Regional Workshop on Health-care Waste Management

Kathmandu, Nepal, 7-9 December 2011
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Abbreviations

AIDS  acquired immune deficiency syndrome
BMW  biomedical waste
CBWTF  centralized [or common] biomedical waste treatment facility
CEPHED  Centre for Public Health and Environmental Development
CFL  compact fluorescent lamp
CHC  community health centre
CPCB  Central Pollution Control Board
GEF  Global Environment Facility
HBV  hepatitis B virus
HCAI  health-care associated infections
HCF  health-care facilities
HCV  hepatitis C virus
HCW  health-care waste
HCWH  health care without harm
HCWM  health-care waste management
HECAF  Healthcare Foundation, Nepal
HIV  human immunodeficiency virus
IEC  information, education and communication
1. Background

Health-care waste (HCW) is generated in the process of providing medical services. HCW is a by-product of health care that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials. These waste products are hazardous by nature and are basically classified as infectious and non-infectious wastes. They can be solid or liquid, but gas emissions from medical waste incineration are also considered as HCW. Outdated pharmaceuticals also contribute to stocks of hazardous waste generated by the health sector. The daily amount of HCW generated in health facilities of countries belonging to the World Health Organization (WHO) South-East Asia (SEA) Region is estimated to be over 1000 metric tonnes.

The improper management of wastes generated in health-care facilities (HCF) can severely affect the health of caregivers, patients and individual members of the community. Additional health hazards occur from scavenging on waste disposal sites and from manual sorting of waste at health-care facilities. These practices are common in many regions of the world. The waste handlers are at immediate risk of needle-stick injuries and other exposures to toxic or infectious materials. The safe disposal of used needles and syringes and other infectious sharps should, therefore, be seen as a critical component of any HCW management programme, if infection is to be prevented.

In the past several years, WHO has been supporting Member countries to develop policies, guidelines and laws on health-care waste management (HCWM) and capacity-building in this area. In 1997, the WHO SEA Regional Office initiated a regional consultation which drew attention to the need for sound management of HCW in Member countries and led to the framing of an action plan for the same. In 2001, the Government of India and WHO launched a pilot project on HCWM in 11 states in that country. National guidelines supporting the new legislation were developed with WHO assistance. WHO, jointly with Indira Gandhi National Open University (IGNOU) in New Delhi, developed a distance learning course on HCWM in 2005. Since then hundreds of health workers from Member countries have enrolled in the course. The WHO SEA
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Regional Office in collaboration with the Ministry of Health (MoH), Government of Nepal, organized a regional workshop to review the status of the progress and also to share and learn from various country experiences.

Sixty-three professionals from the health sector and municipalities from Bangladesh, Bhutan, Democratic People’s Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste, and from several United Nations (UN) agencies, international nongovernmental organizations (INGOs) and local nongovernmental organizations (NGOs) participated in the workshop.

2. Objectives of the workshop

The general objective was to improve HCW management in the Region.

Specific objectives were:

(1) To review the situation with respect to HCWM in Member countries.

(2) To discuss strategies and approaches, including new technologies, to strengthen HCWM.

(3) To develop country-specific actions by programme managers in the context of their own countries.

3. Inaugural session

The workshop began with the inaugural session chaired by Dr Lin Aung, WHO Representative to Nepal. The chair delivered the message of Dr Samlee Pliangbangchang, Regional Director, WHO SEA Region. The Regional Director stated that while health-care services restore health and save lives, on the other hand, unsafe management and improper disposal of the wastes and by-products produced by these services pose a number of life-threatening risks. In the SEA Region, needle-stick injuries from contaminated sharps are estimated to cause about 200,000 cases of hepatitis B, 85,000 cases of hepatitis C and 30,000 cases of human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS).
annually. He also noted that open burning and inadequate incineration of medical waste is still practiced in many countries. Such practices may cause adverse health effects due to the release of highly toxic fumes, as well as contributing to global warming. Dr Pliangbangchang reiterated the support provided by WHO in addressing HCWM through the development of a global policy, capacity-building of Member countries – especially through a distance learning course on HCWM jointly developed with IGNOU – and currently the support in pilot testing of HCWM in Nepal.

Ms Payden, of WHO SEA Regional Office presented the objectives of the workshop and the expected outcomes.

The Chief Guest, Dr Praveen Mishra, Secretary, Ministry of Health and Population, conveyed his appreciation to the Regional Director, WHO SEA Regional Office and the WHO Representative in Nepal for organizing the Regional workshop in Kathmandu. The Secretary said that although healthcare services were often the topic of discussion, wastes generated by healthcare activities were never discussed. He felt that awareness among medical and other workers in health facilities was very low and should be addressed immediately. He remarked that only about 20% of HCW is hazardous and it is manageable. It is the will that matters and not funds. It was necessary to propagate the issues and the need for sound HCWM to all health-care levels and the work could be done. He said that in Nepal at the national level there was no emphasis on waste management. He also highlighted the issue of low-quality incineration which produces toxins. He suggested that countries must see how best they can incorporate the issues of HCWM in policies. He hoped that the workshop would come up with good strategies and an action plan. He ended his address by expressing the need to open up a new chapter and develop HWM systems that are environmentally friendly, resource-friendly and health-protective.

Ms Payden then introduced the participants, who included representatives of the 11 Member countries, the United Nations Environment Programme (UNEP), the United Nations Children’s Fund, INGOs and local NGOs.
4. Global and regional overview of management of HCW

4.1 Essential environmental health standards in health care –
Yves Chartier, Public Health Engineer, WHO-HQ, Geneva

Health-care settings are environments with a high prevalence of infectious disease agents. Patients, staff, carers and neighbours of health-care setting face unacceptable risks of infection if environmental health is inadequate. The health-care setting might even become the epicentre of outbreaks of certain diseases, such as typhus or diarrhoea.

The effective functioning of health-care settings depends on a number of different requirements such as safe and sufficient water, basic sanitation, adequate management of HCW, appropriate knowledge and application of hygiene, and adequate ventilation. However, many of these requirements are not available in many health-care settings across the world. Health-care associated infections (HCAI) contribute to morbidity and mortality, and the associated burden of diseases is extremely high and a significant drain on health-sector and household resources worldwide.

HCAI affect between 5% and 30% of patients. Legionellosis is a well-established risk associated with HCF, with an average proportion of healthcare associated infections close to 10%.

In 2004, 6.8% of legionella cases in Europe were due to nosocomial infections (13% in 1994). In the USA from 1966 to 2001, 43 outbreaks of water-borne nosocomial infections were reported. In 1999 in England alone, HCAI cost the National Health Service £1 billion. At least 300 000 patients a year develop one or more infections during a stay in hospital.

Disease risks and preventive measures in health-care settings

<table>
<thead>
<tr>
<th>Disease risk</th>
<th>Prevention measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airborne infections (e.g. legionella, avian influenza, severe acute respiratory syndrome [SARS], tuberculosis)</td>
<td>Ventilation</td>
</tr>
<tr>
<td></td>
<td>Space available per patient and spacing of beds</td>
</tr>
<tr>
<td></td>
<td>Safe water systems</td>
</tr>
</tbody>
</table>
### Regional Workshop on Health-care Waste Management

| Health-care Waste Management | Use of separate rooms for highly vulnerable or infectious patients  
Use of masks and correct incineration of wastes  
Water-, food- or hand-borne infections (e.g. hepatitis E virus, diarrhoea)  
Excreta disposal  
Hygiene facilities  
Food hygiene  
Hand hygiene  
Infection of wounds/surgical incisions from contaminated water, medical devices and dressings (e.g. sepsis)  
Use of single-use medical devices and dressings  
Pre-disinfection  
Cleaning and sterilization of instruments and dressings  
Good-quality water  
Asepsis in surgical or dressings procedures  
Blood-borne infections due to contaminated needles and syringes, unsafe blood transfusion (e.g. hepatitis B virus [HBV], hepatitis C virus [HCV], HIV)  
HCWM and use of single-use needles and syringes  
Safe blood transfusion  
Heat- and cold-related stress and discomfort (e.g. higher fever)  
Heating, ventilation, air-conditioning and insulation  
Vector-borne disease transmission (e.g. leptospirosis, malaria, dengue, leishmaniasis)  
Control of disease vectors in and around buildings  
Protection of patients  
Protection of infrastructure  |

In some circumstances, people may choose not to seek care because the nearest facilities are not functioning or because treatment is uncertain due to shortages of water, electricity or supplies. Health-care settings include hospitals, health centres, clinics, dental surgeries and general practitioner facilities.
Environmental health interventions in HCF act not only to directly reduce the disease burden, but are by nature targeted at high-risk populations. They can protect staff and also impact visitors by providing opportunities to educate visitors and the general population about minimizing disease transmission through targeted messages and a model safe environment which will be reflected in communities through good practices in safe water, sanitation, hygiene and waste management.

The development and implementation of national policies, guidelines on safe practices, training and promotion of effective messages in a context of healthy medical facilities will decrease the number of infections associated with health-care settings. Putting policy into practice in this area demands strong links between sectors such as health, water supply and sanitation, planning, building management and construction.

**Key steps for improving environmental health conditions in health-care settings**

- Develop specific national standards that are relevant to various health-care settings in different contexts.
- Support the application of national standards and set specific targets in health-care settings.
- Assess the situation regarding environmental health in existing health-care settings to evaluate the extent to which they may fall short of national plans and local targets.
- Plan and carry out the improvements that are required.
- Ensure that the construction of new health-care settings is of acceptable quality.
- Prepare and implement comprehensive and realistic action plans so that acceptable conditions are achieved and maintained.

**WHO’s role in HCWM**

- Setting, validating and monitoring norms and standard through guidelines e.g. *Environmental Health Standards in Health-Care Settings*. 
- Developing tools and guidelines for disease control and risk reduction, e.g. *Legionella and the Prevention of Legionellosis*, *Water Safety in Public Buildings*, *Natural Ventilation for Infection Control in Health-Care Settings*, *Water, Hygiene and Sanitation for HIV/AIDS Home-Based Care Patients*, *Safe Management of Waste from Health-Care Activities*.

- Supporting the development of ethical and evidence-based policy through a series of policy papers, e.g. *Safe Health-Care Waste Management*.

- Stimulating research and development and testing new technologies, such as working with practitioners and academic institutions in testing and verifying sustainable and safe options for resource-poor settings.

- In close collaboration with national authorities, WHO is involved in country assessments leading to national plans for healthy buildings.

- Providing support for sustainable capacity-building on water, sanitation and waste management in buildings and knowing better buildings environment and impact on their associated burden of diseases e.g. HCAI in low-income countries specifically related to water, sanitation, hygiene and HCW.

### 4.2 HCWM in the SEA Region – Ms Payden

**HCW definition and categories**

HCW is a by-product of health care that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials.

<table>
<thead>
<tr>
<th>Waste category</th>
<th>Description and examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious waste</td>
<td>Waste suspected to contain pathogens, e.g. lab cultures, waste from patients in isolation wards, tissues (swabs, bandages) and equipment that have been in contact with infected patients</td>
</tr>
<tr>
<td>Waste category</td>
<td>Description and examples</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Pathological waste</strong></td>
<td>Human tissues or fluids such as body, blood and other body fluids, foetuses</td>
</tr>
<tr>
<td><strong>Sharps</strong></td>
<td>Syringes, needles, disposable scalpels and blades, broken glass</td>
</tr>
<tr>
<td><strong>Chemicals</strong></td>
<td>Lab reagents, film developer, disinfectants that have expired or are no longer needed, solvents</td>
</tr>
<tr>
<td><strong>Pharmaceuticals</strong></td>
<td>Expired, unused, and contaminated drugs, vaccines and sera</td>
</tr>
<tr>
<td><strong>Genotoxic waste</strong></td>
<td>Highly hazardous, mutagenic, teratogenic or carcinogenic, such as cytotoxic drugs used in cancer treatment and their metabolites</td>
</tr>
<tr>
<td><strong>Radioactive waste</strong></td>
<td>Glassware contaminated with radioactive diagnostic material or radiotherapeutic materials</td>
</tr>
<tr>
<td><strong>Heavy metal waste</strong></td>
<td>Batteries, broken mercury thermometers, blood pressure gauges etc.</td>
</tr>
</tbody>
</table>

The United Nations Conference on Environment and Development in 1992 led to the adoption of Agenda 21, which recommends a set of measures for waste management:

- Prevent and minimize waste production.
- Reuse or recycle waste to the extent possible.
- Treat waste by environmentally safe and sound methods.
- Dispose of the final residues by landfill in confined and carefully designed sites.

