Follow up proper disposal procedure for different segregated wastes; • Procedures mentioned in the DoE's regulation can be followed by all

Sl. No.	Issues of MWM	Observation	Action needed
		Segregated MW are disposed in incinerator for burning, having no temperature control as required. Few HCFs follow strict code of MWM.	HCFs that need consensus by all the agencies involved In MWM.

3.2 Description of Health Sector

The total health care facilities in the country belong to the following categories:

- Community clinic for family planning, maternal and child welfare centers having various programs including immunization, communicable disease control, symptomatic curative for common complaints etc., serving about 6,000 people.
- Health and family welfare canters (Union Health and Family Welfare Centre (UHFWC) – there is Family Welfare Assistant on union basis and a Medical Officer and a Pharmacist have been posted in each of the upgraded 1,362 unions and 4,000 physicians have been recruited for posting at union level. There also exist MCWC at 13 unions with required man-power.
- Upazila health complexes (UHC) have 31-50 bed capacity, with operative room facilities for minor surgery and caesarean operation and facility for outpatient treatment. Main activities deal with clinical contraception and disease control. About 160 UHCs claim to provide comprehensive emergency obstetric care and a range of diseases namely gastroenterology, gynecology and obstetrics, pediatrics, hematology, infectious diseases to pulmonary disease are treated in UHCs .
- District hospitals have bed capacity ranging from 100 to 250 with the responsibilities for clinical care, community and public health.
- Medical college hospitals and specialized hospitals - there are 18 public medical college hospitals for learning up to degree level and 7 specialized hospitals along with post graduate institute providing tertiary level care.
- Maternal and Child Welfare Centers (MCWC).
- Private hospitals - covering approximately 51.67 % of the total bed capacity and expected to rise considerably.
- Hospitals run by other ministries like Ministry of communication (Railway), Ministry of Labour;
- All other medical services (both health services & family planning) providing government/private organizations/ institutions (which exist outside the above purview), personally donated charitable hospitals/dispensary, Tea garden hospitals etc. existing in the whole country also to be considered in this connection.
- The current bed capacity for Bangladesh is about 6.8 beds per 10,000 populations, which is about 17 percent of the norm, according to WHO standard.

The number of health care facilities and bed capacities of the country are furnished in the following tables.

Table-3.2: Division-wise No. of health care facilities and functional beds, according to Health Bulletin, 2010

Division	District and general HCFs		Medical/ Dental colleges/ Alternative medicine HCFs		UHC/THC HCFS		Union level HCFs*		Specialized HCFs		Infectious/ Chest/ Leprosy HCFs		HCFs Under DGFP**		Other HCFs	
	No. of HCFs	No. of beds	No. of HCFs	No. of beds	No. of HCFs	No. of beds	No. of HCFs	No. of beds	No. of HCFs	No. of beds	No. of HCFs	No. of beds	No. of HCFs	No. of beds	No.of HCFs	No. of beds
Barisal	06	750	01	600	33	1175	09	140	-	-	1	20				
Chittagong	11	1850	02	1510	85	2912	12	140			3	190				
Dhaka	17	2400	08	3945	103	3687	05	100	9	2264	2	130			3	180
Khulna	10	1350	01	500	50	1816	02	30			3	140	72	1600	1	25
Rajshahi	14	1850	04	2550	111	3935	06	80	1	500	6	200			1	50
Sylhet	04	700	01	900	31	1056	02	30			4	176			1	50
Total	**62**	**8900**	**17**	**10005**	**413**	**14581**	**36**	**520**	**10**	**2764**	**19**	**856**	**72**	**1600**	**6**	**305**
Thus, the total functional beds in public HCFs = 39,531 and the total number of functional beds in private HCFs = 42,237 (as per Health bulletin, 2010), totalling to 81,768 nos. of functional beds in the whole country.																

* Data on union level HCFs are taken from Health Bulletin, 2009; ** Beds of DGFP include 2 large MCWCs at Azimpur and Mohammadpur, Dhaka and 70 MCWCs spread around the country.

According to Health Bulletin, 2010 the bed capacities of various typed of Health care facilities are provided in the following table:

Table-3.3
Distribution of number of beds on various types of HCFs in in the country

Type of HCFs	No. of HCF	No. of total functional bed	Average size of HCF
Specialized HCFs with PG teaching institute	7	2114	302
Specialized Centers	2	150	75
MCH/Dental CH/Hospitals affiliated with college for alternative medicine	17	10005	589
Upazila/Thana Health complexes	413	14581	36
Union level HCFs	36	520	14
Specialized HCF (mental)	1*	500	500
Infectious disease HCF	5	180	36
District HCFs	53	7650	144
General HCFs	9	1250	139
Chest/TB HCFs	11	546	50
Leprosy HCFs	3	130	43
MCWCs (with EOC) under DGFP	70	1300	19
Large MCWC under DGFP	2	300	150
Other HCFs	6	305	51
Total public	**635**	**39531**	**62**
Total private registered hospitals and clinics	2501	42237	17
Total Country	**3136**	**81768**	26

**Another specialized HCF (in Khulna) has no functional bed as yet.

3.3 Situation of MW Generation and its Trend

3.3.1 Types of Medical Waste

Health care activities like immunization, diagnostic tests, medical treatment and laboratory, although protect and restore and lives, generate various wastes and by-products as stated below:

- Infectious wastes – cultures and stock of infectious agents, waste from infected patients, wastes contaminated with blood and derivatives, discarded diagnostic samples, infected animals from laboratories and contaminated materials (swabs, bandages) and disposable medicals equipment and devices.
- Anatomic wastes– recognizable body parts and animal carcasses.
- An infectious and anatomic waste together represents about 15% of the total medical waste.
- Sharps – syringes, disposable scalpels, blades, glasses etc. representing about 1% of medical waste.
- Chemical wastes – mainly solvents and disinfectants.
- Pharmaceutical wastes – expired, unused and contaminated drugs and their metabolites, vaccine and sera.
- Chemicals and pharmaceuticals amount to about 3% of total medical waste.
- Genotoxic waste – highly hazardous, mutagenic, teratogenic or carcinogenic, such as cytotoxic drugs used in cancer treatments and their metabolites.

- Radioactive matter, such as glassware contaminated with radioactive diagnostic material or radio therapeutic materials.
- Wastes with high heavy metals content, such as broken mercury thermometer.
- Radioactive matter and heavy metal content together represent about 1% of the total medical waste.

3.3.2 Background Information

So far several surveys have been conducted on different status of medical waste management in Bangladesh and a wide variation is observed in various surveys/researches/investigations. It is interesting to note that it is found from survey that hospitals with modern medical facilities have higher generation of MW. For example BMCH and Samorita HCF have waste generation rate of 0.73 and 0.74 kg/patient/day as compared with DMCH with 0.67 kg/patient/day.

Medical waste generation in Bangladesh is 0.8-1.67 kg/bed/day or 1.16 kg/bed/day of which 0.17 kg/bed/day is hazardous[2].

According to another study of MWM practices in 60 HCFs in Dhaka city[3] average waste generation rate 1.9 kg/bed/day. The above findings have been furnished in the following table:

Table 3.4
Quantity of different type of MW according to above survey

No of HCFs	No of inpatients	Total quantity of HC waste	General waste	Total hazardous	Infectious waste	Plastic waste	Liquid waste	Sharp items
60	2,927	5,562	4,305	1,257	790	211	189	67
Waste in per cent		100.0	77.4	22.60	14.2	3.8	3.4	1.2

At the time of the study (2005-2006) 2 big hospitals of Dhaka city, DMCH (public) and BMCH (private) would disclose their waste into the DCC bins without any segregation. A few private HCFs used to segregate their waste and send it to the International Centre for Diarrheal Disease and Research in Bangladesh (ICDDR,B) for incineration.

