Regional workshop on healthcare waste management
A Report

Yak and Yeti Hotel, Kathmandu, Nepal
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World Health Organization
Regional Office for South-East Asia

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Acronyms

AMR	antimicrobial resistance
BMW	bio-medical waste
BMWMC	bio-medical waste management committee
CBMWTDF	Common bio-medical waste treatment and disposal facility
EPL	Environmental Protection License
GEF	Global Environment Facility
HAI	healthcare associated infections
HCF	health care facilities
HCW	healthcare Waste
HCWM	healthcare waste management
HECAF	Healthcare Foundation
IGNOU	Indira Gandhi National Open University
IPC	infection prevention and control
KMC	Kathmandu Medical College
LHMC	Lady Hardinge Medical College
MOH	ministry of health
POP	persistent organic pollutant
PPE	personal protection equipment
PVC	Poly Vinyl Chloride
RRR	reduce, reuse, recycle
RUP	reuse prevention
SWL	solid waste license
SEA	South-East Asia
UNDP	United Nations Development Programme
UNOPS	United Nations Office for Project Services
UV	ultraviolet rays
VBH	Velaichenai Base Hospital
WASH	water, sanitation and hygiene
WASH FIT	water, sanitation and hygiene facility improvement Tool
WHO	World Health Organization
SEARO	WHO Regional Office for South-East Asia

1. Introduction

Healthcare activities such as immunization, diagnostic laboratory tests and medical treatment protect and restore health and save lives. On the other hand, however, unsafe management and improper disposal of the waste and by-products of these activities pose a number of life-threatening risks both within the health facility and in the environment. WHO estimates that only around 15% of wastes produced in health facilities are infectious and hazardous (risk). However, lack of waste management systems renders the entire (100%) waste as infectious and hazardous. Hence the need to set up proper waste management system with segregation (at point of generation), on-site disinfection (as appropriate), safe transport, treatment and final disposal. The most vulnerable to these risks are patients and health workers within the health facility and the community and waste workers outside the health facility.

WHO-SEARO organized a regional meeting on healthcare waste (HCW) management in 2011 where progress in areas of policy, guidelines, and good practices in countries were reviewed. Most Member States of the Region confirmed that policies and guidelines on healthcare waste management were in place. However, systematic implementation of these guidelines was not carried out in countries at that time. Lack of awareness, capacity, and resources were identified as challenges. To support countries in addressing the challenges, WHO supported several national workshops, study visits, diagnostic assessment of HCW and development of model hospitals for HCWM. Other UN agencies, development partners and NGOs have also supported countries.

It was felt necessary to review the progress made in countries, their preparedness capacity to manage healthcare wastes during epidemics and devise ways to further strengthen safe and sound management of healthcare waste in countries.

2. Objectives

a) To review progress with respect to management of healthcare waste in countries including preparedness for managing wastes during epidemics or infectious disease outbreaks.

b) To update actions taken on the recommendations of the 2011 regional workshop.

c) To identify gaps and challenges for managing healthcare wastes.

d) To discuss strategies and approaches, including new technologies, integrating with infection control and effective way of managing wastes during epidemics.

e) To share evidence and raise awareness on the linkage between AMR and hospital waste.

f) To identify priority actions by countries.

3. Opening session

Ms Payden, WHO-SEARO welcomed the participants and thanked the Ministry of Health, Government of Nepal for granting permission to hold the training in Kathmandu. She mentioned that basic services such as water, sanitation, waste management and hygiene in healthcare facilities are essential for preventing infections in health facilities, and are a critical measure for patient safety. The workshop was organized to share latest information and best practices from Member States and introduce emerging issues such as antimicrobial resistance and finally to develop action plans for further strengthening healthcare waste management in the Region. She welcomed and thanked the Chief Guest, Dr Bhola Ram Shrestha, Chief of Curative Services, Ministry of Health and Dr Jos Vandelaer, WHO Representative to Nepal for gracing the opening session. She welcomed the participants from 10 Member States, international and local resource persons, development partners and WHO colleagues from HQ and Nepal. She requested participants of the diverse group of resource persons to seek technical clarifications as needed.

Dr Jos Vandalaer welcomed the participants and delivered the message of Dr Poonam Khetrapal Singh, Regional Director, WHO South-East Asia Region. The message emphasized the huge amounts of healthcare waste that is produced by thousands of hospitals, clinics, diagnostic centres and small health facilities in the South-East Asia Region. Improper management of these wastes could lead to transmission of infectious diseases in the community and put the lives of patients and hospital workers at risk. Recent experiences from the Ebola and MERS-CoV outbreaks highlight the need for strong infection prevention and control measures, as transmission of the viruses occurred in healthcare facilities in several countries. Healthcare waste management together with safe water, proper sanitation and hygiene are key measures for preventing and controlling the spread of infection in healthcare facilities which is one of the strategies for combating antimicrobial resistance. Combating AMR is one of the flagship projects of the Regional Director and she emphasized the need for the WASH group to work with AMR focal points to address the issue jointly. She said that the regional workshop had been

organized to provide an opportunity to Member States to share progress, new initiatives, innovations and commitments to address healthcare wastes.

The Chief Guest, Dr Bhola Ram Shrestha, Chief of Curative Services, Ministry of Health, stressed the importance of services such as water supply, sanitation and hand washing facilities as basic needs for proper management of healthcare waste for control of infections. He admitted that government had limited resources and HCW was not a priority. Many encouraging models of HCWM in Kathmandu and nearby districts are waiting to be replicated in the rest of the country. But, liquid waste management from hospitals remains a big challenge. He gave the example of target 6.3 of goal 6 of the SDGs, for preventing contamination of water bodies from the disposal of wastes including healthcare waste. Nepal has its own national guidelines on HCWM, and uses many non-burn technologies for HCWM, he added. Coordination among stakeholders and other ministries need to be improved. However, he was happy that a dedicated unit, "Disease Control, Climate Change and Environmental Health", had been established under the curative division, in the ministry. Finally, he thanked WHO-SEARO for organizing the workshop in Nepal and wished participants successful deliberations.

Dr Shrestha launched SEARO's short video on management of healthcare waste in small healthcare facilities. A copy of the video was distributed to all participants.

Dr Sudan Raj Panthi, focal point for WASH in the WHO Nepal office thanked SEARO for holding the workshop in Nepal. He thanked the Regional Director for her message and the participants and resource persons for their useful contribution. He iterated that even in many developed countries, incineration is being used, without proper monitoring of its consequences, and expressed big hope to discuss the issues and to come to an agreement for its use in future. Dr Panthi also thanked HECAF for managing the field trip.

Introduction of participants and workshop programme

Programme managers for healthcare waste and infection control, directors of hospitals, sanitarians from Bangladesh, Bhutan, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste attended the workshop. The workshop was facilitated by international and regional experts and technical staff from WHO-HQ, SEARO and WCOs.

The workshop, with 53 participants including resource persons was conducted over four days with a one-day field visit to three different healthcare facilities in Kathmandu.

4. Day 1, Session 1: Country, regional and global overview- *moderated by Ms Payden, WHO-SEARO*

a. Current status of healthcare waste management in Bangladesh

The country has more than 631 hospitals, 12584 community clinics, 4280 private hospitals and clinics and 9061 diagnostic centres. The Directorate General of Health Services is the focal department for healthcare facilities and is responsible for providing guidance on healthcare waste management to these facilities. The Directorate also liaises with the City Corporation or municipality and private partners. Several policies and rules are in place related to hospitals and management of waste.

- Medical Waste (Handling and disposal) Rules 2008
- National Guideline for Medical Waste Management (Revised-2016)
- The Environment Conservation Act 1995
- The Private Hospitals and Laboratories (Regulation) Ordinance 1982
- Private Hospital, Clinics and Diagnostic Centres Administration Rules 2016

The recommended approach for healthcare waste management is to segregate at the source of generation in different colour-coded bins, temporary storage, and final disposal by the city corporation and municipalities. Infectious wastes are treated before disposal.

A few assessments have been conducted in the last 7-8 years to determine the status of waste management system. A study by Patwary M et al (2009) in Dhaka city in 2008 revealed that the total quantity of medical waste generated in Dhaka city is 37 ± 5 tonnes per day. About 21% of that waste is hazardous as per WHO criteria. The proportion of hazardous waste varies significantly with the size and types of healthcare facility. The rate of hazardous waste production is 0.28 kg per bed per day.

Challenges faced by the country:

- ✓ Large population and a vast network of healthcare facilities put a huge pressure on waste management
- ✓ Scarcity of land for final disposal of general waste
- ✓ Lack of awareness and training of service providers (staff/handlers)
- ✓ Shortage of human resources and logistics
- ✓ Monitoring of HCWM is lacking
- ✓ Healthcare waste management is not given due importance

Way forward

- ✓ Healthcare waste management is included as a priority activity in the 2016-21 Health

Sector Programme

- ✓ Strengthening of inter-ministerial coordination (local government) for ensuring final and safe disposal of healthcare waste
- ✓ Orientation of health managers and training of waste handlers
- ✓ Inclusion of provision for treatment of liquid waste in the next sector programme
- ✓ Ensuring uninterrupted supply of logistics.

Discussions

There was a question about how widely colour coding is followed. The Bangladesh team clarified that it is not followed by all but efforts are being made to create awareness and improve supervision and monitoring.

Questions were raised about liquid waste management, disposal of radioactive waste and syringes. It was clarified that liquid waste is not managed properly, and that radioactive wastes are disposed by the Atomic Energy Commission of Bangladesh. Syringes are chemically treated and disposed. Autoclave treatment is under consideration.

b. Infection Control and Medical Waste Management Programme , Bhutan

The Royal Government of Bhutan provides free healthcare services to all people through a network of about 31 hospitals, 14 grade I basic health units, 178 grade II basic health units and 550 outreach clinics. The country has enacted several acts and rules related to waste management such as the Medicine Act of the Kingdom of Bhutan 2003, Waste Prevention and Management Act of Bhutan 2009 and Waste Prevention and Management Regulation 2012. Infection control and medical waste management committees have been established at all levels of healthcare facility. A system for annual reporting of hospital waste is in place. The infection control and medical waste management programme was established in 1994. The first edition of Infection Control and Healthcare Waste Management guidelines was developed in 1994 and the fourth revision was done in 2014. Healthcare-associated surveillance started in 2012 but the main challenge is effective recording and reporting of HAI.

