Waste
Guidance Document for Members

Reduce, treat and safely dispose of healthcare waste
The GGHH Guidance Document Series

Global Green and Healthy Hospitals is producing a series of Guidance Documents—one for each of the ten GGHH goal areas. These documents are intended to assist GGHH member hospitals and health systems around the world reduce their environmental footprint and promote environmental health.

They are also designed as integral parts in a system that logically progresses from the Action Items in the GGHH Agenda; to Self-Assessment Checklists that members can use as a benchmarking tool; to the Guidance Documents themselves and associated case studies and resources; to a series of measurement tools to help members measure their progress over time.

These documents, which are available to members as an integrated online system via GGHH Connect, are also downloadable in PDF format. They are designed as participatory, living documents. That is to say, GGHH wants membership feedback and suggestions for actions, examples, case studies with photos, links and the like so that these Guidance can evolve based on the real experience and input of our members. We aim to update them regularly.

About this Healthcare Waste Guidance Document

Healthcare waste management is often neglected by sectoral leaders, who do not regard it as a priority in comparison to the many other tasks involved in caring for the sick. However, scientists have estimated that over half of the world’s population is at risk from environmental, occupational or public health threats deriving from improperly treated healthcare waste1 and the UN Human Rights Council agree that improper waste treatment often breaches human rights2.

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This health care waste management guide sets out ways to meet the target of treating waste in the most sustainable way considering that the different situations found in different countries will mean there is no perfect solution that will suit all circumstances. The recommended actions are supported with links to case studies and other resources that have been successfully implemented and should provide good models to those trying to tackle this complex issue.

This document was produced in collaboration with Mazetti, Foursight - an employee-owned benefit corporation providing Finance, Planning, Project Delivery, Research and Policy in a number of fields, including designing human-centered healthcare infrastructure. GGHH acknowledges the significant technical contribution made by Mazetti, Foursight in developing this document, as well as the GGHH Water document. For more information see: http://www.mazzetti.com

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The aim of the waste goal:
- to reduce the amount and toxicity of the waste generated at the facility;
- to ensure staff area able to handle waste safely;
- To ensure that any waste that is generated is transported, stored, treated, recycled, or disposed of in the most environmentally friendly way possible and poses no threat to staff, patients, or the public.
- To promote a policy framework that supports the safe management of wastes from health care activities

www.greenhospitals.net  www.noharm.org  www.medwastealternatives.org

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Overview

Healthcare waste management is often neglected by sectoral leaders, who do not regard it as a priority in comparison to the many other tasks involved in caring for the sick. However, scientists have estimated that over half of the world’s population is at risk from environmental, occupational or public health threats deriving from improperly treated healthcare waste and the UN Human Rights Council agree that improper waste treatment often breaches human rights.

The World Health Organization has specified in its Core Principles that “a holistic approach to healthcare waste management should include a clear delineation of responsibilities, occupational health and safety programs, waste minimization and segregation, the development and adoption of safe and environmentally-sound technologies, and capacity building.”

This guide sets out ways to meet the target of treating waste in the most sustainable way considering that the different situations found in different countries will mean there is no perfect solution that will suit all circumstances. However, among the case studies and other resources, there are examples of diverse methods that have been successful and should provide good models to those trying to tackle this complex issue.

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Policy framework for national legislation/regulation on health care waste management

It is the responsibility of governments to set up the necessary legal framework for the safe management of healthcare waste and to ensure that health care facility managers take their share of responsibility to manage wastes safely and comply with national regulations. GGHH members can work to advocate for appropriate policy including “zero waste” policies that will reduce the amount of waste generated and enable health systems efforts on sustainability.

Legal provisions

National legislation is the basis for improving healthcare waste practices in any country. It establishes legal controls and permits the national agency responsible for the disposal of healthcare waste, in most cases the ministry of health, to apply pressure for their implementation. The ministry of environment or national environmental protection agency may also be involved; there should be a clear designation of responsibilities before the law is enacted.

The law should be complemented by a policy document, and by technical guidelines developed for implementation of the law.

This legal “package” should specify regulations on treatment for different waste categories, segregation, collection, storage, handling, disposal, and transport of waste, responsibilities, technical guidelines and training requirements. It should take into account the resources and facilities available in the country concerned and any cultural aspects linked to waste handling.

A national law on healthcare waste management may stand alone or be part of more comprehensive legislation such as the following:

- law on management of hazardous wastes: application to healthcare waste should be explicitly stated;
- law on hospital hygiene and infection control: a specific chapter or article should be devoted to healthcare waste.

The law should include the following:

- harmonization with legislation on waste from other sectors e.g. color code for waste streams, policies on radioactive waste, dangerous goods transport, etc.
- a clear definition of healthcare waste and of its various categories;
- a precise indication of the legal obligations of the healthcare waste producer regarding safe handling and disposal;
- standards governing the protection of workers’ health and safety
- specifications for record-keeping and reporting;
- specifications for an inspection system to ensure enforcement of the law, and for penalties to be imposed for contravention;
- designation of responsibilities for handling disputes arising from enforcement of or non-compliance with the law.