3.3.3 Estimation of Medical Waste Generation

Quantity of hazardous medical waste depends on many factors and it has variation in different observation; a conservative average has been considered here calculation. The

[2] *"Medical waste management in Asia, C. Visvanathan", 2008.*

[3] *"Pattern of Medical Waste Management: existing scenario in Dhaka city (M. Manzurul Hassan et. al published in BMC Public Health, 2008.*

assumed occupancy rate varies on types of HCF, type of diseases and many other socio-economic factors. Following assumption rate of medical waste generation for this report.

Table-3.5
Assumption on estimation of total MW generation in the country

Parameters	Values
Total Occupancy rate 110%	110%
Hazardous waste generation	250 gram/inpatient/day
Composition of MW	
General waste	75%
Sharp	1.5%
Other infectious waste	23.5%

Based on the above assumptions and the number of bed capacity based on Health Bulletin, 2010, the total amount of medical waste can be estimated as shown in the following table:

Table 3.6
Estimated generation of different MW in Bangladesh (in kg/day), 2009

HCFs	No. of patients/ day	Total hazardous waste (250 gm/p/d) (in kg)	Sharps (1.5%) (in kg)	Other infectious waste (23.5%) (in kg)	General Waste (75%) (In kg)	Total MW (in kg)
Barisal	2,954	739	44	694	2,216	2,954
Chittagong	7,262	1,816	109	1,707	5,447	7,262
Dhaka	13,977	3,494	210	3,284	10,483	13,977
Khulna	4,247	1,062	64	998	3,185	4,247
Rajshahi	10,082	2,521	151	2,369	7,562	10,082
Sylhet	3,203	801	48	753	2,402	3,203
MCWC	1760	440	26	414	1,320	1760
Sub-total (public)	**43484**	**10,871**	**652**	**10,219**	**31,488**	**43484**
Private	46,461	11,615	697	10,918	35,913	46,461
Total (country)	**89,945**	**22,486**	**1,350**	**21,137**	**67,401**	**89,945**

Source: Health Bulletin, 2010

The annual MW generation can be estimated from the data of above table as furnished below:

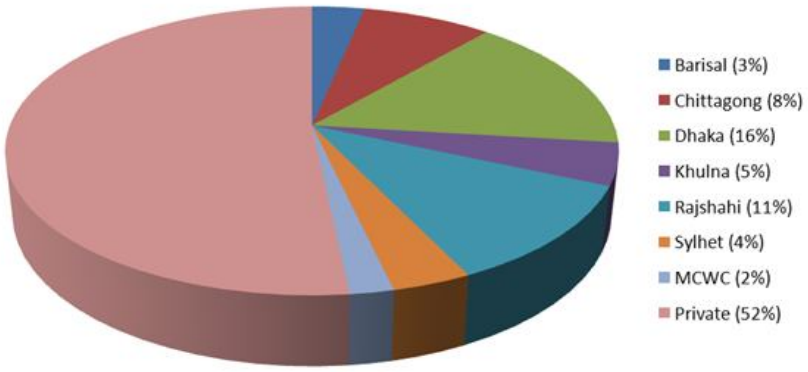
Table-3.7
Estimated generation of MW in Bangladesh (in tones/year), 2009

HCFs	Total hazardous waste	General waste
Barisal	270	809

HCFs	Total hazardous waste	General waste
Chittagong	663	1,988
Dhaka	1275	3,826
Khulna	388	1,163
Rajshahi	920	2,760
Sylhet	292	877
MCWC	161	482
Sub-total (public)	**3,969**	**11,905**
Private	4,239	13,108
Total	**8,208**	**25,013**

The figure below shows the distribution of the waste generation of Public HCFs and private HCFs in the country.

Figure 3.1: Distribution of generation of medical waste in the country, 2009 (Source: Health Bulletin 2010)



3.3.4 Projection of Future MW Generation

Following are the main factors, among some others, will influence the future generation of MW.

- The number of patients to be treated.
- Development in use of equipment and materials
- Quality of segregation of the MW.

The number of patients to be treated in turn depends on a number major factors like:

- The number of population and rate of incidence to illness
- Development in availability of health services
- Development of health and population services
- Socio-economic status of the population

The population growth rate ranges between 1.54 to 1.48 per year during the last few years. No dramatic change is expected in the coming years, so it is anticipated that the population growth will remain at the level of 1.5% per year.

The health situation of the population is expected to be improved through the vaccination and nutrition programs, although catastrophes like flood, drought or severe earthquake or any other may deteriorate the situation dramatically.

Present availability of health services will, most likely, to be improved in the years to come and there will be an increased demand for health services as well.
According to Bangladesh National Health Accounts, 1999-2001 there has been an increase in the total health expenditure of 5.2-7.2% in the period from 1996-2001. If this increase is assumed to continue an, average growth in the health sector in the coming years can be estimated to 6.5%.

There is every likelihood that the use of equipment and materials will increase in the coming years due to upgrading of health care sector. Although more disposable materials will be used it will not cause sudden increase hazardous health care waste as adoption of improved health care waste management following improved technology including segregation, storing, transporting and use of proper method for final disposal (as approved) of the medical waste with installation of more appropriate equipment and awareness building. However, some increase of MW will take place, very logically. For the calculation of the future quantities of health care waste the followings have been assumed:

Generic assumptions for calculating future amounts of medical waste

Population growth = 1.5 % per annum
Health of population = No significant change in the demand of health services.
Availability of health services = 6.5%

This may lead to an increase in the no of patients for treatment of about 8% per annum
The use of more disposable materials may increase of general waste of 1.5% per annum
Increased quality of waste segregation may lead to a relative reduction of infectious waste of about 5% and a relative increase of general waste of 2-3 per cent.

Summing up, both quantities of hazardous and general waste categories will increase at about 3% per annum in the coming years.

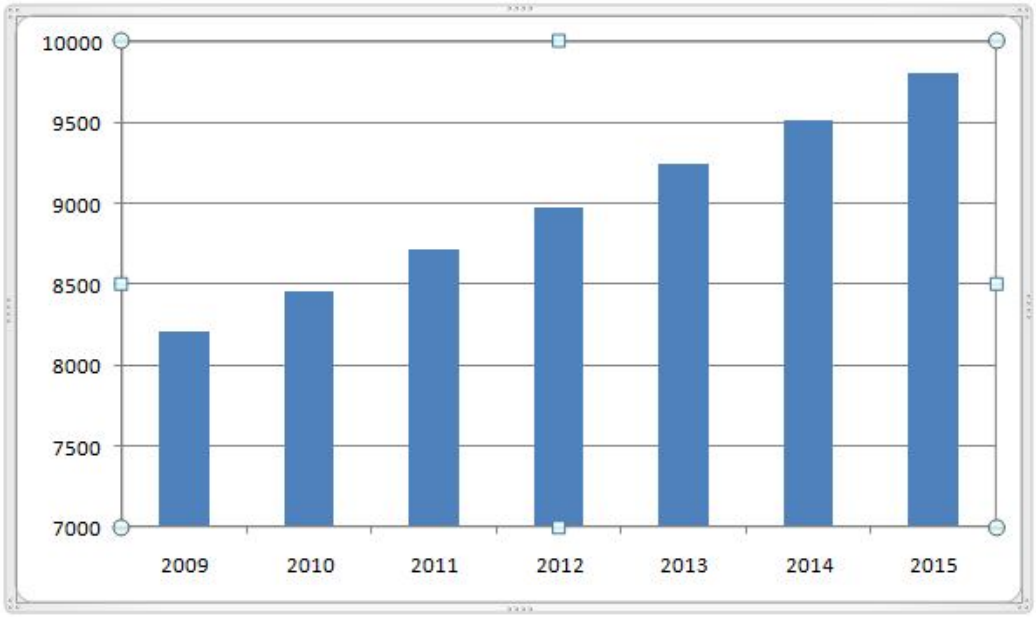
Based on the above assumptions projections for generation of MW in the country, as presented in the table below:

