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Health Care Waste Management in the Kyrgyz Republic

An innovative low cost system

Swiss Red Cross

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Content

List of abbreviations

FMC	Family Medicine Centre
GEF	Global Environment Facility
HCWM	Health Care Waste Management
I-RAT	Individualised Rapid Assessment Tool
MoH	Ministry of Health
RCIC	Republican Centre for Infection Control
SDC	Swiss Agency for Development and Co-operation
SES	Sanitary-Epidemiological Station
SRC	Swiss Red Cross
TEQ	Toxic Equivalency

Executive Summary

Health Care Waste Management (HCWM) poses a challenge particularly for low-income countries. Requirements are to have a replicable system with low investment and low operating costs which meets safety requirements for patients and health staff. In Kyrgyzstan, a HCWM system has been developed that meets these challenges. The development and expansion was financed by the Swiss Agency for Development and Cooperation (SDC) through a project implemented by the Swiss Red Cross (SRC).

Before the introduction of this system, infectious waste in Kyrgyzstan was either disinfected in hypochlorite solution or disposed of by burning on the hospital premises to save costs. Both practices exposed health workers to toxins and risk of injury. Much waste was simply dumped on the hospital grounds without treatment.

The HCWM system developed in Kyrgyzstan has the following elements:

1. Needles and syringes are cut and destroyed immediately after use with a **mechanical needle cutter**, which renders both unusable. After autoclaving, the needles are sold to metal recyclers and the syringes to plastic recycle firms.
2. All infectious wastes are collected in **10-liter enamel coated buckets** (enamel-coated against corrosion in autoclaves) and placed directly in an autoclave for treatment.
3. Infectious waste is autoclaved with **top-loading gravity-displacement autoclaves** widely used for medical sterilisation in countries of the former Soviet Union.
4. Anatomical waste is dumped in a **cement-lined pit** of roughly 5 cubic meters, of which each hospital has three.
5. Garden waste from the hospital compound is **composted**, greatly reducing waste volume.
6. Personal protection equipment (while dealing with Health Care Waste) and first aid kits (used in case of emergency or accidental contact with hazardous wastes, blood or body fluids) are made available and used when appropriate in all high-risk areas.
7. Non-recycled decontaminated infectious waste and household waste is transported by the hospital owned trailer to the municipal dump site.
8. Facilities have written HCWM guidelines, implemented through regular training, documentation, record-keeping, monitoring and a continuous improvement system.

The investment costs for a 100-bed hospital are about USD 16’000 including training. For a 500-bed hospital, the costs are about USD 45’000. The pro-rated cost per covered population was 0.61 USD (based on 67% of hospital beds in hospitals countrywide covered with the HCWM system); this compares very favourably with models in other countries.

Hospitals have 33% less operating costs on average compared with previous waste related expenditures, mainly due to lower costs for hypochlorite and transport. The savings and the income from selling syringes and needles outweigh new expenditures like electricity for autoclaving. The lower operating costs endear the system to hospital managers and make it sustainable. Staff like it because there are fewer injuries and no more exposure to hypochlorite and smoke.

In 2013[i] an external evaluation applied a slightly modified version of the UNDP-GEF-WHO individualised rapid assessment tool (I-RAT). Six hospitals[1] assessed during the evaluation had an average of 95 points (out of a maximum of 100).

Starting in 2014, a project of the Global Environmental Fund (GEF) will expand this system to the facilities not yet covered by the programme's implementation so far.

1 Background

In 2011, a report of the United Nations Special Rapporteur to the Human Rights Council of the U.N. General Assembly raised concern that improper HCWM jeopardises human rights[ii]. In 2009, a systematic review of HCWM in 40 low- and middle-income countries found HCWM to be a serious public health challenge due to the increasing quantities of waste, improper disposal methods, lack of training, insufficient financing and infrastructure, and weak governance and administration, among other problems. The researchers proposed focusing on alternatives for syringe waste, tools for reducing total volumes, and affordable treatment and disposal methods[iii]. Transferring solutions developed in high-income countries proved inappropriate because, even if investment costs were borne by donor agencies, the high running costs made them unsustainable in low- and middle-income countries.