Agenda 21 also stresses that any waste producer is responsible for the treatment and final disposal of its own waste; where possible each community should dispose of its waste within its own boundaries. In the case of HCW, the management of the health facilities should take responsibility in managing its waste in a manner that protects health and the environment.
### Current status of HCWM in the Region

<table>
<thead>
<tr>
<th>Questions</th>
<th>Bangladesh</th>
<th>Bhutan</th>
<th>Democratic People’s Republic of Korea</th>
<th>India</th>
<th>Indonesia</th>
<th>Malaysia</th>
<th>Myanmar</th>
<th>Nepal</th>
<th>Sri Lanka</th>
<th>Thailand</th>
<th>Timor-Leste</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCWM legislation</td>
<td>Yes *</td>
<td>Yes</td>
<td>Being drafted</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>HCWM policy</td>
<td>Yes</td>
<td>Draft</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Draft</td>
<td>Yes</td>
<td>Yes, included in other policies</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Guidelines on HCWM</td>
<td>Yes</td>
<td>Yes</td>
<td>Draft</td>
<td>Yes</td>
<td>Yes</td>
<td>Draft</td>
<td>Yes</td>
<td>Many</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>HCWM programme at national level</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Assessments/studies done on HCWM</td>
<td>Yes</td>
<td>In process</td>
<td>In process</td>
<td>Yes *</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Guidelines for management of waste from immunization activities</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>HCWM activities being implemented</td>
<td>In process</td>
<td>Yes</td>
<td>In process</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Partly</td>
</tr>
<tr>
<td>Status on the use of mercury-based devices in health facilities</td>
<td>No</td>
<td>Not yet</td>
<td>Collected and reprocessed, replacement ongoing</td>
<td>Yes *</td>
<td>Working with HCWHg, Bali focus</td>
<td>Not yet</td>
<td>Not started yet</td>
<td>Mercury phase out plan</td>
<td>Planning for phase out</td>
<td>Pilot on “clean and green” hospital project</td>
<td>Nil</td>
</tr>
</tbody>
</table>

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c Gradual phase-out and replacement of mercury-based equipment with non-mercury based equipment recommended for all central government health centres and hospitals and included in the Indian Public Health Standards for Sub-Centres, Primary Health Centres, Community Health Centres, Sub-districts and district hospitals.

*d No, but HCWM is addressed in some hospitals and capacity-building is continuing.

*e PG students of hospital administration does every year in different state-level hospitals.

*f Kathmandu, Pokhara, national level by FH360/United States Agency for International Development, Chitwan supported by Environment and Public Health Organization, Institute of Medicine, MoPH, Ministry of Public Health (MoPH), PPPEU/United Nations Development Programme (UNDP).

*g Health Care Without Harm
Key drivers for HCWM

Sound and safe HCWM reduces exposure to unsafe environment and minimizes the related health risks for health workers, scavengers, waste-handlers and the public. Several cases of hepatitis B and C and HIV infection could be prevented through sound HCWM, especially sharps. Many SEA Region Member countries are party to international conventions on waste management and therefore they have an obligation to fulfil the mandates in the conventions. A human rights special report on the adverse effects of dangerous products and waste including sharps was presented to a special session at the UN General Assembly in July 2011. There are good examples of partnerships among WHO, UNEP, governments, INGOs and NGOs to address the issue.

Current initiatives

WHO SEA Regional Office jointly with IGNOU developed a distance learning programme on HCWM in 2005. Since then, Member countries have benefitted from the course. The environmental health conditions of health facilities have been assessed in India and Timor-Leste. WHO supported training of health workers on HCWM in three provinces. WHO with other partners has supported the piloting of HCWM in Bir hospital in Kathmandu, Nepal. The Global Environment Facility (GEF) supported a project in India focusing on demonstration and promotion of best techniques and practices for reducing HCW to avoid environmental releases of dioxins and mercury.

4.3 HCWM: Issues and challenges – Ruth Stringer, Health Care Without Harm

Issues and challenges

Technology for managing HCW is often regarded as the heart of the issue. Open burning of medical waste is very common and some hospitals have incinerators. However, studies show that many small-scale incinicators perform poorly. Open burning and inadequate incineration release dioxins and furans, these are persistent organic pollutants which can last for decades in the environment. Therefore, non-incineration technologies are becoming mainstream. There are many large- and small-scale options for infectious waste management; however, more research is needed on technologies for treating pathological waste and chemical waste. An option
for pharmaceuticals and chemicals is to tie up with the manufacturers to take back all the expired or unwanted stock.

**Low awareness and lack of capacity** for HCWM is another issue faced by many countries. Some assessments show that nurses are better informed than doctors. Most workers received little or no waste management training. Some are completely unaware of the health risks from poor waste management. There is also a need to improve understanding at senior levels.

**Lack of worker protection** is linked to lack of training. The staff who clean the hospital and collect waste may often be at greater risk than medical staff who produce it. These workers are usually poorly educated and trained and little attention is paid to their safety. It is uncommon for them to have vaccination or proper protective equipment.

**Unsafe recycling and reuse of medical waste** is observed in many countries. Selling of waste was reported in some countries, including syringes which were washed, repackaged and resold without proper sterilisation. There were also instances where waste sent to common treatment facilities was sold to recyclers along the way.

**Lack of priority, management support** — donors and governments focus on high-profile issues, e.g. maternal health, HIV, Expanded Programme on Immunization, and do not give HCWM the attention it deserves. Very often, management do not provide finance or make sure waste management rules are enforced.

**Poor infrastructure:** unreliable power, especially where autoclaves are used; lack of transportation; non-availability of recycling markets to reclaim non-hazardous waste; and lack of proper landfills for final disposal of treated waste.

**HCWM approaches**

HCW could be treated through three options depending on local conditions and infrastructure, such as on-site treatment where the hospital treats its own waste; cluster treatment, where the hospital treats wastes from few neighbouring health facilities in a small area; or central treatment, where a dedicated facility collects and treats waste from many health facilities in an urban centre or region.
UNDP GEF project on HCW - Key features of the new technologies

There are examples of safe and sustainable management of HCW. One current initiative is the UNDP/GEF global medical waste management project which is creating model hospitals which are mercury-free and have non-incineration medical waste management technologies. This is carried out in collaboration with seven countries, with WHO and HCWH as principle cooperating agencies. The key features of the new technologies used in the projects are:

- Low-cost, modular, ergonomically designed autoclaves with multiple energy options (electricity, bottled gas, other fuels).
- Autoclavable metal waste containers that are leak-proof, colour-coded, designed for rapid steam penetration, and durable to last for many years.
- Container stands with foot pedals to lift the container lids thus reducing cross-contamination.
- Mechanical sharps destroyer or autoclavable sharps container for use with an autoclave-shredder.
- Compactor to reduce waste volume with an integrated baler to inhibit scavenging at landfills.
- No generation of dioxins, furans, toxic metals, acid gases etc.
- Potential for recovery and re-melting of sterilized waste materials.
- Designed to be affordable and cost-competitive with incinerators with little pollution control of the same capacity.
Addressing the challenges

Adressing the issues and challenges of HCW management requires the commitment and participation of all levels of the health facility and also the cooperation of other agencies dealing with water and sanitation, environment, health and finance.

There are many possible technological solutions; however, these need to be adapted to the local situation. Treatment and disposal options must be tailored to the facility in question.

Adequate training of staff and financial resources must be dedicated to waste management. Staff must be supported as they learn new practices and made to comply with them.

Waste management policy and guidelines are necessary for all health facilities. Annual review is recommended.

Administration, record-keeping and enforcement of rules must be strengthened at all levels. A proper monitoring system should be established to ensure sustainability of the system.

4.4 Indian legislation on HCWM: Issues and challenges –
Dr Geeta Mehta, Consultant

Medical waste was earlier considered a part of municipal waste. It was only when the problems with mixing the two were realized that separate policies were framed for their treatment. In India, there was no legislation on medical waste until the Ministry of Environment and Forests (MoEF) came up with the first draft rules in 1995, followed by the Supreme Court of India’s directions to hospitals with more than 50 beds in 1996. The final rules were notified on 20
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July 1998 and were called Bio-medical Waste (Management & Handling) Rules, 1998 (BMW rules ’98), notified under the Environment (Protection) Act 1986 (http://www.cpcb.nic.in/upload/Publications/(32)%20biomedical.doc). The rules include the duty of the occupier (the HCF), grant of authorization, annual report, advisory committee, maintenance of records, accident reporting and provision of appeal.

Since the notification of the rules in 1998, three amendments have been made. The first amendment was notified on 6 March 2000 and is referred to as the Bio-medical Waste [Management and Handling (Amendment)] Rules, 2000. The amendment provided for a schedule or graded timeline to establish HCWM facilities in different categories of hospitals and the standards for incinerator, autoclave and microwave for waste treatment. The second amendment to the rules was notified on 2 June 2000. The State Pollution Control Boards/Committees were identified as the prescribed authorities for enforcement. The role of the municipal bodies was delineated and they were made responsible for providing suitable common disposal sites in their jurisdiction. They were also to pick up and transport segregated non-biomedical waste as well as duly treated biomedical waste (BMW) for disposal at municipal dump sites. A window for state-of-the-art technologies other than incinerator, autoclave and microwave was also provided, which could be submitted to the Central Pollution Control Board for approval. The third amendment was notified in September 2003. In this amendment the Director-General, Armed Forces Medical Services was the designated prescribed authority for HCF under the Ministry of Defence.

The Indian BMW rules divide biomedical waste into 10 categories and enumerate treatment and disposal options for each of them. Health-care institutes are free to select the option best suited to them. In addition to standards for incinerator, waste autoclave and microwave, the rules provide the standards for effluent released from hospitals. An important feature of the BMW rules is the segregation of plastic waste and treatment by non-burn options for this category.

Some practical issues and grey areas in the regulations have been observed, especially in treatment and disposal methods of cytotoxic waste, sharps, latex gloves, blood bags and mercury. The treatment of waste by chemicals is also not clearly defined in terms of validation and safety. On the whole, safety considerations, particularly occupational safety issues, need to be revisited and provisions are required. The categorization is also deemed complex and requires simplification. Currently India is revising its regulations and addressing some of the gaps and issues.
Issues in implementation of the Act – It is observed that segregation of waste is not taken seriously at user level and compliance with colour coding is also poor at times, attributed to lack of awareness and lack of sustained supply of colour-coded containers, personal protective equipment (PPE), etc. Quantification of waste mandated by the rules is not accurately done. As in many countries of the Region, recycling systems are well developed in India. Treated and non-hazardous waste can be recycled in an authorized manner. However, due to problems in segregation and lack of an efficient system, much of the medical waste lands in landfill sites, and rag pickers sort recyclable and reusable material from these sites. Some of the waste taken to common treatment facilities is sold on the way to middlemen before treatment. This is then recycled or reused without proper treatment. It is supposed that some items of HCW, especially used syringes are improperly treated and sold back to the industry.

Some of the challenges faced by India are establishing robust waste management policies within health facilities; lack of awareness about the health hazards caused by poor waste management; insufficient financial and human resources; lack of monitoring and control of waste disposal; lack of clear responsibility for appropriate handling and disposal of waste; reaching out to rural areas; and provision of infrastructure to support.

Despite the challenges, the government and nongovernmental sectors are making efforts towards sound waste management. Salient features are:

- Minimization of waste.
- Segregation at source and maintained until disposal.
- Worker protection.
- Decontamination and mutilation at source with minimal handling.
- Safe collection and transport.
- Waste water treatment
- Promotion of centralized biomedical waste treatment facility (CBWTF).
- Development of sanitary landfills.
- The legislation and guidelines have served to give direction to these efforts.
5. Panel discussions

5.1 Country-level initiatives in HCWM: Case studies from Nepal, India and Indonesia – Moderated by Terrence Thompson

*Panellist: Dr Senendra Raj Upreti, Chief Curative Service Division, Ministry of Health and Population, Nepal*

Dr Upreti presented a brief overview of HCWM in Nepal. Nepal has about 171 hospitals with capacity of 25 or more beds and 90 medical schools. There are more than 4000 health care providers, 46 000 employees and 52 000 volunteers. Waste generated is about 43 000 tonnes per year. HCWM in Nepal is not very organised. About 70% of the health institutions use land pits, 50% have incinerators, 8% burn in open spaces, and 1% do not have any system. In 2002, with support from WHO, the National Human Rights Commission developed guidelines and training manuals on HCWM. These have been disseminated to all institutions. A country wide assessment of HCWM was done in 2003. The Department of Health is the focal department for providing training and health-care facilities, technologies and methodology on HCWM. The National Kidney Centre is one of the first hospitals to develop and implement safe and sound management of HCW.

Some challenges are not having appropriate and sustainable technologies and commitment from the management of the facilities. There is a need to standardize technologies. There is the possibility of tax exemption on equipment that used in waste management. All levels of management should be involved in HCWM.