Table-3.8
Estimated amounts of medical general and hazardous wastes in Bangladesh, tons/ year, 2009-2015

General wastes	2009	2010	2011	2012	2013	2014	2015
Barisal	809	833	858	884	910	938	966
Chittagong	1,988	2,048	2,109	2,172	2,238	2,305	2,374
Dhaka	3,826	3941	4059	4181	4306	4435	5468
Khulna	1,163	1,198	1,234	1,271	1,309	1,348	1,389
Rajshahi	2,760	2,843	2,928	3,016	3,186	3,200	3,296
Sylhet	877	903	930	958	987	1,017	1,047
MCWC	482	496	511	527	542	559	576

General wastes	2009	2010	2011	2012	2013	2014	2015
Total Public HCFs	**11905**	**12,262**	**12,630**	**13,009**	**13,399**	**13,801**	**14,215**
Private HCFs	13,108	13,501	13,906	14,323	14,753	15,196	15,652
Total	**25,013**	**25,763**	**26,536**	**27,332**	**28,152**	**28,997**	**29,867**
Hazardous waste	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Barisal	270	278	286	295	304	313	322
Chittagong	663	683	703	724	746	769	792
Dhaka	1,275	1,313	1,353	1,392	1,435	1,478	1,522
Khulna	388	400	412	424	437	450	463
Rajshahi	920	948	976	1,005	1,035	1,066	1,098
Sylhet	292	301	310	319	329	339	349
MCWC	161	166	171	176	181	187	192
Total public HCFs	**3,969**	**4,088**	**4,211**	**4,337**	**4,467**	**4,601**	**4,739**
Private HCFs	4,239	4,366	4,497	4,632	4,771	4,914	5,062
Total	**8,208**	**8.454**	**8,708**	**8,969**	**9,238**	**9,515**	**9,801**

Estimated Quantities of Hazardous Medical Waste in the Country (In ton), 2009-2015



MWM has achieved some progress in Bangladesh but they inadequate as per the generation of total medical wastes in the country and present efforts need to be extended both quantitatively and qualitatively. Moreover, there exists gap in adoption of required technology at all stages of MW management in environmental –friendly ways. A statement PRISM, Bangladesh that " they are involved in MWM of about 328 HCFs out of total about 1,200 HCFs in Dhaka", which is about 27.33 per cent and there exists no other mentionable agency for MWM in the city area. This is an indicative situation of MWM activities. Some MWM activities are visible in Jessore, Khulna and Chittagong. In other parts of the country the MWM situation has not progressed mention-ably.

Medical waste management at Upazila level HCFs are in progress. (According to Health Bulletin, 2009, page-35). Government of Bangladesh, under HNPSP, included medical waste management as a priority sector as an activity under improved hospital service component. The Upazila and below level were not considered in the previous initiative as they fall under the primary health care. Considering the situation government incorporated the waste management initiative for hospitals at the Upazila and below as a component of essential service delivery (ESD) in line with the national goal to ensure safe, environment-friendly, cost-effective and sustainable management of medical wastes derived from curative, diagnostic, preventive and rehabilitative health care services both in public and private sectors.
To implement proper medical waste management system at primary health care level the main components in implementing the strategies are:

a) Construction of pits (for infectious, sharps, general and recyclable waste) in UHC.
b) Procurement and regular supply of logistics for collection and transportation of waste and the safety material for the waste handles.
c) Training/ Orientation of personal on proper waste management.
d) Community awareness on waste, its management and individual responsibility.

Target is to establish a sustainable medical waste management system in all the UHCs by 2010-11 fiscal year.

Achievement in 2008

According to Health Bulletin, 2009

a) Pits were constructed in 133 upazila (included in the fiscal year 2007-2008)
b) Necessary logistics (for safety and managing waste) were procured and distributed to those 133 upazila.
c) Hands on training were imparted to 133 upazila waste related personnel's and concerned district officials to establish proper waste management system in those UHCs.
d) Orientation on MWM of key officials of Civil Surgeon's office and all the Upazila staffs (except field staffs) of 18 districts.
e) Construction of pits in 7 more Upazila health complexes completed by July 2009.
f) Procurement process through CMSD was started for procuring logistics for the 2008-09 fiscal year.
g) For behavior change communication one poster is developed on medical waste management to use at UHCs.
h) In emergency obstructive care (EOC) service of MCWCs locally made incinerators are used for burning of medical waste.

Achievement in 2009

According to Health Bulletin, 2010 the waste management function for the health facilities at Upazila and below level has been entrusted with the operational plan of essential services delivery (ESD). The components of the program are (i) construction of pits (for infectious, sharps, general and recyclable waste) in the Upazila health complexes; (ii) procurement and regular supply of logistics for collection and transportation of waste and the safety materials

for the waste handlers; (iii) training and orientation of the health personnel for proper waste management; and (iv) community awareness on medical waste, its management and individual responsibility.

Achievement in MWM of UHCs

In the Upazila health complexes (UHCs), training of the medical staffs for MWM has been imparted to about 60 per cent of the UHCs of the country and the process is in progress. Accordingly different colour bins have been supplied to the UHCs for collection of different MW at their generation points. Mainly nurses and ayas carry out segregation and collection of MW and the doctors are responsible for their monitoring. MWM of UHCs has started from 2005-2006. The UHCs have also been provided with trolley for transporting the segregated waste to storage.

The general waste, infectious solid waste, infectious liquid waste and sharp waste are collected separately. The general waste and sharp are disposed separately in different pits; the infectious wastes (both solid and liquid)are treated with bleaching powder and the solid portion is disposed in separate bin, whereas the liquid portion is mixed with water (different dilutions for different wastes) and disposed in sewerage channel.

According to Essential Service Delivery (ESD), the filling of the pits would require a period of 6-7 years, by which the waste would be decomposed. Monitoring of the MWM in the UHCs is also done from Dhaka office time to time.

ESD, however, feels the need for enhanced monitoring of MWM of UHCs that requires increase of expert man power for the purpose. They have also stated that there is no proper management for disposal of radio-active waste (although such waste is decreasing with the introduction of ultra-sonogram).

According to ESD establishment of improved facility for waste disposal (with modern technology) at district/divisional locations by DGHS would improve the MWM of the UHCs. The transportation, treatment and disposal of the MW can be done by expert NGO for the purpose that should be paid by MOLGRD.

Achievement in MWM at Secondary & Tertiary Level Hospital

A . Inter-ministerial level Decision (MOHFW and MOLGRD)

a. In house medical waste management is the responsibility of MOHFW.

b. Out-house medical waste management (collection, transportation and final disposal of medical waste) are the responsibility of MoLGRD (by City Corporation / Pouroshova) or can contract out through NGOs.

c. Approval of Committee & TOR for out house medical waste management (final collection, transportation and disposal of medical waste)

- National level
- City corporation level
- District level
- Upazila level

d. In house medical waste management, segregated and temporary storage of medical waste will be done under uniform color code approved by MOHFW

e. MOLGRD will issue necessary directives at City Corporation, District and Upazila level.

f. Establishment of a centralized out-house MWM technology, so that all the public & private health care facilities could be brought under the same umbrella (treatment technology).