The challenge, therefore, lies in designing HCWM systems for these countries that require both low replicable investment costs, and low operating costs to be sustainable, and yet fulfil generally accepted requirements of safety.

The HCWM system developed in Kyrgyzstan meets these challenges. This publication describes the innovative system that was developed and implemented in the frame of a bilateral cooperation project financed by the SDC. The project was implemented by the SRC in partnership with the Republican Centre for Infection Control (RCIC) under the Ministry of Health (MoH) of the Kyrgyz Republic.

2 Medical waste management situation in the Kyrgyz republic

Until a few years ago, Kyrgyzstan represented typical characteristics of a country of the former Soviet Union with poorly maintained medical infrastructure that also lacked proper waste management systems. Furthermore with its independence in 1991 Kyrgyzstan was one of the poorest countries of the former Soviet Union.

Infectious waste used to be disinfected in hypochlorite solution or disposed of by open burning on the hospital premises to save costs. Both practices exposed health workers to toxins and risks of injury. Much waste was simply dumped on the hospital grounds without treatment. Considerable piles of waste were scattered beyond designated areas due to infrequent waste removal to the existing landfills. Even overflowing cement pits for anatomical waste were not cleared.

[1] The evaluation covered 6 hospital (1 in Osh oblast, 1 in Jalalabad oblast, 2 in Naryn oblast and 2 in Issyk-Kul oblast).


Typical waste dump and burning site on hospital campus before the introduction of the new HCWM system

An assessment of unintentional releases of polychlorinated dibenzo-dioxins and furans was made in 2003. It showed estimated total releases to be 30.5 gram Toxic Equivalency (TEQ), of which releases into air accounted for 14.37 gram TEQ (47.11%), water - 10.87 gram TEQ (35.63%), and soil - 0.16 gram TEQ (0.52%)[iv]. Despite a high degree of uncertainty in the calculations, the preliminary inventory of unintentional releases into the air indicated that the majority were from burning medical waste (7.01 gram TEQ).

In 2005 Kyrgyzstan subsequently ratified the Stockholm Convention on Persistent Organic Pollutants, thereby committing to the reduction and ultimate elimination, where feasible, of releases of dioxins and furans.

3 The Kyrgyz model of HCWM

3.1 Description of the Kyrgyz HCWM model

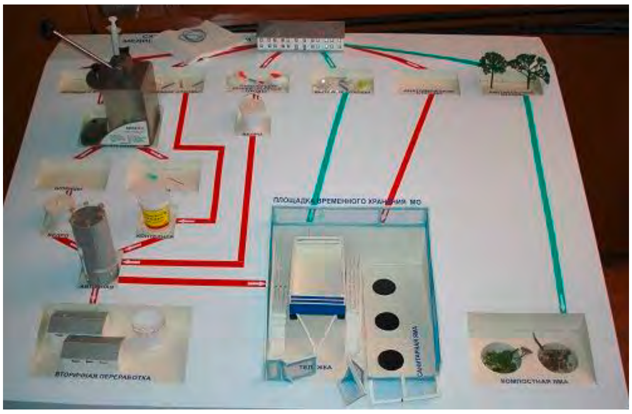
3.1.1 Development of the model

The objective of the HCWM project was to develop and implement a HCWM system that was appropriate for rural hospitals in Kyrgyzstan. It was important that the HCWM system reduced the potential for disease transmission, enhanced the safety of health workers, protected the environment and met the Stockholm Convention guidelines. Special care was taken to develop a system with low investment and operating costs that could be replicated throughout the country and sustained by facilities without further support.

