



N-E-PS-1

Technical assistance on sustainable Medical Waste Management

Task 6 (D.7): Updated Health Care Waste Master Plan

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WATER AND ENVIRONMENT SUPPORT IN THE ENI SOUTHERN NEIGHBOURHOOD REGION

The "Water and Environment Support (WES) in the ENI Neighborhood South Region" project is a regional technical support project funded by the European Neighborhood Instrument (ENI South). WES aims to protect the natural resources in the Mediterranean context and to improve the management of scarce water resources in the region. WES mainly aims to solve the problems linked to the pollution prevention and the rational use of water.

WES builds on previous similar regional projects funded by the European Union (Horizon 2020 CB/MEP, SWIM SM, SWIM-H2020 SM) and strives to create a supportive environment and increase capacity all stakeholders in the partner countries (PCs).

The WES Project Countries are Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Libya, Palestine, Syria and Tunisia. However, in order to ensure the coherence and effectiveness of EU funding or to promote regional cooperation, the eligibility of specific actions can be extended to neighboring countries in the Southern Neighborhood region.







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ABBREVIATIONS

BEP	Best Environmental Practices
DMs	Decision Makers
EQA	Environment Quality Authority
нс	Health Centre
HCF	Health Care Facility
нсw	Health Care Waste
нсwм	Health Care Waste Management
нмм	Hazardous Waste Management
JSC	Joint Service Council
КРІ	Key Performance Indicator
KRM	Khan Yunis, Rafah, and Middle area (in Gaza Strip)
LGU	Local Government Unit
M&E	Monitoring and Evaluation
MoFP	Ministry of Finance and Planning
MoFP MoH	Ministry of Finance and Planning Ministry of Health
MoFP MoH MoLG	Ministry of Finance and Planning Ministry of Health Ministry of Local Government
MoFP MoH MoLG MOU	Ministry of Finance and Planning Ministry of Health Ministry of Local Government Memorandum of Understanding
MoFP MoH MoLG MOU NGOs	Ministry of Finance and PlanningMinistry of HealthMinistry of Local GovernmentMemorandum of UnderstandingNon-Governmental Organizations
MoFP MoH MoLG MOU NGOs PCBS	Ministry of Finance and PlanningMinistry of HealthMinistry of Local GovernmentMemorandum of UnderstandingNon-Governmental OrganizationsPalestinian Central Bureau of Statistics
MoFP MoH MoLG MOU NGOs PCBS PHCF	Ministry of Finance and PlanningMinistry of HealthMinistry of Local GovernmentMemorandum of UnderstandingNon-Governmental OrganizationsPalestinian Central Bureau of StatisticsPrimary Health Care Facility
MoFP MoH MoLG MOU NGOs PCBS PHCF PPE	Ministry of Finance and PlanningMinistry of HealthMinistry of Local GovernmentMemorandum of UnderstandingNon-Governmental OrganizationsPalestinian Central Bureau of StatisticsPrimary Health Care FacilityPersonal Protective Equipment
MoFP MoH MoLG MOU NGOs PCBS PHCF PPE PPP	Ministry of Finance and PlanningMinistry of HealthMinistry of Local GovernmentMemorandum of UnderstandingNon-Governmental OrganizationsPalestinian Central Bureau of StatisticsPrimary Health Care FacilityPersonal Protective EquipmentPublic Private Partnership
MoFP MoH MoLG MOU NGOS PCBS PHCF PPE PPP SDGS	 Ministry of Finance and Planning Ministry of Health Ministry of Local Government Memorandum of Understanding Non-Governmental Organizations Palestinian Central Bureau of Statistics Primary Health Care Facility Personal Protective Equipment Public Private Partnership Sustainable Development Goals
MoFP MoH MoLG MOU NGOS PCBS PCBS PHCF PPE PPP SDGS TBAS	Ministry of Finance and PlanningMinistry of HealthMinistry of Local GovernmentMemorandum of UnderstandingNon-Governmental OrganizationsPalestinian Central Bureau of StatisticsPrimary Health Care FacilityPersonal Protective EquipmentPublic Private PartnershipSustainable Development GoalsTraditional Birth Attendants
MoFP MoH MoLG MOU MOU NGOs PCBS PCBS PHCF PPE SDGS SDGS TBAS WB	Ministry of Finance and PlanningMinistry of HealthMinistry of Local GovernmentMemorandum of UnderstandingNon-Governmental OrganizationsPalestinian Central Bureau of StatisticsPrimary Health Care FacilityPersonal Protective EquipmentPublic Private PartnershipSustainable Development GoalsTraditional Birth AttendantsWest Bank







1 INTRODUCTION AND JUSTIFICATION

Short context reminder

Health care waste management in Palestine is driven by a number of concerns about potential health and environmental impacts.

Some improvements in health care waste management have been noticed since 2006 (issuance of Health Care Waste Master Plan) in terms of preparedness and willingness to improve some practices in governmental as well as private hospitals, the legal environment (new legislation adopted in 2012). Nevertheless, a number of studies and reports still refer to a number of challenges and common problems. The last one conducted by the Japanese cooperation agency (JICA) in 2019 identified several gaps and needs, including inadequate waste management, high operational cost, improper and poor control over disposal practices, insufficient financial resources and level of awareness about health hazards (see WES N-E-PS-1 inception report).

Aiming at further improvement in medical waste management, the EQA requested the WES Project to implement a national activity entitled "Technical assistance on sustainable Medical Waste Management".

The specific objectives of the activity are to:

- support Palestine in the update of the Master Plan with its Roadmap for health care waste and to reinforce capacities of different actors to improve management practices;
- define a set of measures and actions to develop a contingency / emergency plan to be executed in crisis situations (outbreaks, conflicts, earthquakes, pandemics, etc.).

Healthcare Waste (HCW) poses risks to human health and to the environment when managed inappropriately. Given the situation during the COVID 19 pandemic, the risks from inefficient HCW management were even higher. Hence the "Master Plan for Healthcare Waste Management West Bank/Gaza Strip" (Master Plan) states the following objective: "To establish a framework for a wide course of activities designed to optimally use the available resources and opportunities to improve the HCW management situation in WB/GS". This was based on a clear vision "to ensure that all waste generated within the health sector is managed without adverse effects on human health and the environment, in an integrated manner that is environmentally and economically sustainable".

In the present document, aiming to support the EQA in its Master Plan update, the gaps of the current Healthcare Waste Management System in the country are identified and accordingly, objectives, key statements and priorities of actions are outlined.

The updated Health Care Master Plan identifies healthcare waste management as an area of concern for health care quality. It states the enforcement of regulations and standards on the management of waste and waste reduction, including healthcare waste.

The purpose is to enforce the "Master Plan" by establishing a countrywide integrated healthcare waste management system, without adverse effects on human health and the environment, which shall be environmentally and economically sustainable.







Master Plan Update Methodology:

The update of the Master Plan for Healthcare Waste Management of 2006 was based on the belowlisted sequential steps:

- 1. A kick-off meeting with the key stakeholders, EQA, MoH and MoLG, where national priorities were identified by stakeholders.
- 2. Review of the 2006 Master Plan, identification of gaps, shortcomings and implementation challenges.
- 3. Review and analysis of national policies, legal instruments, laws and bylaws and ongoing plans and procedures for the management HCW.
- 4. Field survey covering HCFs in most of the West bank and Gaza area to collect data aiming at updating existing and reported data.
- 5. Review of several key documents provided by the EQA including:
 - a. National Solid Waste Strategy 2017-2022
 - b. WHO, 2014, Safe management of wastes from health-care activities, 2nd edition
 - c. Cabinet of Ministers (COM) number 10 for the year 2012 related to healthcare waste management
 - d. National Health Strategy 2021-2023, Ministry of Health (MoH)
 - e. The Environmental law No,7 of the year 1999
 - f. MOU signed between EQA, MOH and MOLG
 - g. Palestine's COVID-19 Response Plan and related COVID-19 protocols
 - Preventive public health and safety measures to be followed by institutions, companies, shops, professionals, drivers of public transport vehicles and citizens, COM, 2019
 - i. Solid Waste Management in the Occupied Palestinian Territory, West Bank, including East Jerusalem & Gaza Strip; Overview Report, Valérie Thöni & Samir K.I. Matar, 2019
 - j. Solid Waste Joint Service Councils annual reports.

HCWM Master Plan Priorities

Driven by the inception report conclusions on the general objectives to be reached, as well as numerous discussions with the EQA, MoH and other stakeholders, the present document is proposing updated Master Plan measures, based on a number of priorities, as follows:

- Review and update of the legal and institutional environment;
- Improve capacities and awareness of Health Care Facilities' staff;
- Adequacy of resources, technical and financial sustainability of HCWM;
- Improvement of emergency preparedness;
- Strengthening of monitoring and evaluation.

All chosen solutions included in the updated Master Plan, are inspired by international benchmarking and based on cost / benefit analysis specific to the State of Palestine.

Furthermore, the updated Master Plan indicates in its introduction paragraph that sustainable medical waste management is of great importance, not only for national health and environmental security reasons, but also as a contribution to the SDGs implementation in Palestine.







HCWM Master Plan objectives

The objectives of the HCWM Master Plan are to:

- 1. Strengthen policy, regulatory structure and mechanism for HCWM;
- 2. Provide infrastructure, commodity supplies and equipment for system strengthening in HCWM;
- 3. Build capacity among healthcare staff in HCWM;
- 4. Create awareness and advocacy on HCWM among healthcare workers and policy makers;
- 5. Prioritize HCWM in the planning process;
- 6. Develop a Monitoring and Evaluation framework plan and tools for HCWM.

The HCWM Master Plan seeks to ensure that health care waste is managed effectively in compliance with existing laws and regulations, in order to protect healthcare workers, their clients (patients, caregivers and visitors) and the environment from potentially disease-causing waste materials.

1.1 HCWM MASTER PLAN SCOPE

All waste that meets the definitions of hazardous waste shall be considered as such and be treated in conformity with all measures and other legal requirements in force at the time.

The HCWM Master Plan applies primarily to all health institutions whether public, private, nongovernmental that operate in the country at all levels:

Tertiary / Teaching / Specialist Hospitals, Health Centres / Clinics, Health Research and Educational Institutions, Laboratories, Alternative Health Care Providers (including traditional healers and Traditional Birth Attendants (TBAs), pharmacies, pharmaceutical industries, blood banks and chemists are also included. Recently established COVID-19 testing, vaccination centres, as well as home-based care for persons infected with COVID-19.

Whilst reference may be made to general domestic waste generated by these institutions, the focus of the HCWM Master Plan is health care waste that is considered hazardous. Institutions and companies with responsibility for treatment, transport and disposal of waste are also expected to comply with all principles and measures laid down in the HCMW Master Plan.

The plan classifies waste into hazardous and non-hazardous waste and details steps in its handling; from generation, segregation, storage, transportation and treatment to final disposal, as well as equipment and tools required. It also assigns roles and responsibilities to various stakeholders and further prescribes measures for protection of handlers.

1.2 HCWM PRINCIPLES

HCWM shall be based on the following frameworks/principles:

• The Basel Convention, signed by more than 100 countries including Palestine, concerns transboundary movements of hazardous waste; it is also applicable to health-care waste. Countries that signed the Convention accepted the principle that the only legitimate transboundary shipments of hazardous waste are exports from countries that lack the facilities or expertise to dispose safely of certain wastes to other countries that have both facilities and expertise. Exported waste should be labelled according to the UN recommended standards.







- The "polluter pays" principle: as was shown in a number of national documents including the National Water Policy for Palestine 2013-2032, and the National Strategy for Solid Waste Management in the Palestinian territory 2010-2014. This principle implies that all producers of waste are legally and financially responsible for the safe and environmentally sound disposal of the waste they produce. This principle also attempts to assign liability to the party that causes damage.
- **The "precautionary" principle** is a key principle governing health and safety protection. When the magnitude of a particular risk is uncertain, it should be assumed that this risk is significant, and measures to protect health and safety should be designed accordingly.
- **The "duty of care" principle** stipulates that any person handling or managing hazardous substances or related equipment is ethically responsible for using the utmost care in that task.
- **The "proximity" principle** recommends that treatment and disposal of hazardous waste take place at the closest possible location to its source in order to minimize the risks involved in its transport. According to a similar principle, any community should recycle or dispose of the waste it produces, inside its own territorial limits.
- The national environmental policy, strategy and procedures which seek to guide development in accordance with quality requirements to prevent, reduce and, as far as possible, eliminate pollution and nuisances.

1.3 HEALTH CARE WASTE MANAGEMENT AND THE SUSTAINABLE DEVELOPMENTAL GOALS

Successes in HCWM in Palestine, as well as anywhere else will speed progress towards achieving a number of the United Nations Sustainable Developmental goals, and in particular:

- SDG 3: Ensure healthy lives and promote well-being for all at all ages.
- SDG 6: Ensure availability and sustainable management of water and sanitation for all.
- SDG 8: Promote inclusive and sustainable economic growth, employment and decent work for all.
- SDG 12: Ensure sustainable consumption and production patterns.
- SDG 13: Take urgent action to combat climate change and its impacts.