B. At the Ministry (MOHFW) level

a) National Implementation Coordination Committee (NICC) for MWM formed.

b) MWM Implementation & Coordination Committee at different administrative level for Out-house management of MW formed.

c) Government hospital will pay service charge to the City Corporation /Powroshova for MWM.

d) MOHFW to donate two vehicles to Dhaka City Corporation for MWM activity.

e) Regulatory affairs: “Medical waste management and Handling rules” has been issued/published.

f) In the District/Divisional Government Level health care facilities, out-house MWM will be conducted by City Corporation or could be contracted out to NGOs.

g) In the Upazila government health care facilities, out-house MWM will be conducted by the hospital authority within the hospital premises by pit method till Pouroshovas develop sufficient capacity for MWM or contracts out to NGOs.

C. At the Directorate level (DGHS, Mohakhali)

a. All Government hospital and Private & clinics in Dhaka city bought under MWM program.

b. One Pickup/Truck already handed over to Dhaka City Corporation for strengthening their capacity in MWM related activity.

c. Handed over one Incinerator from Shohid Sohorawardi Hospital complex to Dhaka City Corporation (DCC) for strengthening MWM program of DCC.

d. Training manual for In-house medical waste management already approved by the TEC committee and printed.

e. Government health facilities will pay service charge to City Corporation for out-house waste management. There is provision for “Service charge” in the Operational Plan.

f. Procurement of Vehicle (2-Pickup covered van) for donation to Dhaka City Corporation is in process.

g. Waste management related logistics supplied to all government hospitals in Dhaka city and other District level hospitals.

h. Coordination meeting conducted among stakeholders and “Out-house MWM committee” members for activation & strengthening Out-house MWM in respective Divisional/District areas.

i. Health care service providers of all government hospital in Dhaka City already trained on MWM program.

j. Health care service providers of all government Medical college hospital, Specialized Hospitals & 31-District Hospital already trained and logistic supplied on MWM program.

k. Finalization and approval of the Chick list for monitoring and supervision of the HCFs on MWM

3.4 Existing Legislative/Regulatory Framework for MW Management

3.4.1 Existing Legislation

The Government of Bangladesh promulgated the Medical waste (management and processing) Rule, 2008 for processing and management of MW in Bangladesh. It was prepared through active participation of MOHFW, MOL and MOEF mainly with the objective of proper management of medical waste and protecting the environment.

The existing Environment conservation Act, 1995 and the Environment Conservation Rules, 1997 had no specific by laws directly related to management of MW management. According to Bangladesh Environment Conservation Act wastes are classified under section 2(1) as "any liquid, solid and radioactive substance that is discharged, disposed or dumped which may cause adverse/ negative change to the environment.
All these procedures were very general for all kind of establishments and not specific for Management of MW. The shortcoming has been addressed by the new medical waste rules, 2008.

Broadly the rule has classified the medical waste (schedule-1) with examples and environment-friendly technologies of management. It also contain suggestion for use of different color bins (schedule-3) for segregation of medical –waste at source and symbol to be used on the packaging of medical-waste (schedule-4) for transporting. In schedule -6 the rule specifies the standard Incineration/ Autoclaving, standard of liquid waste with permissible limits, standard of microwaving, standard for deep burial and standard for radioactive waste treatment and disposal along with other issues related to MWM (The important part of the Medical waste Rule, 2008 has been enclosed in the annexure).
The new medical waste rule has urged for 'formation of authority' within 3 months of proclamation which will be will be in charge of all activities related to MWM of their area.

The regulation specified for different (6 nos.) color bins to be used for segregation of different MW along with specification of container, standard for operation of equipment, effluent and emission standards.

City Corporation Laws
It includes responsibilities for maintaining public health, responsible for sanitation and collection and disposal of municipal solid waste.

4. Status of Implementation of MWM & Enactment of New MWM Rule

- Improved MWM initiated in Khulna in 2000, where Prodipon, an NGO started collecting medical waste and managing them through dumping and pit burning.
- Segregation of MW was started in 2003-2004 along with improved HCWM in Dhaka and Jessore (by PRISM, Bangladesh).

- Training on improved MWM was started from February, 2005 in Dhaka and Jessore and by now training has been completed in all the Medical college hospitals and 30 districts of the country;

- National Implementation Coordination Committee (NICC) has been formed by MOHFW for MWM on 26.8.2007.

- The first incinerator of the country was established in 2007 (in Dhaka), funded by Active Asian Association (Japan).

- MOHFW has arranged another incinerator and 3 covered vans during 2008 facilitating MWM in Dhaka city (being done by DCC and PRISM);

- Pits were constructed in 133 upazila with supply of necessary logistic during 2007-08 with target is to establish a sustainable MWM system in all UHC by 2010-2011(by DGHS).

- First inter-ministerial meeting on MWM was held in 2008, where representatives of MOHFW, MOLGRD, MOL and MOEF were present;

- MWM rule has been promulgated by DoE on 5th November, 2008.

There has not been significant or widespread improvement in MWM implementation since the rule was promulgated. The primary reasons are as follows:

- Low awareness and capacity in the HCFs
- Inadequate legal provisions
- Lack of expertise on the issue
- Resource constraints.

There are many valid reasons in this connection. Lack of manpower (in DoE, various hospitals etc.), lack of coordination (among the implementers of MWM), lack of required fund are the main reasons for delay in the implementation of proper MWM in the country.

But the proper authority lacks the participation of local authority which is the representation from the City Corporation or pourashava /municipality, who are the active agents of total waste management of the area. The issue can be reviewed and member from City Corporation and municipality/ pourashava (as it is applicable) can be included for implementation of improved MWM in the country as a whole.

The issue of MWM is not common or popular among the people in general population of the country. Management of general and hazardous waste have got different dimensions and include sharp difference in technology. Available agency for MWM is also very scarce. Expanding of expertise through wide training and other related means need to be adopted for better implementation of MWM.

Implementation of proper MWM requires both investments in equipment and on human resources (employees and staff) for building their capacity in managing MWM activities. Achieving improved performance on a sustainable basis also demands investments in creating appropriate systems and frameworks. The increased budget required for improved MWM is not normally included in the regular health budget, which is considered as a significant barrier to improve the MWM. Appropriate allocation by introducing a budget line in the HCF operation budget can solve the problem.

5. Improving MWM in Bangladesh

Various steps and efforts need be carried out for improvement of medical waste management in the country. The important issues are as follows:

5.1 Strategy and Action Plan for Improving MWM

Various steps and efforts need to be carried out for improvement of medical waste management in the country.

HNPSP stressed on taking steps to improve the capacity of DGHS and DGFP for strengthening, inspection and monitoring of MWM by the office of the LDs. As in-house management of MW is the responsibility of MOHFW and out-house (off-site) management of MW to be done by MOLGRD, inter-communication should be established and maintained between them. Cleanliness of public and private HCFs will be checked by using a formal tool. It may be estimated that about 35 per cent of HCFs are conducting MWM on the whole country basis, although according to the HNP sector program (2003-2011) the target was 100 per cent achievement. The progress in MWM is expected to attain 40-45 per cent (safely 40%) by 2010-2011.

Based on the recommendations of the MWM review a MWS an action plan has been developed. The key elements of the strategy for improving MWM are the following:

- Building awareness and capacity at all levels.
- Developing appropriate guidelines and manuals.
- Create accountability through appropriate legal\regulatory framework.
- Create appropriate institutional framework to facilitate implementation of MWM on a sustainable basis.
- Making targeted and phased investment.
- Creating the enabling framework for private sector participation in centralized facilities.
- More accountability of the MOLGRD in capacity development and out-house management.

