



Healthcare waste management: Moving towards sustainability

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FOREWORD

Waste generation is inevitable in any industry, and healthcare is no exception. While much of the waste produced by healthcare can be considered non-hazardous, managing healthcare waste is both a public health and environmental concern.

There have been substantial strides taken in the international policy landscape concerning waste management over the last few decades. In parallel, national governments have developed their laws, regulations and practice.

In this report we provide an overview that describes current thinking on appropriate healthcare waste management. In addition, the report reflects on the importance of a circular economy, which will be key in healthcare becoming truly sustainable. We also reflect on Qatar's development and current practice as the country and its health system has undergone an extraordinary transformation over the last few decades.

The report ends with recommendations that all countries need to consider in managing waste as their healthcare systems develop and the world moves towards sustainability.



A handwritten signature in black ink, appearing to read 'Ruth Stringer'.

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SECTION 1: HEALTHCARE WASTE MANAGEMENT: AN OVERVIEW

Healthcare waste

All human activities generate waste, and healthcare is no exception. As healthcare becomes more sophisticated and coverage extends across the world, the amount of healthcare waste increases accordingly. Generation ranges from less than one kilogram per hospital bed per day (kg/bed/day) in low-income countries in Africa and Asia to over 8kg/bed/day in Canada and the USA.¹

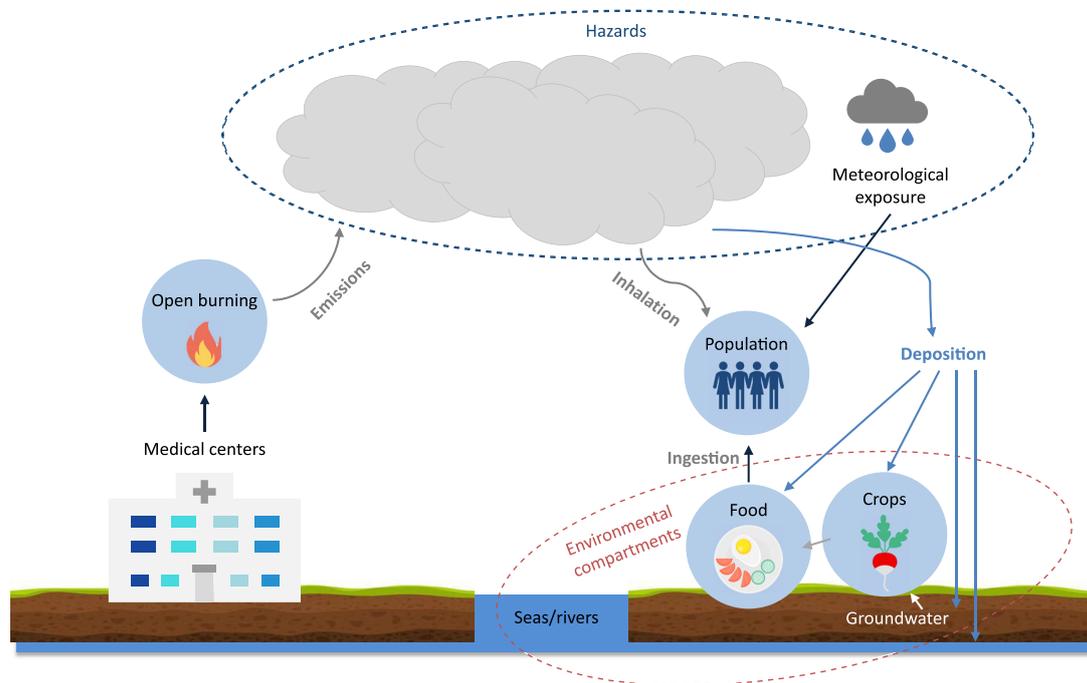
The capacity to safely treat municipal and healthcare waste often lags behind the growth of a country's economy and healthcare services. The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recently estimated that one in three healthcare facilities globally do not manage their waste safely.²

Most of the waste generated by healthcare is similar to ordinary municipal waste, but a small fraction of around 15–25 percent is hazardous.³ Hazards include the potential to transmit infectious disease, cause physical injury, to pollute the environment, and contribute to climate change.

Hazardous waste is a danger for healthcare staff and those tasked with managing waste. Over one-third of the hepatitis infections in healthcare workers are due to needle-stick injuries, and over 20 percent of these happen during disposal.⁴ In addition, a high prevalence of hepatitis in rag pickers and municipal waste workers in some countries is thought to be due to the improper treatment of waste.⁵

Burning waste can lead to environmental pollution entering the atmosphere, and can potentially enter the local food chain (see Figure 1). The highly persistent and toxic polychlorinated dioxins and furans have been detected in high concentrations in eggs produced close to healthcare and other waste incinerators that do not have air pollution control.⁶

Figure 1: Effects of burning healthcare waste on humans and the environment



Source: Adapted from Cook and Velis (2020)⁷

International priority

A Human Rights Council Special Rapporteur found that improper healthcare waste management interfered with human rights, including the right to life and health, and the right to a safe working environment.⁸

Technical solutions for most of the problems associated with healthcare waste management are available, but the issue needs to have a higher priority and be funded properly. The World Health Assembly Resolution 72.7 urged governments to improve healthcare waste management, as an essential step toward meeting the targets set in the Sustainable Development Goals (SDGs), particularly: SDG 3 (Good health and well-being); SDG 6 (Clean water and sanitation); SDG 1 (No poverty); SDG 7 (Affordable and clean energy); SDG 11 (Sustainable cities and communities); and SDG 13 (Climate action).⁹ Other relevant international conventions are listed in Table 1.