Regardless of the impacts of security and current geopolitical conditions on efforts to achieve the Sustainable Developmental Goals, the State of Palestine already started aligning its priorities with the SDGs. The Palestinian government has established a National SDG Task Force via a Presidential decree. Therefore, and within this master plan on HCWM, the MoFP and other stakeholders should be obliged to take strategic actions to achieve such goals (Table 1-1).







Table 1-1: HCWM actions to achieve SDGs

Goal No.	Goal	Context	Proposed actions	
SDG 3	Ensure healthy lives and promote well-being for all at all ages	Annual health indicators in Palestine for the year 2020 as well as other previous records are indicating progress in life expectancy, maternal and child health, and other areas. Regardless, more can still be achieved if HCWM was given additional attention; regardless of the well- known efforts of workers, patients and the community. Solving this problem would remove direct and indirect threats to the health of Palestine people.	HCWM to be well-recognised and properly budgeted.	
SDG 6	Ensure availability and sustainable management of water and sanitation for all.	It was reported in a number of research papers in Palestine that poor management of HCW has a direct impact on water quality and sanitation processes. The World Health Organization, recognizing the interrelation between waste and water, has incorporated healthcare waste management into its water, sanitation and health program for healthcare.	Treatment of waste and minimization of toxic or harmful discharges, incidents, or general pollution from HCW at all generation points in Palestine.	
SDG 8	Promote inclusive and sustainable economic growth, employment and decent work for all	Palestine poverty rates are increasing, and there are national efforts to stop this increase and alleviate poverty and improve well-being of the communities in the West Bank and Gaza Strip. Throughout the preparatory work for this plan, as well as PCBS records and MoLG records do recognise that waste workers are too often underpaid, under-educated and under- protected. In many cases, not only do workers lack a living wage, but working conditions may not be described as a safe working environment. This is not within HCWM systems only, but waste management in Palestine in general	Improve how waste management and its workers are viewed. It needs to be recognised as an essential public service, with professional standards, vaccinations, training, decent conditions, a living wage and respect for the men and women that carry it out.	
SDG 12	Ensure sustainable consumption and production patterns	Disposables are a key component of HCWM. Palestine strategic objectives of waste management are based on waste reduction, recycling, reuse targets on reducing pollution and health impacts through environmentally sound management of all waste.	Sustainable procurement is also required: Hospitals in particular and HCFs' purchases should consider reduced generation of waste as much as possible that is toxic, non-repairable, non- recyclable or simply unnecessary.	
SDG 13	Take urgent action to combat climate change and its impacts	Palestine is committed to climate change agreements and is part of the global efforts to minimise emissions, waste, segregate at source, avoid incineration, recycle, conserve resources and energy.	Treatment efforts and technologies to be considered should take this into consideration; all signed agreements and protocols should be considered, and selected technology is to be in harmony with internationally approved terms and conditions.	



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1.4 STRATEGIC DRIVERS OF HCW MANAGEMENT IN PALESTINE

Improper treatment of HCW poses serious risks of disease transmission to waste workers, health facility workers, patients, and the community in general, through exposure to infectious agents. Poor management of the waste emits harmful and deleterious contaminants into the environment.

Given the situation with the COVID-19 pandemic, WHO has set out guidelines for the management of healthcare waste; these guidelines helped to manage the highly contagious healthcare waste resulting from the pandemic. It is each country's responsibility to adopt or develop such guidelines. Proper HCW management may add value by reducing the spread of viruses and increasing the recyclability of materials instead of sending them to landfill. Disinfecting and sorting out HCW facilitates sustainable management and allows their utilization for valuable purposes.

Palestine emergency planning as well as long term strategies are based on:

- 1) Compliance with local and international regulations;
- 2) Health and environmental protection;
- 3) Definition of responsibilities of stakeholders and employees;
- 4) Definitions/classification of healthcare waste;
- 5) Specific procedures based on best management practices for handling healthcare waste within facilities;
- 6) Training of related staff and workers.

1.5 PRIORITY AREAS

Based on the list of challenges as identified within the inception report, including:

- Incomplete regulations in a number of HCW aspects, and limited clarity on procedures,
- Limited HCF staff capacities in safety, collection and treatment,
- Lack of financial resources for HCW system development,
- Random compliance with current regulations,
- Limited reliable data or records.

The following are identified as priority areas for HCWM in Palestine:

- 1) Institutional, Policy guidelines, Standards and Regulations: Review, complete and disseminate HCWM policies, Regulations, Guidelines and standards.
- 2) Institutional Capacity: Strengthen institution capacity on HCWM.
- 3) Services sustainability: ensure technical and financial sustainability of the services.
- 4) Best Environmental Practices (BEP): Promote best practices on HCWM stream.
- 5) Monitoring, evaluation and operational research: Strengthen the monitoring and evaluation system for HCWM.
- 6) Improve emergency preparedness.

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7) Infrastructure, equipment and supplies, treatment and disposal options: Improve infrastructure, equipment and supplies, treatment and disposal options for HCWM.







- 8) Awareness and commitment among decision makers: Conduct advocacy to raise awareness and commitment among decision makers in HCWM.
- 9) Public Private Partnership (PPP): Promote PPP in HCWM.







2 GAPS IN THE 2006 MASTER PLAN

The main elements missing from 2006 HCWM Master Plan are as follows:

- Emergency planning; keeping in mind the number of emergencies in Palestine, including security, closures, COVID-19 pandemic, weather and climate change related, it is a must now to include emergency preparedness in any master planning.
- Clear call for an independent regulatory "Body": HCW is governed by a number of legal and policy tools under a number of stakeholders, and the whole HCW system is operated by several operators which implies having an independent body to monitor the operations through clear indicators, targets and benchmarks. This can be either under one authority, or each stakeholder puts a number of indicators related to its mandate and monitors progress accordingly. Still, it would be useful if all of these monitoring reports are put together by the National Solid Waste Committee or a unit under this committee. If found useful, an independent body reporting to the National Solid Waste Committee can monitor solid waste as well as health care waste.
- Financial and technical sustainability: although this was covered by the National Health Plan and MOH strategies, the particular issue of HCW was not referred to in any of these plans.
- Magnitude and size of treatment: central or individual treatment systems were not finalised in any policy or plan. It is time to look into the issue whether HCW should be treated and disposed of locally, regional or at a national level.
- Reference to the Sustainable Development Goals.







3 LEGAL CONTEXT

3.1 LEGAL FRAMEWORK

Medical waste, health care waste or in a larger context hazardous waste (including medical waste by definition) was legally covered under a number of legal instruments in Palestine as described below.

With the establishment of the Palestine Environmental Authority in 1996, serious work was until the year when **Law No 7** of the year **1999** Concerning the Environment was issued under the Ministry of Environmental Affairs (established in 1998).

Within this law, HCW was listed within its definition for hazardous waste, i.e. 'Residues of various activities and operations or ashes thereof, which preserve the characteristics of the hazardous materials with no subsequent utilization such as nuclear waste, medical waste, waste resulting from the processing of any pharmaceutical preparation, medicines, organic solvents, paints, pesticides or any other similar hazardous material'.

This Environmental Law identifies the Ministry of Environmental Affairs (which became the Environment Quality Authority (EQA) in 2002), as being responsible (in coordination with other competent bodies) for specifying legislation for managing hazardous waste (in the form of orders and directives) and for issuing lists of what constitutes hazardous wastes.

In 2012, the Medical Waste Management by-law was approved by the Palestinian Council of Ministers with the Cabinet Decision No. 10 on 10/07/2012. The by-law entered into force following its publication in the Official Gazette on 27/02/2013. As per this by-law:

- Each HCF has to develop an internal plan for managing the medical waste produced.
- Similarly, the JSC-KRM (all JSCs) has to develop a specific operational procedure for off-site collection, transport, treatment and disposal.
- MoH and EQA have to develop procedures for monitoring and enforcing the regulations inside and outside the HCFs respectively.

In 2015, Palestine signed the Basel Convention; with this, technical guidelines on the environmentally sound management of biomedical and healthcare wastes (Y1; Y3) is mandatory within the country. (Basel convention concentrates on the trans-boundary movement of (HZW)).

In 2019, the Solid Waste Management by-law 3/2019 was issued by the Cabinet of Ministers; this bylaw, among other issues, regulates and encourages waste reduction, reuse, recycling, and composting and delegates to the private sector the role in investment of solid waste management.

In 2021, the Hazardous Waste by-law was issued; Articles 3, 13 and 14 establish a national plan for Hazardous Waste Management, including the definition of recovery, treatment and disposal activities. The by-law promotes the use of safe technology to reduce hazardous waste generation. Hazardous waste producers should follow methods reducing hazardous waste generation and apply clean technologies to reduce waste, using raw materials that are non-hazardous for the environment and public health, and reduce the production of non-biodegradable waste. Hazardous waste producers can utilize the 3Rs approach for waste reduction or other approaches reducing hazardous waste.







3.2 PENDING LEGAL GAPS / REQUIREMENTS

The Medical Waste Management by-law should be complemented by a policy document, and by technical guidelines developed for the implementation of the by-law. This legal "package" should specify regulations on treatment for different waste categories, segregation, collection, storage, handling, disposal, and transport of waste, responsibilities, and training requirements; it should take into account the resources and facilities available in the country and any cultural aspects of waste-handling. Still, the by-law has a number of gaps including:

- The purpose of the by-law; although before issuing the by-law a detailed memo with the objective and purposes were submitted to the Cabinet of Ministers, still, this is to be published.
- The need for the development of a pollution prevention plan by the institutions.
- The inclusion of targets and benchmarks including collection frequencies, for example (targets and benchmarks which could be addressed in instructions issued by MOH).
- Reference to principles including the "polluter pays principle", "precautionary principle" and "duty of care" principle, as well as "proximity principle".
- 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; the penalties addressed by the Environment Law can be used and referred to.

To have a complete and implementable legal system, by-law related instructions are to be completed. However, a number of those were listed in the by-law and never drafted, including:

- Article 4: instructions related to house medications, remote areas and veterinary treatment centres.
- Article 7: the endorsement of the Ministry to develop an operational manual for all medical institutions.
- Article 12: instructions related to medical waste classifications based on nature and degree of dangerousness.
- Article 19: instructions related to radioactive waste and disposal methods.
- Article 31: submission of waste transportation to the Ministry.
- Article 38: identification of disposal sites and conditions.
- Article 40: licensing conditions in coordination with local authorities.
- Article 40: licensing application and license forms.
- Article 46: disposal site conditions.
- Article 48: instructions related to waste landfilling.
- Article 51: identification of chemicals waste filters.
- Article 66: emergency plan (this shall be addressed in this update of the Master Plan).
- Article 67: identification of emergencies related to medical waste.
- Assignment of responsibility to fill and submit the annexed form.







4 MANAGEMENT AND INSTITUTIONAL SETTINGS

4.1 CURRENT RESPONSIBILITIES OF KEY STAKEHOLDERS BASED ON THE HCW BY-LAW

HCFs, LGUs, MOH, EQA, and private contractors are the key stakeholders in the HCW management system in Palestine. Key responsibilities for each, as stipulated in the medical waste by-law, are described in the following Table:

Table 4-1: Key Responsibilities of HCWM Stakeholders as referred to in the 2012 Medical Waste bylaw

Stakeholder s	Responsibilities		
HCFs	HCW segregation		
	Waste reduction, including reuse and recycling		
	Pollution protection planning		
	Primary waste treatment		
	Waste collection and temporary storage		
	Waste quantities documentation		
	Staff training		
LGUs	Waste transportation to treatment or disposal sites		
	Set untreated waste transportation fees		
	Set with EQA waste disposal sites, specifications and conditions		
MoLG	Approves policies, budgets and working procedures for LGUs		
	Chair of National Solid Waste Committee		
	In direct contact with developmental partners for HCW interventions funding		
	Upper supervision on JSC, transportation of waste, approval of landfills sites, designs, funding and operational plans.		
МоН	Issuance of instructions		
	Approval of waste operational manual inside health care facilities		
	Issuance of waste categorization instructions		
	Identification of materials and tools that can be treated and used if exposed to radioactive waste		
	and methods of treatment and disinfection		
	Set- HCFs waste treatment unit specifications		
	Licensing of waste treatment facilities		
	Issuance of licenses and licensing conditions		
	Issuance of waste treatment methodology based on waste nature		
	Identification of chemical waste filters		







	Operational inspections of HCFs
	Follow non-compliance acts by HCFs
	Provision of technical support to HCFs
	Follow up handling of emergencies within institutions
	Inform EQA of potential impacts outside the HCFs from emergencies
	Issuance of emergencies instructions in coordination with other stakeholders
EQA	Issuance of instruction for handling radioactive wastes
	Monitoring, and supervision of waste transportation outside HCFs, temporary storage facilities outside HCFs, and disposal sites
	Approval of hazardous waste transboundary crossing/exporting
	Environmental approval of waste treatment facilities and disposal site locations, and conditions
	Issuance of waste burial procedures
	Waste sampling for analysis
	Set emergency plans outside HCFs
Private	Waste collection, segregation, recycling, treatment and disposal
sector	Collection of health care wastes under contracted or 'paid for' service
	Upskilling and training of workforce
	Design, operation and maintenance of treatment facilities
	Treatment and/or disposal of health care wastes under contracted or 'paid for' service
	Awareness, capacity building and training of workforce
	Management of HCW at source
	Offer take-back and reverse logistics for expired or unused products
	Investment in waste collection, treatment and reuse/recycling
Government	Investment in waste collection, treatment and reuse/recycling Setting and approval of budgets to Palestinian institutions
Government of Palestine.	Investment in waste collection, treatment and reuse/recycling Setting and approval of budgets to Palestinian institutions Coordination of financial support, priorities and actions with developmental partners
Government of Palestine. Cabinet of	Investment in waste collection, treatment and reuse/recycling Setting and approval of budgets to Palestinian institutions Coordination of financial support, priorities and actions with developmental partners Approval of policies, legal provisions
Government of Palestine. Cabinet of Ministers	Investment in waste collection, treatment and reuse/recycling Setting and approval of budgets to Palestinian institutions Coordination of financial support, priorities and actions with developmental partners Approval of policies, legal provisions Announcement and establishment of new institutions including regulatory bodies and

4.2 CURRENT AND PROPOSED INSTITUTIONAL SETTINGS

A number of institutional and technical bottlenecks have been identified, which have been considered within the scope of the update of the HCWM Master Plan. A summary of these gaps is presented below (Table 4-2).