As in other countries the main categories of waste are infectious, hazardous, sharps, pharmaceutical, chemical, pathological, heavy metals and general waste. Wastes are segregated using colour-coded bins and transported to the treatment site in designated trolleys. The main treatment options followed are autoclaving and chemical disinfection (bleaching solution).

Way forward

- ✓ Develop SOPs on infection control and medical waste management practices

- ✓ Train all health workers nation-wide on infection control and medical waste management
- ✓ Develop mechanism to assess compliance with infection control guidelines and standards at different levels of health facilities
- ✓ Develop guideline on effective recording and reporting of HAI surveillance
- ✓ Develop national policy to promote research on patient safety.

c. **Biomedical waste management in a tertiary care hospital, India**

The bio-medical waste management rules of India 2016 apply to all persons who generate, collect, receive, store, transport, treat, dispose, or handle bio-medical waste in any form including hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories, blood banks, ayush hospitals, clinical establishments, research or educational institutions, health camps, medical or surgical camps, vaccination camps, blood donation camps, first aid rooms of schools, forensic laboratories and research labs. The Ministry of Environment, Forest and Climate Change is responsible for monitoring implementation of the rules. Segregation of bio-medical waste is compulsory and has to be treated and disposed either onsite or through common treatment facilities.

Lady Hardinge Medical College (LHMC) and associated hospitals have constituted a bio-medical waste management committee with members from infection control, microbiology units, stores, civil and electrical sections chaired by the Director of LHMC. The senior microbiologist of LHMC is the nodal officer or waste management officer.

The hospital has a good monitoring system in place implemented by the BWMM team, the feedback of which is used for improving the system as well as tailoring the training programme.

The hospital conducts a regular training programme for all categories of healthcare workers. Training for doctors, nursing staff and group C and D employees is conducted every week. Pre- and post-test evaluation is also carried out. Waste disposal methods are demonstrated in the training. Post-exposure prophylaxis of HIV infection and infection control practices are included in training. Certificates are issued after the training. A total of 550 doctors, 396 nurses and 144 cleaners were trained in 2015 and a similar number were trained in 2016.

A team from the Department of Microbiology has conducted two studies, one to understand awareness regarding bio-medical waste management among healthcare workers in the same hospital and the second to look at the impact of on-site training of healthcare workers on bio-medical waste management. The first study found that awareness was much higher in

staff that had attended regular trainings. The study recommended carrying out regular and refresher training to improve awareness levels. It also recommended to make training mandatory at the time of recruitment and to include it in the medical and nursing curriculum. The second study found that waste segregation practices were higher in staff who attended on-site training.

Discussions

A question was raised about the BMW rules focusing on incineration or plasma pyrolysis for soiled wastes and discarded or expired medicines. Experts commented that plasma pyrolysis released a lot of furans while vendors promote it as producing low dioxins. There are other cleaner options available such as autoclaving for soiled waste and chemical treatment (alkaline hydrolysis) for drugs. The Indian team informed that the review committee is debating on this issue and will propose appropriate amendments.

d. Healthcare hazardous waste management in Indonesia

Indonesia has several regulations on health and environment and on hazardous waste aimed at protecting human health, minimizing risks to patients, health workers and the community at large by promoting best practices on healthcare waste management. The country has ratified the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Basel Convention on hazardous waste and other waste and has signed the Minamata convention on mercury.

Government regulation number 6 issued in 2013 requires all hospitals to be assessed with a rating system ranging from black, red, blue, green and gold. Black means no efforts taken to manage healthcare waste, red means environmental management efforts are not implemented in accordance with the law, blue means implementation of environmental management efforts are in accordance with the law and green and gold is beyond criteria or compliance is more than what is required.

A total of 121 hospitals were monitored against the criteria and the ratings were black 8, red 70 and blue 43 which means that most hospitals were not implementing the government rules and regulations. However such monitoring will help hospitals to improve in future.

The strategies for managing wastes are:

- Obligate all healthcare facilities to manage the waste properly in accordance with established standards
- Waste management to follow the principle of reduce and recycle.

- Strengthen human resources capacity
- Strengthen public - private partnership
- Improve monitoring and evaluation
- Explore alternative technologies other than incineration

Challenges faced by the country are:

- Human resources
- The huge volume of biomedical waste generated
- Low priority by policy makers.

e. Healthcare waste management in Maldives

Maldives has 362 healthcare facilities consisting of 175 private facilities (170 clinics and five hospitals) and 187 government facilities (22 hospitals and the rest are health centres) spread across several islands.

The current system is to segregate infectious and general waste at the point of generation. However, when the waste is taken out of the hospitals it is mixed into one bin. A few hospitals treat waste by autoclaving before disposal while the majority burn waste in open areas. In order to address these issues, the Ministry of Health initiated the development of healthcare waste management policy with WHO support in 2015. The policy was endorsed by the Government in 2016. The healthcare waste management strategic plan has been finalized recently. The first pilot of waste management using non-burn technology (autoclave) will be implemented in Laamu atoll as part of a low emission climate-resilient development project. The pilot includes training of health staff in all health facilities.

f. Current status of healthcare waste management in Myanmar

The Ministry of Health and Sports through its five departments as shown in the following table is the custodian of the government healthcare facilities.

Departments under the Ministry of Health and Sports	Type and number of health facilities
Medical Services	• Hospitals: 1118 (Central: 37, District: 68, Township: 258 and Station: 755) • National Health Laboratory • Blood bank: National Blood Bank
Public Health	• Rural health centres RHC: 1778 • Sub-center: 9083 • Lab: Environmental and Toxicological Laboratory

Medical Research	• Lab: Central Biomedical laboratory
Traditional Medicine	• 30 Traditional medicine hospitals (Central: 3, State and region: 9, District: 6, Township: 12) • Traditional medicine laboratory
Food and Drug Authority	• Food and Drug Laboratory

Around 206 hospitals, 4776 clinics and 855 dental clinics are run by the private sector. The major sources of healthcare waste in the country are hospitals (at tertiary, district, primary levels and private), healthcare facilities (RHC, Sub-centre, Urban Health Centre), laboratories (national, public, private), research Institutions, blood bank, mortuary and autopsy centre and the Military Medical Service. Minor sources are general practitioners (medical, dental, traditional medicine), nursing homes for elderly, acupuncturists, ambulance services and home treatment.

The country has laws and policies such as the Public Health Law 1972 and National Health Policy 1993 in place wherein health and environmental protection are explicitly mentioned. However there is no separate legislation or policy on healthcare waste management. There is a plan to develop them in future.

The estimated quantity of healthcare waste generated by various health facilities in two big cities of Yangon and Mandalay is around 1.5 tonnes/day. Yangon had a good HCWM system from 1966 to 2000 but it became weak after that.

According to the hospital management manual of 2011, each hospital should have a hospital waste management committee chaired by the Medical Superintendent with microbiologist or pathologist as secretary and with ward incharges, pharmacist, hospital engineer and sister-in-charge as members. The current practice is to segregate waste in three colour coded bins – general waste in black bin, infectious waste in yellow bin and highly infectious waste in red bin. Infectious wastes are incinerated, sharps, syringes and needles are buried in deep concrete wells and general waste is disposed with medical waste.

The occupational and environment health division of the Department of Public Health is implementing HCWM project with the support of the World Bank. It is a three-year project from 2016-2018. The project will review the current status of HCW in Myanmar, develop standard

operating procedures for HCWM and also develop guideline and policy. A pilot study has been conducted in Mon State and the data is under analysis.

Myanmar ratified the Basel Convention in 2015 and the Stockholm Convention in 2004 and plans to ratify the Minamata convention. The country does not consider incineration as a suitable option in the future and feels the need to shift to non-burning methods for waste management. Some options identified are on-site steam autoclaving, off-site wet thermal treatment facility, a mobile wet-thermal treatment unit and then a sanitary landfill as disposal site.

Discussion

A question was asked about licensing of incinerators. The team responded that there is no such system and not all hospitals use incineration. The healthcare waste is collected, stored and managed by the local municipality. Incineration and deep burial are common methods of management.

There was a comment about the terminology used for infectious and highly infectious waste as it creates confusion in distinguishing between the two. It was suggested to use infectious only.

g. Healthcare waste management in Nepal

Types of healthcare facilities	Number of healthcare facilities
Government hospital(central, teaching and specialized)	16 hospitals
Regional and sub-regional hospital	7 hospitals
Zonal hospital	10 hospitals
District level (including general)	82 hospitals
Primary health care centres	202 PHCCs
Health post	3803 HPS
Private healthcare facilities	1168 HCFs

The Ministry of Health in 2015 estimated the healthcare waste (HCW) generation rate at 1.35 kg per person per day, of which 37% of the waste is risk waste.

The country has an Environmental Protection Act and Environmental Protection rules of 1997. The Solid Waste Management Act 2011 provides the legal basis and regulations for HCWM. Healthcare Waste Management Guidelines 2014 provide minimum standards for healthcare waste management for healthcare facilities. The guidelines focus on safe and proper techniques for the segregation, collection, transportation, storage, treatment and final disposal of healthcare wastes and also support non-burn green technology. The Ministry of Health imposed a blanket ban on import, purchase and use of mercury-based equipment in the health sector in

Nepal from July 2013. The National Immunization Injection Safety Policy mandates the use of auto-disable (AD) syringes in the immunization programme.

Till date there is no specific institutional setup for healthcare waste management. Recently a new unit, namely disease control, climate change and environmental health was established. This unit will be also responsible for HCWM. The Department of Environment (Ministry of Population and Environment) is responsible for monitoring overall environmental issues including HCWM in the country. The Department of Health Services, Regional Health Directorate and district level public health offices monitor health activities including HCWM.

New initiatives on HCWM

- Segregation of waste initiated in all healthcare facilities
- Autoclaving of risk waste in government hospitals is in place (e.g.Bir hospital, western regional hospital, Baglung zonal hospital , civil hospital, maternity hospital)
- Autoclaving of HCWM is being implemented in 750 smalls health facilities in earthquake-affected districts
- Biogas plant is being established in Seti zonal hospital, maternity hospital and Chainpur health post.
- HCWM has been integrated with infection prevention in national training manual
- Government has approved separate budget allocation for HCWM at district hospitals and PHCCs.