Gradual implementation of the law—for example, requiring the largest facilities to comply first—is recommended in preference to any attempt to introduce all measures simultaneously, particularly where existing practices are inadequate. The government should provide adequate funding for public hospitals to include health care waste management (HCWM).
Policy and Strategy document(s)

The policy document should outline the rationale for the legislation, plus national goals and the key steps essential to the achievement of these goals. It may contain the following:

- harmonization with legislation on waste from other sectors e.g. color code for wastestreams, policies on radioactive waste, dangerous goods transport, etc;
- descriptions of the health and safety risks resulting from mismanagement of healthcare waste (HCW);
- reasons for sound and safe healthcare waste management practice;
- listing of approved methods of treatment and disposal for each waste category;
- warning against unsafe practices, such as disposing of hazardous HCW in municipal landfills;
- management responsibilities within and outside healthcare establishments;
- strategies to encourage and facilitate collaboration among stakeholders such as hospitals, suppliers, inspection authorities;
- assessment of the costs of health-care waste management (HCWM);
- key steps of HCWM: minimization, segregation and containerization, transport, storage, treatment and final disposal of waste;
- Technical specifications for the implementation of each step should be described in separate technical guidelines;
- Performance targets to be achieved and overall goals of the legislative strategy.

ensure that safe practices are observed and appropriate standards achieved:

- legal framework covering safe management of HCW, hospital hygiene, and occupational health and safety (limits of emission of atmospheric pollutants and measures for protection of water and soil resources may be addressed here or in the other national guidelines);
- the responsibilities of public health authorities, the national environmental protection body, heads of HCWs, of the scattered and smaller producers of HCW; and the heads of any private or public waste-disposal agencies involved;
- training requirements;
- safe practices for waste minimization;
- segregation, handling, storage, and transport of healthcare waste;
- recommended treatment and disposal methods for each category of HCW and for wastewater.

For ease of application, the definitions of HCW categories included in the law should be repeated in the technical guidelines.

Zero Waste

Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.

Technical Guidelines

Technical guidelines should help each health-care facility (HCF) to set procedures and plans for safe and environmentally sound HCWM, including a HCW monitoring system. They should include the following specifications, with sufficient detail to

Action Items

The action items are aimed at implementation at the level of the health facility, based on those in the GGHH agenda and grouped under the headings of: Policy; Context/Setting the baseline; Implement the most environmentally friendly waste management system; Reduce waste volume and toxicity.
Policy

Set up a waste management committee and allocate a dedicated budget for waste management

A Waste Management Committee (WMC), composed of representatives from various departments, assesses and develops goals, programs, and policies for safe, efficient, effective and sustainable waste management operations that reduce waste and minimize disposal impacts on the community and environment. This may be a subcommittee with delegated authority from the environmental health and safety or infection prevention and control committees.

How-to Guide:

1. **Form the Committee - membership**
   a. Representative of the head of the hospital and key departments including health and safety manager, housekeeping, facilities, maintenance, laboratory, purchasing, nursing administration, medical services, pharmacy. Volunteer participation is preferable to mandatory, but representatives of every mentioned area are needed to develop and implement policies, programs and procedures, including goals to be achieved applicable to every service and time should be set aside in participants’ workplans for these duties.
   b. Additional members include interested staff who are able and willing to volunteer.
   c. Ad hoc members with special expertise can be called at any time. Ad hoc members could be also representatives of services that generate special wastes as odontology, radiology, oncology or pathology, and called only when meetings need their participation.

2. **Appoint a Waste Management Officer.** This could either be a full-time position or a designated responsibility of an existing member of staff. Tasks and Terms of Reference include:
   a. Convene meetings of the Committee,
   b. Control and plan environmental initiatives,
   c. Organize orientation to new hires on waste management plans and policies,
   d. Oversee and audit facility to determine potential sustainable changes,
   e. Participate in purchasing decision making to ensure adequate supply and quality of needed commodities including waste bins, sharps containers, personal protective equipment for waste handlers,
   f. Liaise with all departments to ensure that they provide suitable documentation and data on environmental improvements, such as waste reduction, financial benefits and environmental impacts,
   g. Determine level of compliance with environmental policies and procedures.

3. **Strategic Planning**
   a. Develop or assess and recommend changes to the facility waste management policy in compliance with national/local policy. The UNDP/WHO/HCWH Global Healthcare Waste Management Project has developed a model facility waste management policy (see additional resources below). A newly formed waste management committees may choose to use this tool for the first year of operation and then adapt it to meet the local situation.
   b. The Committee needs to know all legislation applicable to healthcare wastes management in their country, state and city.
   c. The Committee needs to develop the overall waste program goals but in order to do that, must understand the place from which you are starting your journey. First gather the baseline information necessary to determine the total weight and cost of each type of waste generated, and then establish your own goals. The goals should be practical, possible and measurable.
   d. Set short and long term numeric (measurable) goals. This might include, for example, increasing the recycling rate to X% by the end of the year and by Y% by the end of 5 years; or the reduction in medical waste per bed to X kilograms or pounds per patient bed. Numerical goals are important to monitor the execution of the program. Basic metrics include pounds or
kilograms of wastes generated per occupied bed, patient visit, and/or staff person. The GGHH self-assessment process will help to track progress towards some goals, but facilities may want to set other or more ambitious targets depending on their situation.

e. The Committee should then develop the facility’s waste management plan of action to meet the goals. The plan of action should have specific objectives, goals, activities and a timeline established by the Committee and approved by managers.

f. Establish a process to continuously collect data, measure and report progress.

g. Determine how the medical facility can engage with their community to raise environmental health awareness.