Gaps / Areas of concern	Description		
Policy, legal and enforcement	Incomplete set of legislation in terms of legal instructions as identified above.		
	Lack of monitoring and enforcement		
	Weak law enforcement		
	Limited powers granted to operational staff		
Institutional and organizational	Although mandates were clarified in the medical waste by-law, some responsibilities of stakeholders need further clarification/explanation.		
	Institutional gap related to HCW within the MoH and EQA, MoLG; coordination level is improved at a higher level, but still require institutionalization at the field and operational level.		
	Insufficient coordination and participation of the private sector.		
	Lack of allocated budgets for HCWM at the national and HCFs' level.		
Technical / operational	Non-adherence to national targets, benchmarks or clear standards of HCWM operations.		
	Limited operational proficiency in a number of HCFs		
	Insufficient segregation of HCW, limited treatment options, and limited disposal options		
Emergency preparedness	Limited planning for emergencies.		
	Limited resources to handle emergencies.		
	Limited infrastructure to deal with emergencies.		
	No institutional arrangements in HCW related to emergencies.		
Financial resources	Limited special HCW budget at the MoH.		
	Limited donors' interest in HCW disposal.		
	Limited options and vision for sustained services.		
Human Resources /	Limited capacities of the national stakeholders.		
Capacity Building	Limited monitoring / enforcement capacities.		
	Lack of self-monitoring capacities.		
Stakeholder & Public Awareness	The need to institutionalize stakeholder communication at all stakeholder levels under the National Solid Waste Committee; meetings should be documented, a follow up mechanism is to be in place, regular meetings should be agreed upon with clear agenda items.		
	Lack of communication strategy with the general public.		
	Additional awareness programs of HCW among public and generators.		

The current institutional setting is in line with the legal mandate for the different stakeholders. However, institutional settings and arrangements are not enough within each institution. There are no clear job descriptions or tasks allocated to individual units, departments or staff.

Within the MoH, the latest MoH hierarchy allocates HCW within a section (together with 18 other sections) under the Environmental Health Department and gives the responsibility to one officer who







is also tasked with 4 other tasks. Therefore, the total human effort within the MoH allocated to HCW is 0.25 of a person's worktime. No clear job description and limited authority are given.

Within the EQA, the HCW management section is under the Hazardous Waste Unit which is under the Environmental Protection Department. Neither the Hazardous Waste Unit nor HCWM section have human resources allocated. The department of inspection and monitoring inside the EQA main office and the sections in each regional office can be strengthened and mandated to monitor HCW management.

4.3 REQUIRED INSTITUTIONAL & REGULATORY ACTIONS

The following institutional and regulatory actions should be conducted in the short-term.

- Setting up a HCWM Unit in the MoH, with a director who will have overall responsibility for HCWM in West Bank and Gaza.
- Setting up a monitoring unit within the EQA to handle HCWM monitoring actions with an inspection team, keeping in mind that there is a monitoring unit but there is no appointed staff for medical waste. The EQA needs staff for following up the medical waste issues. It has a department for monitoring and inspection that can also monitor HCW.
- Establishing a HCWM Advisory Committee, with representatives from the EQA, MoH and MoLG, as well as two external experts under the National Solid Waste Committee. As a starting point this can be in a form of an advisory committee. The role of the committee should be identified by the National Solid Waste Committee.
- Agree among the advisory committee members on the prioritization of legal requirements, instructions and procedures as set in the by-law.

4.4 **PROPOSED GOVERNANCE STRUCTURE**

There are significant differences in the management of HCW between different areas in Palestine. A number of key stakeholders have a role as outlined in the HCW by-law. These are the EQA, MoH, MoLG, MoFP, and others. However, waste handling is not within the scope of the mandate of any of these key stakeholders, but is limited to service providers (HCWFs, private sector and LGUs).

Directly below in table 4-3 are identified management options (scenarios) for HCWM in Palestine. These scenarios have a number of options involving HCFs, JSC, LGUs, the private sector and an additional establishment of a Solid Waste Commission that starts handling waste from transfer stations onwards.

Having either the scenario No. 1 or No.6 would make it easy to track and record HCW and would result in potential improvements. Still, having the private sector involved in any stage of the operations would have an additional added value.







	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6*
Internal collection	HCF	Private	HCF	HCF	HCF	HCF
Segregation	HCF	Private	HCF	HCF	HCF	HCF
On site storage	HCF	Private	HCF	HCF	HCF	HCF
On site treatment	HCF	Private	HCF	HCF/Private	HCF/PPP	HCF
Transportation	LGU	Private	LGU	Private	PPP	LGU
Regional treatment		Private	LGU	Private	РРР	Solid Waste Commission
Reuse / recycling	JSC	Private	Private	Private	РРР	Solid Waste Commission
Final treatment	JSC	Private	Private	Private	РРР	Solid Waste Commission
Disposal	JSC	JSC	JSC	JSC	JSC	Solid Waste Commission

Table 4-3: Management Options (Scenarios) for HCWM

Option 6 can only be valid once the Commission is officially established

4.5 HCF OPERATION RESPONSIBILITIES

Every employee of a Healthcare Facility is responsible for the safe handling of waste that is generated within its premises; however, certain personnel will have specific waste management tasks and responsibilities assigned to them (Table 4-4).

Table 4-4: Responsibilities assigned to HCF Personnel

	Entity	Responsibilities
1	Facility director	Overall responsibility and accountability for waste generated and managed on site, as well as for transport from the facility for treatment and/or disposal off-site. The director is also responsible for ensuring that sufficient resources are allocated to waste management to ensure compliance with legal and other requirements.
2	Facility supervisors	Responsible for checking that appropriate standards are set and maintained on a daily basis in their areas and ensuring that problems are resolved.
3	Waste producers	Ensure that only they handle the waste and also ensure that it is properly segregated at the source and suitably contained to reduce risk of exposure of others.
4	Waste handlers	Ensure that waste in the intermediate storage areas is properly segregated, contained and labelled. Any problems noted must be immediately brought to the attention of the responsible person in that area.
5	Quality / Waste management officers	Responsible for ensuring that waste is managed according to legal and other requirements, checking that standards are maintained, that everyone is aware of these requirements, that relevant personnel are appropriately trained to safely deal with waste in their areas and that all necessary data are recorded and transmitted to the waste management committee and regulatory authorities.
6	Waste management committee (if available)	Comprising of representatives from senior management, those who generate waste, waste handlers, infection control, procurement and stores, catering, long-term or resident contractors and waste management service providers. This committee should meet monthly to discuss the key performance indicators (e.g. volume of waste generated, hazardous versus general waste ratio, incidents, audit findings, etc.) and



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	Entity	Responsibilities				
		to plan awareness programs and other initiatives to improve compliance with leg and other requirements. For smaller facilities, this committee can be the infection control / safety or health (and environmental) committee.				
7	Contractors	Ensure that employees are properly informed and trained to comply with waste management requirements, routinely checking to ensure that standards are maintained.				







5 HCWM INFRASTRUCTURE

5.1 CURRENT INFRASTRUCTURE

The MoH has recently purchased 30 autoclaves¹ of 120 lt capacity each, which were distributed to the West Bank hospitals, PHCFs, and COVID-19 centres.

The still to be answered question, is this together with previously in place treatment facilities enough to handle the daily generated HCW estimated by the MoH at 4-4.5 tone of infectious HCW generated in the WB? (This report estimated the generated HCW at 1.22 kg/bed/day, and with a total of 3950 hospital beds in the WB, then the generated HCW is 4.82 tons per day, very close the MoH estimates).

There is some cross-over between disposal of non-clinical and clinical waste resulting in sharps and infectious materials turning up at the municipal waste dumps. Though more robust than normal plastic bags, hospital waste containers do not identify their contents as infectious. Moreover, these bags become a target for scavengers searching for plastic as they contain a higher quantity of plastic than the average household waste bags. Scavengers with no protective gloves and clothing are therefore at great risk of infection at these sites. Other urban areas of Gaza have a similar problem of lack of separation between household waste and clinical waste.

The available infrastructure is summarized below:

Governorate	Hospital beds	HCW generated (kg/day)	HCW vehicles	120 L autoclave	575 L autoclave	50 kg/cycle Incinerator	160 L autoclave	Microwave	600 L autocla ve
Jenin	284	346.48	0	2	1				
Tubas	44	53.68	0	2					
Qalqelia	120	146.4	0	2		1			
Tulkarem	169	206.18	0	2					
Nablus	646	788.12	0	2	1				
Ramallah	549	669.78	1	2		1			1
Hebron	691	843.02	2	7		1		1 (1.5 tn/day)	
Bethlehem	615	750.3	0	2	1				
Jericho	54	65.88	0	3		1			
Jerusalem	728	888.16	0	2					
Salfit	50	61	0	2					
North and Gaza Governorates			2			2	1	1 (700 kg/day)	
Middle, Khanyounis and Rafah Governorates			2			2		1	
Central lab							1		
Total	3950	4819	3	28	3	4	1	1	1

Table 5-1: HCW infrastructure in Palestine MoH

¹ Based on the MoH who purchased the 30 autoclaves, the final list of distribution is not there yet, still in the process, but tentatively 2-3 units for each governorate.







At the same time, the MoLG has taken a number of steps including:

- 1. The implementation of a COVID-19 preventive project funded by JICA.
- 2. The procurement and installation of three microwave units in the North serving Jenin, Tubas and Tulkarem, Hebron, serving also Bethlehem (that was be operational within a month of this authoring) and middle area.
- 3. Nablus and Jericho units are not installed yet and are planned to serve Nablus and Salfeet areas as well as Jerusalem and Jericho.
- 4. Almost 60% of generated health care waste is being covered with the MoLG interventions.

In terms of **current medical waste treatment facilities**, in addition to localised, inhouse treatment facilities within a number of institutions as shown above, there are a number of planned or operational large-scale facilities distributed in the West bank and the Gaza Strip as follows:



5.2 GOOD PRACTICES FOR HCW MANAGEMENT

The following technologies and infrastructure are identified as best practices for HCW management.

5.2.1 COLLECTION, STORAGE AND TRANSPORT OF HCW

5.2.1.1 SOURCE SEGREGATION

The following general principles of waste segregation, storage and transportation relate to the control of waste flow from generation to disposal:

• HCW should be segregated into different fractions, based on their potential hazard and disposal route, by the person who produces each waste item.







- Segregation should be carried out by the producer of the waste as close as possible to its place of generation, which means segregation should take place in a medical area, at a bedside, in an operating theatre or laboratory by nurses, physicians and technicians. If classification of a waste item is uncertain, as a precaution it should be placed into a container used for hazardous health care waste.
- Separate containers should be available in each medical area for each segregated waste fraction (examples of specifications are indicated in the document referenced below ²).
- Waste containers, when filled (100% filled or according to the medical waste by-law), should be labelled to help managers control waste production.
- Closed local storage inside or near a medical area may be needed if wastes are not collected frequently.
- Hazardous and non-hazardous wastes should not be mixed during collection, transport or storage.
- Collected waste is often taken to central storage sites before onsite or offsite treatment and disposal.
- Staff should understand the risks and safety procedures for the wastes they are handling.

The simplest waste-segregation system is to separate all hazardous waste from the larger quantity of non-hazardous general waste. However, to provide a minimum level of safety to staff and patients, the hazardous waste portion is commonly separated into two parts: used sharps and potentially infectious items (typically tubing, bandages, disposable medical items, swabs and tissues). Consequently, the segregation of general, non-hazardous waste, potentially infectious waste and used sharps into separate containers is often referred to as the "three-bin system". Further types of containers can be used for other categories of wastes, such as chemical and pharmaceutical wastes, or to separate out pathological waste, where it is to be handled and disposed of in different ways from the other portions of the waste flow.