Despite the success stories, the country faces the following challenges:

- Insufficient resources
- Low priority for HCWM
- Inadequate knowledge on HCWM
- Different organizations still focusing on burning technology (incineration)
- Lack of transportation of recycled/ reusable materials in rural and remote areas
- Enforcement of law and regulation
- Monitoring mechanism.

h. Healthcare waste management in Sri Lanka

The country is divided into nine provinces and further into districts. Districts are divided into 334 Medical Officer of Health (MOH) areas. Each MOH area has a medical officer and supportive staff. MOH is supervised by the district health authority headed by the Regional Director of Health Services.

Government health facility	No.
National hospital	1
Teaching hospitals	20
Provincial general hospitals	3

District general hospitals	18
Base hospital type A	22
Base hospital type B	46
Divisional hospital type A (>100 patient beds)	42
Divisional hospital type B (50-100 patient beds)	129
Divisional type C(<50 patient beds	322
Primary medical care units -central dispensaries and maternity hospitals	474
Board managed hospitals	2
Special hospitals	5
Private sector healthcare facilities	**No.**
Registered health institutes	204
Medical laboratories	623
Part time medical clinics	1288
Full time medical clinics	480

Some of the factors for proper management of healthcare waste are:

- ✓ It is an integral part of infection control which further cuts down on use of antibiotics and facilitates fast recovery of patients.
- ✓ Proper waste management minimizes occupational health risk, needle stick injuries, reusing of needles, and soiled cotton wool etc.
- ✓ Sri Lanka has a good health status within the Region, proper waste management will further improve the status.
- ✓ It is a legal requirement under the legislation of Central Environmental Authority(EPL effective from 01.02.2008)
- ✓ Sri Lanka is a party to the Basel Convention, which deals with internal management of hazardous waste
- ✓ National Policy & Guidelines mandates all health institutions to be responsible for proper healthcare waste management
- ✓ HCWM plan is considered as an integral part of the health-care system.

A recent situation analysis shows overall production of hazardous HCW at the national level to be about 15 tons/day with Colombo responsible for approximately 25% and the greater Colombo Area for an estimated 4.2 tons/day including private hospitals. Gampaha, Kandy, Kurunegala, Galle and Anuradhapura accounted for 30% of the national estimate of HCW generation.

The country has related laws, policies and guidelines on healthcare waste management. Hospitals, medical laboratories, clinics and medical research institutions are included in the regulations since January 2008. Two licenses have to be obtained from the Central Environmental Authority namely Environmental Protection License (EPL) and

Scheduled Waste License (SWL). The Ministry of Environment is responsible for legislation, and the Ministry of Health is responsible for implementation.

As per the national policy, all health institutions are supposed to segregate their healthcare waste. More than 70% of healthcare institutions are complying with the policy while it is an issue in some smaller institutions. The Ministry of Health is taking steps to implement proper waste management systems in all healthcare institutions.

National colour code used in Healthcare waste segregation

Infectious waste such as cultures, body tissues, blood and body fluids, clothes soiled with infected substances are disposed in yellow bins, sharps consisting of disposable syringes, scalpels, sharp objects in yellow with red checked bins, and general waste consisting of small pieces of soiled paper, plastic, polythene, mixed wastes are disposed in black bins. Bio-degradable waste such as garden waste, kitchen waste and food waste are disposed in green bins, glass bottles that can be recycled in red bins, plastic consisting of polythene bags, plastic containers, saline bottles that can be recycled in orange bins and paper and cardboard in blue bins.

Waste transporation

Waste material is transported inside the health facility using special carts which are not used for any other purpose. The collection route is from point of collection to storage. Hired cleaning service and hospital cleaning staff is responsible for transport. Some buildings have separate waste chutes and all new construction is supposed to have them. There are specially designed vehicles available for transport outside the hospital. There are private agencies responsible for transport of healthcare waste out of the healthcare facility. All agencies responsible for transportation of healthcare waste have to obtain approval from the Central Environmental Authority.

Waste storage

Storage rooms are well ventilated. Hazardous and non-hazardous wastes are stored separately. Rooms are locked with no access to unauthorized persons, scavengers and animals. Cleaning and disinfecting facilities are available with proper water supply and drainage. The storage is painted as per the national colour code.

Treatment and disposal

The current practices of treatment are high temperature incineration, steam sterilization and disposal with general waste and safe burial in lime pits. Some small institution practice low

temperature incineration. Pharmaceutical wastes are incinerated in cement kilns, while geno-toxic/cyto-toxic waste is incinerated in high temperature incinerators. Mercury-based equipment and devices have been phased out as Sri Lanka has signed the Minamata convention. Radioactive waste is managed as per the regulations of the Atomic Energy Authority. Sharps are disposed either through high temperature incineration, steam sterilization followed by destruction in shredder machines and disposal with general waste or safe burial in lime pits. Open burning is still observed in a few facilities.

Wastewater treament

Wastewater discharge is done according to the standards developed by the Central Environmental Authority. Chemically-treated wastewater is discharged in the sewer system with excessive amounts of water. In Pannipitiya Pvt hospital, wastewater is collected in a tank and treated using bioremediation, sand filter and UV and released in the sewer.

Occupational safety of waste handlers

As per regulations, waste handlers are required to wear protective gear, minimize manual waste handling at all points and have to be provided handwashing facilities. However, only about 60% healthcare establishments are using proper PPE. Immunization against Hepatitis B is provided for relevant staff.

Capacity development

Healthcare waste management is included in relevant university curricula and in medical and public health staff trainings. The Ministry of Health and the Central Environmental Authority carries out TOT programmeme in healthcare waste management.

Monitoring

National level monitoring is done by the national steering committee for clinical waste management. Provincial-level monitoring is vested with the relevant bodies in provincial councils. At the institutional level, hospital management sets out healthcare management plans. The infection control committee headed by the director monitors the situation in the institutions.

Incentive

Sri Lanka has also instituted awards for best performing and green hospitals. The base hospital in Moneragala and the base hospital in Ninthavur were awarded silver and bronze Green awards respectively.

i. **Thailand Hospital Wastes Situation 2016**

Management of solid waste and sewage is prescribed in Chapter 3 of the Public Health Act, B.E. 2535 issued in 1992. The Act gives powers and duties to local governments for the safe disposal of solid waste and maintenance of cleanliness.

The government has undertaken key actions pursuant to the Roadmap on Waste and Hazardous Waste Management approved by the National Council for Peace and Order on 26 August 2014 whereby communities and municipal authorities are encouraged to reduce waste, implement waste sorting at source and dispose of waste in an appropriate manner and to promote discipline in waste management among the public. Rules and regulations regarding solid waste and hazardous waste management and the National Waste Management Master Plan have been drafted.

Provincial public health offices and the Bureau of Policy and Strategy, Ministry of Public Health through hospital inspections has compiled a list of healthcare facilities in the country as summarised in the following table.

Types of healthcare facilities	No. of facilities	No. of beds
1 Government hospitals	10845	120322
1.1Hospitals under MoPH	10730	99193
1.1.1 Regional hospitals	28	21106
1.1.2 General hospitals	88	28601
1.1.3 Community hospitals	780	38065
1.1.4 Sub-district health promoting hospitals	9777	9777
1.1.5 Hospitals under departments in MoPH	57	1644
1.2 Hospitals under other ministries	115	21129
2 Private hospitals	343	30028
3 Private clinics	23054	-
4 Animal hospitals/clinics	2522	-
5 Pathogenic microorganism laboratories	1198	-

In Thailand waste generated or used in medical diagnosis or remediation, disease immunization or experiments, autopsy or examination of animal carcasses including in research, are deemed infectious waste.

The Pollution Control Department, Ministry of Natural Resources and Environment estimated the quantity of infectious waste produced in Thailand in 2015 at 53 868 tonnes, an increase of 1 721 tonnes (3.3%) from 2014.

The waste management system is similar to other countries where waste is segregated at source using colour coded bins and transported in separate trolleys to dedicated waste storage rooms and then sent to various offsite waste treatment centres – 10 incinerators managed by local governments and six incinerators run by private companies. While 37 hospitals which are not accessible to these waste treatment facilities have their own incinerators, four hospitals have thermal inactivation systems to treat infectious waste.

The Ministry of Public Health had set a goal for 953 health promotion centre hospitals, general hospitals, community hospitals and hospitals to achieve standards for infectious waste management. About 880 facilities (92%) have achieved the standard.

j. Healthcare waste management in Timor-Leste

Timor-Leste has one national hospital, five referral hospitals, 12 district health centres, 68 community health centres and 205 health posts. The Environmental Health Department under the National Directorate of Public Health, Ministry of Health is responsible for healthcare waste management. The Health sector national strategic plan (2011-2030) has an exclusive indicator on healthcare waste management. The environment health strategy has eight components and one of them is on healthcare waste management focusing on minimizing the impact of medical waste on the environment and health of people.

An assessment of environmental health conditions of 74 healthcare facilities was carried out in 2011. The results showed that there was no HCWM guideline or policy in the country, only 24% of the facilities had a responsible person for waste management, 33% had functioning incinerators and 28% had facilities for waste water treatment.

To address the gaps, the Environment Health Department has initiated awareness programmeme and capacity development of health workers. The national guideline on HCWM has been drafted and is under approval. Pilots have been initiated in two referral hospitals and two community health centres.

Challenges faced

- Lack of human resources for health environments programme in CHC and HP (infection control and sanitarian)
- Lack of financial support from government
- Lack of monitoring system between district health Centre and the national programme
- Lack of health professionals with HCWM capacity
- No appropriate management of HCW for emergency response.