4. **Develop procedures to ensure safe handling of materials and waste at each step along the way.** Gather current waste management policies and procedures including handling, storage, and transportation of waste from facility. Safe handling starts even before the materials become waste. Procedures need to be consistent with infection prevention and control and occupational health and safety specific procedures.

a. Procedures must be compliant with national legislation. Contact local authorities to ensure environmental, health and safety issues are being considered.

b. Where written protocols and procedures already exist, conduct an audit to assess whether the current reality is consistent with the procedures. If not, determine how to address the gaps and update the procedure if necessary.

5. **Operations**

a. Work with waste haulers and vendors to maximize the effectiveness of the management plan for each waste.

b. Hold regular meetings to discuss and address issues related to waste management. During the first year during the development and implementation of a waste management program, weekly or biweekly meetings may be needed. Thereafter they may be monthly or quarterly depending on the issues requiring resolution and the time and resources required for the meetings.

c. Develop a process to gather input from department managers and other staff.

d. Develop a problem resolution plan for waste management problems as they are brought to the attention of the Committee.

6. **Training and Education**

a. Ensure that all members of staff are properly trained (see also training sections below).

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Recycled drink bottles used to build walls, Philippines. Photo: HCWH-Asia
Schematic of a waste management committee

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Case Studies

- Philippines Heart Center & Philippines Children’s Medical Center, Quezon City, and San Lazaro Hospital, Manila, Philippines “Best Practices in Healthcare Waste Management,” HCWH Asia  
- Royal Adelaide Hospital, Adelaide, SA, Australia  
  http://www.hcifonline.org/content/document/detail/940/
- Inova Fairfax Hospital, Falls Church, VA, USA Practice Greenhealth. “Greening the OR.” Guidance Documents. 2011  
  http://practicegreenhealth.org/initiatives/greening-operating-room

Additional Resources

- World Health Organization’s Health Care Waste Management website  
  http://www.who.int/water_sanitation_health/healthcare_waste/en/
  http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf
  http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/03/01/000356161_20130301132159/Rendered/PDF/756790v10WP0P000Management0Vol10VolII.pdf
  https://noharm-global.org/documents/facility-waste-management-oversight-committee-%E2%80%92-guidance

Waste segregation trolleys, Nepal  
Photo: Nakarmi/HECAF
An audit will help illustrate areas with good practice, deficiencies as well as opportunities for improvement. Periodic check-ups ensure the facility is on target and allow for adjustments to the program in order to meet waste management goals.

The main purpose of the waste audit is to identify and track the different types of waste, but other issues should also be audited according to similar procedures:

- assess medical waste handling, worker safety of waste handlers, transportation, and storage practices
- assess level of compliance with governmental and other relevant guidelines
- assess availability and placement of waste bins and sharps containers (safety boxes)
- audit existing waste-related equipment to ensure everything is functioning properly
- determine possible options for an alternative process or treatment technology
- determine awareness and attitudes about waste management at all levels
- determine status and need for training on health care waste handling

Procedure for a waste assessment:

1. **Gather data benchmarking factors:** Number of beds, average occupancy (also known as average daily census), number of full-time staff/equivalent (FTE), number of patient visits. These will be important to set targets for year-to-year progress. The most commonly used measures are, total waste/bed/day, infectious waste/bed/day, total waste/occupied bed/day and infectious waste/occupied bed/day. Waste/FTE/day may also be useful especially for non-bedded settings such as health or diagnostic centers.

2. **Perform a comprehensive audit of medical waste streams.**
   a. Determine weight and volume of each hazardous and non-hazardous waste stream. Refer to locally applicable legislation for the relevant categories; otherwise use the WHO categories below. For information about construction waste, refer to
the Buildings guidance; wastewater is dealt with in the Water guidance.
- **Sharps waste**: Used or unused sharps (e.g. hypodermic, intravenous or other needles; auto-disable syringes; syringes with attached needles; infusion sets; scalpels; pipettes; knives; blades; broken glass)
- **Infectious/biohazardous waste**: Waste suspected to contain pathogens and that poses a risk of disease transmission (e.g. waste contaminated with blood and other body fluids; laboratory cultures and microbiological stocks; waste including excreta and other materials that have been in contact with patients infected with highly infectious diseases in isolation wards)
- **Pathological waste**: Human tissues, organs or fluids; body parts; fetuses; unused blood products
- **Pharmaceutical waste, cytotoxic waste**: Pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals; cytotoxic waste containing substances with genotoxic properties (e.g. waste containing cytostatic drugs—often used in cancer therapy; genotoxic chemicals)
- **Hazardous chemical waste**: Waste containing chemical substances (e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents; waste with high content of heavy metals, e.g. batteries; breakage from mercury-containing thermometers and blood-pressure measuring devices)
- **Radioactive waste**: Waste containing radioactive substances (e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources)
- **Non-hazardous or general health-care waste**: Waste that does not pose any particular biological, chemical, radioactive or physical risk such as food waste, uncontaminated paper, plastics, bottles, cans, carton, etc which can be early targets for recycling.

3. **Collect Waste Cost Data**
   a. Collect data in bills, invoices, manifests relating to waste generation, collection, transport, treatment and disposal and all associated costs for at least 12 months.
   b. Determine monthly and annual weights and costs for each waste stream and for the total waste generated.
   c. Determine the potential value of recyclables such as paper, plastic, glass and metal.