According to the previously report prepared on MWM (Nov., 2004) the strategy included establishing a National implementation co-ordination committee (NICC) for MWM and making suitable budgetary provision. Some of the relevant issues are briefed below:

5.1.1 Building Awareness and Capacity at all Levels

Awareness building has already been initiated during the last 2-3 years back, but it needs to be strengthened and continued. It needs the following issues among others:

- Planning for conducting training activities in the new areas where it has not started.
- Identification/selection of training organization (NGO).
- Updating of training materials as per requirement and to be translated in Bangla.
- Refreshing course for the areas already done long before.
- Provision of required fund for smooth training activities.

5.1.2 Developing Appropriate Guidelines and Manuals

MW management is a technical subject and proper guidance to be provided to the HCF associates for safe management of MW, which is hazardous and infectious, may cause

human and environmental suffering to several degrees. The guideline/manual will need to be developed in a consultative process and be disseminated to all stakeholders. The environment guideline for MW management, 2008 would assist in this connection for preparing a sound guidance document for MWM.

Guideline must be developed by DOH for effective implementation of occupational safety measures in health facilities and proper waste treatment and disposal as prescribed by the Medical Waste Management Rules. These could be prepared maintaining safety of medical professionals, nurses, health care workers and staff. Pictorial instructions could be utilized also.

5.1.3 Making Targeted and Phased Investment

All activities related to MWM cannot be initiated and implemented simultaneously because of various limitations (like fund, time, agency, expert-manpower etc.). So, there is need of prioritization of activities (say for example, awareness building and imparting training to HCFs of Chittagong Division) to be targeted and implemented phase wise, although other MWM activities will continue as usual. Thus a specific target along a time based realistic plan has to be formulated on the basis of the present scenario and capacity of MWM

5.1.4 Creating the Enabling Framework for Private Sector Participation in Centralized Facilities

It is found that private sector HCF is highly progressing and their bed capacity is exceeding the public capacity. The framework for MWM should be made in a way that the centralized facilities created/or to be created by the Government agencies for MWM) can be used by the private HCFs. This would ensure the scope of MWM by all. It has to be cleared here that the responsibilities of the MWM of private HCFS lies with their owners, although MOHFW is responsible for its monitoring. Thus, there should be active participation of the private HCF owners in building centralized facility for MWM.

For this objective, following steps can be taken:

- Conducting an experience sharing workshop on centralized MWM facilities;
- Ensure representation of private HCFs in all level of activities in MWM and in the related committees;
- Ensure financial and executive participation of private HCFs in construction of centralized facility for MWM;
- Inviting expression of interest (EoI) from private sector;

5.1.5 Active Role of National Implementation Co-ordination Committee (NICC)

NICC is taking necessary steps since 26.8.2007 for implementation of MWM throughout the country under the active role of MOHFW, where several ministries and departments have their roles and functions for its success. This effort should be continued regularly with holding meeting with intensive frequencies (monthly or bi-monthly). In this connection some representation of an organization with expertise on soil, water, air and environment having research facilities would enrich the team activities related to environmental protection.

5.1.6 Making Suitable Budgetary Provisions for Implementation

In order to ensure timely implementation of MWM program, it is suggested that cost of implementation to be estimated upfront (to the extent possible) and budgeted in the next sector program.

5.2 Policy Framework

In the light of above discussion, the following guidelines are required to establish a functional MWM in addition to some others:

- MWM to be implemented as a stepwise process to attain gains over an extended time. This is realistic due to resource constraint and it provides scope for sustained use of best and latest technology as provided by the donor;
- The implementation of MWM in the HCFs under DGHS and DGFP will take place according to the latest guidelines by MOHFW. They will also be responsible legally to take action for MWM of private HCFs;
- Adjustment in program planning should be made during program implementation based on both effectiveness and cost consideration through effective monitoring;
- Imparting training to all level of HCF (administrators, doctors, nurses, cleaning staffs, word boys, lab. Technicians) should be arranged to ensure that materials and methods chosen are used correctly and consistently;
- All hospitals staffs should be informed and involved in MWM decisions making implementation process as part of participation;
- Local community should be consulted periodically to understand the socio-economic factors and local concerns;
- All MWM related items should be standardized to the extent practicable but keeping flexibility for individual HCFs;
- In large cities centralized disposal service may be created if possible, ensuring private sector participation;
- Excess capacity for treatment/disposal of existing facilities should be utilized in full capacity;
- Sustainability is the main factor to be considered for technology choice of MWM, that includes low operation cost and easy maintenance of equipment;
- Use of incinerator in the large city, where there is air pollution, should be avoided/ done in sustainable way;
- If on site space for final disposal of hazardous waste is not available, arrangement for off-site disposal facility to be made with required budgetary provision;
- HCFs should have adequate yearly budget provision for proper operation of MWM;
- Adequate provision for occupational health and safety measure should be adopted including vaccination of all workers for hepatitis-B.

6. Implementation of the MWM Strategy

6.1 Proposed Institutional Framework

The various options for strengthening the institutional set up of the organizations involved in MWM need improving the following key areas:

- Establishing improved framework for the overall planning and administration of the MWM aspects in the country.
- Strengthening the HCFs for in-house MWM
- Strengthening the capacity of the out-house organizations for MWM
- Ensure proper implementation through monitoring and reporting
- Enhancing environmental monitoring on impact of all MWM activities (through observation/research etc.)

The MOHFW has the overall responsibility for the health sector, will also be responsible for creating appropriate planning framework for improving MWM in the country, although in the present scenario MOLGRD has also large share of the responsibility in the out-house MWM.

Since a considerable number of institutions and stakeholders are in the MWM at various levels, their interests and opinion should be reflected in the planning and implementation of the program. The stakeholders could include the following:

- MOLGRD(responsible for providing all out-house facilities for MWM);
- MOEF (responsible for monitoring the environmental quality of MWM in situ and immediate and long time impact of MWM activities on environment);
- Association of Health care staff including , nurses, sweepers, doctors, workers etc. (public & private);
- Associations of city corporations and pourashava and municipality;
- MOL (responsible for legal aspects of environmental issues).

DGHS should therefore, have the responsibility of implementation of MWM program guided by a national committee of stakeholders and experts at the appropriate level. They will also be responsible for improvement of MWM standard.

6.1.1 Implementation Modalities

At the upazila and below level facilities, the current practice of MWM will be continued. Different colour bins will be supplied to the UHCs for collection of waste at their generation points. Mainly nurses and cleaners will segregate and collect the waste while the doctors will be responsible for their monitoring. The UHCs will also be provided with trolley for transporting the segregated waste to storage.

General waste, infectious solid waste, infectious liquid waste and sharp waste will be collected separately. The general waste and sharps will be disposed separately in different pits. Infectious wastes (both solid and liquid) will be treated with bleaching powder; the solid portion will be disposed in separate bin while the liquid waste will be mixed with water (different dilutions for different wastes) and disposed in sewerage channel.

MWM activities at the Upazila level will be rolled out in phases with the following targets:

Indicator	Unit of measurement	Baseline	Projected target	
			Mid 2014	Mid 2016
UHC with proper	No. of UHC implementing	206		421

Indicator	Unit of measurement	Baseline	Projected target	
			Mid 2014	Mid 2016
MWM	MWM according to criteria			
Training on MWM	No. of UHC with personnel trained on MWM	250	400	421
UHC with disposal pits	No. of UHC having disposal pits	206	306	421
Waste handlers using safety gears	% of waste handlers using safety gears	49%	73%	100%

As per the Government decision in 2008, out-house management of waste will be continued by MOLGRD, while in-house management of waste will be carried out by MOHFW. As detailed out in Annex B, Dhaka City Corporation along with PRISM (an NGO) is implementing out-house management of health care in Dhaka. MOHFW pays a service to the City Corporation for this. There is a centralized facility at Mautail which is managed by the MOLGRD. The incinerator in Mautail Sanitary Land Fill is also maintained by the City Corporation. Supervision for out-house management of waste is provided by MOHFW, MOLGRD and the MOEF.
MOLGRD will come forward in establishing out-house management so that MWM can be implemented at all secondary and tertiary level hospitals also. If the other City Corporations do not have sufficient capacity like Dhaka City Corporation it can be contracted out to NGOs.