Table 1: International conventions and healthcare waste management

<p>26th United Nations Climate Change Conference of the Parties to the Paris Convention (COP26)¹⁰</p> 	<p>Sustainable healthcare waste management is part of the commitment to build and support climate-resilient low-carbon healthcare systems that 52 countries signed up to at COP26 in 2021.</p>
<p>Minamata Convention on Mercury¹¹</p> 	<p>Adopted in 2013, the Minamata Convention aims to eliminate mercury, which is hazardous and hard to dispose of safely.</p> <p>The convention includes:</p> <ul style="list-style-type: none"> • a ban on new mercury mines, and the phase-out of existing ones. • the reduction of mercury use in products and processes. • control measures on emissions to air and on releases to land and water. • regulation of the informal sector of artisanal and small-scale gold mining.
<p>Stockholm Convention on Persistent Organic Pollutants¹²</p> 	<p>Coming into force in 2004, the objective of the Stockholm Convention is to eliminate or reduce persistent organic pollutants, including the polychlorinated dibenzo-p-dioxins and furans which are generated by incineration.</p>
<p>Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal¹³</p> 	<p>The Basel Convention came into force in 1992 in response to hazardous waste being shipped to countries with less stringent regulations.</p> <p>The Convention aims to:</p> <ul style="list-style-type: none"> • reduce hazardous waste generation and promote environmentally sound management of hazardous waste wherever it is disposed of. • restrict the movement of hazardous waste over borders, except where it is in accordance with the principles of environmentally sound management. • develop a regulatory system for transboundary movement of hazardous waste.

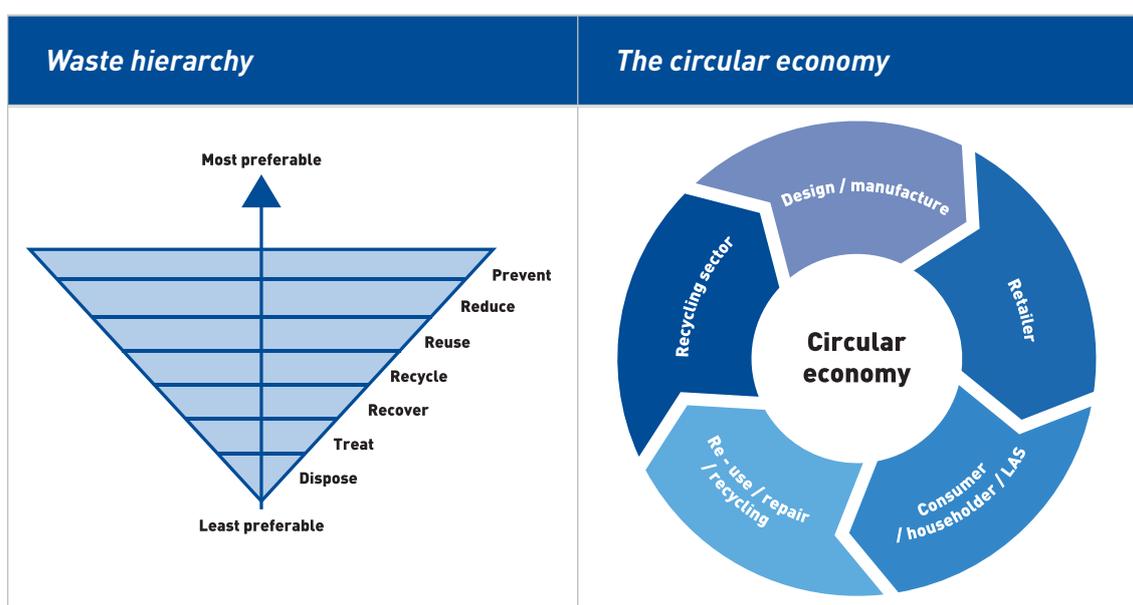
Reduce and reuse

The conceptual models of the waste hierarchy and the circular economy can help guide policy on healthcare waste management (see Figure 2). The waste hierarchy helps prioritize different ways to deal with waste, whereas the circular economy puts waste in the context of a product's life cycle.

Both of the models encourage the reduction of waste. Examples of healthcare waste reduction include avoiding the use of chemicals that are known to be of environmental concern¹⁴ including mercury and polyvinyl chloride (PVC), and prescribing oral medicines rather than injectable ones to reduce the amount of sharps waste. The circular economy model emphasizes the need to consider waste in product design so that hazardous materials are avoided, and products can be reused, repaired or recycled.

Single-use items are increasingly common in healthcare, which leads to a substantial volume of waste. Reusing washable gowns or other textile products and avoiding disposable plates or crockery in canteens reduces healthcare waste. There is also an upsurge in 'reprocessing' medical items such as surgical instruments. Reprocessing companies will clean, disinfect, repackage and certify the safety of these products, keeping them out of the waste stream for as long as possible.