The transformation of the HCWM system in Kyrgyzstan involved the following:

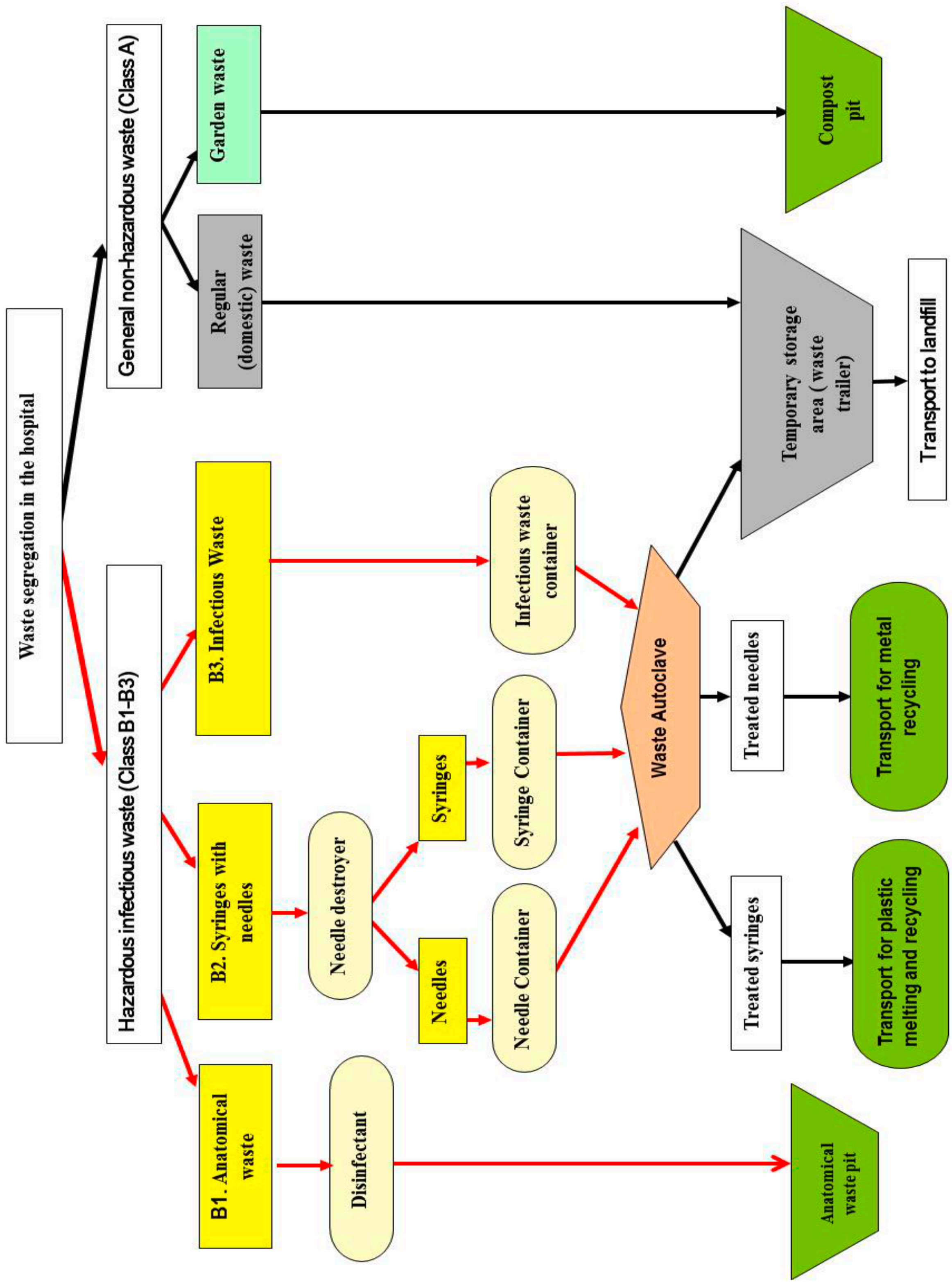
a) a survey and analysis of HCWM in the Kyrgyz Republic;
b) development of a HCWM model with stakeholder participation;
c) pilot testing to determine the efficacy, practicality, economic viability, and sustainability of the model;
d) evaluation and improvement of the system;
e) development and promulgation of national regulations based in part on lessons learned from the project;
f) phased expansion of the new system throughout the country.

The model was developed in 2005-2006 and pilot tested in five facilities of the rural Naryn region in 2006. Thereafter, the model was included in the medical waste strategy of Kyrgyzstan and informed several national guidelines regarding medical waste management. In the following years, the model was further improved and expanded throughout the country. By end of 2013, it functioned in 232 facilities, including all general treatment hospitals with 25 beds or more and all urban primary health care centres and other ambulatory services. Facilities in the capital Bishkek and primary care services in villages are, as of yet, not covered.