Ideally, the same system of segregation should be in force throughout a country. Colour coding makes it easier for medical staff and hospital workers to put waste items into the correct container, and to maintain segregation of the wastes during transport, storage, treatment and disposal. Colour coding also provides a visual indication of the potential risk posed by the waste in that container. The World Health Organization (WHO) scheme is described in the following Table.

² Reducing UPOPs and Mercury Releases from The Health Sector in Africa: Technical specifications for healthcare waste management equipment-2019 - https://procurement-notices.undp.org/view_file.cfm?doc_id=170571







Table 5-2: WHO-recommended segregation scheme

Type of waste	Colour of container and markings	Type of container
Highly infectious waste	Yellow, marked "HIGHLY INFECTIOUS", with biohazard symbol	Strong, leak-proof plastic bag, or container capable of being autoclaved
Other infectious waste, pathological and anatomical waste	Yellow with biohazard symbol	Leak-proof plastic bag or container
Sharps	Yellow, marked "SHARPS", with biohazard symbol	Puncture-proof container
Chemical and pharmaceutical waste	Brown, labelled with appropriate hazard symbol	Plastic bag or rigid container
Radioactive waste	Labelled with radiation symbol	Lead box
General health-care waste	Black	Plastic bag

[WHO, 2014]





Old radiation symbol



New radiation symbol

Figure 5-1: Biohazard and radiation symbols

Chemical hazard symbols are found in the United Nations Economic Commission for Europe's (UNECE's) Globally harmonized system of classification and labelling of chemicals (http://live.unece.org/trans/danger/publi/ghs/pictograms.html).

Regarding handling of specific hazardous HCW:

- Where mercury thermometers and sphygmomanometers are still in use, medical staff should be supplied with a spill kit and trained on how to use it. Any spill larger than a thermometer should be dealt with in consultation with the local health and safety authority. Brushes and vacuum cleaners should never be used for spilled mercury. Mercury can be cleaned up easily from wood, linoleum, tile and similar smooth surfaces. It cannot be completely removed from carpets, curtains, upholstery or other absorbent materials. The affected portion should be isolated and disposed of in accordance with official guidelines.
- Where specialist disposal services exist, they should collect and handle radioactive wastes. Otherwise, waste may be stored in secure, radiation-proof repositories (leak-proof, lead-lined and







clearly labelled with the name of the radionuclide and date of deposition) where it should be left to decay naturally.

- Waste containers should be sturdy and leak-proof, and (except for sharps containers) lined with a sturdy plastic bag. The recommended thickness of bags for infectious waste is 70 μm (ISO 7765 2004). Plastics used for either containers or bags should be chlorine-free. Not all plastic bags can withstand temperatures of 121°C, and some can melt during an autoclave process.
- Both contaminated and uncontaminated sharps should be collected in a puncture-proof and impermeable container that is difficult to break open after closure. Sharps containers may be disposable or designed for disinfection and reuse. Disposables are boxes made of plasticized cardboard or plastic; reusable designs are plastic or metal. Low-cost options include the reuse of plastic bottles or metal cans. If this is to be done, the original labels should be removed or obscured, and the containers should be clearly re-labelled as "Sharps containers".



Figure 5-2: Examples of Containers for used needles and sharps

The appropriate waste receptacle (bags, bins, sharps boxes) should be available to staff in each medical and other waste-producing area in a health-care facility. This permits staff to segregate and dispose of waste at the point of generation and reduces the need for staff to carry waste through a medical area. Posters showing the type of waste that should be disposed of in each container should be posted on walls to guide staff and reinforce good habits.

Segregation success can be improved by making sure that the containers are large enough for the quantity of waste generated at that location during the period between collections. Up-to-date waste audit data can be used to assess the volume and type of waste containers necessary.

Containers should have well-fitting lids, either removable by hand or preferably operated by a foot pedal. Both the container and the bag should be of the correct colour for the waste they are intended to receive, and labelled clearly. Mixing colours – such as having yellow bags in black bins – should be avoided, because it will increase the potential for confusion and poor segregation.

Containers should be of similar size to overcome the observed tendency for staff to put waste in the largest receptacle.

Unless patients are known or suspected to have readily transmitted infections, the assumption should be that general waste generated in a medical area is of low risk. However, if there is a known







communicable infection, all waste used in and around the patient should be classed as an infection risk and placed in the yellow, potentially infectious waste container.

Regarding placement of containers:

- Where containers for segregating hazardous and non-hazardous health care wastes are in use, they should be located close together, wherever possible.
- Containers for infectious waste should not be placed in public areas because patients and visitors may use the containers and come into contact with potentially infectious waste items.
- Static bins should be located as close as possible to sinks and washing facilities, because this is
 where most staff will deposit gloves and aprons after treating patients. If the general waste
 container is closest to the sink or under a towel dispenser, it will encourage staff to place towels
 into the non-infectious receptacle [WHO, 2014].

5.2.1.2 COLLECTION AND ON-SITE TRANSPORT

Collection times should be fixed and appropriate to the quantity of waste produced in each area of the HC facility. General waste should not be collected at the same time or in the same trolley as infectious or other hazardous wastes.

Waste bags and sharps containers should be filled to no more than three quarters full. Once this level is reached, they should be sealed ready for collection. Plastic bags should never be stapled but may be tied or sealed with a plastic tag or tie. Replacement bags or containers should be available at each waste-collection location so that full ones can immediately be replaced.

Waste bags and containers should be labelled with the date, type of waste and point of generation to allow them to be tracked through to disposal. Where possible, weight should also be routinely recorded.

Collection should be daily for most HCW, with collection timed to match the pattern of waste generation during the day. For example, in a medical area where the morning routine begins with the changing of dressings, infectious waste could be collected mid-morning to prevent soiled bandages remaining in the medical area for longer than necessary. Visitors arriving later in the day will bring with them an increase in general waste, such as newspapers and food wrappings; therefore, the optimum time for general and recyclable waste collection would be after visitors have departed.

Onsite transport should take place during less busy times whenever possible. Set routes should be used to prevent exposure to staff and patients and to minimize the passage of loaded carts through patient care and other clean areas. Depending on the design of the health-care facility, the internal transport of waste should use separate floors, stairways or elevators as far as possible. Regular transport routes and collection times should be fixed and reliable. Transport staff should wear adequate personal protective equipment, gloves, strong and closed shoes, overalls and masks.

Hazardous and non-hazardous waste should always be transported separately. In general, there are three different transport systems:

- Waste transportation trolleys for general waste should be painted black and labelled clearly "General waste" or "Non-hazardous waste".
- Infectious waste can be transported together with used sharps waste. Infectious waste should not be transported together with other hazardous waste, to prevent the possible spread of infectious







agents. Trolleys should be colored in the appropriate color code for infectious waste (yellow) and should be labelled with an "Infectious waste" sign.

• Other hazardous waste, such as chemical and pharmaceutical wastes, should be transported separately in boxes to central storage sites.

Separate hazardous and non-hazardous routes should be planned and used. Collection should start from the most hygienically sensitive medical areas (e.g. intensive care) and follow a fixed route around other medical areas and interim storage locations.

The frequency of collection should be refined through experience to ensure that there are no overflowing waste containers at any time. Infectious waste must be collected at least daily. Spare trolleys should be available in case of breakdowns and maintenance. The vehicles should be cleaned and disinfected daily.

A routing plan would be influenced by:

- waste volume and number of waste bags or containers
- waste types
- capacity of the waste storage within medical areas and at interim storage areas
- capacity of the transportation trolleys
- transport distances and journey times between the collection points. [WHO, 2014].

Details for inclusion in a HCW Management Plan

Location and organization of collection and storage facilities

- 1. Drawings of the establishment, showing designated bag-holder sites for every ward and department in the hospital; each bag site shall be appropriately designated for health care waste or other waste.
- 2. Drawings showing the central storage site for HCW and the separate site for other waste. Details of the type of containers, security equipment, and arrangements for washing and disinfecting waste-collection trolleys (or other transport devices) should be specified. The document should also address eventual needs for refrigerated storage facilities.
- 3. Drawings showing the paths of waste-collection trolleys through the hospital, with clearly marked individual collection routes.
- 4. A collection timetable for each trolley route, the type of waste to be collected, the number of wards and departments to be visited on one round. The central storage point in the establishment for that particular waste should be identified.

Design specifications

- 5. Drawings showing the type of bag holder to be used in the wards and departments.
- 6. Drawings showing the type of trolley or wheeled container to be used for bag collection.
- 7. Drawings of sharps containers, with their specification.

Required material and human resources

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- 8. An estimate of the number and cost of bag holders and collection trolleys.
- 9. An estimate of the number of sharps containers and health-care waste drum containers required annually, categorized into different sizes if appropriate.
- 10. An estimate of the number and cost of yellow and black plastic bags to be used annually.







11. An estimate of the number of personnel required for waste collection.

Responsibilities

- 12. Definitions of responsibilities, duties, and codes of practice for each of the different categories of personnel of the hospital who, through their daily work, will generate waste and be involved in the segregation, storage, and handling of the waste.
- 13. A definition of the responsibilities of hospital attendants and ancillary staff in collecting and handling wastes, for each ward and department; where special practices are required, e.g. for radioactive waste or hazardous chemical waste, the stage at which attendants or ancillary staff become involved in waste handling shall be clearly defined.

Procedures and practices

- 14. Simple diagram (flow chart) showing procedure for waste segregation.
- 15. The procedures for segregation, storage and handling of waste requiring special arrangements, such as autoclaving.
- 16. Outline of monitoring procedures for waste categories and their destination.
- 17. Contingency plans, containing instructions on storage or evacuation of HCW in case of breakdown of the treatment unit or during closure down for planned maintenance.
- 18. Emergency procedures.

<u>Training</u>

19. Training courses and programmes.

5.2.1.3 ON-SITE STORAGE

Central storage areas are places within a HCF where different types of waste should be brought for safe retention until it is treated or collected for transport offsite. The storage area should:

- have an impermeable, hard-standing floor with good drainage (away from watercourses); the floor should be easy to clean and disinfect.
- keep other (non-infectious and non-hazardous) waste separated from infectious and other hazardous waste.
- have a water supply for cleaning purposes.
- have easy access for staff in charge of handling the waste.
- be lockable to prevent access by unauthorized persons.
- have easy access for waste collection vehicles.
- have protection from the sun.
- be inaccessible to animals, insects and birds.
- have good lighting and at least passive ventilation.
- not be situated in the proximity of fresh food stores and food preparation areas.
- have a supply of cleaning equipment, protective clothing and waste bags or containers located conveniently close to the storage area.
- have a washing basin with running tap water and soap that is readily available for the staff.
- be cleaned regularly (at least once per week).
- have spillage containment equipment.







• be appropriate to the volumes of waste generated from each health care facility.

The storage place of infectious waste must be identified by using the biohazard sign. Floors and walls should be sealed or tiled to allow easy disinfection. If present, the storage room should be connected to a special sewage system for infectious hospital wastewater. The compacting of untreated infectious waste or waste with a high content of blood or other body fluids destined for offsite disposal (for which there is a risk of spilling) is not permitted. Sharps can be stored without problems, but other infectious waste should be kept cool or refrigerated at a temperature preferably no higher than 3 °C to 8 °C if stored for more than a week. Unless a refrigerated storage room is available, storage times for infectious waste in warm climate (e.g. the time gap between generation and treatment) should not exceed 48 hours during the cool season and 24 hours during the hot season.

When planning storage places for hazardous chemical waste, the characteristics of the different chemicals to be stored and disposed of must be considered (inflammable, corrosive, explosive). The storage place should be an enclosed area and separated from other waste storage areas.

Keeping clear records of the wastes stored and their treatment and disposal dates is important to ensure a good control of waste management [WHO, 2014].

5.2.1.4 OFF-SITE TRANSPORT

Drivers of vehicles carrying hazardous health care waste should have appropriate training about risks and handling of hazardous waste. In addition, drivers should be declared medically fit to drive vehicles.

In case of an accident, contact numbers or details of the emergency services and other essential departments should be carried in the driver's cab. For safety reasons, vaccination against tetanus and hepatitis A and B is recommended, and vaccination and training details of staff should be recorded.

A fundamental requirement is for the vehicle transporting hazardous waste to be roadworthy and labelled to indicate its load, and its payload to be secured to minimize the risk of accidents and spillages.

Vehicles should be kept locked at all times, except when loading and unloading, and kept properly maintained.

Vehicles or containers used for transporting HCW should not be used for transporting any other material.