Figure 2: The waste hierarchy and the circular economy



Source: Domenech (2014)^{15,16}

Managing waste

Since as much as 75–85 percent of healthcare waste is the same as municipal waste, much of it will be recyclable or recoverable. Simply segregating waste at its generation point can ensure that not all healthcare waste has to be treated as hazardous. Many medical products, such as plastic saline bottles, or syringes with needles removed, are highly recyclable when simple precautions are taken, such as disinfection or dismantling to prevent illicit reuse. Not all countries allow for the recycling of disinfected waste, but where it is allowed, up to 40 percent of the entire healthcare waste stream can be recycled.¹⁷

The most common methods for managing infectious healthcare wastes are burning, incineration and steam disinfection. The Stockholm Convention (see Table 1), to which 185 countries are parties,¹⁸ and WHO recommend using non-incineration technologies for healthcare waste, as this does not emit persistent organic pollutants (POPs) such as polychlorinated dioxins and furans.

The most sustainable methods for treating infectious waste avoid incineration, and other high processes – defined by the United Nations Environment Programme (UNEP) as operating over 180°C – or the use of hazardous chemicals. Autoclaving and microwaving, which use steam at less than 134°C¹⁹ are the most commonly used sustainable methods. These techniques can leave waste safe for recycling or disposal.

The WHO definition of healthcare waste recovery²⁰ includes incineration with energy recovery (which is not environmentally preferred), and composting and biodigestion, which are sustainable options. Both composting and biodigestion depend on microorganisms to break waste down. Composting requires oxygen and is used for solid materials, whereas biodigestion is carried out in a liquid medium in the absence of oxygen. Biodigestion has been applied to organic healthcare wastes, predominantly hospital food waste and pathological waste such as placentas. The process produces biogas, a renewable fuel containing methane, and an organic slurry or 'digestate'. The digestate derived from wastes from agricultural and municipal sources is often used as a fertilizer, but this is not recommended for wastes from the healthcare sector, so biogas is the main product recoverable in this case.²¹

When other options have been exhausted, or are not available, waste is destined for a final disposal method, usually landfill or incineration. National legislation may dictate incineration for wastes such as chemicals and pharmaceuticals, for which there is little sustainable disposal capacity. Because these methods permanently take products or materials out of the economic cycle, both should be avoided under the circular economy model.

Upgrading waste management systems

It was recently estimated that upgrading waste management systems in the 46 least-developed countries would cost \$3.7 billion between 2020 and 2030. The amounts needed are described as “modest” in comparison with the overall healthcare spend²² and would represent approximately 3 percent of the outlay on healthcare by the governments of those countries, or \$0.30 per capita per year.²³

The COVID-19 pandemic caused an unprecedented amount of waste, and brought into sharp focus the benefits of safe healthcare waste management. Future events, including environmental disasters, extreme weather, or new disease outbreaks have the potential to similarly increase the amount of healthcare waste generated. This challenges safe and appropriate waste management because, as the pandemic highlighted, many countries lack sufficient capacity, and so struggle to manage healthcare waste.

SECTION 2: A SPOTLIGHT ON QATAR: DEVELOPMENT AND PRACTICES

A well planned and implemented healthcare waste management system can lead to numerous benefits, including: reduced risk to hospital staff and patients; operational cost savings; and mitigating the effect of waste and pollution on the environment.^{24,25,26}

Only about 15 percent of healthcare waste is considered hazardous and potentially infectious, toxic or radioactive.²⁷ Nevertheless, appropriate management of all waste is a public health and environmental concern. In 2012, the United Nations highlighted: “basic human needs such as clean water, clean air and safe food are jeopardized by improper waste management practices, with severe consequences for public health.”²⁸

Healthcare waste in Qatar

WHO categorizes waste based on the risk it poses to the environment and human health.^{29,30} Similarly, Qatar’s Supreme Council of the Environment and Natural Reserves (SCENR)³¹ Resolution no. 8 of 2006 categorizes healthcare waste as:

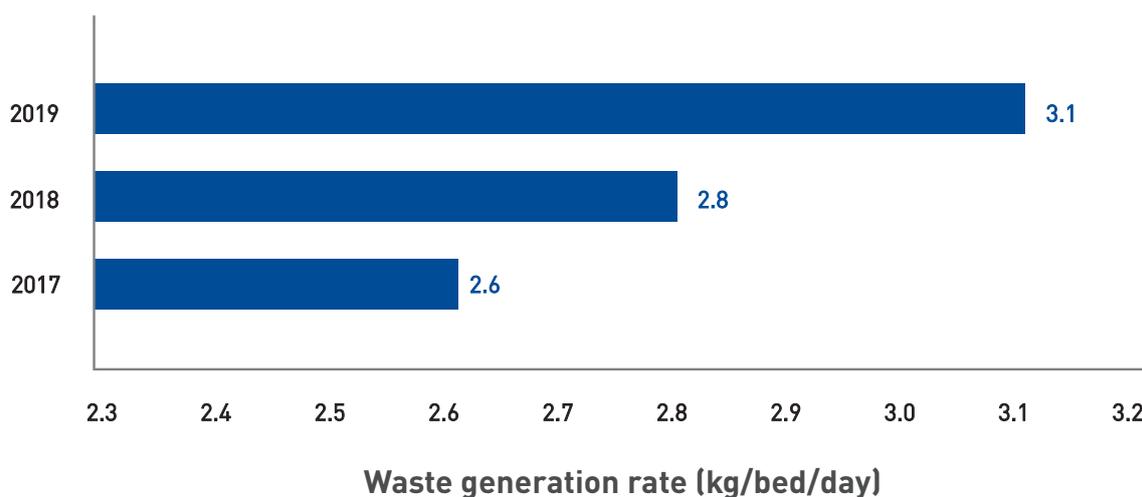
- 1. Non-hazardous healthcare waste:** Waste that is not infected or contaminated, with no direct hazard to human health or the environment, that requires no special handling – for example, office waste, plastic bottles or leftover food.

