



# New Horizons through Non-Incineration Medical Waste Treatment in Iraq

## SUMMARY

Decades of wars and violence have led to severe disruptions in the health system in Iraq as well as to the absence of sound sectoral policies, strategies, and enforcement of legislation. This has contributed to a significant deterioration of health services, especially for the handling and disposing of health care waste. Poor management of healthcare waste can cause serious diseases and poses a major threat to health-care personnel, waste workers, patients, and the general public.

In Iraq, most hospitals do not apply any type of medical waste treatment and simply mix medical waste with the domestic waste. However, some hospitals do have incinerators, but the use is intermittent and, when used, these incinerators can produce air pollution to the neighboring households.

The UNICEF Iraq country office, in coordination and collaboration with the Ministry of Health and the Ministry of Environment, is working with a new, advanced treatment technology, combining shredding and sterilization by microwaves in one single vessel, to mitigate the risk of contamination and to ensure safer management of the medical waste generated by hospitals in urban areas.

## Introduction

With the increase in population and the ongoing impact of COVID-19, solid waste increases and pollution has become a serious environmental and public health issue. Medical waste includes all the waste generated by healthcare activities and produced by a medical institution (public or private), a medical research facility, or a laboratory. However, not all waste produced by medical facilities can be considered medical waste. About 75–90 per cent of the waste produced by medical facilities is general waste or municipal waste; this is usually managed by

municipal waste services. The remaining healthcare waste (10–25 per cent) is medical waste and can be very hazardous and dangerous to health. Medical waste is classified into four categories: infectious waste, which includes bandages, gloves, cultures, swabs, blood and body fluids; hazardous waste, which includes sharps, instruments, and chemicals; radioactive waste (cancer therapies); and, finally, pharmaceutical waste. An Iraqi government official report indicated that medical waste management in Iraq is very poor and requires extensive reform and review<sup>1</sup>.

<sup>1</sup> Mensoor2020\_Article\_Medical Waste Management in Iraq

In terms of incinerators, eighty-four official (58 per cent) and 63 private hospitals (90 per cent) have working incinerators. However, 1462 PHC centers (86 per cent) lack incinerators and depend on primitive ways to discharging solid healthcare wastes, such as burning them improperly or transferring their waste to the nearest official hospital disposing of an incinerator<sup>2</sup>.

**Figure 1: Poor management of medical wastes**



Although the risks associated with hazardous medical waste and the ways and means of managing that waste are relatively well known and described in manuals and other literature, the treatment and disposal methods are not always known.

Safe health care waste management, including segregation, collection, transport, treatment, and waste disposal, is fundamental to wider efforts to provide safe and quality healthcare. Safe healthcare waste management practices also support the UN Sustainable Development Goals

<sup>2</sup> Assessment of Health Care Waste Management

(SDGs): Goal 3 on health, Goal 6 on safely managed water and sanitation, Goal 13 on climate change and Goal 12 on sustainable consumption and production. According to new global data released by WHO/UNICEF in 2019, there is no or very limited safe management of health care waste in a large proportion of facilities.

In reference to WASH Infection, Prevention and Control comprehensive assessment conducted by the ministry of Health in cooperation and collaboration with UNICEF and WHO for 3,600 HCFs throughout Iraq, the percentage of waste segregation and safe handling disposal of medical waste is 56%.

#### BOX 1.

### WASTE CARE MANAGEMENT RESPONSIBILITY IN IRAQ

*Hospitals are responsible for the waste they produce. They must ensure that the handling, treatment, and disposal of that waste will not have harmful consequences for public health or the environment*

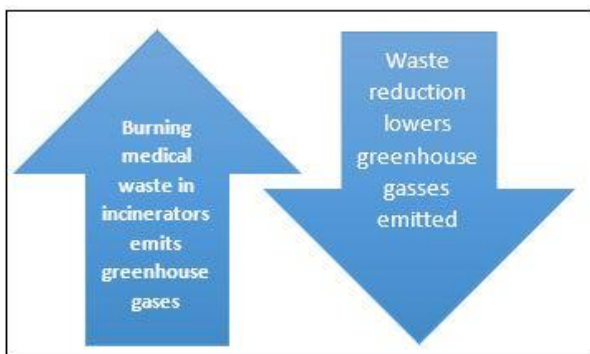
Many countries collect information on segregation of health care waste, and national estimates were available for 66 countries in 2019. On average, 69% of health care facilities had at least some segregation system. Slightly fewer countries had national estimates on waste treatment and disposal than had estimates on waste segregation. (WHO 2020).