Summary of country presentations and discussions

- There are rules, policies and guidelines in most of the countries; some countries may need to review and revise
- Institutional setup exists, however, capacity building and awareness among staff needs to be carried out on a regular basis. On-the-job training was recommended strongly as an effective training methodology.
- All countries have started to segregate waste and are using colour code but implementation varies at different levels.
- Treatment of infectious wastes is done either on site or offsite. Common treatment options used are autoclaving, chemical treatment and incineration. Most countries are in the process of reducing use of incineration as much as they can, as it is difficult to maintain emission standards and monitoring of air pollution is not an easy task.
- Liquid waste management has been started in a couple of countries and there is need to promote, especially with the risks posed by AMR.
- Reduce, recycle and reuse(RRR) principles have been promoted in the WHO guidance document and it is being followed by many countries but not in all healthcare facilities. This needs further promotion.
- There are many competing priorities in countries and hence challenges are faced on strengthening HCWM in the Region. However, the approach is to work on it and make incremental improvements over time.

k. Recommendations of regional workshop in 2011and progress status

Ms Payden gave an update on the progress made on the recommendations of the regional workshop held in Kathmandu from 7-9 December 2011. The workshop was attended by 44 officials from 11 Member States, eight representatives of development partners, seven external resource persons and seven WHO focal points. The participants visited two sites – healthcare waste management system in Bir hospital and constructed wetland wastewater treatment system in Dulikhel hospital. The participants developed draft action plans which were followed up and implemented mostly with SEARO support. The progress made was in the following areas:

- Awareness and advocacy on healthcare waste management in several countries
- Capacity development in all countries
- Pilot or development of HCWM models – in Bhutan, Nepal, Sri Lanka, Timor-Leste
- HCWM included in nursing and medical curricula – in Sri Lanka
- Study visit to Bir hospital – officials from Bhutan, Myanmar and Timor-Leste
- Replication of HCWM in other health facilities – India, Nepal, Sri Lanka, Thailand
- Baseline assessment of HCWM – Indonesia, Thailand, Timor-Leste
- Finalize HCWM policy, guidelines and regulatory framework – in progress in Maldives and Timor-Leste

- Establish monitoring system for HCWM – Thailand has a good system which can be replicated
- Establish surveillance system on HAI and AMR- some countries have started HAI surveillance but not on AMR
- Promote environmental-friendly technology – all countries are working on it

WHO-SEARO provided support in the following areas:

- Technical support in developing policy, guidelines and piloting innovative, sustainable and appropriate HCWM approaches.
- Local capacity building to adopt appropriate HCWM including training of key country stakeholders in global best practices
- Identifying appropriate technologies for HCWM for developing and resource-poor countries
- Organizing workshops and invite experts from relevant organizations as resource persons
- Technical and financial support for the development of policy/guidelines for HCWM including mercury control and implementation programme.

l. **Introduction to UNEP's compendium of healthcare waste management technologies**
- Surya Prakash Chandak

Professor Chandak presented a summary of UNEP's compendium of healthcare waste management technologies. The basis for development of the compendium is the WHO Policy paper of 2004 which called for promotion of environmentally sound technologies for safe healthcare waste management to:

- Prevent the health risks associated with exposure to healthcare waste for both health workers and the public by promoting environmentally sound management policies for healthcare waste;
- Support global efforts to reduce the amount of noxious emissions released into the atmosphere to reduce disease and defer the onset of global change;
- Support the Stockholm Convention on Persistent Organic Pollutants (POPs); and
- Promote safe and environmentally sound technologies for the final disposal of healthcare waste to prevent the disease burden from: (a) unsafe healthcare waste management; and (b) exposure to dioxins and furans.

Hence the objectives of the compendium are to assist developing countries in assessment and selection of appropriate technologies for the destruction of healthcare waste and promote environmentally sound technologies.

The compendium gives detailed information about treatment technologies which are based on thermal, chemical, irradiative and biological processes. The thermal process includes

autoclave, microwave, dry heating and incineration. The chemical process includes alkaline hydrolysis, chemical disinfection and others and the biological process includes composting, vermin-culture and biodigestion. Other emerging technologies are ozonation, dry chemical (calcium oxide-based) and promession for anatomical waste.

The compendium provides comparisons of investment and operational costs, environmental, occupational safety, social, cultural aspects and regulatory requirements between various waste treatment technologies such as autoclaves, incineration and alkaline hydrolysis.

m. **Injection safety programme in India** - *Chandrakant Lahariya, WHO India*

Injections are an integral part of health services such as in prevention programme (immunization), diagnosis and during treatment. Global use of injection in 2000 is estimated at 16 billion per year – 5% for immunization, 90% for therapeutic purposes and the remaining for blood transfusion, IV drugs, injectable contraceptive etc. A proportion of these injections are found unnecessary. About the same time, around 3 billion injections were administered for various purposes in India. This comes to an average of 2.9 injections per person per year. It is estimated that nearly two third injections are unsafe. While increasing steps are being taken to improve injection safety, issues remain.

The issues recognized in injection safety are reuse of injection equipment, accidental needle stick injuries, overuse of injections and unsafe sharps waste management. Globally in 2000, it was estimated that 6.4 billion (40%) injections were given with re-used injection equipment and caused an estimated 21 million new HBV cases (32% of all new cases), 2 million new HCV cases (40% of all new cases) and ~260 000 HIV cases (5% of all new cases). Three million accidental needle-stick injuries were also recorded.

WHO recommends the use of injection devices with sharps injury protection feature (SIPs), and a reuse prevention feature (RUPs) as opposed to devices without ‘a sharps injury protection’/’reuse prevention’ feature by healthcare workers delivering intramuscular, subcutaneous or intradermal injectable medications to patients.

WHO is implementing a three-year injection safety project in India, Egypt and Uganda. Further, WHO India is planning to implement the project in Punjab state jointly with the central and state

health ministries. The project will focus on injection safety but also address related programme on infection prevention and control (IPC) practices, patient safety and quality of healthcare and healthcare waste management.

n. **Regional assessment of HCWM -** *Satish Sinha, Toxics Link*

WHO-SEARO has engaged Toxics Link to carry out a systematic assessment of healthcare waste management in the South-East Asia Region. The objectives of the assessment are to update and review progress of implementation of HCWM in the Region focusing on policy and regulatory frameworks including allocation of finance and human resources as well as preparedness for managing waste in hospitals for treating epidemics or infectious disease outbreaks, integration of HCWM in infection prevention and control and quantity of healthcare waste generated in the Region. Finally, the assessment will identify gaps in current country plans, policies and strategies and recommend strategic action at country and regional levels.

Questionnaires for the assessment prepared by Toxics Link and SEARO were pilot-tested and then shared with Member States. So far data have been received from Sri Lanka, Thailand and Timor Leste. Mr Sinha requested the remaining countries to submit the data at the earliest. Country profiles on HCWM and a regional synthesis report will be prepared.

Summary of discussions

There was a question on how to dispose plastic (PVC) slides used in laboratories and PVC blood bags as BMW rule in India requires these to be incinerated; however, incineration of PVC releases dioxins and furans. Experts recommended that these can be sanitized and then used for in road making. The BMW also has a similar recommendation for use in road making. In the long term PVC should be phased out.

The problem with incineration is that it requires strict monitoring of air quality for which many countries do not have the capacity. Release of dioxins and furans from incineration is not only an environmental issue but a public health problem which is more serious – a whole range of cancers and reproductive health problems are related to dioxins. It is seen to affect children's IQ. Dioxins are bio-accumulated in our bodies from food and water. Dioxins are very persistent with a half life of 100 years.

On the question of third party audit of incinerators, the experts said it is recommended.

5. Day 2, field visit

A field visit to three healthcare facilities (one government hospital, one private and one government health post) was organized to observe healthcare waste management system in both big and small facilities. Participants were divided into three groups and visited the following facilities:

a. Paropakar Maternity & Women's Hospital, Ministry of Health/ Government of Nepal, Thapathali

The hospital was established in 1959 and is a central government referral hospital that specializes in obstetrics, gynecology and neo-natal care. This 415-bed hospital caters to about 125 000 women and children annually. The hospital faced issues with waste management and approached HECAF for technical support. The new system was initiated by the director and a team consisting of the nursing director, waste management coordinator, hospital administrator and deputy administrator. Baseline assessment was done in 2012 and showed that the hospital generated an average of 400kg of waste per day. About 332 kg was a mixture of risk and non-risk waste hence rendering the entire waste as risky. After a segregation system was introduced in the hospital, risk waste was drastically reduced to 42%.

A waste management system based on zero waste concept was first introduced in one ward. Once the system was tested and found efficient, it was replicated in other units of the hospital. The system is now fully functional in all inpatient wards. The system comprises:

i) Waste segregation – Risk and non-risk waste is segregated further in colour-coded bins. Clear pictorial labels are put up near the bins so users can easily understand where to put the waste. Proper instructions are given to staff to monitor segregation of waste and to take timely action. A separate trolley is provided in each ward for nurses and other staff to segregate waste when they go on ward/rounds.

ii) Waste treatment and storage –The centre has two distinct areas for risk and non-risk waste. The non-risk waste is weighed by category and recorded. Items have different recycling values and thus are stored in separate compartments in the non-risk areas. Risk waste is autoclaved and recyclable ones are sold while the rest are sent with municipal waste. Genetoxic waste is stored separately and treated chemically – 5% sodium hypochlorite is used to denature genotoxic cancer drugs. After chemical treatment it is processed and sent for recycling. A biodigester is being installed to process food and placenta waste. The hospital is also carrying out research on vermin-composting of disinfected cotton and gauze waste and sanitary pads.

iii) Safe injection practice has been introduced as part of the new system whereby nurses are trained and they undertake to follow safe injection practice.

iv) A waste tracking system has been introduced where waste from the point of generation till final disposal is tracked and recorded.

b. Visit to Kathmandu Medical College (KMC) and Teaching Hospital, Kathmandu University, Sinamangal

KMC in Sinamangal is a 664-bed teaching hospital. The hospital provides a range of services including laboratory, radiology, hemodialysis etc. Initially the hospital incinerated all its waste. KMC management saw the sound healthcare waste management in Bir hospital which was developed by HECAF with support from WHO and HCWH. Hence KMC requested HECAF to develop a similar system. HECAF jointly with a team from KMC conducted baseline assessment in 2013. It showed that KMC produced about 300 kg of waste per day during 59% occupancy. Of this, 85% was risk waste which was incinerated and the remaining was sent to a landfill. The rooftop of KMC which had the incinerator and had scrap piled up which were removed and converted to a waste treatment and storage centre. An autoclave replaced the incinerator to treat infectious wastes.

The new waste management system was inaugurated in November 2016. It is similar to the one at the maternity hospital with proper segregation of risk and non-risk waste, provision of improvised medication trolleys for ease of segregation for nurses and separate waste transportation trolleys for risk and non-risk waste. Two bio-digesters for processing food and placenta waste were installed and has been in operation for some time. They can treat about 20 kg of food waste and 5 kg of placenta waste. The bio-digesters have been producing 1.2m3 of biogas per day which is used for cooking.