*Panellist: Mr Satish Sinha, Assistant Director, Toxics Link*

*Presentation: Indian Experience on Managing Biomedical Waste*

Medical infrastructure forms the largest portion of the health-care pie. In 2006, the ratio of hospital beds available per thousand population was 1.03 for India, whereas it was 4.3 for countries like China, Korea and Thailand. India is far behind in the number of beds available and is likely to reach a ratio of 1.85, and under the best-case scenario 2, by 2012.

The health-care infrastructure in India is in both the government and private sectors. The government health-care infrastructure can be divided into two sections, rural and urban. Infrastructure in rural areas has been
developed as a three-tier system (Community Health Centre, Primary Health Centre, and sub-centre) and is based on the population norms. Urban hospitals can be divided into two types: those under the Government of India, and private hospitals. India is seeing major growth in the private health-care sector.

**Overview of HCWM in India, 2009**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of HCF</td>
<td>129,511</td>
</tr>
<tr>
<td>Total number of beds</td>
<td>1,368,839</td>
</tr>
<tr>
<td>Quantity of waste generated</td>
<td>405,702 kg/day</td>
</tr>
<tr>
<td>Total quantity of waste treated</td>
<td>291,983 kg/day</td>
</tr>
<tr>
<td>Number of HCF utilizing CBWTF</td>
<td>95,410</td>
</tr>
<tr>
<td>Number of HCF with treatment and disposal facilities</td>
<td>20,670</td>
</tr>
<tr>
<td>Total CBWTF operating</td>
<td>168</td>
</tr>
</tbody>
</table>

Source: Central Pollution Control Board (CPCB)

Mutilation of gloves and catheters after use to prevent illegal recycling.
Toxics Link has been working towards making health-care delivery hazard-free by replacing toxic products, processes and technologies with cleaner and safer alternatives. The organization played a central role in facilitating the framing of India’s first legislation for BMW handling in the country, and supported the creation of national standards for BMW and all the guidelines. It has been part of the CPCB “Peer and Core” group standards committee for technology approval.

Toxics Link has supported many initiatives in partnership with medical and nursing associations, hospitals, government bodies, bilateral agencies, NGOs etc., such as the creation of several waste management models throughout the country. Several regional workshops and trainings with other agencies have been carried out every year. Toxics Link also conducts facility audits.

**Challenges in implementation**

Though poor management of HCW poses lot of health risks, it still gets little attention, thereby translating into low allocation of resources. It also has to do with the fixed mindset of the medical fraternity which focuses on providing services and thinks waste management is somebody else’s business. The related challenges include inadequate capacity among the concerned people in health facilities, limited awareness among the general public, poor implementation, lack of segregation practices, open burning of medical waste by clinics, dispensaries and hospitals, problems with old incinerators and poorly maintained incinerators and the informal sector involved in recycling and reusing medical waste items without proper treatment.
Some emerging issues are the use of mercury-based medical equipment and the problems related to disposal of this broken or unwanted equipment. Chemicals safety with the use of glutaraldehyde, formaldehyde, benzene, cytotoxic drugs etc. is another issue that needs attention.

Future strategy – As most medical equipment and devices either use energy, produce by-products, or have a certain lifespan, a procurement policy that supports pro-environment technologies is needed to minimize the negative effects of equipment on the environment. Poor management of HCW causes serious problems and therefore adequate resources have to be allocated. Developing and maintaining a pool of trainers at block and district levels would be help in expanding HCWM in rural areas. Diverse models with appropriate technology selection have to be explored and developed for each type of health facility, based on local conditions.

Panellist: drg. (Mr) Tony Wibowo Harianto, Environmental Health, MoH
Presentation: A brief introduction to HCWM in Indonesia

In Indonesia the major producers of HCW are HCF. Other sources of HCW are clinics, laboratories, traditional therapeutics, industrial pharmacies and academic institutions. The number of health facilities are:

- Hospitals - 1686
- Primary health care - 9133
- Mother and child health care - 266827
- Drugstores - 16603

General distribution of HCW

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste from hospitals</td>
<td>0.14 kg/bed/day</td>
</tr>
<tr>
<td>Non-infectious waste</td>
<td>80%</td>
</tr>
<tr>
<td>Pathology and infectious waste</td>
<td>15%</td>
</tr>
<tr>
<td>Chemical and pharmacy waste</td>
<td>3%</td>
</tr>
<tr>
<td>Sharp solid waste</td>
<td>1%</td>
</tr>
<tr>
<td>Tubes and broken thermometer</td>
<td>Less than 1%</td>
</tr>
</tbody>
</table>
Issues and challenges for HCWM in Indonesia

Almost every hospital in the country has a facility to manage its waste on site. About 65% of hospitals have taken the initiative to segregate their waste into infectious and non-infectious waste. About 86% of hospitals have incinerators as of 2009; however, only about 75% incinerators are functional. Not all HCF have easy access to waste disposal sites and about 15% of hospitals do not have any facility for treating liquid waste.

A national regulation on HCWM was approved in 2009. It was developed to support global commitments such as the Stockholm Convention on Persistent Organic Pollutants and the Basel Convention on
Waste Management. The regulation obliges all HCF to manage their waste according to existing national standards and in a way to prevent environmental pollution, and to protect the health of workers and communities from exposure to hazardous and infectious wastes.

Health care workers and waste handlers have poor understanding of the health risks from poor management of HCW. HCWM is not taken as a priority issue and therefore it lacks operational budget and regular implementation. At the province and district levels, there is inadequate support for implementing HCWM.

**National efforts on HCWM** – The government is conducting workshops and trainings for the critical staff of hospitals and primary HCF to create awareness and to promote the effective use of the regulations and standards. Environmental health impact assessments of HCW are commissioned in some provinces. The government is also making available alternative technologies to manage HCW in remote districts.

**Key notable government strategies to support HCWM** are through partnering with the private sector to manage waste, a “clean and green” hospital programme and conducting research on alternative technology and soundness of HCWM.

**Discussion**

Clarifications were sought on whether incineration can be banned in all countries and the availability of treatment options for tissue waste in resource-constrained settings.

Incinerators cannot be completely banned, especially in countries where alternative methods are not available, and in some cases certain wastes have to be disposed of through incineration. The issue lies with monitoring to ensure that the incinerator operator maintains the right temperature. Any tissue waste can be processed through biological digesters in resource-constrained settings.
5.2 **Best practices and approaches on management of HCW and phasing out mercury equipment in health-care services – Moderated by Yves Chartier**

*Panellist: Ms Faye V. Ferrer, Mercury in Health Care Programme Officer, Health Care Without Harm*

**Health Care Without Harm** (HCWH) is an international coalition of 443 organizations in 52 countries working to transform the health-care sector so it is no longer a source of harm to people and the environment. HCWH works with health professionals, hospitals, health-care systems, ministries of health and environment, and international organizations on issues ranging from chemical substitution and HCW to climate change.

**United Nations Mandate on Mercury** – The UNEP Governing Council at its 21st session in February 2001 decided to initiate a global assessment on mercury. The finding was that mercury is persistent and cycles globally: emissions in any continent can contribute to deposition in others. Thus it is an international issue.
Addressing mercury in health care protects worker and patient safety as well as the global environment and is an important early step toward green and safe hospitals.

**WHO policy on mercury in health care**

Short Term: Develop and implement plans to reduce the use of mercury equipment and replace with mercury-free alternatives. Address clean-up, storage, disposal.

Medium Term: Increase efforts to reduce use of unnecessary mercury equipment.

Long Term: Support a ban on mercury-containing devices and promote alternatives.

A global initiative was launched by WHO and HCWH in 2008. The goal is to phase out by 2017 the demand for mercury-containing fever thermometers and sphygmomanometers by at least 70% and to shift the production of all mercury-containing fever thermometers and sphygmomanometers to accurate, affordable, and safer non-mercury alternatives.

**Strategy**

1. International guidance on accuracy.
2. Awareness-raising and mobilization of the health-care sector in all countries in order to shift demand.
3. Model policy development and catalytic activities to shift demand at global, regional, national, state and municipal levels.
5. Shift production to accurate affordable alternatives.

**Global status:** In the United States of America there are thermometer bans or severe restrictions in 28 states. In the European Union mercury thermometers were banned in 2007 and blood pressure devices are on their way out. Countries in pilot phase are Brazil, Chile, China, Ecuador,
Indonesia, Latvia, Lebanon, Nepal, Nicaragua, Senegal, Syria, Tanzania, Thailand and Viet Nam. The Philippines and Argentina have each developed a national policy on mercury, while Costa Rica, India, South Africa and Uruguay are in the process of doing so.

**Challenges**

1. **Accuracy and quality of alternatives**: Countries that have phased out mercury have developed their own criteria, often based on the British Hypertension Society or another validating body. Major US health systems are using non-mercury blood pressure devices without problems. Sweden has determined that there is no problem.

2. **Affordability**: Affordability varies by country. Studies in Argentina and Brazil have shown that there was a cost saving on replacing mercury thermometers with digital thermometers.

3. **Mercury waste**: Guidance on the cleanup, temporary or intermediate storage and transport of mercury waste from HCF is available (UNDP and GEF Global Health-Care Waste Project).

4. **Shifting production**: Quality non-mercury devices must be made available at an affordable price globally. China is the largest producer of mercury-based medical devices in the world. China also produces many of the alternatives for the world already. To shift supply to accurate, affordable alternatives, changes in policy and demand from health systems are necessary.

**Next steps towards mercury-free health care**

1. Global phase-out of mercury in health care
   - Implementing the policies that are in place and scaling up and broadly replicating policies in other countries
   - Developing regional and global guidelines and standards
   - Building markets for alternatives and transforming production

2. Treaty process and the health sector
Many countries have already taken action in health care and it has been seen that this is politically and economically viable. A treaty will probably mandate a phase-out of mercury in health care and can reinforce greening of the health sector.

**Mercury-free health-care system: Case study from Nepal**

**Panellist: Mr Ram Charitra Sah, Executive Director, Centre for Public Health and Environmental Development (CEPHED), Kathmandu, Nepal**

CEPHED is an NGO working towards improved environment management and public health in Nepal. One of its aims is to bring about a mercury-free health-care system in the country. The initiatives taken towards this are:

- Sector-wise study and inventory.
- Production and dissemination of information, education and communication (IEC) materials.
- Development of mercury spill toolkit and distribution and demonstration.
- Awareness-raising and capacity-building.
- Feasibility study for mercury-free health-care system.
- Strategy development for mercury-free health-care system.
- Piloting mercury-free health service delivery from five HCF (PropKar, Kanti, Stupa, Nobel and BP Koirala Institute of Health Sciences).
- Estimation of mercury usage and release from health-care instruments in Nepal.
- Mercury in compact fluorescent lamps (CFLs) and cosmetics.

Some of the findings from CEPHED studies showed that during 2008-2009, 150 kg of mercury was imported to Nepal. The number of mercury thermometers and CFLs imported during the year were 331,591 and 8,382,020, respectively. It was estimated that a total of 499 kg of mercury was present in thermometers and sphygmomanometers. Business enterprises supplying dental fillings materials revealed that a total of 115-150 kg of mercury is used in dental fillings annually.
There was a lack of awareness on the hazards of mercury and little knowledge about safe spill and breakage management of mercury-containing equipment in HCF.

Regarding the hazard of mercury-containing dental amalgam, studies revealed that 25% were unaware about the health impact of mercury and that only 35% of selected dental hospitals and clinics in Bhaktapur, Thimi, Kathmandu, Lalitpur and Kritipur districts had any training in the handling of mercury.

A study of school and college students from selected academic institutions in Kathmandu valley revealed that 32% had touched mercury at some point, 28% had played with mercury, and 18% indicated that they had inhaled mercury.

CEPHED studies showed that mercury was present in the hospital environment, drainage water, lake water (Fewa Lake) and in fish. However, an analysis of leachate from the landfill site at Sisdol did not show any mercury.

Regarding the feasibility of mercury-free health-care in Nepal, high willingness was seen among health-care workers and surgical suppliers (89%). Constraints were attributed to the cost and the availability of alternatives to mercury-containing equipment. Concern was expressed about how to manage obsolete and existing equipment containing mercury. Economic analysis of establishing a mercury-free system in selected hospitals showed that the switchover to digital thermometers from mercury thermometers was feasible, would take under two years and was economical in the long run.

**Strategy for mercury-free health-care system**

Enact the proper legal instruments (policy, guideline, act and regulation) for mercury-free health-care services.