2. Hazardous healthcare waste: Waste that is generated from local healthcare facilities, or home healthcare that is infectious, genotoxic or cytotoxic, a toxic or injury hazard, biological, or radioactive.

Qatar's Primary Health Care Corporation (PHCC), which has 28 health centers nationwide, estimates that 70–90 percent of generated waste in their healthcare facilities is non-hazardous. This highlights the importance of good waste segregation.

Hamad Medical Corporation (HMC) is the largest healthcare provider in Qatar, comprising 14 tertiary hospitals and an ambulance service. A 2021 study analyzed the hazardous healthcare waste data from 10 HMC hospitals, and provides quantitative insight into the healthcare waste generation across the country. The study showed that the amount of hazardous waste generated by HMC was increasing, estimated to be 3.1 kg of waste per hospital bed per day in 2019 (see Figure 3).³²

Figure 3: HMC yearly average hazardous healthcare waste generation rate

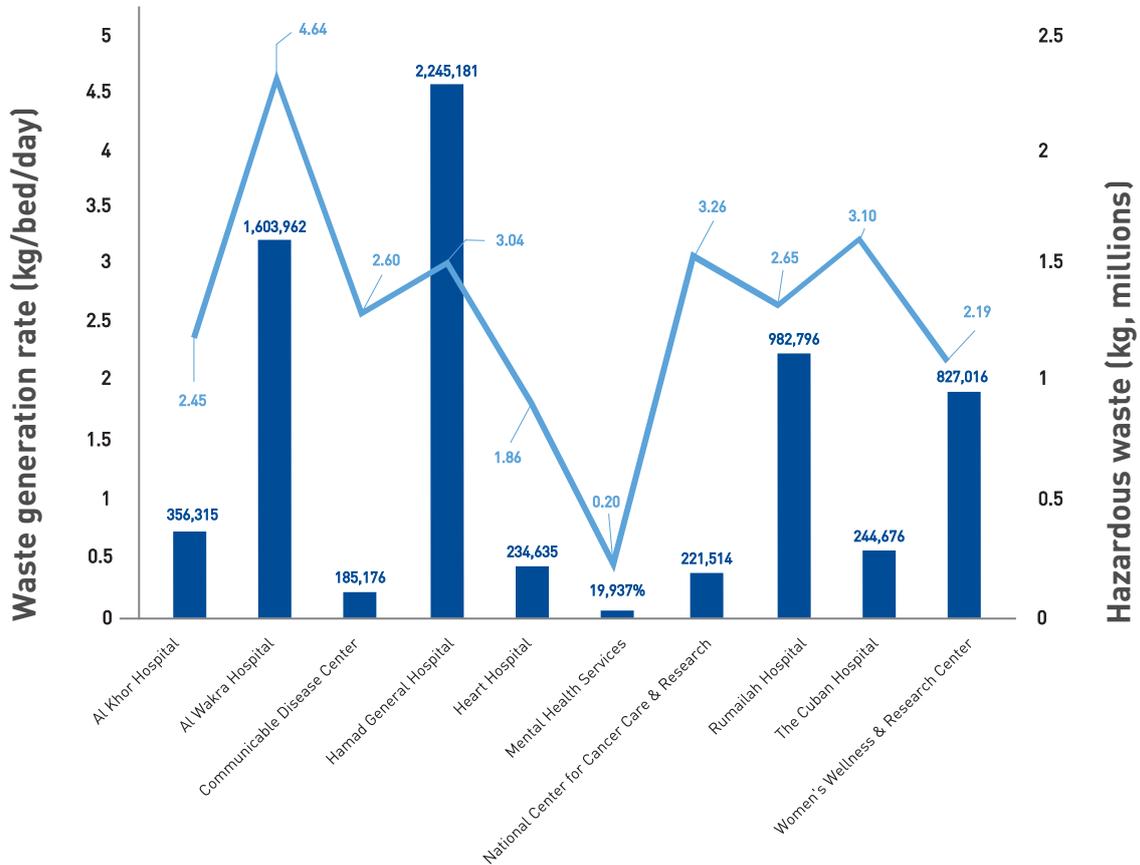


Source: Al Naemi (2021).³³

Unsurprisingly, the amount of hazardous healthcare waste produced depends on the size of a facility. The hospitals included in the study ranged in size from just under 700 active beds to less than 70 beds. The type of facility also has a strong bearing on the amount of waste produced. For example, mental health services produced far less hazardous waste per bed than a general hospital (see Figure 4).