Rapid increase in waste generation production is putting a tremendous strain on Iraqi waste handling infrastructure, which has been heavily damaged after decades of conflict and mismanagement. In the absence of modern and efficient waste management in HCFs, hospitals

(HCWM) in Iraq; Effects and Control, 2021

are critical sites for the generation of hazardous waste. Each hospital has its own profile for the generation and transportation of waste according to its location. It is extremely important to manage hospital generated waste properly to avoid health and environmental risks. Incineration of waste has been widely practiced, but inadequate incineration or the incineration of unsuitable materials results in the release of pollutants into the environment. Incineration of heavy metals or materials with high metal content (notably lead, mercury, and cadmium) leads to the spread of toxic metals in the environment. In addition to health risks derived from direct contact, healthcare waste can adversely impact human health by contaminating water bodies during waste treatment and by polluting the air through emissions of highly toxic gases during incineration.

**Figure 2: Waste incineration impact**



This process of waste incineration poses a significant threat to public health and the environment. The major impact on health is the higher incidence of COVID-19 transmission and respiratory symptoms among children and their families.

Reports from the Iraqi ministry of Health found that more than 20% of municipal workers who are responsible for garbage collection got infected by COVID-19. This was a result of hospitals waste generated through the infected patients. The viruses/spores/germs can not only survive, but also thrive on this waste over periods ranging from several days to several weeks. The medical

treatment units therefore allow hospitals to treat this waste directly on-site with no risk of external contamination rather than delivering hazardous waste by health care workers to garbage containers, then collected by the municipal workers to open sites close to residential locations. Thus, there is a need to shift to newer, widely accepted, economical, and environment-friendly technologies with lower gas emission.

### Persons potentially exposed

All persons (health care workers, clients and municipal workers) who are in contact with hazardous medical waste are potentially exposed to the various risks it entails: persons inside the establishment generating the waste, those who handle it, as well as the persons outside the facility who may be in contact with hazardous wastes or their by-products, if there is no medical waste management or if that management is inadequate.

Many hospitals — both public and private — are struggling to cope with the size and quantity of hazardous medical waste generated by the provision of healthcare services and procedures. If not properly addressed, this situation has the potential of causing injuries and of spreading diseases. Moreover, the indiscriminate dumping of waste material in front of hospitals, combined with its improper transport and disposal by waste-management firms, can result in waste being transferred to municipal waste sites. Such practices expose citizens to a series of immediate and longer-term public health threats.

### Risks associated with the inappropriate processing and dumping of hazardous medical waste

#### INCINERATION RISKS:

In some cases, particularly when waste is incinerated at low temperatures (less than 800°C) or when plastics containing polyvinyl chloride

(PVC) are incinerated, hydrochloric acid (which causes acid rain), dioxins, furans, and various other toxic air-borne pollutants are formed. They are found in residual and other air-borne ash as well as in the effluent gases released through incinerator chimneys. Exposure to dioxins, furans and other coplanar polychlorinated biphenyls can have effects that are harmful to public health.

### Baghdad Case Study:

The situation of medical waste management in Baghdad is a priority as 32 per cent of all Iraqi hospitals are located in the city. A study was conducted on the ten state-owned hospitals in Baghdad with the biggest bed capacity. The study used structured interviews with staff in charge of waste management in the sampled hospitals to collect data. The results showed that the generation rate of medical waste in the ten hospitals was approximately 0.5 kg / bed per day. The study flagged that there were improper isolation, collection, storing, processing, and safe disposal of medical wastes. The study recommended that the Iraqi Ministry of Health take extensive and quick measures to better monitor and evaluate medical waste management and provide ongoing training to personnel responsible for waste management in the hospitals.