Any vehicle used to transport health care waste should fulfil several design criteria:

- The body of the vehicle should be of a suitable size commensurate with the design of the vehicle.
- There should be a bulkhead between the driver's cabin and the vehicle body, which is designed to retain the load if the vehicle is involved in a collision.
- There should be a suitable system for securing the load during transport.
- Empty plastic bags, suitable protective clothing, cleaning equipment, tools and disinfectant, together with special kits for dealing with liquid spills, should be carried in a separate compartment in the vehicle.
- The internal finish of the vehicle should allow it to be steam-cleaned and internal angles should be rounded to eliminate sharp edges to permit more thorough cleaning and prevent damage to waste containers.







- The vehicle should be marked with the name and address of the waste carrier.
- The driver should be provided with details of the waste being carried.

An international hazard sign should be displayed on the vehicle and containers, as well as an emergency telephone number. The vehicle should be labelled according to the type of waste that is being transported. The label that is displayed will depend on the United Nations classification of the waste. No specific vehicle labelling is required if less than 333 kg (i.e. the "gross dangerous goods charge") of infectious waste (UN 3291) is transported – although labelling is recommended. Vehicles transporting more than 333 kg gross weight must be provided with warning plates.

Articulated or demountable trailers (temperature-controlled if required) are particularly suitable as they can easily be left at the site of waste production. Other systems may be used, such as specially designed large, closed containers or skips that can be lifted onto a vehicle chassis. The container may be used for storage at the HC facility and replaced with an empty one when collected. Refrigerated containers could be used if the storage time exceeds the recommended limits, or if transportation times are long.

Vehicles and transporting containers used for the transportation of waste should be cleaned and disinfected daily after use. Mechanical cleaning, combined with soaps and detergents, which act as solubility promoting agents, can be used. A standard operating procedure for cleaning should be prepared and explained to cleaning staff. In addition, a schedule for preventive maintenance should be set up for all equipment and vehicles used in the transportation process [WHO, 2014].

5.2.2 HCW TREATMENT AND/OR DISPOSAL

At a minimum, HCW treatment entails segregation and other practices to minimize the amount of waste that needs to be treated; a treatment process that achieves at least the minimum required disinfection level; and safe disposal. Treatment can be done on the premises or at a centralized treatment facility. When treating onsite, the technology should be carefully selected based on waste characteristics, technology capacity and requirements, environment and safety factors, and cost. In low-income settings, this may mean modifying an existing autoclave. Other health-care facilities may be able to invest in small steam treatment units or use existing incinerators with air-pollution control equipment. Anatomical waste can be buried in cemeteries or approved burial sites. Except for sharps waste, treated waste can be disposed of with regular municipal solid waste.

Improving segregation and waste minimization are important initial steps towards improving existing waste treatment systems. For HCFs that already use autoclaves, microwave units or other steam-based technologies, the addition of a shredder, grinder and/or compactor, especially for sharps waste, is an option. Scheduling regular validation tests, documenting test results and improving ventilation are important improvements. HCFs should also adopt good preventive maintenance procedures.

There are five basic processes for the treatment of hazardous components in health-care waste, in particular, sharps, infectious and pathological wastes: thermal, chemical, irradiation, biological and mechanical. Thermal treatment methods are the most commonly used for HCW treatment. These processes rely on heat (thermal energy) to destroy pathogens (low-heat and high-heat designs).

Low-heat thermal processes are those that use thermal energy at elevated temperatures high enough to destroy microorganisms but not sufficient to cause combustion or pyrolysis of the waste. In general, low-heat thermal technologies operate between 100°C and 180°C. The low-heat processes take place







in either moist or dry-heat environments. Moist (or wet) thermal treatment involves the use of steam to disinfect waste and is commonly performed in an <u>autoclave or steam-based treatment system</u>.



Figure 5-3: Autoclaves with internal shredder [WHO, 2014. Credit: Tesalys/Sterishred, France]

<u>Microwave treatment</u> is essentially a moist thermal process because disinfection occurs through the action of moist heat (hot water and steam) generated by the microwave energy. Dry-heat processes use hot air without the addition of water or steam. In dry-heat systems, the waste is heated by conduction, convection and/or thermal radiation using infrared or resistance heaters.



Figure 5-4: Simplified schematic of batch and semicontinuous microwave technologies [WHO, 2014]

Three generic kinds of incineration technology are commonly used for treating HCW:

 dual-chamber starved-air incinerators, which operate in the starved-air mode (below stochiometric conditions) in the primary chamber and are designed to burn infectious healthcare waste;







- Water and Environment Support in the ENI Southern Neighborhood region
- multiple chamber incinerators, including in-line incinerators and retort incinerators used for pathological waste, which operate in the excess-air mode (above stochiometric conditions);
- rotary kilns, normally capable of reaching temperatures that break down genotoxic substances and heat resistant chemicals.

HCFs that use incineration may be able to further minimize air emissions by adding air-<u>pollution control</u> <u>devices</u> or upgrading the existing flue gas cleaning system. Incinerator stack tests can be expensive but are a necessary tool for improving the combustion process and for ensuring compliance with emission limits. HCFs should also consider installing continuous emission monitoring systems. Periodic maintenance is a must for any incinerator.

Flue (exhaust) gases from incinerators contain fly ash (particulates), heavy metals, dioxins, furans, thermally resistant organic compounds, and gases such as oxides of nitrogen, sulfur, carbon and hydrogen halides. The flue gases should be treated, and this should be done in at least two different stages:

- "de-dusting" to remove most of the fly ash,
- washing with alkaline substances to remove hydrogen halides and sulfur oxides.

Flue gas treatment can be performed by wet, dry or semi-dry treatment, or a combination of these processes. The temperature of the combustion process has to be very closely controlled to avoid generating furans and dioxins, and the temperature in the flue gases should be cooled down rapidly to prevent dioxins and furans from reforming.

<u>Mechanical treatment</u> processes include several shredding, grinding, mixing and compaction technologies that reduce waste volume, although they cannot destroy pathogens. In most instances, mechanical processes are not stand-alone health-care waste-treatment processes, but supplement other treatment methods. Unless shredders, mixers and other mechanical devices are an integral part of a closed treatment system, they should not be used before the incoming HCW is disinfected. If they are used, workers are at an increased risk of being exposed to pathogens in aerosols released into the environment by mechanical destruction of untreated waste bags. If mechanical processes are part of a closed system, the technology should be designed in such a way that the air in and from the mechanical process is disinfected before being released to the surroundings.

With regard to <u>land disposal</u>, the HCF could work with other stakeholders and the local municipal authorities to upgrade the existing landfill, if necessary, for the safe disposal of waste in the area. HCFs should make arrangements with a local landfill to provide a special cell or pit, daily soil cover, and restricted access. Encapsulation, inertization and land disposal could be used for some pharmaceutical and chemical wastes, as well as sharps waste. A well-designed sharps pit is another minimum option for sharps waste. Among the desirable features of a landfill are:

- restricted access to prevent scavenging,
- daily soil cover to prevent odors, and regular compaction,
- organized deposit of wastes in small work areas,
- isolation of waste to prevent contamination of groundwater and surrounding areas,
- trained staff.







In extreme circumstances where no treatment is possible, hazardous HCW from small HCFs could be buried within the premises of the facility where public access can be restricted. A safe burial pit design

Another issue that is often neglected is proper handling and disposal of toxic <u>incinerator ash</u>. Sludges from wastewater treatment and from cooling of fly ash should be considered as hazardous waste. They may either be sent to a waste-disposal facility for hazardous chemicals, or be treated onsite by drying, followed by encapsulation. Solid ashes from HCW incineration (known as bottom ash) are often assumed to be less hazardous than fly ash and in the past have been reused in civil engineering works [WHO, 2014].

Techniques implemented in other countries

should be used.

Jordan, according to recent information, has 21 operational incineration units and 20 non-combustion medical waste treatment units, primarily autoclaves (The Jordan Times, March 2020: *UNDP introduces medical waste disposal technologies in Jordan facilities amid virus outbreak*).

In **Lebanon**, infectious HCW are treated at the national level by the ARCENCIEL association, which has been managing the national network for the collection and the treatment of infectious HCW. The treatment technique which was adopted involves sterilization by autoclaving (ARCENCIEL, 2014. *Guide of the Healthcare Waste Management - Lebanon*).

In **Cyprus**, hazardous HCW is managed inside and outside the HCFs, by sterilization or incineration for infectious HCW, exclusively by incineration for mixed hazardous HCW and by incineration, recovery or disposal for other hazardous HCW. The existing collection and transport network for hazardous HCW includes 22 licensed companies operating throughout the country. The network of management facilities includes 5 sterilization units (total capacity ~24 tn/day) and 1 incineration unit (capacity 30 tn/day) (Ministry of Agriculture, Agricultural Development and Environment, 2016. *Waste Management Plan - Analysis Report and Evaluation of Existing Situation*).

In **Greece**, a central facility for the incineration of hazardous HCW is the only fully licensed hazardous waste incineration plant, serving the whole country. It has been operating since 2002 in Attiki and receives 4000 tons of waste per year from 1800 locations throughout the country (hospitals, clinics, microbiological centers, private clinics, dental clinics, veterinary clinics and pharmacies). There are also privately owned central units for sterilization of infectious HCW and storage of mixed hazardous HCW (in Thessaloniki, Volos, Larissa, Crete, Rhodes).

5.2.3 MANAGEMENT OF WASTEWATER FROM HEALTHCARE FACILITIES

A large part of the wastewater from HCFs is of a similar quality to domestic wastewater and poses the same risks. Just as domestic wastewater is potentially infectious, wastewater from HCFs must also be considered in a similar manner and precautions taken.

A proportion of the generated wastewater from HCFs will pose a higher risk than domestic wastewater. Depending on the service level and tasks of the HCF, liquid waste might include chemicals, pharmaceuticals and contagious biological agents, and might even contain radioisotopes. Segregation, minimization and safe storage of hazardous materials are just as important for liquid wastes as they are for solid wastes.







Sources of Hazardous Wastewater in HCFs

The following are potential sources of hazardous liquid HCW:

- The urine of patients from some <u>wards (oncology, infectious disease</u>) will probably contain higher amounts of antibiotics, cytotoxic, their metabolites and X-ray contrast media. Additionally, higher concentrations of disinfectants can be found.
- <u>Theatres and intensive-care units</u> generate wastewater with high contents of disinfectants (glutaraldehyde), detergents and pharmaceuticals. Additionally, the organic content can be high due to the disposal of body fluids and rinsing liquids (such as those from suction containers).
- <u>Laboratories</u> are a possible source for chemicals in the wastewater stream. Of special relevance are halogenated and organic solvents, colorants from histology and hematology (Gram staining), cyanides (hematology) and formaldehyde and xylene (pathology).
- <u>Radiology</u> departments are the main generator of photochemical (developing and fixing) solutions in wastewater and potentially contaminated rinsing water. In some countries, this source of wastewater contamination is declining due to the increasing use of digital X-ray technology.
- <u>Hemodialysis</u> requires the disinfection of the dialyzers and sometimes the used filters. Accordingly, the concentration of disinfectant in the wastewater can be high.
- <u>Dental departments</u> can contaminate wastewater with mercury (amalgam) from the filling of dental cavities if no amalgam separators are installed in the sink waste pipe system.
- <u>Central sterile supply departments</u> are one of the main consumers of disinfection solutions, including aldehyde-based disinfectants. Hot water from the sterilizers and detergents from the CD-machine (cleaning and disinfectant) might also increase pollution load in the wastewater.

Separate Collection and Treatment / Disposal of Hazardous Wastewater from HCFs

Hazardous Wastewater from HCFs must never be disposed in the sewage network of the common municipal wastewater collection system. The basic principle of effective HC wastewater management is a strict limit on the discharge of hazardous liquids to sewers.

The following are recommended management practices for hazardous liquid HCW:

 <u>Chemical waste</u>, especially photochemical, aldehydes (formaldehyde and glutaraldehyde), colorants and pharmaceuticals, should not be discharged into wastewater but should be collected separately and treated as a chemical HCW. Pretreatment is recommended for wastewater streams from departments such as medical laboratories. This pretreatment could include acid–base neutralization, filtering to remove sediments, or autoclaving samples from highly infectious patients.

Liquid pharmaceuticals in vials (but not cytotoxic materials) can be crushed in a closed bucket, mixed with sawdust, and the solid mass incinerated or encapsulated.

Glutaraldehyde should be stored after use and can be neutralized using glycine. Subsequently, it can be slowly disposed of via a soakaway pit.

Non-hazardous chemicals such as syrups, vitamins or eye drops can be discharged to the sewer without pre-treatment.







• Collected <u>body fluids</u>, small quantities of blood and rinsing liquids from theatres and intensive care can be discharged in the sewer without pretreatment. Precautions against blood spatter should always be taken (e.g. wearing PPE and following standardized handling procedures), and care should be taken to avoid blood coagulation that could block pipes.

Blood should be first disinfected, preferably by a thermal method, or disposed of as pathological waste. Blood can also be disposed of directly to a septic tank system if safety measures are followed. 5% sodium hypochlorite (NaOCI – bleach) is not effective for disinfecting liquids with a high organic content such as blood and stools. Sodium hypochlorite should never be mixed with detergents or used for disinfecting ammonia-containing liquids, because it might form toxic gases. Lime milk (calcium oxide) can be used during emergencies and if no appropriate autoclave or other disinfectant is available.