- Create a timeframe for making the move from mercury-based health-care services to a non-mercury based health-care system.
- Mercury auditing: assess all objects that potentially contain mercury in all HCF and plan a corresponding mercury minimization programme as well as a phase-out programme.
Regional Workshop on Health-care Waste Management

- Implement mercury phase-out programme in accordance with the timeframe, with proper progress monitoring.
- HCF should take the initiative with concrete decision to replace mercury-based with non-mercury based equipment.
- Develop and adopt a mercury equipment shifting strategy, e.g. gradual replacement and/or one-at-a-time replacement.
- Safe collection, storage and disposal of mercury, mercury-containing devices and waste. Promotion of alternatives by government as well as HCF themselves.
- Allow the production, import, sale and distribution only of quality and validated alternative products.
- Continuous awareness- and capacity-building for all levels of health-care staff as well as other auxiliary and administrative staff, including decision-making bodies.
- National workshop on mercury.
- IEC material production and dissemination.

Management of infectious HCW in Nonthaburi: A model for sustainable environmental management

Panellist: Ms Pornsri Kictham, Municipal Clerk, Nonthaburi, Thailand

Nonthaburi municipality in Thailand has an area of 38.9 sq km and a population of 260 000. The municipality has developed a sustainable environmental management model for waste management. (Figure) Non-hazardous solid waste is managed by foam separation, sorting and composting. Health-care infectious waste is included in the hazardous waste component. By definition, infectious waste means waste that contains pathogens with virulence or in quantity such that exposure to it could cause infectious disease. It includes:

- Cadavers or parts of the human body or animals resulting from surgery, autopsy, animal carcasses and laboratory animals.
- Sharps such as needles, scalpels, syringes, glass slides, vials, coverslips.
Materials in contact or suspected to have been in contact with blood, blood components, blood products and body fluids from humans as well as animals, and live vaccines.

All kinds of waste from severe infection patient wards.

**Sustainable Environment Management Model at Nonthaburi Municipality**

The municipality provides collection services to 114 healthcare facilities. There are four infectious waste collection vehicles are deployed, collecting an average of 499,835 kg a year. The average service fee for infectious waste collection is 3,436,100 Baht per year. The infectious waste collected is transported to Bangpa-in Land Development Co, Ltd at the Bangpa-in Industrial Estate, where it is disposed of through incineration.
Participants debated the affordability of using mercury-free medical equipment, the issues related to disposal of broken mercury-based equipment and broken CFL bulbs which contain mercury. The use of mercury in dental amalgam and its safety were discussed.

The understanding that came out was that digital devices are expensive but last longer or break down less frequently. So in the long run it becomes more cost-effective. Compared to mining and industries, use of mercury in HCF is not very high and therefore it will not be very difficult to phase out. When using mercury in dental amalgam, the element is not released into the mouth except during fixing and removal. But used dental fillings land in sewers and contaminate water bodies.

So far there are no proper disposal measures for mercury and therefore only onsite storage is encouraged. In 2013 there will be a legally binding treaty on mercury which will have regional storage facility. Until then, countries are advised to contain and store it safely till a regional or onsite facility becomes available.
6. **Field visit to model waste management systems**

6.1 **HCW water treatment at Dhulikhel**

The participants visited the community hospital at Dhulikhel to observe the waste water treatment system as well as the HCWM in the hospital. The hospital manages its waste water by treating it with the use of a constructed wetland, and the treated water is used in agriculture. The hospital waste water is passed through the constructed wetland which is planted with local phragmites reeds. Details of the model waste water system at Dhulikhel hospital are in Annex 4.

The visitors appreciated the innovative effort of the hospital in treating its waste water in an eco-friendly way to prevent the pollution of the environment, particularly the water body in the vicinity. They examined the system and discussed the details with the hospital staff. The following points were raised:

- Issues of disposal of the reeds when the bed needs to be replaced
- Monitoring of effluent water quality was lacking.
- Regarding the solid waste management in the hospital, segregation in the wards was seen to be partial, as some collection bins showed risk waste mixed with non-risk waste. Open burning of waste was observed in the grounds outside the hospital.

6.2 **HCWM system at Bir Hospital, Kathmandu**

A visit was organized to Bir Hospital, a large publicly funded multispecialty hospital in Kathmandu which had shown a recent turnaround in the status of waste management and established a model HCWM system with the assistance of the Healthcare Foundation Nepal (HECAF). The system aims for “zero” waste. Details of the model system are in Annex 4.

The participants were welcomed by the Director of Bir Hospital and a video film was screened showing the journey of Bir hospital from having no waste management system in 2009 to the development of a model waste management system in 2011.
The participants were divided into groups and taken on a tour of the hospital to observe the system of waste management. Systems of colour coding, segregation, collection, transport and treatment of risk waste were examined. Disinfection of risk waste by autoclaving and its recycling as well as treatment of non-recyclable but biodegradable waste through a biogas digester plant evoked a lot of interest. Participants were taken around by the Bir hospital staff and HECAF volunteers.

Points noted and issues raised by participants:

1. Very comprehensive system for HCWM aimed at achieving zero waste through an evolved segregation and recycling system. This could serve as a model for health-care institutions in other countries.

2. The Bir hospital model was an excellent example of what can be achieved by dedication and commitment in a large busy public hospital.

3. It was noted that the systems developed at Bir Hospital were very labour-intensive and needed a lot of human resources, currently provided by HECAF. Thus sustainability could be an issue in the long term.

4. While developing the model HCWM, the hospital administration had regular meetings with the city council. The biogas digester plant established at Bir was designed and funded by the city.

5. Although solid waste was well looked after, it was observed that the hospital lacked a system for treatment of its waste water. The hospital administration will be addressing it with the support of the city council in the next few years.

7. **Group work: development of country-level action plans**

Participants were grouped into country teams and were assigned to draft action plans to improve HCWM in their respective countries. The current status and action plans by the country teams are as follows:
7.1 Bangladesh

Current status

- There is legislation for HCW: Bangladesh Environmental Conservation Act (1995) and Medical Waste Management Rules 2008. The country has an HCWM policy and guidelines on HCWM are available. The generation of HCW in Dhaka alone is 255 tonnes/day, of which 10%–25% is hazardous. Waste generated per bed per day is estimated to be 0.8 kg–1.67 kg.

- However, waste is not segregated in many hospitals and is disposed of together with municipal solid waste. Some hospitals practice open burning of waste.

- Local initiatives have been taken to improve HCWM by NGOs (e.g. Prodipan)

- No policy on phasing out mercury in health care as yet

- Medical waste segregation, recycling and reuse by informal sector

### Action plan

<table>
<thead>
<tr>
<th>Sl</th>
<th>Activity</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Formation of a national steering committee on HCWM</td>
<td>June 2012</td>
</tr>
<tr>
<td>2</td>
<td>Advocacy on HCWM for policy- and decision-makers</td>
<td>2012 onwards</td>
</tr>
<tr>
<td>3</td>
<td>Mass awareness campaigns, seminars, TV spots, news, IEC materials</td>
<td>2012</td>
</tr>
<tr>
<td>4</td>
<td>Develop master trainers, conduct Training of Trainers</td>
<td>2012–2013</td>
</tr>
<tr>
<td>5</td>
<td>Pilot HCWM programme in selected tertiary and secondary HCF</td>
<td>2013</td>
</tr>
<tr>
<td>6</td>
<td>Resource mobilization</td>
<td>2012</td>
</tr>
<tr>
<td>7</td>
<td>Incorporation of HCWM in nursing and medical curriculum</td>
<td>2012–2014</td>
</tr>
<tr>
<td>8</td>
<td>Development of mercury reduction strategy in healthcare system</td>
<td>2012</td>
</tr>
</tbody>
</table>

#### 7.2 Bhutan

**Current status**

**Policy and guidelines**

- Medical waste management policy is in process; it will be soon endorsed by the cabinet and implemented in the country after endorsement.

- Infection control and HCWM guideline (Version 2006) is in place throughout the country.

**Waste management: specific problems**

- No incinerators for HCW in the entire country at present
- A few hospitals have no deep burial pits and many pits are almost filled already.
- Supply of autoclaves for autoclaving of infectious waste is not adequate and many hospitals dispose of their infectious waste without autoclaving.
- Red/biohazard bags are in short supply and some hospitals do not have them at all.
➢ No national guideline for radiological wastes. At present all such waste goes into the normal drainage system.
➢ No guidelines for chemical waste: most is buried or burned
➢ No guideline for radionuclear wastes (but not a problem at present since we do not use them at present)
➢ Supplies and logistics problems for infection control and HCWM activities
➢ No biohazard signage in hospitals
➢ No hand-washing posters in hospitals
➢ No work plan at present. HCWM work plan and activity reports need to be prepared from now on.
➢ Autoclaves to be distributed uniformly for contaminated wastes. Some facilities have good numbers while others have no provisions for the autoclaving of infectious wastes.

New guideline for medical waste is already in process, and will soon be printed and distributed throughout the country for implementation.

**Action plan**

<table>
<thead>
<tr>
<th>Sl</th>
<th>Programme/Activity</th>
<th>Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Finalise the current draft national Guidelines on Medical Waste Management</td>
<td>2012</td>
</tr>
<tr>
<td>2</td>
<td>Printing and distribution of 5000 copies of Guidelines on Medical Waste Management for all HCF in the country</td>
<td>2012</td>
</tr>
<tr>
<td>3</td>
<td>Conduct region-based training of health workers on the use of guidelines across the country</td>
<td>2012</td>
</tr>
<tr>
<td>4</td>
<td>Identify one hospital to pilot model HCWM</td>
<td>2012</td>
</tr>
<tr>
<td>5</td>
<td>Develop plans and implement the activities in pilot hospital: capacity-building, advocacy, procurement etc.</td>
<td>2012</td>
</tr>
<tr>
<td>6</td>
<td>Visit by experts from Bir hospital and HECAF to help initiate the pilot programme</td>
<td>2012</td>
</tr>
<tr>
<td>7</td>
<td>Institute HCWM in RIHS curriculum</td>
<td>2014</td>
</tr>
<tr>
<td>Sl</td>
<td>Programme/Activity</td>
<td>Time Frame</td>
</tr>
<tr>
<td>----</td>
<td>-------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>8</td>
<td>Sensitization of mercury-free initiatives at all health centres</td>
<td>2013</td>
</tr>
<tr>
<td>9</td>
<td>Evaluation of the pilot hospital and information dissemination</td>
<td>2013</td>
</tr>
<tr>
<td>10</td>
<td>Inclusion of basic HCWM in school curriculum</td>
<td>2015</td>
</tr>
<tr>
<td>11</td>
<td>Replication of HCWM activities in all health facilities</td>
<td>2014–2016</td>
</tr>
</tbody>
</table>

### 7.3 Democratic People’s Republic of Korea

**Current status**

MoH has set up hospital infection control committee responsible for HCWM in each HCF.

HCWM is supported and inspected by various agencies such as health, municipality, infrastructure sectors.

HCW is divided into gas, solid and liquid waste. Solid waste is managed by segregation, collection, disinfection, burning in incinerator and burying in special pits. Liquid waste disposed of by deposition, purification and disinfection according to national legislation and guidelines.

MoPH drew up a National Infection Control Guideline in 2007.

**Action Plan**

- Activate hospital infection control committee
- Establish model HCWM systems based on Nepal Bir hospital model

Short term: Select one hospital for model HCWM

Long term: Extend model HCWM to other hospitals, other cities and the community.
7.4 India

Current status

- The central Ministry of Health and Family Welfare (MoHFW) is concerned with management of BMW. However, health being a state subject in India, it is the primary responsibility of state governments to take all necessary actions for proper management and disposal of BMW.

Policy

- The policy statement of MOHFW aims “to provide for a system for management of all potentially infectious and hazardous waste in accordance with the BMW (Management & Handling) Rules, 1998 (BMW, 1998).

Legislation

- State Pollution Control Boards (SPCBs), and Pollution Control Committees (PCCs) in the Union Territories, are the prescribed authorities for implementation of the Rules.
- Rules provide a regulatory framework for:
  - Segregation, labelling, transportation and storage of BMW generated from by health-care facilities
  - Treatment and disposal options for different waste categories
  - Colour coding for segregation of various categories of waste
  - Operation and emission standards for BMW treatment equipment
- HCF serving 1000 or more patients per month require authorization from the prescribed authorities. However, all HCF are required to comply with the Rules.
To deal with hazardous wastes like mercury and their transboundary movement, storage, handling, treatment and disposal, the MoEF notified the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2008.

**Guidelines**

- National Guidelines (MoHFW) on Hospital Waste Management (2002) distributed to all states for implementation.
- National policy document and operational guidelines for community health centres, primary health centres and sub-centres for implementation of Infection Management and Environment Plan under RCH II (2007).
- Guidelines to reduce environmental pollution due to mercury and e-waste in central government hospitals and health centres by Directorate-General of Health Services.
- Guidelines for CBWTFs.