The generation of hazardous medical waste calls for effective handling methods to protect staff, patients, the general public, and the environment.³⁴

Figure 4: HMC hospitals' average hazardous healthcare waste generation, 2017-2019



Source: Al Naemi (2021).³⁵

Changing the policy landscape

The policy landscape on waste management in Qatar has changed dramatically over the last quarter of a century (see Figure 5). Qatar's healthcare system has also experienced an ambitious journey of development and investment over the last two decades.

In 1998 the Council of Ministers in the Gulf States issued the National Guidelines for Safe Management of Health Care Waste,³⁶ based on WHO guidelines, and the Regional Working Papers on Safe Disposal of Hospital Waste³⁷ (see Figure 5). In

the past, Qatar used autoclaving and open burning as the primary medical waste treatment in healthcare facilities. This practice stopped in the early 1990s. As described in the previous section, burning of plastics and chemicals can generate harmful emissions. Qatar developed the HMC waste management program, making important investments in state-of-art solid waste management facilities, related infrastructure, and waste transfer storage stations.

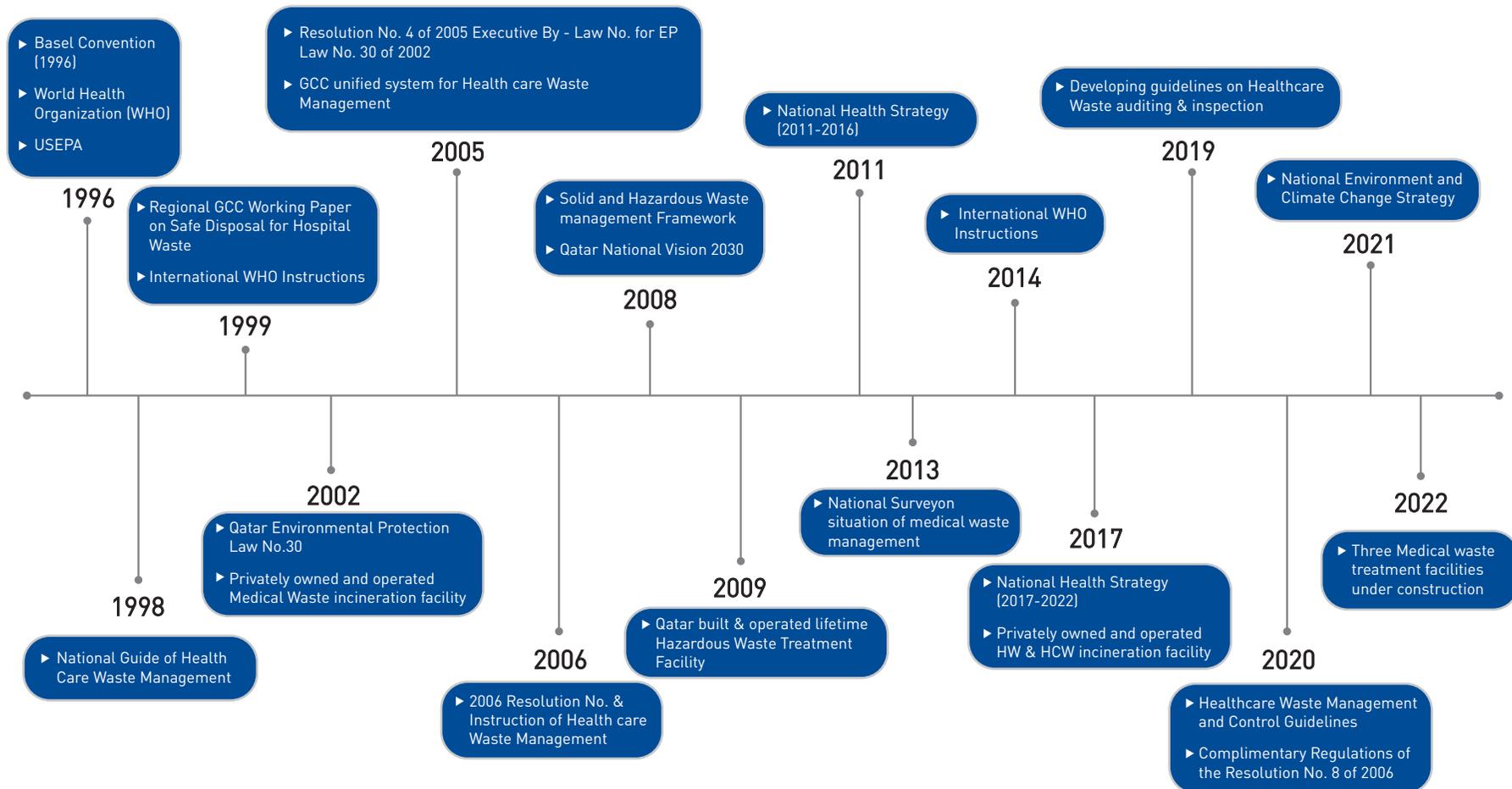
The Qatar National Vision 2030 (QNV 2030) national development plan was launched in 2008. QNV 2030 comprises four central pillars, with the “human and environmental development” pillar setting out the need to develop a sustainable healthcare system.^{38,39} Aligned with QNV 2030, the First (2011–2016) and the Second National Health Strategies (2018–2022)⁴⁰ (NHS-1 and NHS-2) focused on developing and strengthening the implementation of an effective and sustainable medical waste system that uses advanced technology and non-technology solutions.