Explanatory Model showing Health Care Waste Management System

Figure 1: Overview of HCWM system
Classes A, B1, B2, and B3 (refer to the waste classification system used in the Kyrgyz republic)



Waste segregation

All waste – infectious waste as well as non-hazardous waste (domestic waste and garden waste) - is segregated.

Regular (non-infectious) waste is placed in bins with usual black plastic bags for household waste. All other infectious wastes are collected in separate enamel-coated buckets. They are marked on the top and sides with the international biohazard symbol, type of waste, the hospital department and a number to keep track of each container.

Infectious waste buckets are only available in areas where infectious waste is generated and are placed side-by-side with non-infectious waste containers. Buckets and containers both with non-infectious and infectious waste are marked accordingly and have visibly written indication which allows clear differentiation. Posters are found in such areas to remind the health workers of segregation practices.

Enamel buckets under a segregation poster

There is standard personal protection equipment available in all facilities to be used when handling and transporting medical waste. It includes gown and apron, cap, mask, safety glasses, protective gloves and puncture-resistant footwear.

3.1.2 Hazardous infectious waste (Class B1 – B3)

B1. Anatomical waste

Anatomical and placenta wastes are treated by sprinkling the top surface of the waste with calcium hypochlorite to minimise the potential for pathogen release during transport and then it is deposited in secure cement pits to decompose. Every hospital has a 2m x 6m x 2m deep pit divided into three compartments, each of which has about 5 m^3 and a 1 m^2 slab as a lid. One compartment is used until it is filled. The lids have hooks to allow the possibility of removing and emptying the pit after the waste has fully decomposed. These pits and a trailer are located inside the fenced waste collection area (see **figure 3**: typical layout of anatomical pits and waste collection area).

Comment:

The current practice of adding calcium hypochlorite to anatomical waste as prescribed by the old guidelines is not optimal, as calcium hypochlorite inhibits decomposition. Efforts are under way to change the guidelines in order to allow either the use of lime or no disinfection at all. It is not yet known how long the pits will take to fill up and how much time will be needed to breakdown the waste, especially given the cold temperatures in the winter months. Even in hospitals which have been using the pits for seven years now the first of the three pits has not yet filled up. The minimum time for all three pits to fill up has been estimated at 20 years. That may be ample time for decomposition, even with the cold seasons, if calcium hypochlorite is not added in the future.

B2. Syringes and needles
Needles and syringes are cut and destroyed immediately after use with a mechanical needle cutter (manufactured by BMDi Pty Ltd, India). Cutting the hub of the syringe and breaking the needle renders both unusable. The broken needle is deposited into a plastic container, as are other sharp wastes. When the needle container is 75% full, a plastic lid is screwed on. The syringes are collected in a 10-liter enamel-coated metal bucket designated exclusively for syringes. When these buckets are 75% full, they are directly carried to the autoclave for disinfection. The enamel coating protects against corrosion in the autoclave.

Autoclaved syringes are sold to plastic recycling firms. The autoclaved broken needles are sold to metal recyclers.

The outside surfaces of the needle cutters are wiped daily with a disinfectant (2% Tetramin).

Comment:
The needle cutters have thus far proven durable and reliable. Since the start of the project, 3'680 needle cutters have been installed. The hospital with the longest experience with these cutters (seven years) replaced only four of its 180 needle cutters - a 2% replacement rate over seven years. The most common problems are breakage of the handle and the stripping of the screw holding the cutting block. Procuring spare parts separately, in particular the cutting drum that was designed for 100'000 cuts, minimises the need to replace the whole cutter. One batch of cutters had plastic instead of steel frames. Plastic frames were prone to break, and after feedback was provided to the manufacturer, the needle cutters switched back to steel frames.