There are 177 CBWTFs in the country (MoEF report 2009-2010).

Guidelines for Design and Construction of Bio-medical Waste Incinerator and Guidelines for Common Bio-medical Waste Treatment Facility (CBWTF) are available. Main features are:

- Incinerator shall be allowed only at CBWTF, and installation of individual incineration facility by a health-care unit is discouraged.
- The CBWTF to be located as near to its area of operation as possible in order to minimize the travel distance in waste collection.
- In any area only one CBWTF may be allowed to cater up to 10000 beds at the approved rate by the prescribed authority (SPCB/PCC).
- A CBWTF shall not be allowed to cater to health-care units situated beyond a radius of 150 km.
Status of mercury in central government hospitals

- Existing mercury-based equipment gradually being phased out.
- Mercury spill protocols are being followed.
- Storage of mercury waste is being done as per recommended protocols.
- Authorized vendors contacted for removal of stored mercury.

Next steps

- Invite suggestions to amend the BMW rules.
- Obtain state-wise information on implementation status:
  - Training status and needs
  - IEC and awareness activities
  - Resources available
  - Monitoring of HCWM
- Identify high- and poor-performing states and document best practices adopted in the states.
- Write a letter to states to allocate budget, share/develop action plans if not available for all tertiary-care hospitals and district hospitals on priority as per rules and guidelines.
- Plan to include components for assessment, strengthening of infrastructure, IEC and capacity-building in national programme.

Action plan for next five years

- Undertake assessment/study of HCWM infrastructure, knowledge, attitude and practices in different states.
- Strengthening of HCWM infrastructure in health care and common treatment facilities.
- Identify training needs, develop training plans and curriculum and implement the plans for capacity-building of all levels of health-care workers and workers of common treatment facilities.
- Improve management at facility level for better implementation, monitoring and supervision.
7.5 Indonesia

Current status

National legislation established in 1999 on hazardous waste followed by legislation on all waste in 2008. In 2009 legislation on hospitals and environment protection and management was decreed.

HCWM policies

Policies about Health Standards for Hospital Environment and policy of healthy city exist.

National guidelines on HCWM

The following guidelines are available:

- Draft of Clean Hospital and Primary Health Care Guidelines.
- Draft of Solid Waste Management in Hospitals.
- Guideline on Hospital Liquid Waste Management.
- Guideline on Waste Management in Primary Health Care.

National HCWM programmes

- Green Hospital Programme.
- Training of Trainers on Hospital Sanitation.
- Training for in-house capacity-building.

National assessment on HCWM

- National Environmental Health Impact Assessment for HCWM from 2007 until present.
- Research on national health facility conducted by MoH once a year.
Regional Workshop on Health-care Waste Management

**HCWM guideline on immunization**


**Activities**

- Inspection and control of hospital sanitation.
- Effective implementation of guidelines on hospitals.
- Environmental audit in hospitals to decide best practice on HWCM.
- Walk-through survey on operational management.
- Five provincial workshops conducted in 2010-2011 with support from WHO.

**Country status on mercury**

- Twenty pilot hospitals are phasing out mercury (16 in Bali and four in Jakarta); Yogyakarta is in process.
- Establishing baseline data using Lumex on Mercury with United Nations Industrial Development Organization.
- Locally made digital thermometers and sphygmomanometers made available to pilot hospitals.
- Workshop to be organised with HCWH and Bali Focus to scale up the pilot.
- Seeking WHO support for electronic thermometers and sphygmomanometers to work on Pilot Indonesia.

**Next steps**

- Extend segregation into not only organic and inorganic waste but also to paper, plastic, and biodegradable waste at source.
- Establish space-limited liquid waste treatment system.
- Conduct trial on autoclave for waste treatment.
- Organise national workshop on HCWM.
**Action plan**

- Strong enforcement against illegal scavenging.
- Policy on phasing out mercury from HCF.
- Model HCWM system to be set up in at least one hospital in each province.
- Work out the economics of different models of in-house HCWM for cost-effective selection.
- Strengthen regional networking and learning on HCWM best practices.
- Strengthen intersectoral collaboration for safer HCWM.

### 7.6 Maldives

**Current situation**

- No legislation on HCWM.
- No update assessment in HCWM: last assessment done in 2005, just after tsunami.
- There is no national waste management system.
- A draft of HCWM policy guideline is available.
- Segregation at the source is practiced in most HCF.
- Most HCF have incinerators and HCW is burned.
- In the capital city, Male, HCW is taken to a nearby island (Thilafushi) to be burned.
- In all HCF hand-washing is promoted with posters and hand-washing facilities.

**Next steps**

- Submit a report to policy-makers in MoH and share the recommendations of the workshop.
Regional Workshop on Health-care Waste Management

- Finalization and implementation of HCWM policy guideline draft (MoH).
- Create awareness among policy-makers and managers of HCF on HCWM.
- Make an update assessment on HCWM in the country.

**Action plan**

**Short term**

(1) Make a baseline assessment on HCWM in the country.

(2) Form a steering committee on HCWM.

(3) Finalize the current draft HCWM policy document, integrating infection control, including hand hygiene, and healthcare worker safety.

(4) Distribute HCWM finalized document to all HCF for consensus review and develop legislation on HCWM.

(5) Develop a mercury phase-out policy plan.

(6) Capacity-building among policy makers, health-care workers, waste handlers and the public on HCWM.

**Long term**

- Advocacy with the public, policy-makers, managers, other sectors and donors for adequate resources and functional support.
- Establish a data-collecting mechanism on HCWM.
- Establish a model hospital in the capital city.
- Establish a monitoring system for HCWM in HCF.
- Establish an effective surveillance system on hospital-acquired infections, microbial infections and antimicrobial resistance.
- Promote and establish environmentally friendly technologies for HCW treatment and disposal.
- Promote and establish mercury-free hospitals.
7.7 Myanmar

Current status

HCWM was initiated in Myanmar in 1996 with the inclusion of HCWM in immunization training. The training was conducted at national, state, division, and township level adapted to various categories of staff. Low-cost small incinerators, and pits for sharps on protected burial space were set up in many of the township-level hospitals. Larger incinerators were used in central hospitals and hospitals for infectious diseases. Needle cutters were provided by WHO and UNICEF for mass tetanus toxoid and measles immunization in some townships. HCWM committees were set up at national, district and township level and in all HCF. Waste bins were colour-coded according to WHO coding norms and appropriate collection, storage and disposal of HCW were done according to waste category and hospital. Waste management responsibilities were assigned. Refresher courses were conducted every six months to one year for new medical staff and workers. A waste treatment plant was constructed at Yangon General Hospital with Japanese aid in 1996.

Action plan (next five years)

- Commitment of the government to support safe HCWM.
- Establishment of a comprehensive HCWM system which is safe, eco-friendly and sustainable with the cooperation of municipal, occupational health department, environmental health department, INGOs, NGOs and communities.
- Development of regulatory framework and guidelines.
- Advocacy targeting policy-makers and health care regarding risk and responsibilities related to HCW and mercury in health care.
- Situational analysis and assessments (number of HCF with safe management system, how many of them are dysfunctional).
- Training and increased awareness of those involved.
- Sensitization for mercury-free environment, including:
  - Safe storage of mercury
  - Promoting use of mercury-free alternatives
Capacity-building of health-care workers.

Set up model hospital on HCWM in every district.

Raising community awareness through media.

Integration with school health programme, including:
- Education on health risks
- Segregation of at least noninfectious waste

Monitoring and supervision of the system.

Studies on effectiveness of interventions.

National purchasing policies to include the knowledge and consideration of waste management.

7.8 Nepal

Current status

At present Nepal does not have legislation on HCWM, but it does have an HCWM policy, guidelines are available, and National Programme. Assessment studies of the status of HCWM have been done in Kathmandu and Pokhra. Guidelines for management of waste from immunization activities also exist. HCWM is being implemented in hospitals and there is a plan to phase out mercury.

Action plan

Seeing the successful implementation of a model HCWM system in the major public HCF (Annex 4), participants felt that it was possible to extend the model to other health-care facilities in Nepal. An action plan to improve the status of HCWM in Nepal was presented. The steps that would be taken in this direction are:

- Formation of central HCWM committee.
- Finalisation of institutional framework.
- Review/update national HCWM guidelines
- Dissemination of national HCWM guidelines.
- National legislation on HCWM.
- National-level survey/assessment.
- Technical expertise – long-term.
- Government budget and plan for sustainable funding.
- Review and update HCWM manuals.
- Regional models – developing appropriate systems in other regions.
- Interaction programme for hospital directors and other decision-makers, professional medical organizations/councils/associations.
- Capacity-building at all levels including formation of facility-level HCWM committees.
- Programme on mercury-free health service.
- Gather information on successful models and incorporate lessons into national plan.
- Incorporate HCWM in all national medical training curricula.

### 7.9 Sri Lanka

**Current status**

- HCW generation – 5643.75 megatonnes per year in government HCF.
- The bulk of HCW is generated in 43 large hospitals out of 1042 in the country, of which 30 institutions have acceptable systems.
- Out of the 22 teaching hospitals, 20 have HCWM programmes in place.
- Written policy and legislation are in place.
- Activities are implemented through a specific unit at the MoH.
- There is good collaboration with environmental and local government authorities.
National-level action plan is implemented under the five-year master plan.

HCWM in smaller hospitals is guided through national circulars and guidelines.

Monitored through National Health Excellence Award Programme (Quality of Health Care).

**Issues**

HCWM in small hospitals and community health centres need to be strengthened.

Private hospitals and private general practices are not sufficiently covered.

Current action plan needs to be updated in the light of recent developments.

**Action plan**

**Vision:** Country free of HCW problems

**Mission:** Providing the necessary advocacy, guidance, regulation and services for the efficient management of HCWM in Sri Lanka through well-coordinated actions by stakeholders

**Objectives**

- To reduce mortality and morbidity due to improper HCWM.
- To reduce the adverse effects due to environmental contamination by HCW.
- To promote a healthy environmental and occupational setting in all health-care institutions.

**Strategy**

- Strengthening policy and institutional arrangements.
- Strengthening the capacity of health-care institutions.
- Securing community participation and intersectoral coordination.
- Strengthening analytical and research capacity and knowledge management.
- Monitoring and evaluation.

**Activities**

**Initial**

- Situational assessment.
- Identification of priorities.
- Advocacy and communication.

Strategy 1: Strengthening policy and institutional arrangements:

- Establishment of national and provincial HCWM system.
- Establishment of national and provincial technical task forces.
- Establishment of HCWM units in hospitals.
- Development of guidelines, procedures and protocols.
- Development of hospital HCWM plans.

Strategy 2: Strengthening the capacity of health institutions:

- Building infrastructure for HCWM care waste management.
- Designing and developing innovative solutions.
- Purchasing and installing equipment.
- Human resource development.

Strategy 3: Securing community participation and intersectoral coordination:

- Establishment of National and Provincial HCWM Steering Committees.
- Conducting public awareness programmes.
Collaboration with UN agencies and other development partners.

Private sector/NGO/community-based organization partnership.

Initiation of income-generation activities.

Strategy 4: Strengthening analytical and research capacity and knowledge management:

- Development of protocols, procedures and guidelines on sampling in HCWM.
- Developing laboratory facilities to monitor HCWM.

Strategy 5: Monitoring and evaluation

- Identifying/developing monitoring tools and indicators.
- Conducting quarterly institutional review of HCWM.
- Conducting annual review of HCWM at national level.

7.10 Thailand

Current status

Thailand has legislation on HCWM, approved in 2002. There is an HCWM policy, and guidelines on HCWM are available. A national programme has been developed and assessments are ongoing (2012–2013). Guidelines for management of waste from immunization activities have been developed and are implemented. HCWM activities are implemented throughout the country. As far as mercury phase-out is concerned, a pilot “clean and green” hospital project is underway.

Next steps

- Monitoring, evaluation and improvement of infectious waste transportation and disposal system.
- Study of autoclave technology for infectious waste treatment system.
- Expand mercury phase-out in “clean and green” hospitals.
Action plan

Five-year plan on HCWM

Objective: 90% of healthcare facilities implement sanitary infectious waste transportation and disposal system.

Activities

- Launch national refreshment courses on HCWM for administration officers of HCF, local governments and private sector.
- Strengthen local governments to improve infectious waste transportation, treatment and disposal system.
- Carry on knowledge management seminars and model development on HCWM.

7.11 Timor-Leste

Currently there is no policy for HCWM in the country and HCF are only partly implementing HCWM. An assessment of HCWM was done in August–September 2011.