Other options for expired blood bags include disposal at a controlled land-disposal site, or treatment in a high-temperature incinerator (1100°C) or in an autoclave that has a special liquid treatment programme cycle. If no other disposal option is available, expired blood bags may be isolated from patients and staff by placing unopened into a protected pit excavated within the grounds of the health-care facility or at another secure location.

- Wastewater from a <u>dental department</u> should be pretreated by installing an amalgam separator in sinks, particularly those next to patient treatment chairs. Mercury waste must be safely stored.
- <u>Radioactive</u> wastewater from radiotherapy (e.g. urine of patients undergoing thyroid treatment) should be collected separately and stored in a secured place until the levels of radioactivity have decreased to background concentrations. After the required storage time, the wastewater can be disposed of into a sewer [WHO, 2014].

On-site Treatment of Wastewater from HCFs

The existing guidelines of WHO state that Wastewater from HCFs can be directly discharged into the domestic wastewater network in case local regulations are met. If not, onsite treatment schemes are suggested, in particular in rural HCFs, followed by sludge disposal techniques. With regard to the local situation, it should be noted that according to 2014 data, only 45.3% of the Palestinian healthcare facilities were connected to wastewater networks [Anayah, F., Al-Khatib, I.A. & Hejaz, B., 2021].

Typically, wastewater treatment involves three stages. The first stage is the removal of solids that are separated by sedimentation (primary treatment). Second, dissolved biological matter is progressively converted into a solid mass using indigenous waterborne bacteria. Some inorganic components will be eliminated by sorption to sludge particles, which are then separated from the liquid phase of the wastewater by sedimentation (secondary treatment). During the third stage (at the end of the treatment process), after the solid and liquid materials are separated, the treated water may be further treated to remove suspended solids, phosphates or other chemical contaminants, or may be disinfected (tertiary treatment) [WHO, 2014].

Al Shifa Medical Complex (Gaza Strip)

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Al Shifa medical complex in Gaza is the main health facility in Gaza with more than 1200 beds. Hospital wastewater is produced from various departments of a hospital including patient wards, surgery units, laboratories, clinical wards, intensive care units, and laundries and contains different compounds due to different duties and various medical compounds.







The Al Shifa medical complex wastewater treatment plant will implement the Mobilized Bed Bioreactor (MBBR) technology to treat the wastewater discharged from the blood bank and Lab. The unit is designed to treat up to 7 m³/day and consists of an equalization tank, 3 MBBR units in series, a secondary clarifier, sludge storage tank and sludge dewatering unit.



Figure 5-5: Process Diagram of the Al Shifa Medical Complex Wastewater Treatment Plant

The unit was structurally accomplished on 25/06/2021 and currently is in the adjustment period. According to MoH, the plant is expected to be operational soon. This new treatment plant is an example of good practice for wastewater treatment in hospitals.

5.3 SELECTION OF HCW TREATMENT TECHNOLOGIES

HCW management is a multifaceted process that consists of collection of waste from the healthcare facility, selection of transit modes and routes to the treatment plants, treatment technology selection, and site selection for the disposal. Owing to its significant environmental and economic impacts, the selection of the most suitable and effective HCW treatment technology has been a subject of intense research interest. In order to select the "Best" treatment technology for HCW, decision-makers (DMs) need to consider various conflicting factors or criteria. A large number of criteria such as capital cost, waste residuals and their environmental impacts, treatment effectiveness, and public acceptance are often incorporated in the assessment of the various HCW treatment technologies. Each treatment option has a different performance score with respect to each evaluation criterion. However, there is no HCW treatment alternative which is superior to other alternatives over all the criteria.

The assessment of HCW treatment alternatives is a complex decision-making procedure that often includes contradictory ecological, social, and economic criteria. A holistic approach is required that involves multiple DMs, appropriately calculates the priorities of intertwined criteria and properly tackles the uncertain experts' judgments to find a suitable HCW treatment technology. Some generic criteria and factors are listed below:

- Economic Factors: Capital cost, Operation and maintenance cost, and Disposal cost.
- Environment Factors: Waste residuals and their environmental impacts, Energy consumption, and Volume reduction.
- Technical Factors: Treatment effectiveness, Level of automation, Need for skilled operators, and Occupational hazards.



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• Social Factors: Public Acceptance and Land Requirement.

After determining the criteria and alternatives through literature review and interview sessions with experts, the judgments are obtained by a group of experts or DMs, that should include competent state and local authorities, any representatives of the local communities and researchers, scientists and engineers. Based on the consolidated opinions, a HCWM framework shall be developed and implemented to select the optimum HCW treatment technology [Hinduja A. and Pandey M., 2019].

Table 5-3 below summarizes the most common methods of HCW treatment.

Treatment Type	Technology	Description
	Autoclaving	Use a combination of steam, heat, and pressure to disinfect waste and medical equipment. Widely used and come in a variety of sizes and configurations. The main types of hybrid autoclaves that are commercially available are rotating autoclaves, autoclaves with internal shredders or mixing arms.
Low heat	Continuous steam treatment systems	Continuous systems are generally composed of a hopper, internal shredder, a slowly rotating screw or auger to convey the waste up an incline, and some method of releasing steam and ejecting the waste into a large bin.
	Microwaving	Should not be used on waste that may contain metal items such as surgical implements. Can operate in two ways: a) Batch-wise - meaning a sample of waste is inserted, thermally treated, and then removed before another batch is processed; or b) Continuous - where waste moves through an automated system.
	Friction heating	Use a high-speed shredder to destroy waste while generating heat. Additional heat is provided by resistance heaters.
Chemical processes	Sodium hypochlorite treatment	Commonly known as bleach, or just "hypochlorite" - is a widely used substance for cleaning and chemical disinfection due to its oxidizing properties.
	Rotary kilns	Normally capable of reaching temperatures that break down genotoxic substances and heat resistant chemicals.
High heat	Dual chamber incinerators	Burn waste in the primary combustion chamber at or above 850°C. Multiple oil or gas burners maintain the temperature in the primary chamber. Vapours produced in the primary chamber are directed into a secondary chamber which has one or more burners to bring the temperature to above 1100°C required to treat HCW. Flue gas treatment is recommended to reduce air pollution and may be required by the relevant national legislation.

Table 5-3: Summary of HCW treatment options

[The Global Fund, Geneva 2020; WHO, 2014]







An important parameter for the selection of technology is the size (and waste treatment capacity) of the treatment facility. When a project involves a group of healthcare facilities—such as all health facilities in a governorate run by the Ministry of Health, or a group of separate health facilities that have pooled their resources to treat their waste at a common site, or health facilities in a geographical area to be served by a central treatment facility, the approach can be decentralized (a treatment technology installed in each facility) or centralized. In most circumstances, centralized treatment, which makes use of the economies of scale, has significant economic advantages.

Cluster treatment is a special case of centralized treatment. A group of health facilities in a small area or district designates a major health facility as its cluster hub. The health facilities in the area transport their waste to the cluster hub to be treated. A typical arrangement is a district hospital serving as a cluster treatment hub for several small hospitals and clinics, private practices, dental facilities, and primary health stations in the district [UNEP, 2012].

Table 5-4 presents important technical comparisons between the different generic technologies. "+" signifies a comparative advantage or benefit, while "-" signifies a relative disadvantage.

Technical Aspects	1	2	3	4	5	6	7	8
Range of capacities	+++	++	++	+	++	+	++	++
Range of waste treated	+	++	++	+	++	++	+++	+
Efficacy of microbial inactivation		++	+	+	+	++	+++	++
Volume reduction	+	++	++	+	++	++	+++	++
Mass reduction	-	+	+	-	-	+	++	-
Space needed for installation		+	+	+++	+	+	-	+
Installation requirements		+	+	+++	+	+	-	+
Degree of automation	+	++	++	+++	++	++	++	++

Table 5-4: Summary of Technical Comparisons of Treatment Technologies

Legend: 1 – Autoclaves; 2 - Hybrid autoclaves; 3 - Continuous steam treatment systems; 4 - Batch microwave technologies; 5 - Continuous microwave technologies; 6 - Frictional heat treatment systems; 7 - Incinerators; 8 – Chemical treatment systems.

Source: United Nations Environment Programme, 2012. Compendium of Technologies for Treatment/Destruction of Healthcare Waste

The following Table summarizes the qualitative comparisons between the different generic technologies. This is intended as a rough comparison, but each specific technology should be evaluated based on its particular merits.







Selection Criteria for Treatment Technologies		2	3	4	5	6	7	8
Environment	+	+	+	++	++	++	-	-
Occupational safety	-	-	-	++	++	++	-	-
Job creation (based on equipment size)	+++	+++	+++	+	+++	++	+++	++
Social acceptance	+	+	+	+	+	+	-	-
Capital cost (per tonne of waste)		++	++	+++	++	++	-	+
Operating cost (per tonne of waste)	+++	++	++	++	++	++	-	++
Institutional requirements	+++	++	++	+++	++	++	+	++
Regulatory requirements	+++	+++	+++	+++	+++	+++	+	++

Table 5-5: Qualitative Comparison Summary of Treatment Technologies

Legend: 1 – Autoclaves; 2 - Hybrid autoclaves; 3 - Continuous steam treatment systems; 4 - Batch microwave technologies; 5 - Continuous microwave technologies; 6 - Frictional heat treatment systems; 7 - Incinerators; 8 – Chemical treatment systems.

Source: United Nations Environment Programme, 2012. Compendium of Technologies for Treatment/Destruction of Healthcare Waste

From a technical point of view, (batch) microwave technologies have the advantages of low space and installation requirements, while presenting a high degree of automation. Hybrid autoclaves also have several advantages, such as flexibility in dealing with varying quantities and HCW streams, as well as volume (and residues) reduction. It should be noted that two microwave treatment systems were recently installed in the Gaza Strip. Their efficiency is high, and the local staff is operating the units in a proper way. Incineration technology is highly effective in terms of microbial inactivation and volume reduction; however, it has several disadvantages that have to be considered, such as environmental impacts, flue gas treatment requirements, health and safety concerns and the need for continuous monitoring.

With regard to economic factors, incineration technology has the highest capital and operating costs, including the costs for pollution prevention. Autoclaves and microwave technologies appear to be more favourable solutions, however economic feasibility is highly dependent on the size of treatment facilities and related economies of scale.

Given the specific circumstances in the area, where space availability, environmental impacts and associated social acceptance are quite important, it is crucial to look into all aspects (technical, environmental, social, economic) in detail before adopting any HCW treatment technology at a large scale.

Conclusion; Treatment Option Recommendation:

Among all treatment options discussed above, and given the local circumstances, incineration, autoclaving, and microwave can be potential options for Palestine regulated HCW. The following facts are considered for the selection of treatment technologies:

a. <u>On-site incineration</u> provides the advantage of a quick, easy disposal method, but there are emissions concerns; some countries have even enacted moratoriums on incinerators to suspend permitting until further information on the safety of the option is available. Operation and







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maintenance may require skills which are not readily available in Palestine and depend on availability of (imported) spare parts.

- b. Autoclaving is the most commonly utilized alternative to incineration. It is both less costly and carries no documented health impacts. Approximately 90% of regulated medical waste are suitable for autoclaving, particularly infectious waste.
- Approximately 90% of medical waste can be treated with microwave process. The shredding c. process results in volume reduction and energy use is reportedly lower than that of an incinerator.

Based on the above facts, microwave with shredding process is suggested as option one, autoclaving as option two and on-site incineration as option three.







6 ACTION PLAN

6.1 ACTIVITIES

The following activities are proposed for the updating of the HCW Master Plan.

Table 6-1: Activities for the updating of the HCW Master Plan

	Priority Area	Activities	Outcomes	Responsibilities	Performance Indicators
1	Legal and institutional preparedness	 Identify gaps and outdated legal documents, Identify overlapping mandates of authorities and relevant stakeholders Review, complete and disseminate HCWM policies, Regulations, Guidelines and Standards Print and disseminate to all HCFs Review knowledge gaps among staff in HCWM Propose units and structure, mandate and operational needs within key stakeholders Conduct an assessment of the effectiveness of the JSCs as part of the current handling procedures, compare with the intended establishment of a National Waste Commission 	Clear understanding of terminology; overlapping mandates and roles and responsibilities identified. Existing legal documents are revised, developed and updated. Relevant stakeholders are informed about the Master Plan and legal documents on HCWM. Roles and responsibilities are documented and approved. Improved institutional arrangements.	MoH and EQA in close coordination with MoLG EQA with the MoLG	No. of reviews No. of by-laws and instructions prepared. No. of units established and operational.