4. **If not in place currently, establish an ongoing system to collect and record data for all waste streams.**

5. **Analyze data and set goals for improvement goals considering the following:**
   a. The proportion of waste being treated and disposed of by environmentally preferable methods such as recycling or autoclaving.
   b. Reduction in the amount of hazardous wastes requiring treatment.
   c. Reduction in the total amount of waste requiring disposal.
   d. Elimination of certain wastes (e.g. mercury containing wastes) through product substitution.
   e. Increases in the proportion of wastes recycled.

6. **Goals should be:**
   a. Feasible, measurable, and set within a specified timeframe.
   b. Reflective of other benchmark goals from other medical facilities.
   c. Goals and the steps for implementation and acceptance should be included in the Action Plan.
   d. Designate a "point person" for each area or department of hospital to communicate goals to respective personnel, report stock-outs and be accountable for the performance of said area or department.

7. **Communicate the results of the assessment and share goals and targets for improvements.**

**Case Studies**
- AMS Bio-Medical Waste Audit Report, India
Additional resources

  http://gefmedwaste.org/downloads/Baseline%20Assessment%20Guidance%20April%202010%20UNDP%20GEF%20Project.pdf

- Self-Assessment Manual for Proper Management of Medical Waste, California Department of Health Services.  

- World Health Organization’s Definitions and Characterizations of Health-Care Waste  
  http://www.who.int/water_sanitation_health/medicalwaste/wastemanag/en/

  http://www.who.int/water_sanitation_health/medicalwaste/hcwdmguide/en/

- Practice Greenhealth’s Eco-Checklist and Greenhealth Tracker Tool  
  http://practicegreenhealth.org/tools-resources/greenhealth-tracker

- Green Guide for Health Care  
  http://www.gghc.org/

- Hospitals for a Health Environmental Self-Assessment Guide  
  www.practicegreenhealth.org/pubs/selfasmt.pdf

Segregate waste at source and initiate recycling

Segregation at the source (where the waste is produced) is essential to reduce the amount of waste requiring special treatment, to maximize the amount of waste that can be recycled and to protect workers. When healthcare waste is not segregated and is comingled, all of the mixed waste becomes hazardous requiring special treatment. Effective waste segregation can reduce the proportion of healthcare waste requiring treatment to 15% of the total or less. Some general rules for waste segregation include:

1. Use consistent color coding throughout the facility. Use either nationally approved coding or, if there is no national scheme, use that recommended by the World Health Organization in its manual: Safe management of wastes from health care activities, 2014 (see table 7.1 on page 79).

2. Size the container for appropriate quantities of waste generated per area or department.

3. All bins should be clearly labelled, with a poster or chart nearby explaining exactly where wastes should be disposed. Use pictures in case staff or the public is unable to read the language used for labeling.

4. Pay close attention to placement of bins.
   - Place the appropriate bins where different types of waste are likely to be generated
   - Avoid placing individual bins by patient beds as they will be used for all types of waste. Involve employees in the determination of container placement.

5. Only non-hazardous waste bins should be placed in publicly accessible areas

6. Bins for infectious and other hazardous waste should be placed on treatment trolleys and safe areas such as sluice rooms.

7. Sharps containers and/or needle or hub cutters should be available within arm’s reach and in sight of the provider wherever injections are given, including on the treatment trolley.

8. Ensure an adequate supplies of sharps containers, bins and color coded bags or staff will not be able to comply with the system.
When a new waste management system is being put in place, initiate the segregation system only after treatment (and recycling) facilities have been established. It is discouraging for staff to be asked to segregate waste only to see it mixed together by the waste hauler at the end of the day. Should this occur, staff are likely to stop complying with the segregation system.

Waste bins and other containment must be appropriate in size and design.

- Pedal bins are recommended so users do not have to touch the lids
- Bins should be leak-proof.
- WHO has set prequalification criteria for sharps containers\(^8\). The most important are that they are:
  - Leakproof (fluid resistant),
  - Puncture proof,
  - Sealable for transportation, and
  - Appropriately sized openings to prevent people putting their hands in and to reduce spillage should they be knocked over.

Hazardous and non-hazardous wastes should be transported and stored separately. Bags of waste should not be carried by hand as they could leak and any sharps that have been misplaced in them can protrude and cause injury. Instead, they should be placed directly into a leak-proof bin on a trolley for transportation.

Transportation routes for hazardous wastes should, as far as possible, avoid public areas, infectious disease wards, and food storage and preparation areas. Waste transportation should be scheduled to avoid visiting hours and meal times. Storage areas should meet WHO guidelines as a minimum standard\(^8\) and hazardous wastes should be segregated according to properties to minimize risk. For example, acids and alkalis can react violently if they are mixed and should be kept separate.

Properly segregated non-hazardous recyclables may be sold to reputable dealers. Certain hazardous materials such as solvents or batteries may be sold to properly licensed operatives where they exist. All transactions should be recorded for auditing purposes.

Before changes to segregation and handling procedures are initiated, they should be discussed with the relevant staff, training provided and procedures implemented progressively to improve the chance for success.

In low income countries, staff sometimes sell wastes informally to supplement their income, even including dangerous wastes such as pharmaceuticals or syringes. Where this occurs, action must be taken to prevent it. Waste should be sold only through designated official channels. Where it has been the practice for staff to sell waste unsanctioned, some hospitals have set up trust funds to use the income from waste sales for the benefit of staff and provide an incentive to adhere to new sales policies.