Key findings

- No HCWM guidelines available.
- Only 23.6% of HCF have a person responsible for HCWM.
- Functioning incinerators were present in 33.3% of HCF and 27.8% of HCF had functional waste water treatment plants
Next steps

- Organize workshop/awareness programmes on HCWM for health staff.
- Rehabilitate and make functional non-functional HCWM facilities/equipment (incinerator and liquid waste treatment).
- Establish health promotion programme with focus on HCWM at all HCF.
- Prepare draft action plans for the next five years for sound management of HCW (2015–2030).
- Health facilities to have waste management systems (with appropriate human resources and equipment).
- Development of waste management monitoring system.

8. Recommendations

HCWM is an important issue in the countries of the SEA Region. Although the risk posed by improperly managed HCW is being realized by many of the countries in the Region, most face common problems:

- Lack of segregation practices and mixing of risky HCW with general waste makes whole waste stream hazardous.
- Open burning by clinics, dispensaries and some hospitals.
- Incinerators are old and poorly maintained.
- Poor regulatory mechanisms; even if legislation exists it is poorly implemented.
Based on the experiences that were shared and after extensive discussions, the participants made recommendations to Member countries and to WHO.

### 8.1 Recommendations for Member States

- On the basis of the draft plan of action and next steps identified by country teams during the workshop, countries should develop a national action plan for the sound management of HCW. Different countries are at different levels in the implementation of the action elements and the action steps. It was recommended that each country identify priorities, strengthen existing systems and move forward in an incremental way.

- Include HCWM as a part of the health system and allocate adequate resources for management of HCW.

- Member countries should take the initiative to provide hepatitis B immunisation for HCW handlers.

- Generate evidence on the health risks to health-care workers and on appropriate technologies.

- Ensure safety from waste generation site, collection, transportation to final disposal.

- Explore and use environmental friendly technologies which are appropriate to the country context.

- Raise awareness of the public on rational use and consumption of drugs or treatment, and of practitioners on rational prescription of drugs or treatment and on related risks.

- Raise awareness of health workers on the risks related to unsafe and improper HCWM.

- Train relevant staff on sound and safe HCWM.
> Provide adequate hand-washing facilities for the staff, patients and visitors.
> Promote the use of mercury-free thermometer and blood pressure devices.
> HCWM to be integrated with existing committees such as infection control.
> Improve compliance of HCWM Rules through IEC, training, monitoring and regulatory mechanisms.
> Promote the development of “green” hospitals.
> Establish sound management of HCW in all health centres.
> Build networks between countries to share knowledge and experiences.
> Conduct a national baseline assessment of HCWM.

### 8.2 Recommendations for WHO

Country participants had the following recommendations for WHO:

> Provide technical support in developing policy, guidelines and piloting innovative, sustainable and appropriate HCWM approaches.
> Support research and assessment at local level on mercury poisoning to support evidence-based decision-making.
> Technical evaluation of claimed best practices in different countries.
> Local capacity-building to adopt appropriate HCWM, including training of key country stakeholders in global best practices.
> Identify appropriate technologies for HCWM for developing and resource-poor countries.
> Organize workshops and invite experts from relevant organizations to be resource persons.
Regional Workshop on Health-care Waste Management

- Technical and financial support for the development of policy/guidelines for HCWM, including mercury control and implementation programme.
- Establish a Regional network on HCWM and facilitate sharing of best practices.

9. Closing

Mr Terrence Thompson, on behalf of WR Nepal, thanked the participants for attending the workshop and for their active deliberations and interactions. WHO also thanked the Global Alliance for Vaccines and Immunization for providing the financial resources for organizing the workshop. The chair noted that the workshop had been very well represented by the Member countries of the SEA Region and had brought together representatives from the health sector and municipalities from Bangladesh, Bhutan, Democratic People’s Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste as well as from several UN agencies, INGOs and local NGOs.

The workshop had been helpful in garnering expert experience in the field from throughout the world. Field visits to model HCWM systems served a very useful purpose in providing first-hand experience and interaction with health workers to discuss practical issues. The deliberations and the field visits inspired and motivated the countries to develop action plans to improve their health-care systems for safe and sustainable HCWM and mercury-free health care. The deliberations indicated that different countries were at different levels in their progress towards developing safe HCWM systems. Some countries had made remarkable progress and shared their experience which was motivational for the group. The action plans and the next steps would provide the basis for further efforts by the countries and allocate priorities. WHO affirmed its support in this endeavour.
Annex 1

Message from Dr Samlee Plianbangchang, Regional Director, World Health Organization, South-East Asia Region
(read by Dr Lin Aung, WHO Representative, Nepal)

Representatives of Member States of the WHO South-East Asia Region, ladies and gentlemen:

Health-care activities such as immunizations, diagnostic tests, medical treatments, and laboratory examinations protect and restore health and save lives. On the other hand, however, unsafe management and improper disposal of the wastes and by-products produced by these activities pose a number of life-threatening risks.

The South-East Asia (SEA) Region produces about 1 000 metric tons of health-care wastes daily. Around 327 million injections were given via the routine immunization programme alone in the Region in 2010. In many instances, these infectious and hazardous wastes are mixed with general waste and thrown in landfill sites, thereby converting them into hazardous places. In some countries, it has been reported that used syringes and transfusion tubes are collected by pickers and then recycled back into the market. This is a very unsafe practice, putting lives at enormous risks. Such dreadful practices must be stopped through effective government regulation and enforcement.

Globally, needle reuse and other unsafe injection practices are estimated to cause 1.3 million early deaths every year. Health-care workers are among the most at risk from improper handling and management of contaminated sharps. Waste handlers, scavengers and the public in general are also at risk from improper management of health-care waste, especially when these are thrown into landfill sites, uncontrolled dump sites or water sources.
In the SEA Region, needle stick injuries from contaminated sharps are estimated to cause about 200,000 cases of Hepatitis B; 85,000 cases of Hepatitis C; and 30,000 cases of HIV/AIDS annually.

Many countries still practice open burning and inadequate incineration of medical waste. Inappropriate incineration may cause adverse health effects due to highly toxic fumes as well as contribute to global warming. Not surprisingly, a United Nations Convention classifies health-care waste as the second most hazardous waste, after nuclear waste.

There are solutions to this issue. However, in many countries, significant challenges persist with regard to the proper management and disposal of health-care waste. The amount of waste generated by health-care facilities and services is increasing owing to their expansion. The situation is exacerbated by the lack of awareness about the health hazards, insufficient financial and human resources and poor control of waste disposal. Many countries do not have appropriate regulations, or do not enforce them.

WHO has given due importance to the sound management of health-care wastes. In response to environmental and health concerns, WHO framed a global policy on this matter in 2004. This policy promotes an integrated, and “complete cycle” approach in health-care waste management. The policy emphasizes the need for environmentally-sound treatment and disposal methods. Incineration is seen as an interim measure or solution of last resort. WHO also prepared guidelines on appropriate systems for safe management of solid waste from health facilities. These guidelines take into consideration local conditions, as well as occupational and environmental safety. To promote the implementation of the policy, WHO has published a number of documents on various related subjects.

Management of health-care waste is a complex issue. However I can assure you that it can be tackled if the right policies and strategies are in place. Advocacy among policy-makers, awareness among health-care workers and waste handlers on health hazards, capacity building at all levels and allocation of funds, are some of the issues that need attention. WHO jointly with the Indira Gandhi National Open University (IGNOU), New Delhi, India had launched a distance learning certificate course on sound management of health-care waste in 2006. Since then many participants from the Region have successfully completed the course. We encourage
countries to avail of this opportunity and hope that many more will enrol in this useful course.

In accordance with the “polluter pays” principle, it is the waste generator who should be responsible for safe management of its discards. Therefore, the health sector is accountable for the health-care waste it produces.

Because of rapid population growth and high disease burden, especially due to non-communicable diseases that require sophisticated treatment technologies, the demand for medical services is increasing very rapidly. This is leading to increase in the production of medical waste. Therefore the need to emphasize on health promotion and prevention of diseases becomes very crucial.

WHO with its partners is currently supporting Bir Hospital, the oldest and largest hospital in Kathmandu, to set up a safe and sustainable health-care waste management system. The initial results are very positive. The regional workshop is being organized in Kathmandu with the objective of sharing the impressive results of Bir Hospital with you all. I hope you will learn a lot and get some inspiration for taking up such initiatives in your country too.

I wish you all success and have a pleasant stay in Kathmandu.

Thank you.
Annex 2

Agenda

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Session 1

Global and regional overview of management of health-care waste

Global overview and latest information on health-care waste management and health implications

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Session 2

Panel discussion – Country-level initiatives in HCWM – moderated by Terrence Thompson

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Panel discussion – Best practices and approaches on management of health care waste and phasing-out mercury equipment in health-care services

Moderated by Yves Chartier
(Panelists: Faye Ferrer, HCWH, Mr Ram Charit Sah, Centre for Public Health and Environment CEPHED, Nepal, and Miss Pornsri Kictham Thailand)

Session 3
Field Visit
Activity
Visit Medical waste and waste water management system in Dhulikhel hospital
Visit HCWM (segregation, collection and waste management center) in Bir Hospital.

Presentations of HCWM
Mahesh Nakarmi and Director of Bir Hospital

Discussions

Activity
Lessons from field visit:
Representatives of each group

Session 4
Country-level action for improving health-care waste management – group work to identify issues and challenges and opportunities for strengthening HCWM and prepare country action plans – country teams (11)

Recommendations of the workshop

Closing
Annex 3

List of participants

Country participants

**Bangladesh**

Dr Md Mumtaz Uddin Bhuiyan  
Director  
Hospital and Clinic DGHS  
Bangladesh  
Email: ihsm@ld.dghs.gov.b

Dr Liaquat Ali Khan  
RMO  
Sadar Hospital  
Gazipur, Bangladesh

**Bhutan**

Mr Gyeltshen Dukpa  
Chief Environment Officer  
Thimphu Thromde (Thimphu municipality)  
Email: gyeltshendukpa@gmail.com  
Ph: 975-17692603; 975-2-336937

Mr Ganga Prasad Rai  
Programme Officer  
Department of Medical Services  
Ministry of Health  
Thimphu  
Email: gangarai@helth.gov.bt  
Ph: 975-77337380

Mr Namgyal Dorji  
Administrative Officer  
Phuntsholing Hospital  
Phuntsholing  
Email: dorjee02@druknet.com  
Ph:975-17609098

**DPR Korea**

Dr Kim Jong U  
Interpreter  
Pyongyang  
191-2X3, 1242, Pyongyang

**India**

Dr Anil Kumar  
CMO  
Dte. General of Health Services  
Ministry of Health & Family Welfare  
Room No. 506-D Wing  
Nirmal Bhawan  
New Delhi  
Email: dr.anilkumar@nic.in  
Ph: +911123061259; +919811637663  
WZ-1427D, Nangol  
Raya, New Delhi - 110046

Dr Charan Singh  
Joint Director  
Public Health Wing, DHS  
F-17, Karkardooma  
Govt. Of NCT of Delhi  
Email: charan688@gmail.com  
Ph:+91-9810150779; 9868536242; 9654100345  
R/O: Andrews CanJ Extm  
New Delhi – 110049- (India)

**Indonesia**

drg. (Mr) Tony Wibowo Harianto  
Environmental Health  
Health Officer of Province of DKI Jakarta  
Ministry of Health  
Republic of Indonesia  
Jalan Percetakan Negara No. 29  
Jakarta Pusat 10560  
Email: tw_harianto@yahoo.com

Mr Eddy Koswara  
Chief of Sanitarian Division of Fatmawati Hospital  
Jakarta
Mr Hendrik Permana, SKM  
Staff  
Subdirectorate of Health Equipment and Infrastructure Management  
Directorate of Medical Support Service Management and Health Equipment  
Directorate General of Health Effort Management  
Ministry of Health  
Republic of Indonesia  
Jakarta  
Email: Hendrik_pohan@yahoo.com

Mr Nandi Pinta, SKM, M.Kes  
Head of BBTKL-PPM Banjar Baru  
South Kalimantan  
Jl. Mr. Cokro Kusumo 2ª  
Banjar Baru  
Banjarmasin  
Republic of Indonesia  
Email: nkampai@yahoo.com

Mr Adhy Prasetyo Widodo, S.Si  
Staff of Waste, Air and Radiation Safety Subdirectorate  
Jl. Percetakan Negara No. 29  
Ministry of Health  
Republic of Indonesia  
Central Jakarta 10560  
Indonesia  
Email: stefanus.adhy@gamil.com

Maldives  
Mr Mohamed Abdul Kareem  
Councillor  
Male City Hall  
Male  
Email: rukuma777730@gmail.com

Ms Aminath Shaufa  
Public Health Programme Coordinator  
Center for Community Health and Disease Control  
Ministry of Health and Family  
Male  
Email: shanfa@health.gov.mv, a_shaufa@hotmail.com