A number of procedures and guidelines were developed and implemented based on NHS-1 and NHS-2, including healthcare waste auditing and inspection (2019), and the implementation of complementary regulations based on Resolution no. 8 (2006) and the Healthcare Waste Management and Control Guidelines (2020). Through these initiatives and investment in state-of-the-art facilities, the health system is set to achieve the QNV 2030 pillar of human and health care.

In 2017, Qatar signed the International Minamata Convention on Mercury (see Table 1) to address mercury pollution. Mercury is found in dental amalgam, and consequently the Ministry of Public Health developed a phase-out plan for the use of amalgam for teeth restoration.⁴¹ As of July 2021, the Ministry of Public Health announced the discontinuation of amalgam in dental restorations.⁴²

In addition, the Qatar National Environment and Climate Change strategy, launched in 2021 by the Ministry of Environment and Climate Change, places particular focus on achieving a circular economy (see Section 1).⁴³

Figure 5: Qatar's history of legislation and healthcare waste management practices



Waste facilities

Different government departments, institutions and industries have established reliable healthcare waste management strategies in alignment with local regulations, WHO, and the UNEP. HMC and PHCC follow similar waste disposal cycles that comply with Qatar's laws and regulations (see Figure 5). The private sector also has an important role in managing healthcare waste and ensuring legal compliance. Since 2019 PHCC has transferred infectious waste to HMC facilities, and hazardous chemical waste is managed by a licensed private company.

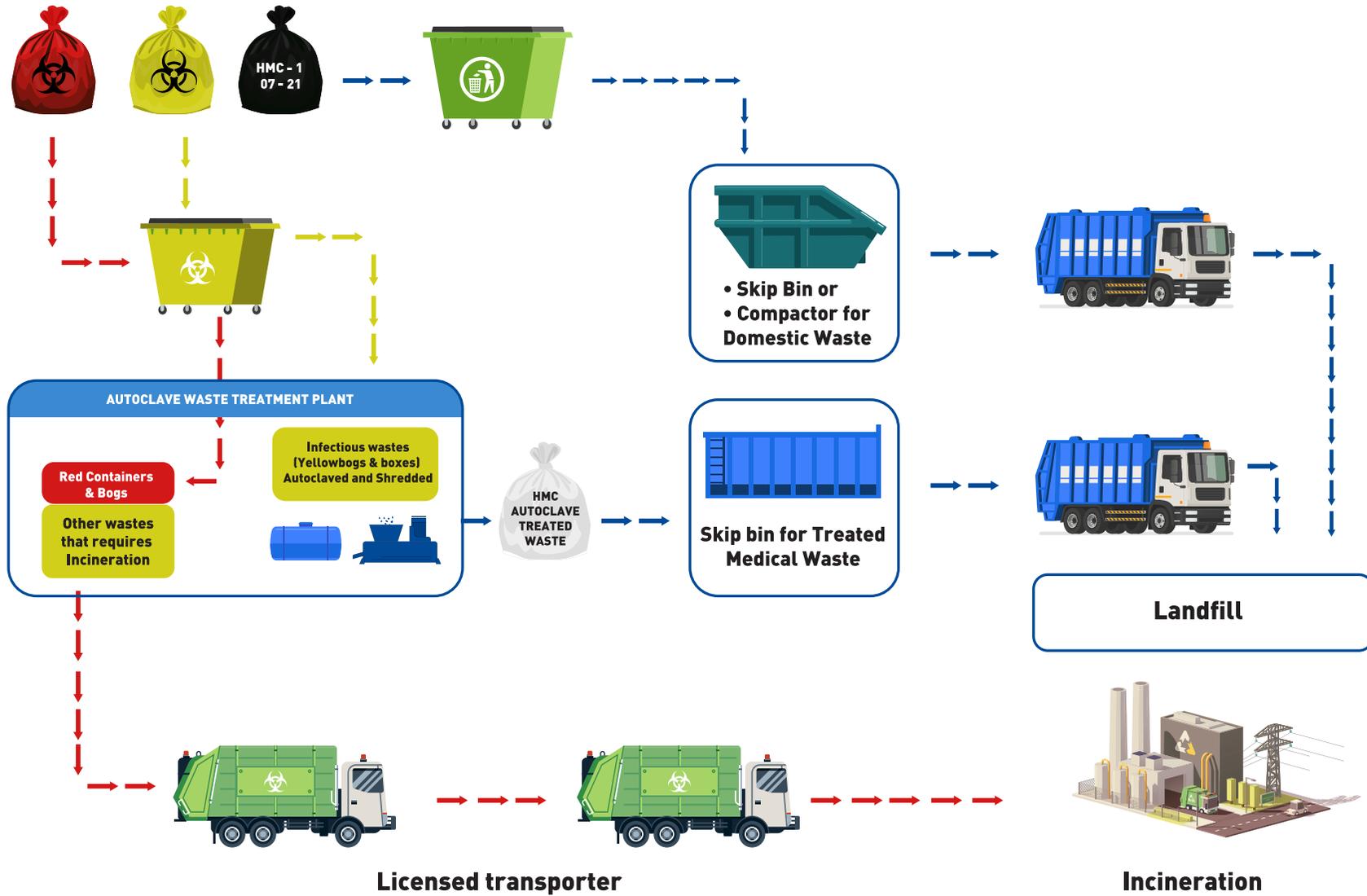
The collection, packaging, labelling, and transportation of all healthcare waste generated in HMC hospitals is centrally managed by two HMC departments: Hospitality, and Occupation Health and Safety (see Figure 6). Non-hazardous healthcare waste is transported to government landfill for possible recycling and final disposal by the Ministry of Municipality.⁴⁴