Needle cutter


Syringe and needle destroyed by needle cutter

B3. Infectious waste

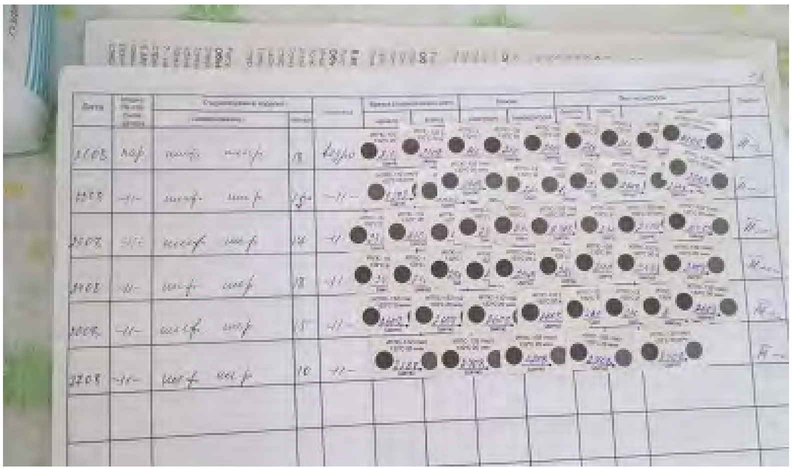
Transport of infectious waste within the hospital compound
A separate 10-liter enamel-coated metal bucket is designated for infectious waste other than syringes. When these buckets are 75% full, they are directly carried to the autoclave for disinfection. Each bucket transporting infectious waste is covered by an enamel-coated metal lid held in place during transport using two standard metal binder clips. Since the buckets are labelled, have handles and lids for easy transport within the facility and are placed directly in the autoclave, the need for color-coded plastic bags is eliminated, thereby significantly reducing operating costs.

Treatment room with autoclave storage
The needle plastic containers from the needle cutters, filled to ¾ and closed with special lids, buckets with syringes, and buckets with other infectious waste are placed on shelves in a storage room that also houses the autoclave. The buckets are weighed before they are placed on the shelves to await treatment. The room is designed to keep contaminated and decontaminated areas separate. Policies and procedures are posted on the walls of the waste storage and treatment room. A record book keeps track of the buckets and the amounts of waste generated as documentation of treatment. After sterilisation this waste goes either to recycling (i.e. syringes) or to the trailer. Other “non-infectious” waste goes directly (bypassing sterilisation) to the trailer for further transportation to the municipal dumpsite for general waste.

Autoclaving
The treatment method of the HCWM system is autoclaving, which does not generate dioxins and furans. The autoclave used is a top-loading gravity-displacement autoclave. Two nearly identical models from two producers - the VK-75 by Tumenski Factory and the Vka-75-Pz by Kasimovski Instrument Factory – are used. This type of vertical autoclave is widely used for medical sterilisation in countries of the former Soviet Union. The vertical chamber of 75 litre volume can accommodate two 10-liter enamel-coated metal buckets and is ideal for a 100-bed hospital, the size of the majority of hospitals in Kyrgyzstan. The technical details of the autoclaving are further elaborated in a text box on the following page.

The autoclaving procedure entails putting two buckets with infectious waste on top of each other in the vertical autoclave. The lids are carefully removed and placed beside each bucket. A triangle of wooden bars on top of the lower bucket creates space between the two buckets to allow the contents of the lower bucket to be fully exposed to steam. Colour-changing (Class 1) thermal indicators are placed on the bucket surface. After the treatment, the indicators are placed in the record book as documentation. Once a month, a steam integrator (Class 5 indicator) is placed with the waste and recovered after treatment. The steam integrator serves as an affordable pass/fail test of the autoclaving process.


Autoclave with filter on the wall, buckets


Logbook of medical waste autoclaving with attached indicators (strips) for monitoring if sufficient temperature and exposition was reached during the procedure


Filter

To avoid releases of pathogens into the environment with the air displaced during the initial introduction of steam, the exhaust of the autoclave chamber passes through a corrosion-resistant sintered metal filter[2]. The holding of a pressure of 220 kPa for five minutes before the initial flushing of air provides additional security against microbes reaching the environment with the initial flushing of air[v].