### Waste Minimization:

Health care waste that is not safely treated can have harmful impact on human and environmental health. In Iraq, a 2017 assessment of 72 hospitals found that each generated on average roughly 8.2 kg of sharps waste per day, of which 5 kg was not safely segregated and only 1.3 kg was safely segregated and treated. Similarly, 11.8 kg of infectious waste was produced per day on average, but only 1.5 kg was safely segregated and treated. While it is critical to ensure hazardous health care waste is safely treated and disposed of, it is also important to exclude non-hazardous waste from waste streams that require costly treatment processes, such as sterilization or high-temperature incineration.

### Incinerator functionality:

High temperature two-chamber incineration is considered a safe treatment method for health care waste, as it minimizes the formation of toxic compounds. However, and in accordance with the Basel Convention<sup>3</sup>, it is recommended that waste treatment techniques that minimize the formation and release of chemicals or hazardous emissions

**Table 1: Average waste generated by hospitals in Iraq**

Hospitals' average generation rate of medical waste per day and month								
Name of hospital	Sum of February	Sum of March	Sum of April	Sum of May	Sum of June	Sum of July	Sum of average generation rate (kg/(bed·mo))	Sum of average generation rate (Kg/(bed·day))
Al-Imam Ali	2,978	2,849	2,309	2,066	2,011	2,156	2,394	0.2
Al-Imamain Al-Kadhumain	8,700	8,989	8,799	7,890	8,011	7,989	8,396	0.5
Al-Karama teaching hospital	9,340	9,120	8,100	8,989	8,488	8,745	8,797	0.73
Al-Shaheed Al-Sader General hospital	5,012	4,834	4,012	4,732	4,052	4,011	4,442	0.4
Al-Yarmook teaching hospital	13,890	12,100	13,670	13,465	13,490	13,879	13,415	0.7
Abu Ghraib General Hospital	7,500	7,000	7,050	7,300	7,250	7,300	7,233	0.5
Al-Shaheed Dhary Alfayadh Hospital	15,000	14,750	14,800	15,000	14,700	14,950	14,866	0.8
Al-Hakeem General Hospital	3,900	4,000	4,050	3,850	4,080	3,850	3,955	0.3

<sup>3</sup> United Nations Environment Programme, The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, UN, Geneva, 1989, <[www.basel.int/TheConvention/Overview](http://www.basel.int/TheConvention/Overview)>

should be prioritized. Incineration or burning is widely practiced, but can cause serious environmental pollution, including the formation of highly toxic dioxin and furan compounds.

**Figure 4: Waste Management Ladder**

WASTE MANAGEMENT	
<b>Basic service</b>	Waste is safely segregated into at least three bins, and sharps and infectious waste are treated and disposed of safely.
<b>Limited service</b>	There is limited separation and/or treatment and disposal of sharps and infectious waste, but not all requirements for basic service are met.
<b>No service</b>	There are no separate bins for sharps or infectious waste, and sharps and/or infectious waste are not treated/disposed of safely.

## Bringing New Technology and Sustainability to Medical Waste Treatment

The WASH programme in Iraq has piloted advanced technology solutions for on-site treatment of biomedical waste by combining shredding and sterilization by microwaves into one single vessel. This solution allows hospitals, healthcare centers, laboratories, and any other sector producing potentially infectious medical waste to efficiently treat and decontaminate medical waste directly in their production site, to control and limit the risks of external contamination. Microwave sterilizations recognized and recommended by the World Health Organization for the treatment of hospital waste. The technology allows, transforms medical waste into uncontaminated inert waste that can then be treated through the same channels as household waste, in only 30 minutes.