1. Pick a model ward to start implementation
2. Orient staff in the new system (knowledge and skills)
3. Discuss with staff issues and needs for amounts and location and agree on the number and placement of bins and sharps containers
   a. Include bins and sharps containers on the treatment trolley so waste can be segregated at the bedside
   b. Consider the practical application in work units and accommodate needs of the staff to facilitate compliance
4. Monitor closely after implementation
   a. Assign responsibility of in-charge on unit to check bins every shift and record segregation status
   b. In-charge should reinforce effective segregation and correct staff as needed in a timely manner using supportive supervision
   c. Make frequent, unscheduled inspection visits
   d. Ensure adequate supplies, collection and replacement of containers when full
   e. Reinforce training if segregation is not done properly
   f. Collect feedback and comments from ward staff, patients and visitors

5. Optimize system based on feedback
6. Once the model ward is working satisfactorily, replicate to other wards
   a. Avoid starting too many wards at once
   b. Be prepared to vary the bin placement according to the needs of the new wards
   c. Enlist the help of staff from the model ward wherever possible to provide training to their colleagues in support of the scaling-up across the facilities
   d. Continue monitoring and acknowledge and/or reward the best performing wards.

Recycling in hospitals is most commonly materials recycling, where paper, plastics, aluminum soda cans, etc. are reprocessed into new products. However, it is also possible to reuse some materials in-house, for example turning old sheets into cleaning cloths. Patients and staff can also use non-hazardous materials for crafts.

**Case Studies**

- Israeliita Albert Einstein Hospital, Sao Paulo, Brazil. “Eliminating Electrical and Electronic Equipment.” [http://www.hospitaisaudaveis.org/arquivos/Eletroeletr%C3%B4nicos%20-%20Albert%E2%80%92%20Einstein%20-%20SP.pdf](http://www.hospitaisaudaveis.org/arquivos/Eletroeletr%C3%B4nicos%20-%20Albert%E2%80%92%20Einstein%20-%20SP.pdf)
- HCWH SEA and UNDP GEF (2013) From the backyard to the frontline: initiatives of Philippine hospital worker on best environmental practices. [http://www.noharm.org/lib/downloads/waste/From%20the%20Backyard%20to%20the%20Frontline.pdf](http://www.noharm.org/lib/downloads/waste/From%20the%20Backyard%20to%20the%20Frontline.pdf)

**Implement a waste management training program**

Wastemanagement training should be mandatory for all staff, including clinical, administrative staff and senior management, with curricula tailored to their needs. Materials such as i.e. job-aids, pamphlets, flyers, video, etc. should be readily available for patients’ and visitors.

It is essential that waste handlers are included not just in educational schemes, but also vaccination and occupational health programs, have the proper personal protective equipment (PPE) and have been trained on its use. Vaccination of clinical staff is commonly done, but waste handlers are often neglected, despite the fact that they are exposed to more infectious material than many health-care providers.

Waste handlers should be immunized with three doses of the hepatitis B virus vaccine and also the tetanus toxoid vaccine.

A lack of attention to the health and safety needs of waste handlers frequently extends to the training and provision of protective gear, a situation that is
exacerbated as more and more healthcare facilities outsource cleaning and waste handling to subcontractors. The subcontractors’ staff may have rapid turnover and little experience, but it is the duty of the healthcare facility management to make sure that they have the same health and safety provisions as their own staff.

When a new healthcare waste management system is implemented in a healthcare facility, it is usually most effective to roll it out incrementally. In this case, a general awareness raising exercise can be carried out for all staff at the start of the process, but it is most effective if detailed training is carried out for each ward or section immediately before they have to start using new practices and products.

Refer to the UNDP/WHO/HCWH Core Competencies Related to Healthcare Waste Management for an overview of the areas on which different members of staff will need to be educated. Other training resources are listed below.

Educate staff in orientation training programs, workshops, lectures, and seminars. Periodic refresher training will be needed. Distribute printed education materials, such as posters for posting in staff break rooms, utility rooms and waste handling areas.

### Additional resources

- **HCWH SEA and UNDP GEF (2013).** From the backyard to the frontline: initiatives of Philippine hospital workers on best environmental practices. 60pp, [http://www.noharm.org/lib/downloads/waste/From%20the%20Backyard%20to%20the%20Frontline.pdf](http://www.noharm.org/lib/downloads/waste/From%20the%20Backyard%20to%20the%20Frontline.pdf)

Implement an environmentally friendly waste management system

Introduce non-burn treatment technology

Waste reduction is an essential element of a sustainable waste management policy and is addressed elsewhere in this document. Segregation will likewise ensure that each waste stream goes to the correct treatment, which is essential for resource conservation and in order to avoid sending more waste than necessary to expensive treatment processes.

Technologies available for the treatment and destruction of healthcare waste include:

- Autoclave and autoclaves with grinders/shredders
- Microwaves
- Chemical treatment technologies such as disinfectants, chemical degradation methods and Alkaline hydrolysis
- Incineration including pyrolysis
- Encapsulation and inertization
- Composting (food and other organic waste)

The different technologies are suited to treat different types of healthcare waste depending on the component and hazardous nature of the waste. More information about the different waste treatment technologies and how they function can be found in the resource documents, especially WHO Safe Management of Wastes from Health Care Activities (2014) and UNEP Compendium of Technologies for treatment/ destruction of healthcare waste (2012).

For waste that requires treatment, it is important to avoid incineration and instead utilize alternative technologies. A listing of suppliers for non-incineration technologies can be found at www.medwastealternatives.org.