KMC is in a busy and congested part of Kathmandu and hence HCWM was developed in the limited space available. The waste treatment and storage area is on the rooftop while the bio-digester is installed underground in a small garden space.

c. Budhanilkantha Health Post, Budhanilkantha

Budhanilkantha health post provides outpatient services, immunization, laboratory, dispensary, dressing, antenatal care, postnatal care and birthing services in the area. An average of 50 patients visit this health post daily. After the April 2015 earthquake, WCO Nepal with the Ministry of Health initiated an assessment to review WASH services in 15 primary health

facilities and this health post was one of them. Based on the damages, WASH services were renovated to make the health post functional. This included setting up a proper healthcare waste management system. Since the patient load is small, it required a simpler system. The system consisted of waste segregation at source, separate collection of waste, treatment of infectious waste by autoclave, storage of waste and recycling or final disposal. Waste is no longer burnt – most of it will be recycled and the remaining small quantity will be sent to a landfill. Placenta is currently buried in a deep pit, however the health post has plans to install a bio-digester. Currently it is testing the use of vermin-composting for treated cotton and gauze waste.

Waste segregation stands were developed for ease of use by health workers. An immunization field kit was designed by HECAF which is very convenient for use during immunization campaigns. It can be carried by the health worker and helps to segregate waste during immunization and bring them back safely to health posts for further treatment and disposal.

6. Session 2: Sharing best practices – *moderated by Ute Pieper*

a. Healthcare Waste Management - Experience of Dalin Tzuchi Hospital–

Dr Ming –Nan Lin Vice superintendent, Dallin Tzu Chi Hospitals, Tzu Chi Foundation

The medical waste management of the hospital is based on the goals of the Global Green and Healthy Hospitals promoted by Healthcare Without Harm. It is focused on Goal 3 - Reduce, treat and safely dispose healthcare waste. The hospital has taken several initiatives to reduce waste by introducing reusable plates, bowls and chopsticks for patients. Filmless and paperless system was introduced where all data can be accessed through single line and single monitor. Thousands of kgs of X-ray films are saved.

All systems are electronic including hospital information system, education, attendance of staff etc.

The hospital introduced awards and competition by encouraging staff to suggest ideas for reusing and recycling hospital waste. E.g. used saline bag is converted to a cushion by filling with air to prevent sores on legs. Recycling is promoted throughout the campus to make it a way of life. Stairs are decorated with health and environmental protection messages and pictures. Examples of messages are – "Cutting down an hour of TV watching can save 0.966 kg CO2" and "Showering can help reduce 0.438 kg CO2 compared with taking a bath". Staff and families are taught various recycling techniques by engaging them in the recycling process.

b. Sound management of laboratory wastes – *Dr Aparna Shah, WHO/SEARO*

Laboratories and blood banks and collection services are two of the major sources of healthcare waste. Microbiology lab waste contains potentially harmful microorganisms which can infect hospital patients, health workers and the general public. Other potential infectious risks may include the spread of drug-resistant microorganisms from health facilities into the environment.

Waste can be a potential health hazard for the laboratory and support staff and communities.Standard operating procedures for waste disposal and spillage in accordance with prevailing scientific concepts and national regulations, should be developed, implemented and reviewed regularly. Prior to disposal, all bio-hazardous waste should be stored separately from the general waste stream and from other hazardous waste. The container used to store bio-hazardous waste should be leak proof, and any bio-hazardous sharps, should be puncture-resistant, leak-proof and closable. Staff responsible for cleaning, laundry and maintenance should be afforded the same protection as lab staff.

Like other healthcare waste, laboratory waste should be segregated, transported separately, treated and disposed or recycled. All infectious waste must be autoclaved, and the material then transferred to a separate location for further segregation. Re-usable sterilized (glassware, etc) items should be separated. Microbiological liquid waste stocks should be autoclaved or chemically disinfected and poured down the drain whenever possible.

Accident reporting is critical for several reasons – for risk management, reporting to local regulatory agencies and preventing serious adverse events in human subjects. The principal investigator must report accidents involving biological agents to the respective higher authority within 24 hours.

c. **Anaerobic digestion as a healthcare waste management technology –** *Marjin Zandee, Healthcare Foundation*

Biogas technology is based on anaerobic digestion which is decomposition of organic matter in the absence of oxygen. Healthcare waste consists of different kinds of infectious, hazardous and general waste and hence different treatment systems are required for these waste

streams. Bio-digester is very appropriate for treating kitchen/food waste, soft tissue pathological waste (placentas) and wastewater.

Bio-digesters have been installed in Bir hospital for kitchen waste digestion (discontinued after earthquake), Kirtipur hospital for wastewater and kitchen waste, Kathmandu Medical College for kitchen waste and placentas, and it is under construction in the maternity hospital and City Grande hospital for processing kitchen waste and placentas.

The total cost of constructing 2m3 and 4m3 bio-digesters at KMC is about US$2800. It has been functional for about seven months. Over the period it had digested more than 450 kg of placentas and 3300 kg of kitchen waste. The process has been stable for more than six months. It has produced over 150 cubic meters of biogas which is equivalent to 4-5 cylinders of LPG.

Design principles for anaerobic digestion systems in healthcare are:

- ✓ For food waste – single chamber design.
- ✓ For food and pathological waste – two chambers.
- ✓ Pathological waste is fed into the first chamber, and later flows into the second chamber to be treated again with the food waste. This gives the pathological waste the maximum possible retention time so that any pathogens die.
- ✓ Slurry flows into the sewer with no further handling.
- ✓ There is no re-infection route for blood-borne pathogens after sewer disposal.

Discussions

Participants asked about how the slurry was disposed. It is released in the sewer line which is much better than the current practice where placenta pits get flooded during rains and overflow into drinking water. It was suggested to document the successful model for replication.

A question was asked about the safety of slurry which is disposed in the sewer system. It is normally considered safe as it is disposed only after 100 days retention time, but more research is needed. Further technology (e.g UV technology), was proposed to be explored for slurry treatment.

d. HCWM in small healthcare facilities – *Mahesh Nakarmi, HECAF*

Healthcare waste management in small healthcare facilities started in 2012 as a UNDP GEF project. The strategic objective of the project was to demonstrate safe and sustainable waste management techniques in reducing persistent organic pollutants (POPs) and climate impact in rural community. Various stakeholders such as the Ministry of Health, municipalities, district

public health offices, village development committees, healthcare facilities and the department of health services were involved. Five health facilities from Chitwan were selected. Waste assessment was carried out in these facilities. Most of the waste material was mixed, syringes were not collected properly and wastes were burnt in open areas. A system was introduced whereby waste materials are segregated at source, collected systematically, validated autoclaves used for proper disinfection of infectious wastes. In the process open burning of wastes was stopped.

HECAF was engaged by WHO Nepal to assess and improve WASH in 15 healthcare facilities affected by the April 2015 earthquake.

The assessment found several gaps in water, sanitation, hygiene and waste management areas. A total of 39 water samples were tested using Palin test kit. About 54% of samples tested positive for fecal coliform indicating contamination. There was no segregation of wastes and bins were found to be unclean and inappropriately located. Sharps were overflowing in containers, placenta pits were open and not maintained, and waste materials were burnt in open. Through this project, training was provided covering all the critical issues. Water filters were provided, and waste management system based on segregation, proper labeling, waste flow, treating risks wastes using autoclave and proper disposal were set up. Hand hygiene training was also provided.

Discussions

Thailand participants asked if diapers can be recycled. One resource person responded that such trials have not been done in our Region but a company in UK was undertaking tests.

Participants remarked that bigger hospitals have systems in place but this was not so in smaller HCFs. The pilot in Nepal can be a model for smaller HCFs. It was also concluded that good coordination with the government system is essential for sustaining such initiatives.

e. **Thailand GREEN and CLEAN Hospital for Safety 2016 -**

Mr. Charoen Hanpanjakit , Ms. Jitlada Rujitip and Dr. Wuttipong Tirakotai, Ministry of Public Health

The GREEN and CLEAN hospital concept promotes collaborative efforts among state healthcare facilities under the Ministry of Public Health to run in a sustainable manner and

reduce global warming. It encourages state healthcare facilities to serve as a role model for other agencies including local authorities and communities in reducing global warming. Finally it aims to increase awareness and understanding among health personnel in reducing global warming through sustainable sanitation management.

GREEN stands for Garbage, Restroom, Energy, Environment and Nutrition - key activities to be implemented and CLEAN stands for Communication, Leadership, Effectiveness, Activities and Networking - the strategy for implementing the activities.

Garbage or solid waste management – solid waste management system in the hospitals are developed using the 3-Rs principles. Wastes are segregated into risks and non-risks wastes with provision of colour-coded bins at strategic locations. Risks wastes are treated and recyclable items from treated risk wastes and non-risks wastes are recycled. Biodegradable wastes are composted .

Restrooms – public restrooms or toilets in the hospitals are improved and maintained to meet healthy, accessibility and safety (HAS) toilet standards.

Energy –reduction of energy use and promoting use of alternative renewable energy within the hospitals and among the staff. Creating awareness on switching off lights when not needed, encouraging carpooling, use of bicycle to come to work, installing solar panels, and bio-digester for biogas.

Environmental improvement and healthy workplace promotion with clean environment and promotion of active participation of the staff.

Nutrition promotion focuses on food safety and the use of organic food for patients. Hospitals are encouraged to buy local products which are grown organically or with less use of chemical fertilizer from neighbouring communities. Buying locally also helps to reduce carbon footprint as it requires minimum energy for transporting food.

The following strategies are used in implementing the GREEN concept in hospitals:

C: communication to create good understanding and awareness on a regular basis .

L : leadership for starting a prototype project and resolving any problems.

E : effectiveness enhancement to achieve the target.

A : activity creation to strengthen the cooperation.

N : networking of all hospitals to share and learn among themselves.

The major highlights of the progamme are - documentation of success stories, tracking carbon footprint of the hospitals through a carbon footprint calculator programme, training courses conducted for staff. An increasing number of hospitals are taking GREEN initiatives. Some lessons from the programme are summarized below:

- ✓ The health-care sector is well-positioned to "lead by example".
- ✓ Sustainable sanitation and climate change can be linked by GREEN and CLEAN Hospital Approach.
- ✓ The active role of the health sector in sustainable sanitation management can benefit health and contribute to long-term goals of reducing global warming.
- ✓ The capacity and awareness of health personnel need to be built continuously.
- ✓ The integrated approach of GREEN activities and routine work should be encouraged among health personnel in the hospitals.
- ✓ The GREEN and CLEAN strategy can be applied and promoted in other sectors.
- ✓ The involvement of other hospitals and other sectors should be increased in the project.
- ✓ A method for monitoring and evaluating the effectiveness of the project implementation should be developed.
- ✓ GREEN and CLEAN Hospital network should be created and strengthened both at national and sub-national levels.
- ✓ Innovation and appropriate technologies in managing sustainable sanitation in GREEN and CLEAN Hospital should be promoted.

f. **Institutionalizing healthcare waste management system in Dr Soetomo general hospital** – *Abdul Chodir, Sanitarian/Environmental Sanitation Installation of RSUD Dr. Soetomo Surabaya, Indonesia*

Dr Soetomo general hospital in Surabaya is a leader in medical services, teaching and research. The hospital has more than 5000 staff and is a 1540-bed facility. It provides a variety of medical services including radiotherapy, heamo-dialysis, obstetrics and gynaecology, palliative care etc. The hospital generates more than 1200 kg of waste per day. Wastes are segregated at source by collecting infectious wastes in yellow bins, sharps in safety boxes and cytotoxic waste in grey bins. These are then incinerated and different waste streams are treated and disposed. The hospital has three incinerators which are running 2-3 times a day. The incinerator is monitored and ash is sent to a registered vendor.