The World Health Organization (WHO) has expressed its interest in assisting MOHFW to pilot application of water safety plan under HPNSDP. This will entail installation of preventive and safety measures for supply of clean water in the health care facilities.

Further implementation details are provided below:

- MWM at secondary and tertiary level (district, MCWCs and specialized) hospitals including private HCFs will be implemented by Line Director-Improved Hospitals Management and primary level (Upazila and below) hospitals by Line Director-Essential Services Delivery.
- The LD may also engage other personnel of DGHS and DGFP to facilitate MWM. S/He should be capable of engaging a professional consultant/other personnel (with the approval of competent authority) for implementation of MWM;
- The NICC for MWM will provide necessary directives and guidelines for implementation of MWM. The committee will also be responsible for monitoring the performance and identification of problem with specific solution;
- DGHS and Line Director for Hospital Services Management will take initiative for implementing MWM at the Private sector HCFs.
- The Superintendent/Director/Manager of a HCF will be the focal person (FP) for implementation of MWM in the HCF. The FP will constitute a service group (MWM-SG) in his facility. The group members will be assigned specific function/responsibility related with rules of MWM;
- The total budget for implementation of the MWM activities will be reflected in the OP of the respective Line Director, DGHS. The LD will act as a focal person of MWM for their respective Ops. He will engage officials, under him for implementation of MWM.

6.1.2 Suggestions on Role and Responsibilities

Some suggestions on role and responsibilities of MOHFW, NICC (which has already been formed by MOHFW and in action) and other institutions/ departments are provided below:

Table-6.1: Role and Responsibilities of different institutions/departments/organizations for MWM

Institution/ Departments	Key roles/responsibilities
Ministry of Health & Family Welfare (MOHFW)	• Endorses the role and responsibilities of NICC for MWM; • Endorses the policy and strategy by ; • Coordinating with MOLGRD for establishing out-house MWM qualitative facilities including transportation and disposal of generated MW; • Co-ordinating with MOEF for maintenance of environmental qualities in the processes of MWM and related issues; • Coordinating with Ministry of Education to include MWM in the medical education curriculum and nursing education curriculum.
NICC	• Endorses the DGHS and DGFP action plan for MWM and follows ; • Provides guidance on the refinement of the institutional framework to implement the strategy and action plan; • Provide guidance on appropriate interventions for MWM including those related to private sector participation and promotion of centralized MW treatment and disposal facilities. • Endorses the DGHS/DGFP guidelines and approves all related studies. • Develops appropriate financial mechanism for supporting DGHS/DGFP facilities.
DGHS/DGFP	• Utilization of allocated budget for implementation of MWM action plan; • Undertakes all activities pertaining to MWM ranging from finalizing guidelines to monitoring of actual implementation; • Oversees the implementation of MWM plan; • Carries out role of administrative agency for co-ordination and monitoring of MWM activities in large and specialized HCFs under MOHFW directly and in the district and periphery level public HCFs through DGHS/DGFP; • Prioritizing proposal which can be implemented based on strategy and budget availability. • Evaluate individual proposal and extend financial support to the HCFs. • Maintain a MWM information system and make arrangement for dissemination of the information; • Use DOE's Rules for Medical waste management, 2008 as national guideline for MWM.
District Health Office (DHO)	• Interfaces between DOHS and all public HCFs of district and periphery level; • Undertakes inspection and audits compliance against MWM approved guidelines/regulation through Health Inspectors; • Providence of guidance and training to all district level HCFs for MWM.

Institution/ Departments	Key roles/responsibilities
Health care facilities (HCFs)	• Responsible for all MWM activities in the HCF; • Responsible for training of all manpower of the HCF including segregation of hospital waste and distribution of equipment and materials ; • Ensuring safe collection and transport of MW generated at different wards and departments; • Treatment of MW, if they own treatment facility and then transporting them to the central treatment facility.

6.2 Training & Capacity Building

Increasing awareness and capacity building are considered to be important components of strategy for improvement of MWM across the country. Various programs on the issues have already been started in many parts of the country, although many other parts lacks its coverage. For example, according to discussion with DGHS, it was found that MWM training to 13 medical college hospitals outside Dhaka and 30 districts (out of total 64 districts) have been completed. Whereas according to DGFP no kind of formal training was imparted to HCFs under them.

Training on MWM was started since February, 2005 in Dhaka and Jessore simultaneously (arranged by MOHFP). Till present (September, 2010) training has been imparted to about 328 HCFs with average 40 participants each.

The various programs that can be proposed for further progress in training and capacity building are as follows:

- Regional awareness program for all stakeholders;
- Capacity building program at local levels, targeting different stakeholders;
- Training of trainees (ToT), who can continue further training subsequently;
- Intensive training program for some HCF staff of each HCF including management of MW from generation to ultimate disposal.
- Refresher training to be conducted after 2-3 years of the initial one or as felt required. Thus, recurrent training program and workshops on MWM to be arranged in a continuous and accelerated process.

Training plan needs to be developed by DGHS with training modules specific to each level of health care workers and staff.

6.3 The MWM Action Plan

The proposed MWM action plan will be implemented from 2011- 2016.
An action plan is presented below that contain phase-wise list of detailed activities in the tubular form:

Broad areas	Activities in implementation stage
Institutional	• MOHFW endorses policy and strategy undertaken by NICC; • NICC functions to be continued with acceleration.
Awareness and training	• Continuation of training of HCFs-FPs and other stakeholders for

Broad areas	Activities in implementation stage
	MWM; • Preparation of target for training in new areas from 2nd to 5th years; • Review of existing training materials in 1st and 2nd years; • Training of trainees during 2nd to 5th years.
Introducing improved MWM for attaining environmental standard under DoE's 2008 regulation.	• Follow the environmental guideline for MWM as specified in the DoE's 2008 regulation for MWM and help conserving environmental quality; • Monitor the environmental parameters related to MWM take immediate action if the value crosses the limitation.
Conducting investigation/research by the existing facilities in different research organizations.	• Carry out investigation/research on impact of MWM on environmental parameters like soil, water, air, biodiversity and microbial world and review the technology of MWM, if required (keeping harmony with international views). • Different Research organizations can be employed in this objectives with provision of funding; • Developing standard models for MWM in the country.
Implementation of MWM program	• After shortlisting of the HCFs they have to be covered under improved MWM program and develop year-wise work plan to cover all HFCs by the 2015-2016; • Carry out planning for timely procurement of equipment in phases required for total program of MWM, so that it does not hamper the progress of MWM program. • Monitoring cell to be organized (by MOHFW) for progress, and quality control of MWM and reporting accordingly. It would continue throughout.
Establishing centralized facilities	• Experience sharing workshop on centralized facilities; • Feasibility analysis of centralized facilities. • Inviting expression of interests from private service providers.
Monitoring, Reporting and sharing of information	• Developing MIS for MWM related information (with immediate action); • Continuation of MIS development and annual monitoring; • Annual dissemination workshop.

A Tentative time line is enclosed for implementation of MWM in Bangladesh for the period from 2011-2016.