	Priority Area	Activities	Outcomes	Responsibilities	Performance Indicators
2	Priority Area Institutional capacity, awareness	 Activities Review legal mandates for stakeholders. Establish communication channels. Establish information exchange system. Conduct exposure sessions to policy makers. Develop a training package for health care 	Outcomes The training package is available; trial training conducted and training package finalized. Online training tool is developed, tested and revised	Responsibilities MoH and EQA with MoLG	Performance Indicators No. of reviews No. of MOUs Communication channel established
		 Develop a chaining package for field field early workers and conduct a trial training for the final revision of the training package. Prepare training curricula on HCWM. Develop an online training tool for regular refresher training activities – trial testing and revision. Conduct training to all levels and teams related to HCWM. Enhance further collaboration and coordination among institutions. Document international treaties and agreements and expose to policy makers. Follow up and refresher training on annual basis at regional level. 	Master trainer and pool of trainers are trained. Have a trained person in HCWM in each HCF. Policy makers and hospital managers are trained. Online training introduced and used. Follow up done and refresher conducted on annual basis. Leaflets/posters/ads developed and disseminated.		No. of exposure sessions No. of training and trainees No. of policy makers exposed to international treaties
3	Services sustainability	 Conduct awareness meetings among key stakeholders. 	Resource mapping, gaps identified.	МоН	No. of meetings Tariff review







	Priority Area	Activities	Outcomes	Responsibilities	Performance Indicators
		 Listing projects approved by the PA or donors (pipeline projects). Identify co-financing possibilities. Conduct advocacy meeting among policy makers including Cabinet of Ministers. Review services cost and tariff. Prepare financial sustainability studies. Prepare action plan and disseminate among development partners. Prepare and disseminate HCWM impact reports. Conduct social marketing plan for recyclable materials. Undertake resource mapping of all health facilities and identify gaps in funding. 	Projects' background studies and emergency plans prepared. Donors' forum in place. Action plan prepared and disseminated. Marketing plans approved and in place.		Action and sustainability plans prepared Feasibility and Impact report prepared
4	Best Environmental Practices (BEP)	 Prepare lists of good practices, procedures and guidelines. Enhance collaboration between public/private colleges, faculties and other stakeholders in order to facilitate research in the area of HCWM. Disseminate among stakeholders. Conduct information sessions to all stakeholders. Conduct experience sharing sessions among staff. 	Locally adapted methods identified. Global best practices contextualized. Policy makers and staff are informed. Potentials for further research are initiated.	EQA and MoH as well as HCFs	Procedure prepared Best practices documented and disseminated A competition program is designed and implemented



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	Priority Area	Activities	Outcomes	Responsibilities	Performance Indicators
		 Document and share best practices. Conduct best practices competitions among HCFs. 			
5	Monitoring, evaluation and operational research	 Establish an independent regulator. Prepare KPIs, targets and benchmarks. Carry out a baseline survey in collaboration with MoH and disseminate the report (online). Conduct periodic operational inspection. Identify operational problems and challenges. Establish a data base for HCWM. Produce and disseminate annual performance reports. Identify research agenda and coordinate with research institutions. Conduct a baseline data study for HCWM. 	Independent regulator is established. Tools and guideline developed. Monitoring and auditing tools are available and shared with relevant stakeholders. Assessment report is available and disseminated Focal points in each large HCF are trained and certified.	Cabinet of Ministers, EQA	A technical committee under the National Solid Waste Committee is established with clear mandate KPIs drafted, baseline data collected Targets are set First performance report drafted
6	Improve emergency preparedness	 Identify current and potential emergencies. Prepare a safety plan, emergency response plan for different types of emergencies. Identify task force for emergencies with clear mandates and power. Allocate budget for potential emergencies. 	All potential emergencies are identified Task forces with focal points are identified. Budget is allocated for emergencies.	MoH, EQA	All potential emergencies are identified Safety plan prepared Occupational health and safety plan distributed and implemented







	Priority Area	Activities	Outcomes	Responsibilities	Performance Indicators
7	Infrastructure, equipment and supplies, treatment and disposal options	 Review all HCFs preparedness in terms of infrastructure availability, conditions and efficiency. Make sure that gaps are filled, staff are trained to use new facilities and equipment. For the above, procure incinerators, autoclaves, storage bins, collection carts, vehicles and PPE. 	Baseline data is verified and documented. Gaps in preparedness and technical capacities are identified. Backup systems are identified and plans are in place to fill in.	МоН	Preparedness plans Infrastructure built/purchased
8	Public Private Partnership (PPP)	 Review legal and institutional settings that promote PPP. Promote farther collaboration and coordination between public and private service providers. 	Institutional and legal reviews supporting PPP is completed. Partnership's scenarios and pilots are tested. MOUs are signed.	МоН	Legal gaps identified Coordination and collaboration mechanisms in place At least one MOU or partnership agreement is signed.







6.2 PLAN IMPLEMENTATION TIME FRAME³

The following measures and actions are considered necessary for the implementation of the HCWM Plan.

Table 6-2: Action Plan

Objectives	Measures / Actions	Type of Intervention	2022		2023	20	24	2025	5	No. of person- days	Expertise	Cost per person- day (USD)	Budget (USD)
	Identify gaps and outdated legal documents	Technical assistance/ Capacity building								10	local	300.00	3,000.00
Improve legal and institutional	Identify overlapping mandates of authorities and relevant stakeholders	Technical assistance/ Capacity building								10	local	300.00	3,000.00
	Review, complete and disseminate HCWM policies, regulations, guidelines and standards	Technical assistance/ Capacity building								15	local	300.00	4,500.00
prepareuriess	Review knowledge gaps among staff in HCWM	Technical assistance/ Capacity building								15	local	300.00	4,500.00
	Propose units and structure, mandate and operational needs within key stakeholders	Technical assistance/ Capacity building								10	international	800.00	8,000.00
Develop	Review legal mandates for stakeholders	Technical assistance/ Capacity building								5	local	300.00	1,500.00
institutional capacity, awareness	Sign MOUs among stakeholders	NA								NA	-	-	-
	Establish communication channels (web site/portal)	Technical assistance/ Capacity building								15	contract	800.00	12,000.00

³ Time frame will be discussed with all stakeholders (Under Tasks 4 & 5).







	Conduct exposure sessions to policy makers	Technical assistance/ Capacity building							5	local	300.00	1,500.00
	Prepare training curricula on HCWM	Technical assistance/ Capacity building							10	local	300.00	3,000.00
	Develop a training package for health care workers and conduct a trial training for the final revision of the training package	Technical assistance/ Capacity building							15	10 local and 5 international		7,000.00
	Develop an online training tool for regular refresher training activities	Technical assistance/ Capacity building							20	local	300.00	6,000.00
	Trial testing and revision	Supervision / monitoring							5	local	300.00	1,500.00
	Conduct training to all levels and teams related to HCWM	Technical assistance/ Capacity building							15	10 local and 5 international	633.33	9,500.00
	Enhance collaboration and coordination among institutions	Technical assistance/ Capacity building							5	local	300.00	1,500.00
	Document international treaties and agreements and expose to policy makers	Technical assistance/ Capacity building							10	local	300.00	3,000.00
	Follow up & refresher training on annual basis at regional level	Technical assistance/ Capacity building							20	local	300.00	6,000.00
Build Services financial sustainability	Conduct financial awareness meetings among key stakeholders and Identify co-financing possibilities	Technical assistance/ Capacity building							5	local	300.00	1,500.00
	Conduct advocacy meeting among policy makers including Cabinet of Ministers	Technical assistance/ Capacity building							5	local	300.00	1,500.00



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	Prepare a financial sustainability plan	Technical assistance/ Capacity building							20	local	300.00	6,000.00
	Review services cost and tariff	Technical assistance/ Capacity building							20	local	300.00	6,000.00
	Prepare Financial Sustainability Action Plan and disseminate among developmental partners	Technical assistance/ Capacity building							15	local	300.00	4,500.00
	Conduct social marketing plan for recyclable materials	Technical assistance/ Capacity building							15	local	300.00	4,500.00
	Undertake resource mapping of all health facilities and identify gaps in funding	Technical assistance/ Capacity building							15	local	300.00	4,500.00
	Listing projects approved by the PA or donors (pipeline projects)	Technical assistance/ Capacity building							10	local	300.00	3,000.00
	Prepare HCWM impact reports and disseminate	Technical assistance/ Capacity building							30	local	300.00	9,000.00
	Prepare lists of good practices, procedures and guidelines	Technical assistance/ Capacity building							40	local	300.00	12,000.00
Suggest and implement Best Environmental Practices (BEP)	Enhance collaboration between public/private colleges, faculties and other stakeholders in order to facilitate research in the area of HCWM	Technical assistance/ Capacity building							20	10 local and 10 international		11,000.00
	Disseminate among stakeholders with information exposure sessions	Technical assistance/ Capacity building							1	local	500.00	500.00
	Conduct experience sharing sessions among staff, document and share best practices	Technical assistance/ Capacity building							3	local	2,000.00	6,000.00







	Conduct best practices competitions among HCFs	Supervision / monitoring							60	local (3 competitions)	300.00	18,000.00
	Prepare KPIs, targets and benchmarks	Technical assistance/ Capacity building							15	local	300.00	4,500.00
	Carry out a baseline survey in collaboration with MoH and disseminate the report (online)	Technical assistance/ Capacity building							60	local	300.00	18,000.00
	Conduct periodic operational inspection and identify operational problems and challenges	Supervision / monitoring							180	local (3 inspections)	300.00	54,000.00
	Establish a data base for HCWM	Technical assistance/ Capacity building							40	contract	300.00	12,000.00
	Produce and disseminate annual performance reports	Supervision / monitoring							30	local	300.00	9,000.00
	Identify research agenda and coordinate with research institutions	Technical assistance/ Capacity building							5	local	300.00	1,500.00
	Identify current and potential emergencies	Technical assistance/ Capacity building							5	local + report	300.00	1,500.00
Develop / Improve	Identify task force for emergencies with clear mandates and power	Technical assistance/ Capacity building							10	local	300.00	3,000.00
emergencies preparedness	Allocate budget and procure equipment for potential emergencies	Investment (Equipment / infrastructure)							NA	TBD		75,000.00
Improve Infrastructure, equipment	Review all HCFs preparedness in terms of infrastructure availability, conditions and efficiency	Supervision / monitoring							25	local	300.00	7,500.00







and supplies, treatment and disposal options	Make sure that gaps are filled, staff are trained to use new facilities and equipment	Supervision / monitoring							15	local	300.00	4,500.00
	Procure waste containers, transportation facilities and treatment units	Technical assistance/ Capacity building							NA	TBD		3,000,000.00
Enhance	Review legal and institutional settings that promote PPP	Technical assistance/ Capacity building							15	local	300.00	4,500.00
Public Private Partnership (PPP)	Promote collaboration and coordination between public and private service providers	Technical assistance/ Capacity building							15	local	300.00	4,500.00
Procurement for HCW disposal	Preparation of 2 HCW disposal cells at Al Minia and Zahret Al Finjan (design and implementation)	Investment (Equipment / infrastructure)							NA	local		800,000.00
	Procure 2 HCW transportation vehicles	Investment (Equipment / infrastructure)							NA	purchase contract		400,000.00
											ΤΟΤΑΙ	4.578.000.00

NA	not applicable
TBD	to be discussed



6.3 FINANCIAL RESOURCES

Adequate financial and human resources, equipment and facilities are to be allocated to ensure safe and smooth management of HCW. Sources of funds include government allocation, health insurances, licensing, waste treatment fees for private sector, grants and support from partners/stakeholders.

Strengthening the efficiency of HCWM practices in health facilities will enable HCFs to achieve required standards and sustain HCWM goals. There should be efforts to strengthen resource mobilization through awareness raising meetings and allocation for HCWM and develop more financial options from different stakeholders. Cost recovery mechanisms are to be established to sustain HCWM. HCWM components are to be incorporated in the comprehensive plans and budgets of HCFs at all levels.

Advocacy should be undertaken to solicit support for the implementation of the policy and guidelines as per the action plan, from all stakeholders. Measures to achieve this include, but are not limited to, the following:

- All relevant reports of HCW management practices should be made available to all interested stakeholders.
- Drawing attention of development partners and communities to the existing situation, in order to obtain the widest possible support, including financial commitment.
- Disseminating information regarding HCWM to the general public through radio, print media, journals, booklets, leaflets, production of documentaries which could be aired on TV and radio stations; posting of related information on websites.
- To ensure their commitment, HCWM plans should involve private HCFs through their respective Boards. The private health institutions in particular should be encouraged to participate in the training programs that the HCWM plan will organise for the health institutions under cost sharing arrangements.

Current donors in HCW in Palestine include Government of Japan/JICA, Qatar Charity Fund, Italian Government, World Bank, and UNDP

6.4 HCWM REGULATORY SYSTEM: STRUCTURE AND MANDATE

6.4.1 MONITORING AND EVALUATION IN HCWM

Monitoring and evaluation (M&E) in healthcare waste management is a continuous process demanding participation of healthcare workers and managers in each HCF to ensure proper implementation of planned activities. Monitoring and evaluation on HCWM is part of the overall quality management and improvement system. Development of a M&E tool, to be developed by MoH in coordination with EQA will help to identify problems, their causes and institutionalize practical solutions; and therefore, will encourage evidence-based decision-making. It will also increase the likelihood of replicating good HCWM practices by applying lessons learnt.