The hospital has a wastewater treatment plant which uses aerobic digestion and membrane filtration for treating the waste.

Training for waste management focal points, operators of waste treatment plant and nurses and doctors has been carried out.

g. Phuentsholing General Hospital: a pilot hospital for model healthcare waste management -

Karma Gyeltsen, Chief Nurse, Phuntsholing hospital, Bhutan

Phuentsholing hospital is 50-bedded with running capacity of 65 inpatient beds. It is run by 144 staff including all categories of personnel. It serves as a referral centre for other nearby health facilities and districts. In addition to curative services, the hospital also provides diagnostic and preventive services. The Royal Audit Authority conducted an environmental audit of waste management in the hospital in 2008 and the following recommendations were made:

- ✓ To maintain proper documentation
- ✓ Develop appropriate medical waste management rules and regulations
- ✓ Hospital authority and the National Environment Commission to conduct regular monitoring
- ✓ To provide awareness on medical waste management to staff and workers
- ✓ To treat waste using autoclave and small autoclaves in laboratories
- ✓ Propagate concept of 3 Rs
- ✓ To segregate wastes at source.

Following the audit, a diagnostic assessment of wastes was carried out in 2014 with WHO support. During the assessment, only 5% of wastes were found to be segregated. Waste bins were not kept in convenient places, and proper labelling was not provided. About 24% of the bins were found to be unclean. Staff were not trained properly. Waste material was treated using a 60-litre vertical autoclave but validation of the autoclave was not carried out.

The recommendations of the audit and assessment were taken up over the last few years depending on availability of funds. The Hospital Administration and Management Transformation Committee has been identified as the infection control and waste management committee. The focal point for HCWM is the nursing head. All unit in-charges are linked to infection control and medical waste management.

Training has been conducted on infection control and waste management, as well as patient safety for all categories of staff through programme support.

Waste storage and treatment house and a deep burial pit was constructed. A waste autoclave machine has been procured and is being installed. Mercury-based equipment is being replaced with digital and mercury-free devices. Waste bin stands and waste transportation trolleys have been fabricated on site.

Risks wastes are segregated at source and treated in autoclave and then sent to the municipal landfill. Pathological and sharps are disposed in deep burial pit. Chemical wastes are flushed down the drain after dilution. Burning is strictly prohibited by the National environment commission for environment concerned. General waste is sold to recyclers. The hospital plans to make it into a model hospital for HCWM in the future.

h. Diagnostic assessment of Valaichenai Hospital in Sri Lanka–

Dr W.K Wickremasinghe

Valaichenai base hospital (VBH) is a 186-bed hospital with 15 wards and nine departments. It covers a population of over 150 000 populations in five divisional secretariat areas. VBH was disposing all its wastes with municipal wastes and since this was posing a risk to waste workers and the community, the management jointly with MoH, WHO and UNOPS decided to carry out a diagnostic assessment to review the current status for setting up a safe system. HECAF, Nepal carried out the assessment jointly with a VBH team in March 2016.

The average waste generation rate of VBH was 1.05 kg/occupied bed/day. The risk waste generation rate and non-risk waste generation rate was 0.21 kg/occupied bed/day and 0.84 kg/occupied bed/day respectively. As in other hospitals more than 50% is biodegradable waste.

A self-administered questionnaire survey was conducted among a random sample of 121 doctors, nurses and support staff who handle waste as part of their duty and are at direct risk from occupational exposure. Of these, 54% reported having a needle stick injury at work within the last one year. About 72% of injuries occurred while using syringe during medication. About 8% of injuries were due to sharps that pierced the disposal container, 3% of injuries occurred from items left on the floor, and 3% of injuries happened during recapping the needle. More than 71% of wastes were not segregated, waste bins were kept in locations which were not easily accessible, more than 91% of bins were found unclean and there was no proper labelling of the bins. Waste material was collected in an open area in the backyard of the hospital and then disposed with municipal waste. There was no proper timing, protocols or staff safety for storage and disposal.Syringes were burnt in a low-temperature brick incinerator.

During the assessment, sensitization workshops and training were organized for VBH staff on the concept of safe and sustainable healthcare waste management system. The findings of the assessment were presented to the VBH team, MoH, WHO and UNOPS. The HCWM team is now strategizing to develop a sound system for healthcare waste management.

i. **Water, sanitation and hygiene (WASH) in healthcare facilities –** *Ms Ute Pieper, WHO-HQ*

A target of universal basic coverage of WASH in healthcare facilities by 2030 is included in the Sustainable Development Goals for water and sanitation and health (SDG3, SDG6). WHO, UNICEF and partners committed at a global meeting in March 2015 to address the urgent need to improve WASH services in healthcare facilities. A global action plan on WASH which includes HCWM elements has been developed. The vision being "By 2030, to ensure that every healthcare facility, in every setting, has safely managed, reliable water, sanitation and hygiene facilities and practices to meet staff and patient needs in order to provide quality, safe people-centered care." Four task teams namely advocacy, monitoring, research and facility-based improvement have been formed and are working on these aspects.

The facility-based improvement team has developed a water and sanitation for health facility improvement tool (WASH FIT). It is a practical tool for improving WASH services in healthcare facilities, ensure clean and safe facilities for staff and patients. It will help to address water quality, sanitation, hygiene, healthcare waste and other aspects of environmental health and facility management. It will be used for developing risk-based plans to improve and maintain WASH services at facility level. It has been implemented in the Chad, Liberia and Mali.

Case study 1 – WHO and the Ministry of Health supported piloting of HCWM in Kyrgyzstan where wastes were segregated; recyclable risk wastes were autoclaved and recycled. Proper waste storage areas were provided and containers were reused.

Case study 2 –Zainoel Abidin Hospital in Banda Aceh after the Tsunami. When the hospital was rehabilitated, a proper waste management system was set up following the same principles of 3Rs.

Some strategic considerations for improving HCWM are:

- Elevating urgency and profile
- Proof of concept and scale-up
- Tools, training and empowerment
- Innovative financing and sustainability
- Monitoring and accountability
- Strengthening and presenting evidence
- Power of partnerships.

j. **IGNOU-WHO/SEARO training programme on HCWM through distance learning –**
Dr Ruchika Kuba, IGNOU

IGNOU and WHO-SEARO jointly developed and launched a distance learning programme on healthcare waste management in 2006. The training programme is currently being updated. It is a collaborative effort of the two organizations to train healthcare professionals and para-professionals on healthcare waste management. The 16-credit programme offered through blended learning helps in good waste management practices among different health functionaries.

The target group is doctors, nurses, paramedics, health managers and other professionals and workers with a minimum of 10+2 qualification.

The objectives of the training are:

- To equip the learner with skills to manage healthcare waste effectively and safely
- To sensitize the learner about healthcare waste and its impact on our health and environment
- To acquaint the learner about the existing legislation, knowledge and practices regarding infection.

The programme package consists of a blended approach with self-learning material, audio-video material, synchronous and asynchronous interactions - chat sessions, discussion forums, face-to-face interactions, workshop and project assignments.

The programme is delivered through various centres identified and notified by IGNOU in India and identified by WHO (SEARO) in the SEAR countries and notified by IGNOU.

7. **Session 3 Emerging issues** –
   moderated by Dr Bardan Jung Rana, WHO-SEARO

   a. **Importance of waste management during disease outbreaks – Ebola disease outbreak in Africa–**
      Dr Jorge Emmanuel, Consultant

Dr Emmanuel was assigned by UNDP to assess healthcare waste management and improve the system in health facilities that were catering to Ebola disease patients in Guinea, Liberia and Sierra Leone. He shared the lessons learnt from his assignment.

Findings of the assessment:

- No sharps waste management. Needles were lying on the ground in almost every hospital the team visited
- No segregation of infectious and non-infectious waste in hospitals (excluding Ebola treatment centres)

- Improper storage of infected waste was observed
- No colour coding of waste bins
- Burial pits were overflowing with waste from the Ebola treatment facilities.
- Burn barrels and burn pits were as near as 4 meters from patients. High levels of smoke, carbon monoxide and other toxic pollutants were seen.
- Many incinerators brought into the countries on an emergency basis did not meet international standards. Many released black smoke, hydrochloric acid, dioxins, etc. Led to opposition by communities.
- Risks to workers due to flammable PPE – full-body suit is highly inflammable and operators who incinerate waste run the risk of getting burnt.

Prerequisites for proper management of healthcare waste for infectious disease are:

- Understanding the nature of the disease
    - Ebola transmission in healthcare facilities
    - Primary modes of transmission - direct physical contact and exposure to contaminated material which includes fomites (inanimate objects including waste)
    - Provision of PPE and disinfectants
    - Universal precautions for infection prevention
    - Containment
    - Isolation of suspected cases
    - Creation of Ebola treatment units or centres
- Understanding the nature of the infective agent
    - Environmental persistence. Laboratory studies show an inactivation of 99.99% of the virus on fomites when kept at 20-25ºC in total darkness for 5.9 days
    - Persistence and inactivation - Ebola virus is relatively fragile, it can be reduced by 99.999% by heating at 60ºC in 22 minutes
    - Infectious waste generation rates - Ebola-contaminated waste was on an average 3 kg per bed per day (20 liters per bed per day). Contaminated PPE (soaked in hypochlorite!) was 7 PPE sets per patient per day and 50 liters of compressed PPE per patient per day.