The treatment of medical waste has historically involved incineration, a significant contributor to environmental emissions and a potential economic burden on healthcare facilities. All but the most basic incinerators operate at over 1000 centigrade (1800 fahrenheit). Less polluting alternative treatment technologies operate at temperatures up to around 180 centigrade (350 fahrenheit). These lower temperatures supply the necessary treatment and disinfection of infectious and medical waste without the physical and chemical changes of combustion, gasification and pyrolysis that produce such hazardous byproducts. More information about the different waste treatment technologies and how they function can be found in the resource documents, especially WHO (2014) and UNEP (2012).

Incinerators emit toxic pollution—including the persistent and highly toxic dioxins and furans. Metals such as mercury will not be destroyed but either emitted or retained to contaminate the ash. Most of the countries of the world—179 at the time of writing—have signed the Stockholm Convention (www.POPs.int). This Convention is dedicated to the elimination of the most toxic and persistent pollutants, including dioxins and furans and recommends that non-incineration methods are used.

Small scale incinerators of the type commonly used in low and middle income countries are particularly polluting and WHO policy calls for their phase-out and substitution with alternative technologies such as steam-based treatment.

Infectious waste is the highest profile risk waste produced by health services. Several non-incineration waste treatment technologies that can deal with this effectively include: autoclave, microwave, dry heat and frictional heating. Given their highly infectious nature, it is recommended that laboratory cultures and stocks are autoclaved in
the laboratory, rather than transporting contaminated waste elsewhere for disinfection.

Sharps, especially hollow-bore needles, cause injury and infection. Unsafe injections cause millions of cases of HIV, hepatitis and bacterial infection every year. Needle destroyers and hub cutters are used in some settings according to local/national regulations. Their use reduces the volume of waste in sharps containers, prevents injury during waste disposal and prevents the illegal reuse of syringes. After disinfection, it may even be possible to recycle the syringe plastic, and recoup some of the costs of treatment.

Wherever possible, purchasing contracts for pharmaceuticals and other hazardous chemicals should include a take-back agreement whereby the supplier takes responsibility for disposal of any unused products. Disposal of pharmaceutical waste down the drain is to be avoided at all costs.

Non-incineration options for waste pharmaceuticals include inertisation or encapsulation. These methods are recommended by the WHO for emergency situations, but can be used routinely where no better option exists. Some chemotherapy drugs can also be inactivated through simple reactions, as described in the WHO manual (WHO, 2014). Finally, alkaline hydrolysis, a technology mostly used for tissue digestion, can also destroy certain pharmaceuticals and other hazardous laboratory chemicals. More research is needed on this last application.

Pathological waste can be dealt with in different ways, according to the local customs, legislation, infrastructure and resources. It may be appropriate for recognisably human materials such as amputated limbs, to be treated like a body, and buried or cremated, as is customary. However, incineration of pathological waste requires large amounts of energy and where the legislation allows and customs permit other options should be explored.

Tissue digesters can dispose of all types of pathological waste, including tissue samples that have been stored in formalin. Certain pathological wastes can be disposed of to sewer so long as there is an adequate sewage treatment plant and precautions are taken to prevent pipe blockage and avoid avoid worker exposure to aerosolized waste particles and droplets. Blood and blood products can be disposed of in this way, and the installation of a macerator also opens this option for placenta and other similar wastes. In low infrastructure areas, well-designed placenta pits can provide an effective way of disposing of pathological and other organic wastes.

Food and other organic waste, eg from the facility gardens, can be biodigested, composted or, where the law allows, sold for animal feed. Other options included MBT (mechanical biological treatment), or, less favourably, maceration and discharge to sewer, or landfill.

More information about the different waste treatment technologies and how they function can be found in the resource documents, especially WHO (2014) and UNEP (2012).

The table below gives certain options for disposing of health-care wastes in low income countries.

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Rotating waste autoclave and centralized treatment facility, Latvia