As the performance of the filter was specified for a maximum gas flow rate per square foot, various filter sizes were tested to ensure that the flow rate during flushing did not exceed the specified flow rate. A filter cartridge of 500 mm length and 63 mm diameter was found to have sufficient surface area to keep the gas flow rate during flushing below the maximum. Subsequent releases of steam during the autoclaving cycle decontaminate the filter.

The sintered metal filters lead to condensation in the hose between the autoclave and the filter; it is let out after each cycle through a tap at the bottom near the autoclave. To prevent condensation from accumulating in the hose from the filter, the filter cartridge is mounted high on the wall to allow condensation to drip outside of the building, generally on to a flower garden or open ground. The filters have no defined end of life. Over time matter collects in the filter wall and thus the time needed for one pulse increases. The filter walls are therefore cleaned once a month with 8 pressure pulses under reversed steam flow while running the autoclave without waste, reducing the time for the pulses back to the baseline level and keeping the overall cycle length short.

Comment:
The selection of the VK-75 autoclave was beneficial since it was already well known in many hospitals for use in the sterilisation of medical and surgical instruments, and has the reputation of being both sturdy and long lasting. Many local maintenance technicians are familiar with the equipment and spare parts are readily available from local vendors.

Once a week the autoclaves are dismantled, soaked in the disinfectant for 10 minutes, then oiled and reassembled. Maintenance of the autoclaves involves monthly cleaning, especially of the heating elements, lubrication of valves, blow-down of the boiler, and the checking and cleaning of gaskets. The most commonly needed spare parts are the lid gaskets, which last three to six months depending on use. During the pilot testing phase, refurbished autoclaves were installed. The oldest autoclave is still in use for the HCWM system. It is 30 years old (having been manufactured in 1984) and remains in good shape at the time of writing, with only minimal corrosion in the inside chamber and all other parts in good condition. During its seven-year operation as part of the new HCWM system in the hospital, the only parts replaced were two of the three heaters in addition to the gasket. Since 2006 two refurbished autoclaves have been exchanged for new ones.

[2] Filter 316L stainless steel, Mott Corporation, USA that captures 99.9% of all particles larger than 0.2 micron in a gas stream passing through the filter surface at a gas flux of 2 m^3/min per m^2 of filter surface area (6 actual ft^3/min per ft^2).