Based on the assessments, healthcare waste management was strengthened in some health facilities in the three countries:

- By introducing environmentally sound and effective technology – 20 autoclaves manufactured by Medi-Clave Pt. Limited were developed in collaboration with UNDP –GEF project
- Staff trained in healthcare waste management, infection prevention and control and maintenance of autoclave
- Training, mentoring, evaluation and re-training

Key recommendations were:

- Build a resilient HCWM system in the country

- Plan for outbreaks *before* they happen including coordination, rapid response, communication plan, containment, PPE & disinfectant supplies; surveillance & contact tracing, guidelines for diagnostic labs, safe dignified burials, IPC, *and HCWM*
- Understand the nature of the infectious disease and the requirements for HCWM including microbial inactivation requirements, lab waste, wastewater, occupational safety, etc.
- Select the appropriate technology – priority consideration-vacuum autoclave + shredder (based on environmental & public health impacts, patient and worker safety, cost), validation, training needs, maintenance requirements, and sustainability
- Train all levels of a facility – using effective training techniques
- Set up a system of monitoring, evaluation, enforcement, and continuous improvement of the HCWM system.

Discussions:

With regard to a question on hand sanitizers, the presenter recommended vinegar- or alcohol-based sanitizer than hypochlorite solution as it breaks skin and makes it very vulnerable to infections.

Participants asked about the sewage effluents that are collected in holding tanks and how these should be disposed. The expert recommended to leave it for some time to let UV rays work on it and then test and release in sewer.

How were the PPEs and linen disposed? PPEs were shredded and buried while linen was washed at high temperature and then disinfected.

One participant asked about the concentration of chlorine to disinfect BMW. The presenter recommended 0.05% for washing hands and 0.5% for cleaning. The most important thing to do is to refresh the solution often. It can be easily tested with a strip. At some facilities during the Ebola disease outbreak, the presenter observed that the solution often was left standing for long, around 24 hours, which rendered it useless.

b. **Waste minimization and management: combining strategies to reduce the impact of pharmaceuticals on the environment** –
Ruth Stringer, International Science and Policy Coordinator, Healthcare Without Harm

Pharmaceutical wastes consist of expired drugs, unused drugs in hospitals and homes, residues from treatment, manufacturing waste, excretions from patients in hospitals, excretions from patients treated at home and unwanted donations.

Impacts of pharmaceuticals are:

- Designed to have biological effects
- Some, especially cancer drugs, are carcinogens
- Endocrine disruption
- Antimicrobial resistance
- Often environmentally persistent
- Mixtures have unknown effects
- Wildlife affected by continual release
- Other hazardous chemicals e.g. phthalates in formulations and pills.

Chemotherapeutic waste

- Chemotherapeutic waste is generated from the use of chemical agents for treatment, especially cancer therapy
- Cytotoxic agents – substances capable of killing or stopping the growth of cells
- Cytostatic agents – capable of suppressing growth and multiplication of cells
- Antineoplastic agents – inhibiting the development of abnormal tissue growth
- Genotoxic agents – capable of inducing genetic mutation
- Teratogenic agents – capable of causing defects in an embryo or fetus.

Pharmaceutical life cycle can pollute the environment through:

- Manufacturing emissions (toxics and carbon footprint)
- Sewage- excretions mostly from home patients and a small percentage from hospitals
- Over-prescription and self-medication
- Drain disposal – homes and hospitals
- Incineration of wastes by releasing dioxins, furans, CO2 and others
- Production and incineration of PVC blister packs
- Disposal in landfill and dump sites.

Environment and mortality

- WHO estimates that, globally, almost a quarter of deaths (23%) are due to a modifiable environmental factor - These particularly result from infectious diseases, but noncommunicable diseases are also a factor
- Emissions from incinerating waste contribute to asthma, heart attacks and strokes, which are caused & exacerbated by air pollution
- Non-incineration options create less pollution and also have a far smaller carbon footprint
- Use of autoclaving is increasing for infectious waste, but the need to dispose pharmaceutical waste is one factor that often drives incineration
- We can reduce >> eliminate pharmaceutical incineration.

WHO healthcare waste guideline underscores the waste hierarchy. Pharmaceutical wastes can be managed by several measures:

- Avoid over use

- Doctors prescribe what the patients want, not what they need (need tighter rules and support for doctors to implement them)
- Stop open sale of critical medicines (especially antibiotics)

- Reduce wastage
  - Earliest expiry used first
  - Purchase only according to need
  - Prescribe only required amount (split packages)
  - Refuse inappropriate donations
    - Unwanted materials, foreign names
    - Short expiry date

Pharmaceutical manufacturing – untreated wastes could harm aquatic ecosystems, generate resistant microorganisms and contaminate drinking water. This could be minimized or prevented by controlling the pollutants aiming at zero discharge and through transparency in supply chain.

Green chemistry vs green procurement

- Green chemistry
  - design more environmentally-friendly chemicals
  - Will never produce pharmaceuticals that do not have a biological impact
  - Environment is lower priority in drug design
  - Environmental effects are unpredictable
  - It does not matter if a drug is NOT persistent if it is being discharged every day
  - Need to act now, not rely on future changes
- Green procurement
  - Can select best available products now
  - Buying green will drive more innovation.

Disposal options for pharmaceutical wastes

Current practice is flushing, uncontrolled landfill, incineration, co-incineration, burning etc. Some take-back programmes are in place. It is not advisable for each facility to take responsibility for disposal of waste pharmaceuticals, especially smaller ones. Centralized treatment is more efficient. While procuring, negotiate take-back with supplier. When there is no option but to dispose the unwanted or expired drugs, then a low-cost option is by encapsulation.

Some technologies are currently being studied namely the GEF technology reactor, alkaline hydrolysis (method originally intended for hazardous waste -mostly sold for tissue digestion) and thermophilic anaerobic digestion.

c. **Antimicrobial resistance and healthcare waste management –** *Prof. Ashok J Tamhankar, National Coordinator, Indian Initiative for Management of Antibiotic Resistance (IIMAR)*

It is estimated that by 2050, millions of people may die due to failure of antimicrobials including antibiotics. The World Health Organization (WHO) has therefore named Antimicrobial Resistance (AMR) as the 'Greatest Menace of the 21st Century'. It's a 'disaster in waiting' and hence, if urgent actions are not initiated a catastrophic situation may arise. There is a pressing need therefore to develop solutions to tackle the problem. For this, it is necessary to develop an understanding about how healthcare waste creates and magnifies the antimicrobial resistance problem? What are the consequences due to it? And what context specific solutions can be developed and employed to resolve the issue?

The infectious and pathological wastes are the agents of generation and propagation of resistant infections and this happens due to both natural selection and horizontal gene transfer (HGT). Non-hazardous or general waste provides substrate for microbial growth and it itself may be infected. The chemical and pharmaceutical (antimicrobial) waste and the sharps generate resistance by way of natural selection as well as due to co-resistance development associated with biocides and metals. Mutations can occur in microorganisms due to exposure to radioactive and mutagenic waste, some of which can be a change in genetic material that is favorable to AMR. Healthcare waste and excretion of antimicrobials after consumption contaminate the soils, water-bodies and biosphere with antimicrobials and resistant bacteria, e.g. a conservative estimate would suggest that in the South East Asia Region (SEAR), the wastewater from hospitals and health care facilities must be releasing about half a ton of antibiotic residues/day i.e. 183 tons of antibiotic residues every year. Wherever there are antibiotics, resistant bacteria get generated. 80 % of waste water in SEAR is not treated before entering the environment plus current treatment plants do not remove antibiotics or resistant bacteria completely from wastewater, therefore the SEAR environment (soils, waters-rivers, tanks, canals- and biosphere) remains highly contaminated with antimicrobials and resistant bacteria. Experiments using waste water on duckweed, algae, daphnia, rotifers, and fish have shown that antibiotics in wastewater posed a risk to all these species. There is an urgent need, therefore, to search for strategies and support experimentation and innovation to remedy the problem. Some such strategies could be, behaviour modification programs for raising awareness about 'healthcare waste and its management', reduction in generation of antimicrobial waste by optimizing antimicrobial use, 'take-back programs' for the public as well as health care facilities, pharmacies and whole sellers to improve left over antimicrobial waste management, surveillance methods (qualitative and quantitative) to estimate antimicrobial residues, which might include modeling based on antibiotic use in healthcare, Efficient and affordable technology to remove

antimicrobial residues and resistant microbes/ bacteria from aquatic niches preferably at the point of origin e.g. photo catalytic disinfection and decontamination, on site treatment plants (OSTP), septic tanks with small size OSTP, development of 'Technology for Recovery and Reuse of antimicrobials (antibiotics)', Location Specific Integrated Antibiotic Resistance Management Strategy (LIARMS).

8. Session 4: Way forward – Recommendations and draft country action plans – *moderated by Mr Sharad Adhikary*

Group work was organized to draft country action plans for the next five years. Each country team reviewed their current status, the gaps and challenges and prepared actions to address the gaps. The draft action plans are summarized in Annex 4.

Recommendations

1. Advocate importance of and improve healthcare waste management, water, sanitation and hygiene (WASH) in health facilities as an integral component for preventing infections, patient safety and safe delivery.

2. Strengthen partnership between government, nongovernmental organizations, experts and local government for advancing management of healthcare wastes.

3. Further enhance capacity and awareness building programme in countries. The most effective way for capacity development and behaviour change is through on-the-job training. Where possible such methods shall be adopted.

4. Develop appropriate monitoring system and implement it in countries.

5. Develop and improve healthcare waste management systems based on the principles of reduce, reuse and recycle. This will reduce air pollutants and greenhouse gases thus providing health benefits as well as contribute to mitigating climate change.

6. Most countries are parties to the Stockholm Convention on Persistent Organic Pollutants. WHO policy paper 2004 promotes environmental-friendly waste treatment technologies. Open burning of wastes should be stopped while use of non-burn technologies should be decided based on local context and by reviewing advantages and disadvantages of various technologies.

7. Establish a regional network for sharing experiences and providing mutual support.

8. Conduct research studies on efficiency and sustainability of technologies and interventions and health impact of unsafe waste management.

9. Build resilience of healthcare facilities to be prepared for and ready to respond to any disaster or public health emergency. Water, sanitation, waste management and energy are important pillars of a resilient healthcare facility.

10. Establish HCWM policy and strategy at national level and ensure implementation of the strategy. Establish adequate linkages with AMR, infection surveillance, global health security, global green and healthy hospitals concept and clean and green hospitals.

11. Hospital wastewater is highly infectious and may contain antibiotic residue and AMR bacteria and genes. The UN General Assembly has declared AMR as an important issue and hence hospitals are recommended to work with AMR focal points to address any potential source of AMR through hospital waste and wastewater.