Photo: Ruth Stringer/HCWH
<table>
<thead>
<tr>
<th>Wastes</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedded</td>
<td>Non-bedded</td>
</tr>
<tr>
<td>Glass sharps</td>
<td>Dispose of in a sharps pit (small amounts) or landfill</td>
<td>Dispose of to landfill. May be recycled if not contaminated.</td>
</tr>
<tr>
<td>Anatomical wastes (visibly human tissue)</td>
<td>Bury or treat as you would a dead body if laws or customs require; otherwise treat as pathological waste</td>
<td></td>
</tr>
<tr>
<td>Pathological (body parts, tissues, placentas, etc.)</td>
<td>Biodigester, where not available, use placenta pit</td>
<td>Biodigester or tissue digester. Maceration and discharge to sewer also possible in larger facilities where proper maintenance and protection against possible exposure to aerosolized particles is possible. Deep burial in landfill if these are not available. Incinerate only if dictated by legislation</td>
</tr>
<tr>
<td>Syringes</td>
<td>Remove needle from syringe using needle cutter. Autoclave plastic syringe body and recycle if possible. Landfill if recycling is not possible. Treat needle as infectious sharps waste (see below).</td>
<td></td>
</tr>
<tr>
<td>Sharps - metal, Syringe needles, lancets, scalp blades etc</td>
<td>As for urban facility, but if not available, dispose in a needle or sharps pit</td>
<td>Contain, autoclave if required by law and send for metal recycling at an authorized facility.</td>
</tr>
<tr>
<td>Lab samples (tissues, biopsies, etc)</td>
<td>Samples that do not contain preservatives should be autoclaved in the laboratory, then discarded as general waste or processed so the glassware can be reused. Those containing toxic preservatives such as formalin, should be drained, the solids contained for landfill, and the liquids sent for treatment.</td>
<td></td>
</tr>
<tr>
<td>Dressings &amp; other soft waste</td>
<td>Autoclaved, then disposed of in wormery if available or landfillfilled.</td>
<td></td>
</tr>
<tr>
<td>Blood and body fluids</td>
<td>Discharge to biodigester/septic tank or discard in a Placenta Pit for small volumes. Discharge to sewer if connected to authorized Wastewater Treatment Works.</td>
<td></td>
</tr>
<tr>
<td>Liquid cultures &amp; stocks</td>
<td>Autoclaved in the laboratory, then discarded to drain as liquid waste.</td>
<td></td>
</tr>
<tr>
<td>Sewage (urine &amp; feces)</td>
<td>Discharged to sewer if authorized Wastewater Treatment Works discharge available. Treated in Biodigester or Septic tank with French drain. Biodigesters should only be used if the waste has a low content of disinfectants and other toxic materials.</td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td>Small amounts to drain once neutralized, larger volumes to be collected and returned to supplier or central treatment facility.</td>
<td></td>
</tr>
<tr>
<td>Cytotoxic and cytostatic drugs</td>
<td>Chemically neutralize residues in giving sets and empty vials etc. before disposing to drain. For larger quantities, ideally return to supplier. Send for centralized treatment if the law requires.</td>
<td></td>
</tr>
<tr>
<td>Pharmaceuticals (unwanted or expired)</td>
<td>Return to supplier. If not possible, encapsulate and inertize, then landfill. Send for centralized treatment if the law requires.</td>
<td></td>
</tr>
<tr>
<td>Solid (including empty hazardous containers)</td>
<td>Return to supplier, including nominally empty containers – do not landfill unless there is no alternative. In this case, crush or puncture containers to prevent reuse, then dispose of in a landfill. Workshop/maintenance wastes – contain and pretreat as per legal requirements for disposal in a landfill designed for hazardous wastes.</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>Regulated gases e.g., ozone-depleting gases (HCFCs), should be collected and returned to supplier; others vented in small quantities.</td>
<td></td>
</tr>
<tr>
<td>Heavy metals (e.g. mercury from broken/redundant equipment)</td>
<td>Safely contain, store and transport to central collection site for treatment prior to safe disposal, as per legal or WHO requirements.</td>
<td></td>
</tr>
<tr>
<td>Radioactive materials</td>
<td>Delay to decay for small quantities of short-lived isotopes. Return sealed sources to suppliers. Otherwise, safely store and send for treatment as per national and International Atomic Energy Agency (IAEA) requirements.</td>
<td></td>
</tr>
</tbody>
</table>

Steps for selecting waste treatment technologies

1. Planning
   a. Form a taskforce to examine current waste treatment and disposal technologies
      - Departments include (but not limited to): Administration, Infectious Control, Engineering, Health and Safety, Nursing, Housekeeping, Environmental Services, Procurement
   b. Determine training needs for the new disposal systems

2. Technology Selection
   a. Taskforce to perform in-depth audit of available technologies
      - Research various treatment technology vendors
      - Research technology manufacturer background
      - Determine reliability of treatment technologies
      - Research treatment capacities of systems and determine capacity needs
      - Determine types of waste treated by systems
      - Determine utility requirements
      - Determine potential emissions from use of treatment technology
      - Determine potential noise and odor factors
   b. Determine and compare viability of on-site treatment compared to off-site treatment, centralized or decentralized to manage health care waste from all of the health facilities in a particular city or region.
   c. Audit current facility capabilities
      - Infrastructure required for installation and operation
      - Determine adequate design for system
      - Labor available and required for equipment use and maintenance
      - Determine if the facility has staff who are trained to fulfill emission testing requirements
      - Review occupational health and safety requirements
      - Determine appropriate monitoring practices for systems

3. System Costs
   a. Determine capital costs of systems
   b. Determine operational costs (monthly, annually)
   c. Determine transportation, processing, and tipping fees for waste disposal
   d. Determine potential repair expenses and time lengths
   e. Research equipment failure costs and backup/alternative systems
   f. Explore funding options

4. Implementation
   a. Appoint a Health Officer as contact person for system
   b. Determine integration of treatment system with current waste management practices
   c. Install alternate technology into facility
   d. Perform tests to find most effective operating cycle
   e. Determine security practices for system

5. Training
   a. Perform training on infection prevention and control
   b. Perform training programs on waste segregation practices
   c. Perform training programs for system operations
   d. Perform orientation for system maintenance on set schedule

6. Monitoring
   a. Conduct internal monitoring
   b. Employ external monitoring to validate internal monitoring
   c. Determine appropriate schedule for monitoring (weekly or monthly or both)
Case Studies


- Fletcher Allen Healthcare, Burlington, VT, USA [http://practicegreenhealth.org/topics/waste/waste-categories-types/composting](http://practicegreenhealth.org/topics/waste/waste-categories-types/composting)


- HCWH Southeast Asia and UNDP GEF (2013). From the backyard to the frontline: initiatives of Philippine hospital workers on best environmental practices. [http://www.noharm.org/lib/downloads/waste/From%20the%20Backyard%20to%20the%20Frontline.pdf](http://www.noharm.org/lib/downloads/waste/From%20the%20Backyard%20To%20the%20Frontline.pdf)