## Results

UNICEF successfully advocated with decision makers at the Ministry of Health and Ministry of Environment to take the lead on medical waste management through financing the procurement of advanced medical waste treatment units for health care facilities.

So far, a total of sixteen medical treatment units were installed and functionally operated in selected hospitals within Baghdad, Kirkuk, Anbar and Dohuk. UNICEF is piloting this initiative in those hospitals patients affected by COVID-19 and is scaling up this initiative to other most affected healthcare facilities in Kirkuk, Anbar, Nianawa and Dohuk.

One of the main challenges is the adaptation and familiarity of technical local staff to operate and maintain the medical treatment units, since they had worked on primitive incinerators years ago and it is well-known to UNICEF-WASH team to focus on strengthening the technical capacity for those local staff by conducting on-site training sessions on operation and maintenance along with provision of operation manuals in Arabic and English languages, installing signages at locations and operating protocol for local staff. UNICEF supported health care facilities two capacities (20 Kg/ hour and 50 Kg/ hours) of medical treatment units based on the generated medical wastes. Selection criteria were developed to prioritize the most health care facilities in need as well as the generated waste to comply with the offered capacities with no sophisticated infrastructure.

**Figure 1: Medical Treatment Unit-AI  
Kadhimiain Hospital-Baghdad**



The capacity of the medical treatment unit in weight metric which depend on the nature and typology of waste which will be loaded into the vessel. It accepts a large type of waste without strict segregation including Pathological waste / Infectious waste, sharps and wounding waste, an atomical waste such as syringe, needles, lancet, test strip, gloves, textile, paper, diaper glass, plastic, soft waste, metallic waste, catheter, funnel, petri, vials, becker, test specimen and tubes.

Depending in the waste loaded, the density of waste may differ. It is unpredictable to know in advance the percentage of waste type which will be loaded into the machine (as it is forbidden to open the bags in advance before treatment. Some wastes are large and light other are small and heavy. As an average in 100 L capacity of the vessel will be loaded between 7 and 12 kg of medical waste per one cycle with 30 minutes period. The most importing piece is that shredding process will reduce the volume of medical waste by 80 per-cent from the original volume and 20 per-cent from the original weight.

As a result of UNICEF advocacy to decision makers, the Ministry of Health are adapting this new technology and financing portion of its annual budget to cover other health care facilities throughout Iraq by bringing additional medical treatment units to replace with primitive incinerators. The technical staff familiarized themselves with this new technology, since the

operation of unit is easy to adapt with low operating cost and without water consuming (effluent).

## Recommendations

### SHORT-TERM RECOMMENDATIONS

- Provide new suitable environmentally and friendly medical treatment units instead of primitive incinerators to cover all health institutions.
- Minimize improper discharging through proper waste separation and waste audit.
- Minimize waste generation.

### MEDIUM-TERM RECOMMENDATIONS

- Strengthen the technical capacity on operation and maintenance.
- Strengthen cooperation between concerned institutions at governorate and district levels.
- Scale-up medical waste treatment at hospitals and public healthcare centres.
- Draft laws and regulations in coordination with the ministry of environment.
- Conduct studies to assess the Health Care Waste Management (HCWM) and strengthen research work in different aspects of the subject.
- Minimize healthcare waste by reducing waste generating sources on site.

## Next Steps

The management of healthcare waste requires increased attention and diligence to avoid adverse health outcomes associated with poor practice, including exposure to infectious agents and toxic substances.

Key elements in improving healthcare waste management are:

- Where feasible, favoring the safe and environmentally sound treatment of hazardous

healthcare waste by microwave treatment integrated with internal mixing.

- Building a comprehensive system, addressing responsibilities, resource allocation, handling, and disposal. This is a long-term process, sustained by gradual improvements.

Raising awareness on the risks related to healthcare waste, and safe practices; Selecting safe and environmentally friendly management options, to protect people from hazards when collecting, handling, storing, transporting, treating, or disposing waste. Government commitment and support is needed for universal, long-term improvement, although immediate action can be taken locally.

## References

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