9. Closing session

Dr Bardan Rana, WHO-SEARO expressed his appreciation for the extensive and interactive discussions that were held in the four days of the workshop. He emphasized the need for various health and related programmes within the countries to work together as well as for collaboration with other countries, agencies and development partners. He thanked the participants and facilitators for a very successful workshop.

Ms Payden, WHO-SEARO congratulated the participants for the progress in countries to address healthcare waste issues. The workshop was very useful to take stock of the country situation, identify gaps and to plan for mitigating the challenges. She said that WHO and partners look forward to supporting countries in operationalizing the draft workplans that were prepared. She thanked colleagues in WCO Nepal and the hotel management for very efficiently running the workshop. She expressed her gratitude to the resource persons for providing technical expertise and guidance and thanked the officials from 10 Member States for very actively participating in the workshop.

Annex 1

Country teams worked in groups to draft an action plan for developing improving healthcare waste management. The action plans are summarized in table below:

Bangladesh		
Country Planned activities	Timeline	Responsibility
A consultative meeting with MoHFW, DGHS, HCF authority, WHO and local government representatives	Dec 2016	Director, hospitals and clinics
A situation assessment of healthcare waste management programme in Bangladesh	Jan-Jun 2017	Director, hospitals and clinics WHO – TA
Include HCWM component as a priority programme in the 4th Health Sector Programme	2016	DGHS
Keep adequate budget allocation in 4th Sector programme (2017-2021) for effective HCWM	Dec 2016	MoHFW DGHS
Review and update Waste Management Rules 2008, National Guidelines and Handbook; Development of Handbook and SOPs for HCFs	Jan-Jun2016	MoHFW DGHS
Piloting of non-burn technology-based HCWM system in selected tertiary, secondary and primary healthcare centres	Jan-Dec 2017	DGHS
Introduction of systematic HCWM in all public HCFs by 2021	Next five years	DGHS
Development of a comprehensive monitoring framework for HCWM implementation	Jul-Dec 2017	DGHS TA-WHO
Conducting regular training of all stakeholders for effective HCWM	Next five years	DGHS
Development and implementation of liquid waste management programme (e.g. ETP) at tertiary level hospitals	Next five years	DGHS
Coordination with local government bodies and private organizations for safe out-house management of waste	Next five years	MoHPW DGHS
Strengthening of regulatory framework and monitoring to ensure standard in house and out-house management of waste in private HCFs	Next five years	MoHFW Director, hospitals and clinics

Advocate to initiate a programme for take-back of pharmaceutical waste by pharma companies		MoHFW DGHS DGDA

- A technical committee at the national level should be formed to guide and monitor HCWM practices in the country.
- Close collaboration with national infection control and patient safety programmes including antimicrobial resistance
- Launch advocacy and awareness raising programme for all stakeholders
- Choice of HCWM technology should be based on country context
- Enhance partnerships with GO, NGO, research Institutions and development partners
- Emphasis should be given for reduction of waste through 3Rs approach.

Bhutan

1. Validation of waste autoclave in the HCWM model hospitals and comprehensive EMOC centres (nine hospitals)
2. Standardization and supply of waste autoclave to all hospitals and grade I BHUs in a phased manner
3. Establish biogas plant in two HCWM model hospitals
4. Strengthen medical waste management in all health facilities with emphasis on proper segregation at source with doable 3Rs
5. Impart refresher training to all IC and MWM focal points including managers
6. Intersectoral collaboration meeting on IC and WM annually
7. Capacity building – on-site training of all health professionals including waste handlers on IC and MWM
8. Revision of IC & MWM manual/guideline; development of SOPs for IC and HCWM
9. Implementation of innovative technologies like waste bin stand, waste transport trolleys, dressing trolleys with provision of different colour bucket stands
10. Experimentation of vermin compost in IC & MWM model hospitals
11. Provision for study tours, training and international conferences/ workshops on IC and HCWM
12. Introduce waste storage and treatment house in all comprehensive EMOC centres and all district hospitals in a phased manner
13. Strengthen monitoring and evaluation system of IC&MWM.

India

- A pilot project can be recommended on anaerobic digestion system in rural areas where centralized waste treatment facility is not available as per the local situation and cultural sensitivities
- Current focus of HCWM is on human hospitals while veterinary hospitals and pharmaceutical industries generate biomedical waste and can cause anti-microbial resistance and bioaccumulation through food chain. Monitoring of the effluent generated for microbial, antimicrobial levels and heavy metals need to be addressed. Should come under the ambit of rules and stringent monitoring
- Encourage take-back policies by manufacturers for supply of pharmaceuticals
- Installation of alkaline hydrolysis units at company and common bio-medical waste treatment and disposal facilities (CBMWTDF)

- Proper monitoring of alkaline units and its liquid waste
- Intercountry and intracountry networking with countries in SEAR, WHO Regional Office and WHO Headquarters, HCWH: Pilot studies on treatment technologies and survey on HCWM practices in India
- Technical help from the agencies related to non-burn technologies, green and clean hospitals and innovations in recycling.
- Strengthening and implementation of BMWM rules, 2016 as per international standards
- Focus on pre-treatment of infectious waste on site (health care facility): Recycling
- Strengthening: Strict monitoring of CBMWTDF by state pollution control board: External agency (NGOs, expert scientists) to monitor the incinerator and other treatment technologies
- HCWM guidelines implementation: tertiary, primary
- National strategy for capacity building training: all levels
- Networking and technical support: non-burn technology, green and clean hospitals and innovations in recycling.

Indonesia

- Report to Ministry of Health the recommendations of WHO regional workshop on HCWM about using non-burning techniques and to aim for global green and healthy hospitals
- Follow-up the recent recommendations of incinerator assessment in hospitals and strenghthen HCWM in hospitals to achieve proper HCWM
- Mapping existing performance to promote of non-burning techniques including the ongoing pilot project in seven hospitals (started at 2013) that have used autoclave for HCWM
- Take initiatives to promote bio-digester and trapping methane for kitchen at hospitals
- Develop instruments/tools to audit and monitoring and evaluation of HCWM and field trial for finalization of the toolsConduct research and development on HCWM through Health Research Directorate, MOH
- Socialization at central level to strenghthen horizontal coordination with different directorates in Indonesia, MoH and stakeholders to increase effectiveness of HCWM
- Conduct national workshop on HCWM as follow-up of WHO regional workshop on HCWM 2016
- Review the national indicators in HCWM in line with Sustainable Development Goals (SDGs) indicators being developed in Indonesia
- Review policy/strategy/ regulation to see the gaps to support promotion of non-burning techniques.

Maldives

Maldives

- Improving legal framework on healthcare waste management

- Improving knowledge management and capacity building
- Implementing an integrated healthcare waste management system
- Carry out assessments
- Setup an integrated system in a pilot atoll
- Improving HCWM planning and procurement process
- Improvement of infectious waste, sharp waste, pharmaceutical and chemical waste management
- Improving and adopting local monitoring and evaluation process
- Establishing sustainable sources for funding
- Policy actions to initiate green hospital policy implementation.

Myanmar

- Advocate with higher level about the importance of HCW
- Develop the SOP for HCWM
- Develop HCWM guideline for all levels of health care setting and support the healthcare policy as a directorate which may be one of the statement in the Public Health Law
- Develop HCWM modules in the curriculum of all health care training centres and institutions
- Implement capacity building of skilled health staff related with HCWM
- Conduct situational analysis of current status of HCWM setting and also health impacts and risk assessment due to HCW
- Maintain the sustainability of proper HCWM system by monitoring and assessing the improvement of health care center at township level
- Co-operate with DMC and integrate HCWM in state and region hospital and revise/update the current hospital waste management manuals
- Implement pilot hospitals and healthcare centre for HCWM system.

Nepal

- Policy and legislation
  - Finalization of policy on healthcare waste management (MOPE/ MOH)
- Advocacy at high level (national workshop)
  - Political
  - Decision makers
  - Managers
  - Private and others
- Institutional arrangement
  - Dedicated division/ section
  - Resource allocation(human, finance, materials etc)
- Capacity building at all levels
- Model setup at each region/ province
  - HCWM set up including liquid waste management
  - Establishment of standard biogas plant
- Diagnostic assessment of HCWM/ compliance of existing HCWM Guideline 2014 (MOH)
- Development of national plan on HCWM

- Development of separate guidelines on pharmaceutical waste management
- Research/ study
  - Antimicrobial resistance (AMR) at country level
  - Existing incineration

Sri Lanka

The national health sector development plan has identified HCWM as a major area to be intervened including strategies for HCWM and allocation of funds

- Draft policy on HCWM: Review to incorporate new knowledge and theories and expedite the process of obtaining necessary approvals and implementation
- Expedite the completion of ongoing assessment of HCWM in healthcare facilities
- Develop action plans for HCWM in healthcare institutions based on the findings of the assessment. (centralization, clustering: capacity building)
- Map and review the existing guidelines, standards and protocol and identify the gaps
- SOPs for implementation of HCWM at different levels of health facilities including the private sector
- Healthcare wastewater management guidelines
- Establish models of HCWM systems at different levels (teaching hospital, base hospital, district hospital, preventive sector), promoting reduce, reuse, recycling and use of non-burning techniques
- Develop a system to monitor HCWM (include as an agenda item in hospital director's meeting and health sector development committee, include indicators of HCWM into quality assurance system)
- Promote to obtain environment protection license (EPL) and hazardous waste license (HWL) for health institutions (at least 50% by 2020).

Thailand

Since 2014, waste management has become a national agenda. This indicates that the government realizes the problems and wants the policy to become general practice through every involved sector.

In 2017, the Ministry of Public Health committed that the green and clean hospital concept will be adopted by healthcare service providers.

Actions under consideration:

- Develop the national master plan of infectious waste (2017-2021)
- Develop the national guideline for healthcare waste management and modify the national guideline for infectious waste
- Standardize the collection and transport of healthcare waste
- Develop training programme for healthcare personnel (esp. highly infectious pathogen)
- Review of technology for HCW management
- Foster technology transfer and perform cost-effectiveness analysis

- Enhance collaboration with 3Rs knowledge hub (esp. green and clean hospital)

Timor-Leste

- Establishment of national HCWM committee
- Finalization of national HCWM guideline
- Expansion of HCWM model to other healthcare facilities in the country
- Monitoring and evaluation for HCWM
- Integration of HCWM and infection control programme in five referral hospital and the national hospital