Mr Mohamed Saeed  
Deputy Director  
Male Health Corporation  
Ministry of Health and Family  
Male

Myanmar  
Dr Phyu Phyu (Mrs)  
Senior Medical Superintendent  
(1000) Bedded General Hospital  
The Republic of Union of Myanmar  
Nay Pyi Taw  
Email: naypyitaw1000bededhospital@gmail.com; aung1945@gmail.com

Dr Tin Nyo Nyo Latt (Mrs)  
Medical Superintendent  
Central Women’s Hospital  
The Republic of Union of Myanmar  
Yangon  
Email: cwhygntnnl@gmail.com

Dr Than Htay Aung (Mr)  
Medical Superintendent  
General Hospital  
Hpalan  
Chin State  
The Republic of Union of Myanmar  
Email: dr.thanhtayaung9585@gmail.com

Nepal  
Dr Senendra Raj Upreti  
Chief, Curative Service Division  
MoHP

Ms Shreejana Shrestha  
Public Health Administrator  
Management Division, DHS  
Email: shrijn@hotmail.com

Dr Buland Thapa  
Director  
NAMS, Bir Hospital  
Email: thapakoji@gmail.com

Ms Sarada Pandey  
EH Focal Point  
MoHP  
Email: spandey315@gmail.com
Regional Workshop on Health-care Waste Management

Director
Institute of Medicine
Maharajgunj

Facilitator (Volunteer)
Saraswoti Thakuri
HECAF
Email: saruthakuri09@gmail.com

Nimesh Dhakal
HECAF
Email: nimesdhakal@gmail.com

Sharawasti Karmacharya
HECAF
Email: sharawastikarmacharya@gmail.com

Sita Thapa
HECAF
Email: thapa.seeta@gmail.com

Prava Panthi
HECAF
Email: pravapanthi@gmail.com

Prerana Dangol
HECAF
Email: prerana.dangol@gmail.com

Sudha Vaidya
Act. Nursing Director
NAMS, Bir Hospital
Email: sudha.vaidya@yahoo.com

Babita Karmacharya
HECAF
Email: babi_km12@yahoo.com

Dina Rai
HECAF
Email: thulung1dina@gmail.com

Sri Lanka

Dr H.D.B. Herath
Deputy Director
Environmental and Occupational Health
Ministry of Health
Government of the Democratic Socialist
Republic of Sri Lanka
Colombo 10
Sri Lanka
Email: hdbh@sltnet.lk
Ph: 009377846226

Dr P. W. C. Panapitiya
Director, Medical Services
Ministry of Health
Government of the Democratic Socialist
Republic of Sri Lanka
Colombo 10
Sri Lanka
Email: panapitiyal@yahoo.com
Ph: 0094112667506

Mr S. Balasubramaniam
Deputy Director-General (Logistics)
Ministry of Health
Government of the Democratic Socialist
Republic of Sri Lanka
Colombo 1
Sri Lanka
Email: balasasci@gmail.com
Ph: 0094775058996

Thailand

Mrs Pariyada Chokewinyoo
Public Health Technical Officer
Senior Professional Level
Bureau of Environmental Health
Department of Health
Ministry of Public Health
Royal Thai Government
Tivanond Road
Nonthaburi 11000
Thailand
Email: pariyada.c@gmail.com
Ph: +66-814816169

Mrs Sriaroon Sukchareon
Public Health Technical Officer, Professional Level
Bureau of Environmental Health
Department of Health
Ministry of Public Health
Royal Thai Government
Tivanond Road
Nonthaburi 11000
Thailand
Email: sriaroon.s@anamai.mail.com
Ph: +66-817102227
Regional Workshop on Health-care Waste Management

Miss Pornsri Kictham
Municipal Clerk
Nonthaburi Municipality
Ministry of Interior
Royal Thai Government
Thailand

Timor-Leste

Mr Joao Nazaret da Piedade Bras
Chief
Department of Sanitation, DNSAS-Mol
Democratic Republic of Timor-Leste
Dili, Timor-Leste

Mr Ivo Cornelio Lopes Guterres
Head
Environmental Health Department
Democratic Republic of Timor-Leste
Dili, Timor-Leste
Email: ivoguterres@gmail.com
Ph: +6707245707

Mr Antonio da Cunha Castro
Sanitarian
Referral Hospital, Maliana District
Democratic Republic of Timor-Leste
Dili, Timor-Leste
Ph: +6707299761

Temporary Advisers

Mr Satish Sinha
Assistant Director
Toxics Link
An initiative of
The Just Environment Charitable Trust
H-2 Jungpura Extension
New Delhi – 110014
India
Email: satish@toxicslink.org

Mr Mahesh Nakarmi
HECAF
Project Manager
HCWM project
Bir Hospital
Kathmandu
Nepal
Email: mahesh.kaharmi@gmail.com

Mr Ram Charit Sah
Centre for Public Health and
Environment (CEPHED)
Nepal
Email: ramcharitra@gmail.com

Dr Geeta Mehta
India
Email: gmehta51@hotmail.com

Other agencies

Mr Henk van Norden
Regional Adviser (Sanitation and Hygiene)
UNICEF Regional Office for South Asia
Kathmandu, Nepal
E-Mail: hvannorden@unicef.org

Mr Rajesh Manandhar
UNHABITAT Nepal
Water for Asian Cities Programme
UN-HABITAT
Kathmandu, Nepal
Email: rajesh.manandhar@unhabitats.org.np

Ms Prativa Upadhaya
Legal officer
Public Private Partnership Urban
Environmental (PPUPE)
Kathmandu, Nepal
Email: prativa@ppupe.org.np

Dr Sumitra Amatya
Executive Director
Solid Waste Management Technical
Support Centre
Shree Mahal, Pulchowk
Nepal
Email: drsumitraamatya@gmail.com

Mr Guilberto Borongan
Programme Officer
Network Support Component
Regional Resource Centre for Asia and the
Pacific
(AIT-UNEP RRC.AP)
3rd Floor
Outreach Building Asian Institute of
Technology
P.O. Box 4, Klong Luang Pathumthani 12120
Thailand
Tel: (66) 2524 6240
Fax: (66) 2516 0825, 2524 6233
Email: guilberto@rrcap.unep.org

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Dr Mohammad Abul Kalam Azad  
Manager Clinical Research and Laboratory Sciences  
Family Health International (FHI 360)  
House-5, Road-35  
Gulshan-2, Dhaka 1212  
Bangladesh  
e-mail: dr.azad.mak@gmail.com

Mr Gopal Panta  
Laboratory Specialist  
FHI360, Nepal  
Email: gpanta@fhi360.org

Ms Maria Mercedes Ferrer  
Executive Director  
Health Care Without Harm  
South East Asia  
Email: merci.ferrer@gmail.com  
Mobile: 09209056113

Observers

Mr Surendra Gautam  
GIZ Returning Expert  
Kathmandu  
Nepal  
Email: gautamsure%@yahoo.com

Mr Sushim Amatya  
GIZ Returning Expert  
Kathmandu  
Nepal

Resource persons

Ruth Stringer  
Healthcare without harm  
UK  
Email: rstringer@hcwh.org

Ms Faye Ferrer  
Coordinator  
Mercury in Health Care Program  
Health Care Without Harm  
South East Asia  
Email: faye@hcwm.org

David Ausdemore  
CDC Atlanta  
Email: dja4@cdc.gov

WHO Country Offices

Mr Terrence Thompson  
Senior EH Adviser, WCO Nepal  
Email: thompsont@searo.who.int

Mr Nam Raj Khatri  
NPO, WCO Nepal  
Email: khatrin@searo.who.int

Ms Deepa Shrestha  
WCO Nepal  
Email: shresthad@searo.who.int

Mr Sharad Adhikary  
EH Adviser, WCO Indonesia  
Email: Adhikary@searo.who.int

Mr SG Mahmud  
NPO, WCO Bangladesh  
Email: mahmuds@searo.who.int

WHO-SEARO

Mrs Payden  
Regional Adviser – WSH  
Email: payden@searo.who.int

WHO-HQ

Mr Yves Chartier  
Email: chartiery@who.int
Annex 4

Field visit sites – detailed information

The schedule of the field trip is as under:

Thursday, 8 December 2011

SESSION 3
07:30 – 17:00  **Field visit to HCWM sites**
07:30-9:00  Travel to Dhulikhel
9:00-11:00  Visit Medical waste and waste water management system in Dhulikhel hospital
11:00-12:30  Travel back to Annapurna
13:30 – 14:00  Travel to Bir Hospital
14:00 – 15:00  Visit HCWM (segregation, collection and waste management center) in Bir Hospital. This will be done in 6 sub groups
15:00 – 16:00  Presentations on Safe HCWM implemented in Bir Hospital – Mahesh Nakarmi, Director, HECAF and Dr.Buland Thapa, Director, Bir Hospital followed by discussions

For the field visit, participants will be divided into six groups with each facilitated by staff from HECAF.

<table>
<thead>
<tr>
<th>Group</th>
<th>Group Name</th>
<th>Facilitator</th>
<th>Contact Telephone</th>
<th>Contact email</th>
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<tbody>
<tr>
<td>I</td>
<td>Syringe</td>
<td>Saraswoti Thakuri</td>
<td>977-9841422700</td>
<td><a href="mailto:saruthakuri09@gmail.com">saruthakuri09@gmail.com</a></td>
</tr>
<tr>
<td>II</td>
<td>Blood Bag</td>
<td>Prabha Panthi</td>
<td>977-984152003</td>
<td><a href="mailto:pravapanthi@gmail.com">pravapanthi@gmail.com</a></td>
</tr>
<tr>
<td>III</td>
<td>Gauze</td>
<td>Sita Thapa</td>
<td>977-9849010293</td>
<td><a href="mailto:thapa.seeta@gmail.com">thapa.seeta@gmail.com</a></td>
</tr>
<tr>
<td>IV</td>
<td>Gloves</td>
<td>Nimesh Dhakal</td>
<td>977-9803157582</td>
<td><a href="mailto:nimesdhakal@gmail.com">nimesdhakal@gmail.com</a></td>
</tr>
<tr>
<td>V</td>
<td>Cannula</td>
<td>Shrawasti Karmacharya</td>
<td>977-9849125422</td>
<td><a href="mailto:shrawastikarmacharya@gmail.com">shrawastikarmacharya@gmail.com</a></td>
</tr>
<tr>
<td>VI</td>
<td>IV set</td>
<td>Prerana Dangol</td>
<td>977-9841444747</td>
<td><a href="mailto:prerana.dangol@gmail.com">prerana.dangol@gmail.com</a></td>
</tr>
</tbody>
</table>
1. **Field Trip to Dhulikhel Hospital**  
*(9:00am – 11:00 am )*

The City of Dhulikhel, which rises 1650 meters above sea level, is 30 km northeast of Kathmandu and 74 km southwest of Kodari Highway. Dhulikhel Hospital is a community-conceived and community-supported health service provider. In 1997, Dhulikhel Hospital implemented the first constructed wetland waste water treatment system in Nepal. Its purpose was to treat all the waste water generated in the hospital and ensure that the people living around the hospital had access to clean water from the treatment system to use for irrigation. The system was designed by the Environment and Public Health Organization (ENPHO), with technical support from the University of Natural Resources and Applied Life Science (BOKU), in Austria.

As this was the first experiment with constructed wetlands in Nepal, the system was designed using fairly conservative assumptions and plenty of safety margins to ensure that the treated water would be of acceptable quality. The Dhulikhel Hospital wetlands are constructed of an earthen basin with a plastic liner. The wetlands consist of a sedimentation tank, horizontal flow bed, and vertical flow bed. The sedimentation tank, which has a capacity of 10 m³, is used for pre-treatment. Water then passes through the horizontal flow bed, which has a surface area of 140 m² and is filled with 0.6 m of sand and gravel. Finally, the water makes its way through a vertical flow bed with an area of 120 m² that is filled with 1.05 m of sand and gravel. Both the beds are planted with local *Phragmites karka* reeds.