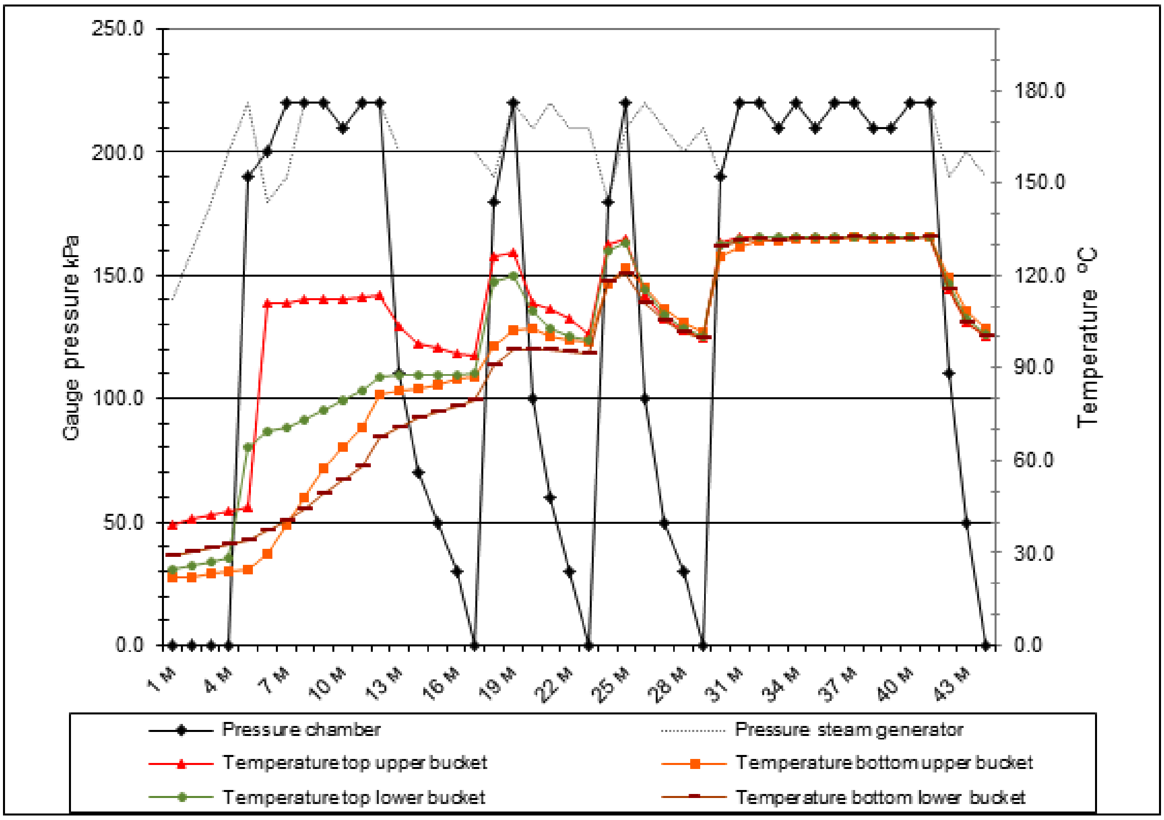
Technical Details of the Autoclaving

Testing the autoclaving cycle

Stolze and Kühling (2009)[vi] as well as Stringer *et al (2010)*[vii], have demonstrated that by using pressure pulses, a gravity-displacement autoclave can safely disinfect medical waste. To identify the optimal autoclaving cycle for the Kyrgyz model, the disinfection of waste in the gravity-displacement autoclaves was tested using thermocouples and biological indicators. The minimum requirement for medical waste disinfection is the microbial inactivation of 10^4 spores of *Geobacillus steatothermophilus*. The Kyrgyz autoclaving cycle was tested with 340 spore strips with 10^4, 10^5, and 10^6 spores of *G. steatothermophilus*[3]. None showed any growth, proving the inactivation efficacy of this cycle to be ten to one hundred times higher than the minimum requirement.

The autoclaving cycle is as follows: After the two buckets of waste are put in the autoclave and the lid closed, steam is introduced while keeping the exhaust steam line closed until a pressure of 220 kPa is reached. The pressure is held for five minutes after which the exhaust steam line is opened and the air-steam mixture released through the sintered metal filter[viii]. The autoclave pressure is again increased to 220 kPa, the steam is released, and then the pressure pulsing is repeated for a third time. On the fourth time, the pressure is maintained at 220 kPa (about 132° C) for 10 minutes before the steam is released. **Figure 3** shows the temperature-pressure curve of a typical autoclaving cycle.

Figure 2: Temperature-pressure-time curves of the autoclave cycle



3 In order to maximise the challenge test, the 10^6 spore discs (ProLine Process Challenge Device, Raven Labs/Mesa Laboratories, USA) were placed inside intravenous tubing at the bottom of the lower bucket

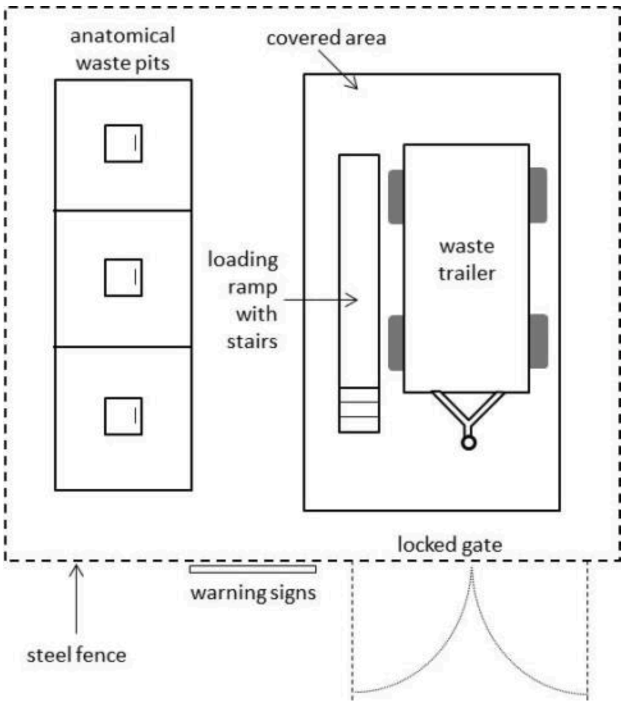
3.1.3 General non-hazardous waste (Class A)