Time line for Implementation of MWM

Issues for MWM	2011-12	2012-13	2013-14	2014-15	2015-16
MOHFW endorses the policy and strategy undertaken by NICC and coordinates with other Ministries and allocate financial assistance					
NICC endorses action plan undertaken by DGHS/DGFP for MWM and provide guideline					
DGHS/DGFP utilize allocated budget for MWM action plan; undertake activities related to administration, coordination and monitoring of MWM activities.					
Short listing of HCFS to bring under various MWM programs					
Joint action for Enactment of DoE's MWM Rules to be done by MOHFW, MOLGRD, MOEF & MOL.					
Training & Awareness Building					
Review of Training Modules					
Training of Trainee (ToT)					
DHO Undertakes inspection and audit compliance of all district level HCFs (public and private) against MWM					
Health care facilities undertakes all activities related to Proper MWM					
Ensuring arrangement for supply of safe water supply and proper sanitation					
Ensure protection from use of hazardous insecticides/pesticides					
Safe management of construction waste					
Inviting Expression of Interest from Public Service Providers					
Strengthening the Services of Public Service Providers					
Review of Existing Guidelines/Manuals for MWM					
Establish Centralised Facilities for MWM					
Develop MIS for MWM for Sharing Information					
Monitoring Reporting					
Conducting Investigation/ Research (for Environmental - Friendly Disposal of MW)					

Continuously

Intermittently

6.4 Cost Estimates

It involves investment in planning and investment in implementation broadly as follows.

6.4.1 Investment in Planning

Developing MWM guidelines/manual, preparing training modules and undertaking of trainers, planning for centralized facilities are considered the key activities in the planning stage. Some of the components have already been started from 2005-2010 phase but have not been completed. Moreover cost escalation is also an important issue that has been considered to 60% increase (calculating 10 per cent per year). Detailed activities and costs associated with them have been broadly described in the table 6.1 below based previous estimation and as affected by cost escalation, which may also need revision.

Table 6.1 Estimate of cost for the planning phase

Components	Remarks	Cost(Taka)
Preparing for Training Material	Includes training of training institution/trainers	1,600,000
Central level awareness program for MOH,MOEF, MOLGRD, DGHS/DGFP etc.	1 workshop at the central level	320,000
HCF level training to be continued	Lump sum annual fees for training	51,20,000
National Workshop on Centralized MW T&D facilities	1 Workshop at the central level	800,000
Total Expenses	**Million Taka**	**7.84**

6.4.2 Investment in Equipment, Technology and O & M

Investment in equipment and technology and the regular O&M expenses associated with MWM depends upon the choices of technology, which in turn depends upon several factors including the regulatory standard which requires review of the existing situation in various occasions. Hence it is difficult to estimate exact costs. However, some general guidance is provided below.

An estimation of the cost for equipment and technology has been prepared in the Environmental assessment report prepared for 2005-2010, which has been followed with consideration for price escalation of 60 per cent (@ 10 per cent per year) as shown below (The costs cover all aspects of MWM e.g. internal collection, segregation, storage, treatment and disposal of MWM including cost of equipment, logistic, cost for related research activity etc. for protection of environmental degradation):

Table 6.2 Estimates of costs for the implementation phase

Parameters	Units	Public HCF	Private HCF
Nos. of total bed	No.	38,171	43,532
Total hazardous MW generated per year	Ton	3,833	4,369
Cost associated with improved internal collection			
Investment in improved collection (logistic)	Tk. 1,680 per bed	64,130,000	73,134,000
Operational cost For improved MW collection	Tk. 2,240 per ton	8,586,000	9,787,000

Parameters	Units	Public HCF	Private HCF
Cost associated with improved treatment and disposal			
Investment improved treatment and disposal @ Tk. 1900000 for each HCF with capacity of 500 kg/day	Tk. 60,80 per bed	232,079,000	264,675,000
Annual operating expenditure @ Tk.1600000 year for HCF with 500 kg/day capacity	Tk. 5,120 per bed	195,436,000	222,884,000
Total		**500,231,000**	***570,480,000**

* The cost of MWM implementation of private HCFs to be borne by HCF owners

6.4.3 Overall Cost for MWM Action Plan in Public HCFs

The total expenditure of MWM to be incurred by the public HCFs for the period from 2010-2011 to 2015-16 including the planning and implementations phases, with the above assumptions are provided in the following table:

Table 6.3: Estimate for Total Cost of MWM for public HCF

Activity	Budget (USD million)	
District level and above		**47.52**
Procurement of incinerators[4]	18.28	
Procurement of other WM logistics (sterilization autoclaves, sharp cutters, shredders, chemicals, etc.)	7.14	
Procurement of vehicles	3.25	
Procurement of vaccination and protective equipment for service providers	7.14	
Capacity development (training, etc.)	7.14	
Mass awareness campaign	1.00	
Operating costs	3.57	
Upazila level and below		**3.21**
Research	0.01	
Capacity development (training, seminar, etc.)	0.86	
Procurement of chemicals	0.07	
Procurement of medical and surgical supplies (vaccines, protective gear, sharp cutters, etc.)	2.12	
Procurement of other logistics	0.05	
Awareness (printing, advertising, etc.)	0.09	
TOTAL		**50.73**

[4] World Bank funds will not be utilized for the procurement of incinerators

6.5 Funding Arrangement for Implementation of MWM Action Plan

The overall cost of the MWM will be incurred for a period of 5 five years starting from 2010-2011. The cost will be year-wise for implementation of MWM by the year ending in 2015-2016. The above figures of USD 50.73 million are indicative and MOHFW is working on finalizing the activities and detailed budget for MWM as well as finalizing which activities will be financed out of the pool funds/IDA credit.

6.6 Monitoring of the Implementation

Monitoring of the implementation of MWM is very essential to ensure the reduction of infection from wastes generated from HCFs and ensuring restoration of environmental qualities in general to ensure the quality of human life and sustainable environment for future perspective.

The NICC will assess the implementation of MWM strategy and make necessary changes to the action plan to ensure achieving the objective of MWM.

Monitoring of the status of present practices of the HCFs is important. The MWM situations of various HCFs are quite different in different areas. Some HCFs, where training has been imparted, motivation fulfilled, logistics are available in the area have got different scenario than those HCFs, where no training has been arranged, no motivation took place and no logistic available. That indicates the need for fulfillment of several parameters before starting of MWM.

So, there is a need of preparation of primary format for all the HCFs of the country, who will furnish information/data regarding the present status of MWM in the specific HCF, to be submitted to DGHS/DGFP annually. Moreover, monitoring of the MWM activities of HCFs who have already participated in improved MWM is also crucial, as there exist many gaps in some HCFs, requiring further improvement. Information relating to the following would be monitored on a regular basis:

- Training of total hospital staff
- Segregation efficiency and disinfection and storing quality
- Transporting efficiency & safety
- Occupational health and safety aspects of related health workers
- Environmental impacts around disposal sites Emission and effluents characteristics from facilities
- Monitoring the total MWM in the light of Environmental regulation of Medical waste management by DoE, 2008.

6.7 Monitoring of incinerator performances

Regular monitoring of incinerator should be done in respect of their compliance standard (operating standard, emission standard etc.) as specified by DoE regulation to avoid air pollution. According to USA Environment Protection Agency (EPA) materials of medical waste to be segregated in such a way that any plastic waste, Hg-containing waste, pharmaceuticals, polychlorinated biphenyls, polycyclic organic matter should not be burnt in incinerator. According to them emission of heavy metals like Co, Pb, Cd, Hg and sulphur dioxide should be within permissible limit.

6.8 Thought for minimization of MWM

"Minimization of medical waste production" should be an important drive for waste management that needs to be incorporated in training component. It would include proper segregation of medical waste (separating recyclables, reusables and non-infectious portion). For recycling of medical waste special attention to be given to segregation of waste and proper management of various wastes maintaining environmental qualities.