The treatment system was originally designed to treat 10 m³ of wastewater per day, but it is currently treating about 75 m³ per day as the capacity of the hospital has increased significantly over the past 10 years (UN- HABITAT, 2008). Both the hospital staff and the local people are very satisfied with the treatment system. In fact, the system has become a showpiece for the hospital. The hospital is now in the process of expanding the system.
Figure 1: Schematic representation of Constructed Wetland at Dhulikhel Hospital

Specs on the Dhulikhel Hospital Constructed Wetlands Waste Water Treatment System

<table>
<thead>
<tr>
<th>Location</th>
<th>Dhulikhel, Kavre district</th>
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</thead>
<tbody>
<tr>
<td>Year of operation</td>
<td>1997</td>
</tr>
<tr>
<td>CW Type</td>
<td>Sub surface flow</td>
</tr>
<tr>
<td>CW configuration</td>
<td>Horizontal Flow (HF) followed by Vertical Flow Bed (VF)</td>
</tr>
<tr>
<td>CW substrate</td>
<td>Sand, gravel</td>
</tr>
<tr>
<td>Type of wastewater</td>
<td>Hospital wastewater</td>
</tr>
<tr>
<td>Wastewater flow per day</td>
<td>10 m(^3) in 1997</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>Settlement tank</td>
</tr>
<tr>
<td>Total surface area of the CW</td>
<td>261 m(^2) (HFB – 140 m(^2) and VFB – 121 m(^2))</td>
</tr>
<tr>
<td>Surface area per m(^3) volume of wastewater</td>
<td>26.1 m(^2) in 1997</td>
</tr>
<tr>
<td>Plant species</td>
<td>Phragmites karka</td>
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</tbody>
</table>

Source: UN-HABITAT (2008)
2. Field Trip to Bir Hospital (2:00pm – 5:00pm)

Background

Bir Hospital, located in Kathmandu, is the nation’s oldest medical institute. Established in 1889, it has since developed into the National Academy of Medical Sciences (NAMS). It has contributed a great deal towards the delivery of health care in Nepal. The hospital faced serious problems regarding the disposal of waste. Although the hospital administrators were aware of the problems caused by poor waste management, they lacked the expertise to change the situation. The hospital’s administrator thus asked the Health Care Foundation- Nepal (HECAF) to provide technical guidance to help design and implement a new system based on environmentally sustainable technology.

The waste management system in Bir Hospital was designed using a zero waste concept in which each and every form of waste is managed and the waste disposed into Kathmandu’s municipal waste stream is negligible. Toward implementation, HECAF first performed a baseline assessment, analysing the contents of every waste bin over the course of a week. HECAF then helped the hospital to select a model ward for initial implementation of a new system. Once the system was working well in one ward, it was replicated in others. The system is now fully operational across the inpatient wards.

Before the system was in place, the approximate waste collection costs were USD 6,000 per year. It is likely that this can soon be reduced to half, or USD 3,000 per year. Now Bir is sending 34% of the waste for recycling and 30% bio-digested. Instead, Bir is earning almost NRs 5,10,000 or USD 6,000 per year from the recyclable waste.

Waste Management System in Bir Hospital

The health care waste management system at Bir works with three large components that support each other—waste management, injection safety, and mercury elimination. This model is similar to a tricycle, with waste management serving as the front wheel and thus driving the direction of the entire project. However, the project cannot succeed without its crucial two back wheels, injection safety and mercury elimination.
(a) Segregating waste at the source

The basic mantra for any successful waste management is “segregation at the source.” Proper containers well marked and easy to use, at the place where waste is generated is crucial. At Bir, we identified a central point in the ward where four buckets of different colors are kept. Colors code for the segregation of bottles and cans, paper, plastic, and biodegradables. Buckets are also labeled with text and simple art. Coloring, labels and art are standardized throughout the hospital so that all staff, patients and visitors quickly become accustomed to a single system. Art makes the system useable by patients, visitors and hospital workers who are illiterate; it also simplifies the system visually for all who use it. Long forceps are provided in each ward to separate general waste in case of accidental mixing of only general waste buckets.

There is also a wooden instrument at each station to compress paper and plastic waste. A small container is provided for floor sweepings.

In addition to the four-bucket area, each ward is equipped with a waste segregation trolley, which is used by nurse and other medical personnel to separate risk waste from non-risk waste. The trolley also contains a needle destroyer and receptacles for the proper disposal of needles and syringes after use.
Figure 2: Segregation at source—that is, in the wards

Figure 3: Trolley used by medical personnel for segregation of risk and non-risk waste

(b) Waste transportation

Before the new health care waste management system was instituted at Bir, the hospital had a transported waste to Kathmandu’s municipal dump three times a day. This was time consuming and inefficient. In the new system, waste is transported to the treatment center once a day. Two different trolleys for waste transportation have been designed—a green trolley for non-risk and red trolley for risk waste. These trolleys were created out of discarded patient trolleys, which had been dumped behind the hospital, and thus they both cost the hospital nothing and solved a problem of discarded trolleys that were piling up.

Waste is now handled by trained staff, who collect separated waste from the wards and bring it to the waste treatment center for further processing and storage. What is more, these staff, who used to work without proper protective gear, have now all been equipped with and trained to use Personal Protective Equipment (PPE), such as gloves, masks, and closed shoes.
Previous to the institution of the new system, waste was dumped in an abandoned mortuary room that was no longer being used. Here, huge piles of the waste collected. The new system took over this space and turned it into a waste treatment center. Waste from the wards and other units is transported by trolley, treated or processed as needed and stored in separate collection bins, which are emptied upon schedule.

The waste treatment and storage center is separated into two distinct areas for risk and non-risk waste. The collected waste from the non-risk trolleys is weighed by category and data is recorded. Items have different recycling values and thus must be kept strictly separated and directly stored in the recyclable waste collection area.
Waste from the risk trolley is brought to its own area in order to undergo packaging for the safety of those working with the waste. For instance, infectious waste is packaged in red cotton. Similarly, syringes are packaged in drums. After packaging, all infectious waste is treated prior to final disposal via one of three processes:

1. Steam based technology, that is, autoclaving
2. Chemical treatment
3. Biological treatment

Among three, only two i.e., steam based technology and chemical treatment, are operational and the biological treatment is not defined as the treatment technology but it is in process of research.

1) Steam treatment technology—autoclaving

Risk waste is disinfected using steam-based autoclave technology that heats it to sufficient levels to disinfect it. Bir Hospital installed two autoclaves for these purposes. To ensure efficacy, these autoclaves were validated by international experts before the system was but into operation. These experts also set clear parameters that Bir’s waste team can follow in the future to ensure that the system remains up to standards. These standards are a temperature of 121 degree Centigrade and 15 PSI pressure, which must be carried out for a period of 30 minutes.
to bacterial spores. There are various ways to ensure that the pathogens in the waste are properly disinfected. To date the autoclaves have passed 100% of the tests.

After wastes are autoclaved the disinfected, they are further processing, that is, they are separated into recyclable and non-recyclable items. The recyclables are sent to the storage area and non-recyclables are sent to the municipal waste stream.

(2) Chemical treatment

Genotoxic wastes from cancer patients are stored separately and treated chemically. This waste includes equipment, such as saline bottles, vials, IV lines, and syringes used in chemotherapy. 5% sodium hypochlorite is used to denature genotoxic cancer drugs. After chemical treatment, it is processed and sent for recycling.

(3) Biological treatment of gauze and cotton

Even after disinfection in the autoclave, the cotton and gauze bandages and other items that are part of risk waste are non-recyclable. At Bir, we are currently researching vermicomposting—a highly effective method of disposing of cotton and gauze using the *Eisenia foetida* species of earthworms. Best practices can then be replicated at other hospitals.

Figure 7: *Eisenia foetida* in a pile of and gauze

Figure 8: Bed used for vermicomposting
(4) Biological treatment of food waste and pathological waste

For the proper management of biodegradable waste, such as food waste and the pathological waste generated by the Operating Theater, we installed a 25 cubic meter biodigestion plant that uses an anaerobic digestion process. The resulting materials include biogas, which is used as an energy source for cooking, and slurry, which is used as fertilizer. The biodigestion plant is capable of processing 150 kg of biodegradable waste per day. It generates about 6 cubic meters of biogas per day. It is currently being used with food waste only and research is planned to demonstrate that it can also deal effectively with pathological waste from the operating theatres.

(d) Mercury collection house

Mercury-containing thermometers, mercury-containing sphygmomanometers (blood pressure devices), and damaged mercury-containing lightning tubes were collected from each and every ward and unit. Because there is not yet a safe way to dispose of mercury into the environment, these must all be stored in the hospital until further solutions are developed and tested. These mercury-containing materials are now sealed and stored in the mercury collection house. Eventually, disposal options may be defined globally. Until then the safe storage of mercury is the best option for avoiding mercury spills and exposure, which are highly toxic to human and other life.

The storage of old mercury-containing products is necessary. But the best practice for the future is to avoid using products that contain mercury. Excellent mercury-free alternatives are already available in the market, including digital thermometers, infrared thermometers, aneroid blood pressure machines, and digital blood pressure machines. Bir Hospital is already using these alternatives.

(e) Handicrafts made from waste plastic

Because some patients (such as those in the Burns Unit) require physiotherapy or diversional therapy while they are in the hospital, we have developed a programme where they create handicrafts out of the non-recyclable plastic from wrappers and food covers, as well as some of the recyclable plastic from milk packaging, polythene bags and other plastic
items. These items turn waste into a raw material for new products. They have also been a source of revenue generation.

![Figure 9: A patient of burns performing physiotherapy using plastic waste](image1)

![Figure 10: Handicrafts made from waste plastic](image2)

(f) Safe injection practice

Safe injection practice is one of the wheels of the tricycle approach of waste management. HECAF has introduced the concept of safe injection along with health care waste management in Bir hospital. As per WHO SIGN safe injection should meet three criteria: safe injection does not harm the recipient, does not expose the provider to any avoidable risk and does not result in a waste that is dangerous for the community.

![Figure 11: Nurses signing on the banner](image3)

HECAF has trained nurses on safe injection practices. Nurses have committed themselves to follow the standard as much as possible according the facility provided by signing on the banner. This is a kind of indirect pressure to make them follow the safe injection standards. Special focus has given on safe handling of sharps and safe disposal. Different types of needle
destroyers and needle cutters have been introduced along with modified locally-made sharp containers. The hub is always cut and the syringes are disinfected in the autoclave so used syringes are made totally risk-free and cannot be reused anymore.

The workers at the centre are immunized against hepatitis B vaccination. Up-to-date record has been maintained and complete dose of immunization has been made mandatory for the workers. Workers of the waste management centre are equipped with full personal protective equipment such as gown, gloves, masks and boots. Staffs are trained on the proper use and cleaning of their equipment and the importance of using it during their working hours.

The HECAF team is also exploring different brands of syringes available in the market. Some of them are defective or even used syringes that have been repackaged. They can often be identified since the labelling is not proper.

**Specifications in respect of the Bir Hospital Health Care Waste Management System**

<table>
<thead>
<tr>
<th>Name of Hospital/Location</th>
<th>Bir Hospital, Kathmandu</th>
</tr>
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<tbody>
<tr>
<td>Established Date</td>
<td>1889AD</td>
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<td>Type of Hospital</td>
<td>Tertiary, Government</td>
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<tr>
<td>Number of Beds</td>
<td>460</td>
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<tr>
<td>HCWM system Implementation date</td>
<td>4th Shrawan, 2067/21 July 2010</td>
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<tr>
<td>Total Unit completed</td>
<td>21</td>
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<tr>
<td>Type of Treatment Technology of Risk Waste</td>
<td>Steam-based autoclave, chemical treatment of genotoxic pharmaceutical waste.</td>
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<tr>
<td>Waste Generated Rate (kg/bed/day)</td>
<td>0.498</td>
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<tr>
<td>Income per year</td>
<td>NRs 5,10,000 or US$ 6,000 per year</td>
</tr>
<tr>
<td>Income (Rs/bed/day)</td>
<td>NRS 3.015</td>
</tr>
</tbody>
</table>

We hope you enjoy the field trip and we welcome any questions you may have.

Thank you very much for your time!
Should you have further queries, please contact:

**Mahesh Nakarmi, Director**  
Healthcare waste Management Programme/HECAF  
mahesh.nakarmi@gmail.com,  
977-9851025549

**Shrawasti karmacharya, Program Coordinator**  
Health Care Waste Management Programme/HECAF  
shrawastikarmacharya@gmail.com,  
977-9849125422  
Mr Deepak Dahal  
kusms@ku.edu.np
Health-care waste poses significant health hazards in all countries of the South-East Asian Region. Health-care waste management is a cross-sectoral issue and requires the support of various agencies such as health, municipalities, infrastructure, the private sector etc.

WHO has been supporting Member States to develop policies, guidelines and laws on health-care waste management.

The WHO Regional Office for South-East Asia, in collaboration with the Ministry of Health (MoH), Government of Nepal, organized a regional workshop on Health-care Waste Management in Kathmandu, Nepal, from 7-9 December 2011, to review the status of the progress and also to share and learn from various country experiences.

Sixty-three professionals from the health sector and municipalities from countries in the Region and from several UN agencies, international nongovernmental organizations (INOGOs) and local nongovernmental organizations (NGOs) participated in the workshop.

This is a report of the proceedings of the workshop, and includes the discussions and recommendations.