The monitoring and evaluation should be undertaken throughout the management of HCW. M&E information is needed to assess HCWM implementation and guide policy and programme strategy, ensure effective operations, meet internal and external reporting requirements and facilitate future HCWM programming and improvement.

To support successful implementation and institutionalization of the M&E processes, it is recommended that HCFs adhere to the M&E plan mentioned above. The M&E / regulatory monitoring tools are to be used to collect data and information on how HCFs are implementing their HCWM programmes and activities in the country. The national HCWM, Monitoring & Evaluation tool / regulatory tools are to be administered annually across all HCFs and waste handlers and transporters. The technical committee supervise the monitoring of HCWM programme compliance and performance from the point of generation to the point of final treatment / disposal. In addition, the M&E / regulatory monitoring tools provide information of facility compliance with HCWM policy, guidelines, and occupational health and safety requirements. Monitoring will be conducted regularly in the health facilities (e.g. on a quarterly basis).

Internal monitoring and evaluation plans and systems are to be developed within each HCF. The internal monitoring system shall conduct day to day monitoring of HCWM in the HCF. Data will be analysed, interpreted and used by health facilities. Reports will be provided regularly (e.g. on a monthly basis). The internal auditor carries out weekly monitoring of HCWM in the health facility. He/she also carries out quarterly evaluation of HCWM in the facility. The different facilities submit their quarterly HCWM reports to the technical committee through the MoH.

HCWM performance data will be routinely compiled and analysed by the regulator. This process will enable HCWM stakeholders to get key information of facility compliance with HCWM policy, guidelines, and occupational health and safety requirements.

HCW management progress at the national, district level and facility levels must be monitored and evaluated. The implementation of the HCWM action plan should be monitored annually through the establishment of baseline, mid-term and end-term reviews. To facilitate this, monitoring and evaluation tools should be developed and used for both internal and external reviews.

6.4.2 MONITORING OF POLICY ACTIONS IMPLEMENTATION

Principles Monitoring is required to follow-up on Master Plan commitment and to ensure the effective implementation of the mitigation actions in the medical waste management so as to protect human health and the environment. This will be achieved through periodic internal and external processes of monitoring, at the levels of all implementation stakeholders involved.

The aim of the monitoring is to establish appropriate criteria to address potential negative impacts of HCWM and to ensure that unforeseen impacts are detected, and the mitigation measures implemented at an early stage. Specific objectives of the monitoring plan are to:

- Ensure that any additional impacts are addressed appropriately.
- Check the effectiveness of the recommended mitigation measures.
- Ensure that the proposed mitigation measures are appropriate.







• Demonstrate that medical waste management is being implemented according to plan and existing regulatory procedures; and,

• Provide feedback to implementing entities to make modifications to the operational activities where necessary.

To measure the effectiveness of the HCWM, all activities to be monitored by a follow-up, within the framework of a coordinating structure which will involve representatives of the MoH, health facilities (notably referral hospitals) as well as the EQA and MoLG. The EQA will coordinate monitoring and will centralize the follow up/evaluation information and data in a data bank and an information system for medical waste management.

Activities	Period	Responsibilities
Monitoring and follow-up of the implementation of the Master Plan	Monthly	Monitoring and inspection section EQA
Monitoring of the capacity building activities - training - awareness-raising	Quarterly	МоН
Percentage of facilities performing HCW segregation	Monthly	МоН
HCW generation per bed (kg/bed/month)	Monthly	МоН
No. of occupational health injuries	Monthly	MoH/MoLG
No. of facilities with approved treatment units	Quarterly	МоН
Final disposal arrangements adherence with applicable laws	Quarterly	EQA

Table 6-3: Monitoring plan for the implementation of the HCWM

A HCWM Steering Committee /Advisory Committee that will be established, with representatives from EQA, MoH and MoLG as well as external experts, shall advise on the handling and disposal of HCW. However, daily supervision is to be carried out by the waste control managers within HCF who in turn report to the Director of the HCF. The institutional directors / managers within HCFs therefore have overall responsibility for ensuring that procedures are in place, are being implemented and sanctions enforced where appropriate. They are expected to work closely with the aforementioned HCWM Technical Committee and conduct regular spot checks.

In addition to daily and weekly inspections of procedures, the following parameters are to be monitored:

• Standard operating procedures (SOPs) for persons involved at each stage of handling waste should be monitored by supervisors in the HCF,





- SOPs should cover areas like waste minimization, segregation of waste, transportation, storage, treatment and final disposal. In addition, it should cover the disinfection of reusable infectious HCW containers based on standards for disinfection.
- Minimum environmental performance requirements for controlled treatment facilities like incinerators, autoclaves or microwaves should be carried out at the beginning of facility operation and at least annually, based on guidelines to be provided by the manufacturer.

The proposed monthly monitoring indicators at the national as well as HCF level are as follows:

- 1) Percentage of facilities performing HCW segregation;
- 2) HCW generation per bed (kg/bed/month);
- 3) % of infectious waste;
- 4) No. of occupational health injuries per month;
- 5) No. of facilities with adequate sharp boxes;
- 6) No. of trained staff for HCWM;
- 7) Health care waste management staff vaccinated;
- 8) No. of facilities with approved HCWM budgets;
- 9) No. of facilities with approved treatment units.

6.4.3 RECORD KEEPING AND DOCUMENTATION

Each HCF is required to maintain records of waste management. In addition to stores and logistics management records at the institutional level issues regarding the type of waste, where it is generated, when separated, by whom and every other subsequent action until final disposal or handing over to a waste disposal authority/facility, when such is the case, shall be documented. The following are important specific information which should be documented by each institution:

i. Information on Waste types and Handling Processes

- Date
- Type and volume/ weight of waste generated;
- Type, origin and weight of waste received from other HCFs (in case of shared facilities);
- Means of transportation, type and volume transported;
- Details of the commissioned waste contractor (name of company, type of license, site of treatment and / or final disposal);
- Disposal method and quantities per method: e.g. volume incinerated, volume at every point of intermediate treatment, volume finally disposed of.
- ii. Records of environmental performance for incinerators.

6.5 INSTITUTIONAL AND CAPACITY BUILDING, COMMUNITY AWARENESS

The fundamental purpose of institutional strengthening is to build capacity in order to improve and retain skills and knowledge needed for proper HCWM. This includes human resources development







(both pre-service and in-service personnel), focusing on the improvement of understanding, skills and knowledge that will enable them to perform effectively.

The process of institutional capacity building may begin by assessing training needs to identify gaps, strengths and weaknesses; the next steps shall involve the development of a training curricula and conducting training courses for healthcare workers. Furthermore, there should be supportive supervision of operations at all levels to improve performance in HCWM.

Institutional strengthening will also be achieved by increasing collaboration and coordination among HCWM stakeholders. To gain political commitment, system support and social acceptance of HCWM, specific objectives as indicated earlier are required, which will be targeted to influence policy makers or decision-makers at the national level and other stakeholders. Thus, communication of HCWM issues through the media to decision-makers and other potential supporters, including the public, may stimulate actions by social institutions, stakeholders and policy makers to support HCWM.

6.6 TRAINING, CAPACITY BUILDING AND RESEARCH

It is essential that training in the safe and correct management of HCW is provided to all staff, including HCF managers. This can be facilitated by the adoption of the following strategies:

- i. Pre- Service and Post Basic training of health workers should include HCW management. There is a need to review health training institutions' curricula to incorporate waste management.
- ii. HCW management should also be incorporated into in-service training curricula. This training should be tailored to the needs of health care providers.
- iii. HCF managers shall ensure that all their staff undergo in-service training in health care waste management.
- iv. Training Curricula, Guidelines, and Training Manuals on HCW management shall be developed to facilitate Pre-Service, In-Service and Post Basic training.
- v. Standard Operating Procedures (based on national guidelines) shall be developed and communicated to all personnel involved in handling, transportation and disposal of HCW.
- vi. These standards should form the basis for the in-service training to be provided for managers and staff involved in the day-to-day management of HCW. Their training should also cover contingency management of incidents involving HCW.
- vii. The responsible agencies within the health sector shall co-ordinate the drawing up of training curricula which should be adaptable for national, regional and localised training in HCW management and should be budgeted for at all levels of the health care system and the necessary funds allocated to it as a matter of priority.
- viii. Collaboration between the health sector and universities as well as other research institutions should be strengthened to facilitate the development and adaptation of technologies available for HCW management.







7 CONCLUSIONS AND RECOMMENDATIONS

7.1 POTENTIAL RISKS ASSOCIATED WITH PLAN IMPLEMENTATION

The potential risks associated with the HCW Management Plan implementation that have been identified are the following:

	Potential Risk	Risk level	Proposed mitigation measures
1	Limited coordination among key ministries and stakeholders	Medium	Institutionalise and strengthen collaboration among ministries and key stakeholders.
2	The Ministry of Health / Government might not fund the implementation of HCWM due to inadequate resources	High	Align the plan with the National Development Plan; lobby and collaborate with cooperating partners for possible funding.
3	Slow or no enhancement, adoption and implementation of national policies, plans and strategies on HCWM which are key in creating an enabling environment for the country	Medium	Lobby and collaborate with stakeholders and cooperating partners for the support in the implementation of HCWM Plan.
4	Wrong technology specifications, lack of transparency, or non-compliance with national bidding requirements and procedures	Medium	Implement E-Procurement system to enable compliance, transparency and efficiency. The competitive bidding process is centralized for the whole country and is transparent and adheres strictly to national requirements and procedures.
5	Health Care Facilities discontinue the use of purchased technologies, and/or discontinue the maintenance resulting in their ultimate breakdown	Low	 Make sure that: maintenance and insurance scheme for a minimum of 3 years beyond the plan's duration is included in any procurement contract; maintenance teams and operators at HCFs are trained in day-to-day maintenance procedures; availability of parts and technical support for repair and maintenance of technologies.
6	Insufficient number of technology suppliers involved in the bidding and/or high purchase costs	High	Ensuring sufficient outreach to vendors, conducted within the scope of HCWM projects, will ensure sufficient vendors. Centralized high-volume procurement will help lower prices. Procurement facilitated by a National Procurement System will ensure that long term agreements with various international suppliers can be relied upon.
7	Health workers not trained on technologies in HCWM thereby abandoning the technologies within a short period of time	Low	Training of health care workers in all purchased technologies. Procurement contracts should include a training component.

Table 7-1: Potential Risks associated with HCWMP Implementation







7.2 CONCLUSIONS / LESSONS LEARNT

The establishment of HCW management policies, plans, legislation and practice should be the outcome of adequate <u>background work</u>, such as situation analysis, evaluating alternatives, and involving key stakeholders in the process, to avoid delays and costly readjustments. By not taking all required steps, HCWM management in Palestine has been a rather complicated process, with delays in the preparation and implementation of HCW legislation and assignment of responsibilities.

Although a number of current institutional arrangements can be recognised as adequate, namely with on-site management by HCFs, transportation by the MoLG and treatment and final disposal by JSCs, still, having a unified system at the national level, including the establishment of a national solid waste commission to handle both domestic, as well as health care waste and other hazardous and special waste from the transfer stations onward, might be a good option. With this, responsibilities are clear, private sector contracting is possible, data and records generation is possible, and further development is easier. Monitoring is also easier.

Hospitals and other HCFs are able to change their <u>waste management culture</u> and to <u>improve HCW</u> <u>management practices</u>. Since the implementation of the Medical Waste Management Plan, and with the assistance provided by a number of Developmental partners to HCFs, the culture at many HCFs has changed to recognize hygiene and HCW management as essential to good hospital management practices.

The <u>private sector's role in on-site HCW management</u> is becoming more and more important. With the implementation of the Health Care Waste policy and increased recognition of the need for good HCW management practices at health care facilities, the private sector's involvement in providing on-site and off-site HCW management services is growing.

A strong and clear <u>regulatory system</u> and commitments improve implementation of HCW management. The decision to establish such a system is urgently needed, and capacity enhancement for the system to function can make a major difference in the effectiveness of implementing the HCW policy.

<u>Information technology</u> has a crucial role to play in HCW management. Information technology has great potential for creating public awareness on HCW management issues and for sharing knowledge about HCW management practices at health care facilities.







8 **REFERENCES**

- Anayah, F., Al-Khatib, I.A. & Hejaz, B. Assessment of water and sanitation systems at Palestinian healthcare facilities: pre- and post-COVID-19. Environ Monit Assess 193, 41 (2021). https://doi.org/10.1007/s10661-020-08791-4
- Hinduja A. and Pandey M., 2019. Assessment of Healthcare Waste Treatment Alternatives Using an Integrated Decision Support Framework. International Journal of Computational Intelligence Systems 12(1) 318–333.
- 3. The Global Fund, Geneva 2020. Technical Brief: Sustainable Health Care Waste Management
- 4. United Nations Environment Programme, 2012. Compendium of Technologies for Treatment/Destruction of Healthcare Waste
- 5. WHO, 2014. Safe management of wastes from health-care activities. 2nd edition