Hazardous infectious waste is transported to waste treatment plants controlled by the Environmental Safety Section of HMC's Occupational Health and Safety Department. The department operates four medical waste treatment plants in Qatar (located at Hamad General Hospital, Al Wakrah Hospital, Al Khor Hospital and the Cuban Hospital). The plants use autoclave with integrated shredding, to decontaminate infectious healthcare waste. Other waste that can't be treated by autoclave is treated off-site by incineration provided by licensed private company.⁴⁵

Qatar has made investments in the state-of-art domestic solid waste management facilities, related infrastructure, and transfer storage stations, including a waste treatment plant in Mesaieed Industrial City in the south of Qatar. The plant was built to EU environmental standards and opened with the capacity to handle 4,600 tons of hazardous and hospital waste per year.⁴⁶ In addition, the Alafga area in Mesaieed Industrial City has allocated over 150 lots to healthcare waste treatment, waste recycling, waste to energy, and waste segregation. Qatar is planning a comprehensive waste management project that targets zero waste to landfill in the next 10 years.

Figure 6: HMC waste disposal cycle

Waste segregated from point of Generation



Beyond waste treatment

The waste hierarchy (see Figure 2) describes different ways to deal with waste: prevention, reduction, reuse and recycling are the most sustainable and preferred methods. While it is important to treat waste appropriately, it is also crucial to implement parallel strategies to reduce waste generation. This has been recognized in Qatar and is exemplified in the Ministry of Public Health's various recycling initiatives, and its work to reduce mercury use in dental amalgam.

The Ministry of Municipality launched a recycling initiative in 2019 for all governmental and semi-governmental institutions,⁴⁷ to be expanded to all organizations, government departments, and academic and research institutions by the end of 2022. HMC set the goal to reduce general waste by 10 percent by 2021 and more than 15 percent by 2022.⁴⁸

In August 2019 PHCC pioneered a waste recycling program that included three-in-one recycling bins across all the health centers and the main office; and a color-coding system for waste bags, waste bins or any type of container used for waste.

In 2021 HMC launched a recycling pilot called Waste Wise in Hamad bin Khalifa Medical City to promote a recycling culture by encouraging staff, patients, and visitors to use segregated bins to recycle paper, aluminum, plastic, and other waste.

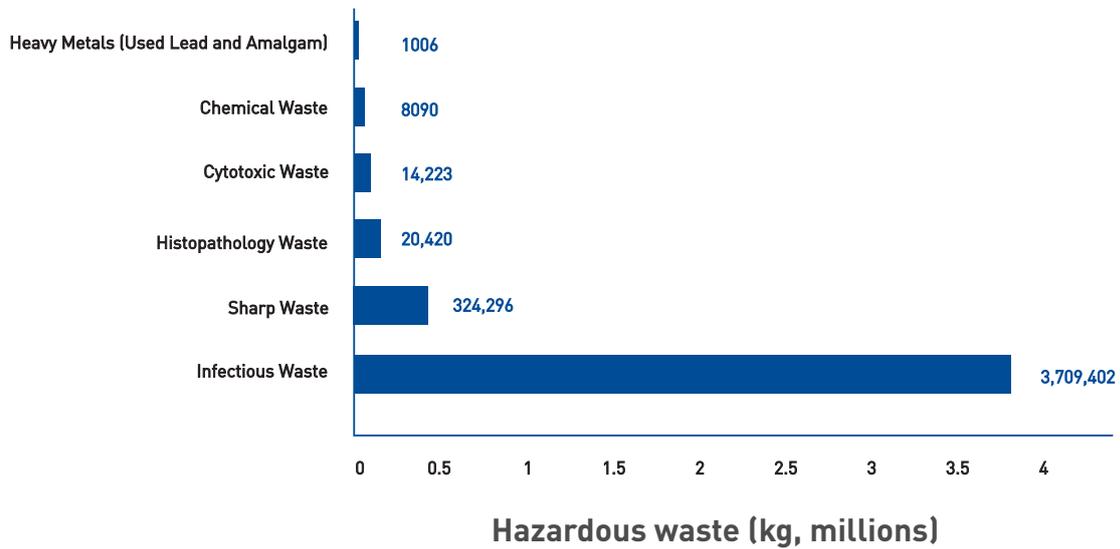
COVID-19 waste management

During the COVID-19 pandemic, the Ministry of Public Health used an integrated government approach and took several measures to control healthcare waste and enhance the existing healthcare waste management program. With the emergence of COVID-19, the Ministry developed a protocol that drew on the principles of key organizations, such as the Global Fund, that recommended that waste should be dealt with as close to the point of production as possible.⁴⁹ National regulations and policies were adapted to manage waste at quarantine locations and isolated centers and camps, helping prevent the spread of infection and ensuring that critical waste management resources were not overstretched.