Additional Resources


- Practice Greenhealth Composting Website [http://practicegreenhealth.org/topics/waste/waste-categories-types/composting](http://practicegreenhealth.org/topics/waste/waste-categories-types/composting)

- Stockholm Convention website: [www.pops.int](http://www.pops.int)


World Health Organization. See Chapter 8: Treatment and Disposal Methods.  
http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf

  http://www.who.int/water_sanitation_health/medicalwaste/hcwmpolicy/en/# (see below in Spanish)

- WHO (2004). Gestión sin riesgo de los desechos generados por la atención de salud  
  http://www.who.int/water_sanitation_health/medicalwaste/en/hcwmpolicies.pdf?ua=1

  http://www.who.int/water_sanitation_health/medicalwaste/unwantpharm.pdf

- Center for Climate and Energy Solutions’ Anaerobic Digester website  
  http://www.c2es.org/technology/factsheet/anaerobic-digesters
Check the treatment process from the hospital to recycling plants, treatment centers and landfill sites

Advocate for secure landfills

Regular inspection and auditing of the different segments of the waste treatment system is essential. Each element of the in-house system should be inspected at least quarterly, and preferably monthly and audited in more detail as necessary. Results from these inspections should be recorded and any action items reported to the Waste Management Committee.

The facility has a duty of care to ensure that any waste transported off site is also managed safely and sustainably. In some countries, it is a legal requirement. It may not be necessary to audit these facilities, if they are able to provide evidence of compliance with national legislation and international standards such as WHO guidelines and the Stockholm Convention on Persistent Organic Pollutants (POPs). Annual checks on external facilities should be carried out, or whenever new contracts are negotiated, whichever is the more frequent.

In many low and middle income settings, the final disposal sites—landfills— to which some of the waste is sent are not engineered to high standards. They may be poorly sited, or lack the liners and caps that prevent pollution leaching out; or accessible to scavenging animals, and pests which spread disease. Rag-pickers may be making a hazardous living from using or selling the scraps they find there; and in some cases, they may even be seeking out medical waste as some of it, such as syringes, can have a good resale value. Where this is the case, the healthcare facility should advocate for improvements, and ensure that their waste is not deposited in a fashion which may cause harm. Measures to prevent harm can include: disinfecting all waste before sending to landfill; making sure that hospital waste is deposited in a fenced area and covered daily; using needle or hub cutters so that syringes cannot cause needle-stick injuries, or be gathered for reuse.

Waste treatment equipment also needs routine maintenance and maintenance logs must be checked during auditing. Resources on this subject are to be found in the section on non-burn waste treatment technologies.

Additional resources

- Stockholm Convention Website: [www.pops.int](http://www.pops.int)
Reduce waste volume and toxicity

Implement environmentally preferable purchasing procedures

Implement a waste reduction program¹⁰

Create in-house procedures and a purchasing plan to reduce waste volume and potential toxicity. A reduction in the quantity of medical waste produced will reduce the demand and frequency for treatment of the wastes, thereby saving resources and energy costs. This will also reduce the final volume of waste entering landfills after appropriate treatment and the emissions produced during treatment.

The pharmacy is a priority target for a waste reduction strategy.

1. Conduct an audit of any drugs disposed by all departments of the facility and quantify the amounts of each type of drug that is unused because it has expired or because only part of a package is used.
2. Implement drug donation program: adhere to the WHO guidelines on donated drugs (see Additional Resources). Only medication needed in the health care center should be accepted, the expiration date should be at least one year at the time of reception unless it is assured that it can be used before expiry. Limit laboratories free samples and accept only those that are used in the health care facility.
3. Put in place strict rotation of products to ensure that those that expire first are dispensed first.
4. Research availability and efficacy of oral alternatives to medicines that are currently delivered by injection. Educate professionals to

¹⁰See also the GGHH guide to green purchasing
prescribe oral medication wherever possible to eliminate sharps use and waste.
5. Review the package sizes of pharmaceuticals to ensure that the correct amount is dispensed, avoiding wastage.

Other priorities for the waste aspect of an environmentally preferable purchasing plan include: substitution of mercury-containing medical devices and non-medical products with mercury-free alternatives; substitution of PVC products; substitution of hazardous chemicals; avoidance of unnecessary disposable products; avoidance of excessive or non-recyclable packaging.

Other ways to reduce the amount of hazardous waste include transitioning to paperless record-keeping and digital imaging, and utilizing sterilizable and reusable medical devices and sharps containers. Both medical devices and reusable sharps boxes can be disinfected either in-house or by a certified contractor and returned to use.

Additional resources

- HCWH website on PVC alternatives: http://noharm.org/europe/issues/toxins/pvc_phthalates/alternatives.php
- Health Care Without Harm's Tools and Resources website http://www.noharm.org/global/issues/toxins/pvc_phthalates/resources.php
- Practice Greenhealth's Mercury Elimination Tools & Resources http://practicegreenhealth.org/topics/chemicals/mercury/mercury-use-healthcare/
About Health Care Without Harm

Health Care Without Harm is an international coalition of more than 500 members in 53 countries that works to transform the health care sector so that it is no longer a source of harm to human health and the environment.

We collaborate with doctors, nurses, hospitals, healthcare systems, professional associations, NGOs, governments and international organizations to promote the development and implementation of safe and environmentally healthy practices, processes and products in the health care sector.

HCWH has regional offices in the United States, Latin America, Europe and South East Asia as well as strategic partners in South Asia and Africa.

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