Since medical waste is a heterogenic mixture of waste containing infective components consisting of plastics, textiles, PVC, syringe, needles, waste of surgical, pathology-anatomical research, overdue medicine etc. In most cases hospitals burn their medical waste and the rest is sent to the landfills. When PVC burns gases like Carbon monoxide, dioxins and furans produce causing air pollution.
Developed Country like USA use a device known as 'pyrolysis' for recycling with recovery of valuable products and commercial fractions depending on the composition of waste. *Pyrolysis is thermal decomposition of the organic compounds in absence of Oxygen.*

Pyrolysis of commonly used plastic wastes leads to production of oils of various kinds. But introduction of such high technology in Bangladesh may involve high investment, not suitable/viable at present.

In the present context attention to proper segregation of MW along with reuse of possible waste after proper treatment/washing (which is mostly neglected) would be useful for minimization of MW, for which intensive training and monitoring are required.

7. Recommendations

Monitoring of the implementation of this EMP will be detailed out in the operational plan. Some recommendations for proper MWM in the country are given below:

7.1 General Recommendations

- Special attention in supplying safe water need to concentrate on supply of arsenic-free water for which a co-ordinated program can be formulated by the joint team of DGHS, DGFP and DPHE collaboration Various efforts including surprise visit to measure quality of water supplied to HCFs and the provision of legal action to be introduced if found otherwise. Moreover, during establishing new HCFs, it is mandatory to ensure adequate treatment facilities are in place for availability and supply of clean/safe water. Same standard should be applied to both the public and private HCFs for supply of safe water to patients, health-workers and others.

- Proper arrangement should be taken immediately by the HCF authorities to adopt proper step for human excreta generated in the HCFs.

- It is highly recommended that details of the total sanitation arrangement of HCFs should be looked after (by Director of Health Services) during planning of MWM at individual HCF level, which should be treated as pre-requisite for permitting the establishing the new HCF.

- Intensive training on importance of proper sanitation in the HCF need to be carried out among various manpower working in the health sector, which would enhance

awareness on the issue. It would also involve additional funding for improved planning and better scenario.

- For control of environmental degradation during construction of HCFs employment of an project Environmentalist (for the period of construction and maintenance) can be done who will be responsible for maintaining all kinds of environmental standard and reporting to DoE and take all steps safeguarding the environmental issues and ensure GoB approved building codes with cooperation from all concerned. DGHS can consider the issue for protection of environment during construction and maintenance activities of HCFs.

The various recommendations are shown in the following table:

Table-7.1: Environmental Issues and Recommendations

Issues	Recommendations
MWM	• Formation of Planning and implementation body with representation of DGHS, DGFP, LGRD, DoE and MOL; • Imparting training and awareness building for carrying proper MWM by following DOE's guideline; • Need conducting nation-wide survey on quality of MWM carried out by the HCFs; • Close supervision of MWM of HCFs and imposition of penalty for the defaulters through regulatory obligation; • For new (to be established) HCFs, provision of proper MWM should be a pre-requisite.
Safe Water Supply	• Need to carry out testing of drinking water quality of all existing HCFs and immediate step to be taken for supply of safe drinking water. • For new (to be established) HCFs, provision of safe water supply should be a pre-requisite
Sanitation	• Need to carry out survey of sanitation situation of all the existing HCFs and immediate step to be taken for making arrangement for proper sanitation facility. • For new (to be established) HCFs, provision of proper sanitation facility should be a pre-requisite
Use of hazardous insecticides/ pesticides	• Provision to be made for using bio-degradable insecticides and prohibiting chlorinated insecticide (like DDT, aldrine etc.) • Maintenance proper arrangement for workers for handling of hazardous insecticides/ pesticides. • Imparting proper training of the concerned heath workers to remain safe from the adverse impact of such chemicals
Construction Waste management	• Strict observation of construction code; • Close monitoring of newly construction site and make obligatory to follow the construction code by different agencies including DoE.

7.2 Recommendations on Role and Responsibilities of NICC and other Institutions/ Departments

Some recommendations on role and responsibilities of NICC and other institutions/ departments are provided in the following table:

Table-7.2: Role and Responsibilities of NICC and other Institutions/Departments

Institution/Departments	Key roles/responsibilities
Ministry of Health & Family Welfare (MOHFW)	• Endorses the plans and functions of NICC for MWM; • Endorses the policy and strategy by ; - Co-ordination with MOLGRD for establishing out-house MWM qualitative facilities including transportation and disposal of generated MW; - Co-ordination with MOEF for maintenance of environmental qualities in the processes of MWM and related issues; - Coordination with Ministry of Education to include MWM in the medical education curriculum and nursing education curriculum.
	• Endorses the DGHS/DGFP action plan for MWM and follows ; • Provides guidance on the refinement of the institutional framework to implement the strategy and action plan of MWM; • Provide guidance on appropriate interventions for MWM including those related to private sector participation and promotion of centralized MW treatment and disposal facilities. • Endorses the DGHS/DGFP guidelines and approves all related studies. • Develops appropriate financial mechanism for supporting DGHS**/**DGFP facilities.
DGHS/DGFP	• Utilization of allocated budget for implementation of MWM action plan; • Undertakes all activities pertaining to MWM ranging from finalizing guidelines to monitoring of actual implementation; • Oversees the implementation of MWM plan; • Carries out role of administrative agency for co-ordination and monitoring of MWM activities in large and specialized HCFs under MOHFW directly and in the district and periphery level public HCFs through DGHS**/**DGFP**.** • Prioritizing proposal which can be implemented based on strategy and budget availability. • Evaluate individual proposal and extend financial support to the HCFs. • Maintain a MWM information system and make arrangement for dissemination of the information; • Use DoE's Rules for Medical waste management, 2008 as national guideline for MWM.
District Health Office (DHO)	• Interfaces between DGHS/DGFP and all public HCFs of district and periphery level; • Undertakes inspection and audits compliance against MWM approved guidelines/regulation through Health Inspectors;

Institution/Departments	Key roles/responsibilities
	• Providence of guidance and training to all district level HCFs for MWM.
Health care facilities (HCFs)	• Responsible for all MWM activities in the HCF; • Responsible for training of all manpower of the HCF including segregation of hospital waste and distribution of equipment and materials ; • Ensuring safe collection and transport of MW generated at different wards and departments; • Treatment of MW, if they own treatment facility and then transporting them to the central treatment facility.

7.3 Concept for Formation of Centralized Facility for Disposal of MW

It is observed that the present main center for disposal of the MW at Mautail is not capable enough to manage all the MW generated in and around Dhaka city. Moreover, generation of MW has an increasing trend with the increase of population and improvement in medical treatments mainly.

The proposed centralized facility for MWM has to be planned for Dhaka city level with the objective for accommodating disposal of the MW generated in all the registered HCFs around, in addition to the activities of Mautail establishment or it (Mautail one) can be expanded (and improved) as per the requirement for all registered HCFs (both public and private).

The responsibility for construction of centralized facility for MWM has to be undertaken by MOHFW and MOLGRD (including DCC) as decided by NICC.

MOLGRD will be responsible for transport, treatment and disposal of the MW, which can be assisted by expert NGO (cost to be borne by MOLGRD)

Monitoring of MWM activities in the central facility has to done by MOHFW, MOLGRD, MOEF (DoE) and MOL.

Participation of private HCFs to be ensured during planning of construction for the centralized facility, so that they can avail the facility of disposing their MW, on payment, through contracting agency (NGO/ others). The rates to be decided by NICC. This revenue will minimize the operating cost of the central MW facility.

The cost for equipment and technology have already been included in the cost estimate of implementation phase (Table-6.2 & Table-6.3) as prepared following the rates quoted in previous report (2005-2010) with 60 per cent price escalation.

Replication of constructing such type of centralized facility for MW may be planned and implemented in the other divisional areas in the later phases, where the expertise of Dhaka central facility for disposal of MW can be useful.