Companies approved to collect, transport and treat hazardous healthcare and household waste generated from COVID-19 centers and camps, were obligated to transport all types of waste as infectious clinical waste that was treated at the medical waste incineration facility.^{50,51,52} After August 2020, when it was recognized that household waste did not transmit COVID-19, and in line with WHO and Centers for Disease Control and Prevention (CDC) guidelines,^{53,54} only hazardous medical waste from COVID-19 patients was treated in autoclaves.

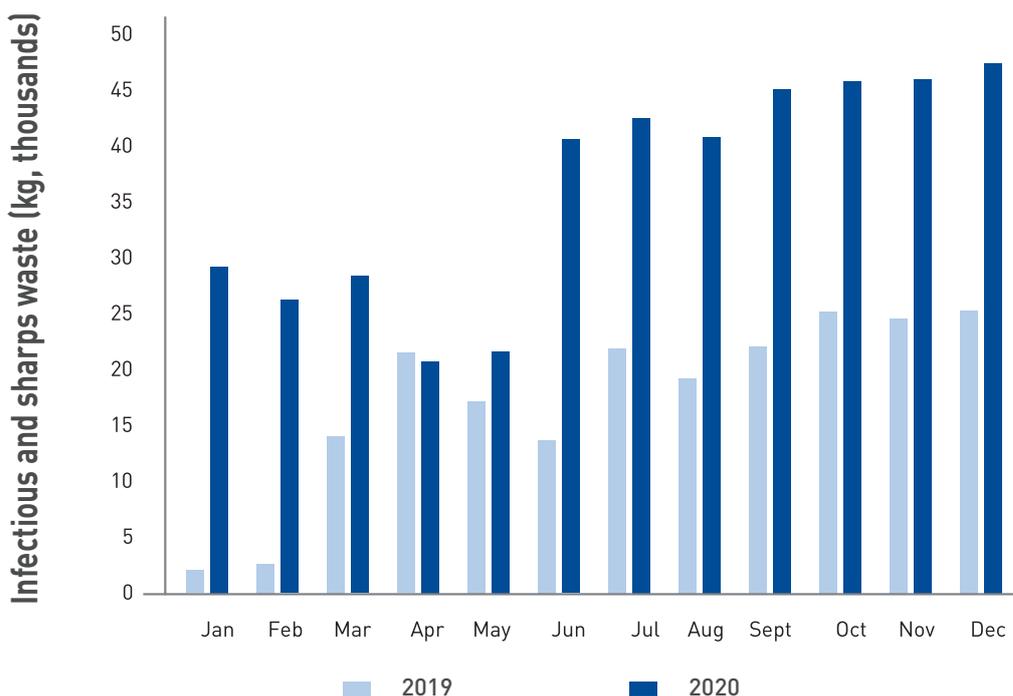
In 2021, the largest volume of hazardous waste generated by HMC was infectious waste. This is due in part because HMC also treated infectious waste from other government ministries (see Figure 7).

Figure 7: HMC hazardous waste, 2021



As a result of the pandemic, the amount of infectious and sharp wastes generated by PHCC doubled between 2019 and 2020 (see Figure 8). This increase underlines the importance of measures to ensure that hazardous healthcare waste is managed safely in order to protect the health of patients, healthcare workers and the public.

Figure 8: PHCC infectious and sharp waste, 2019-2020



SECTION 3: RECOMMENDATIONS

The following recommendations are intended to complement existing policy commitments, and guide strategies to safe and sustainable healthcare waste management for all.

Recommendations:

- Waste management strategies should follow circular economy principles. Policies should deprioritize disposable products and those that generate excessive, hazardous, or hard-to-dispose-of waste, and promote reuse, recycling and environmentally sustainable treatment and disposal of waste.
- All countries should create plans or road maps to provide safe and sustainable healthcare waste management services for all healthcare facilities, as part of water, sanitation, hygiene and infection prevention and control strategies. Policy development should formally include subject matter experts in environment, safety, and sustainability.
- Plans and roadmaps should include clear targets, with timetables and budgets for achieving them.
- Responsibilities should be clearly defined at all levels, with measures in place to promote compliance. All necessary government agencies and stakeholders from other societal sectors should co-ordinate and co-operate to achieve the targets set out in the national plans or roadmaps.
- Healthcare waste tracking and manifesting systems should be established and regularly monitored, ideally as part of the minimum service standards required for a healthcare facility to achieve and retain its license to operate.
- Healthcare waste management staff should be properly trained, and provided with the necessary equipment, vaccinations and other protections to carry out their responsibilities safely.
- Standards should be in line with international environmental conventions, including the Stockholm Convention, the Basel Convention, the Minamata Convention, the Paris Convention, and other relevant national and international standards.
- Education and awareness raising around safe and sustainable healthcare waste management should be used to raise its profile and empower those who are responsible for conceptualizing, financing and establishing it.

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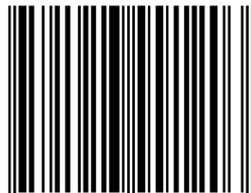
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