Regular domestic waste
Regular domestic waste is collected in the black plastic bags within buckets or bins marked with “Class A” or “household waste”. After filling the bags they are transported to the waste collection area and put on the waste trailer along with decontaminated infections waste class B3 for further transportation to the municipal dumpsite for general waste.

Garden wastes
To minimize waste, hospitals use two compost pits for garden wastes. Each compost pit is 2m x 2m with a depth of between 1.5 and 2 m. Stems are placed in the bottom layer along with large sticks to create air pockets for aeration. The second layer has smaller items such as grass, leaves and other plant waste. The third layer is soil mixed with manure, ash and about 5-10 kg of compost from the previous season. Water is added to keep the waste moist and speed up decomposition. At the end of the season, the pit is covered with 4-5 cm of soil and vertical holes are created with sticks to improve aeration. The other compost pit is used for the following season. The compost from the compost pits is used as fertiliser and soil conditioner by the hospital. The compost area is surrounded by a wire fence.

Waste collection area and final waste disposal
All solid waste (infected - after autoclaving process, non-infected – directly, except garden waste) is collected in the fenced territory of the temporary waste disposal site. It is fenced and has a roof and is inaccessible to unauthorised persons and stray animals. In this fenced territory stands a trailer for the collection and disposal of solid waste and there are three leak-proof waste pits for disposal of anatomical and biological waste.

Figure 3: Typical layout of anatomical pits and waste collection area



Requirements for sites for temporary storage of medical waste are:

- only staff involved in HCWM has access to it;
- no access for unauthorised individuals, patients and animals;
- is located
  - at a distance from the clean areas and the catering department,
  - at least 50 meters from any water source,
  - not in an area prone to flooding;
- walls of pits for anatomical and biological waste must be made from waterproof material and stay above ground level with paving around it. At the bottom of the pit should be a layer of gravel or it should be poured with concrete. The hole for dumping should have a tight locked lid;
- the transport way of waste to the disposal site out of the institution should not ran near the medical building and kitchen;
- there should be warning signs to restrict access to the site.

Waste collection place with trailer and pits for anatomical waste

Comment:
The option of the trailer was chosen for several reasons: there are neither communal utility services nor special trucks for removal of garbage containers in rural areas. By choosing this solution the regular hospital vehicles can transport filled trailers, without outsourcing it to expensive private services and other transport companies.

3.2 Training, coverage and costs of the system in Kyrgyzstan

3.2.1 Organisation and training

The laws of the Kyrgyz Republic on “Waste of Production and Consumption“, “Environmental Protection”, “Public Health” and other regulations provide a legal basis for authorities and responsibilities within the HCWM. In specific institution HCWM is implemented following the special order of the Director of the Institution where all consecutive HCWM steps and responsible person(s) are clearly described. There are developed and implemented standard operating procedures for all phases of medical waste management.

First aid kits are made available in all high-risk areas and used in case of emergency or accidental contact with hazardous wastes, blood or body fluids. This includes:

- disinfectant for the decontamination of spills of blood and body fluids;
- alcohol, cotton, plaster and finger cot for treating cuts or pricks;
- solution of potassium permanganate for the treatment of eyes;
- protargolum solution for the treatment of nasal mucosa;
- alcohol solution for the treatment of oral mucosa;
- lodging for emergency cases.

Awareness-raising workshops with all stakeholders and one-day trainings of all hospital staff accompanied the installation of the equipment. Clearly defined roles and responsibilities coupled with frequent monitoring ensured compliance with the new procedures. Two autoclave operators per hospital received special training for one day on the operation of the autoclave, the prescribed autoclaving cycle, documentation of treatment, and basic procedures for regular maintenance (such as general cleaning and replacement of gaskets) for which they are responsible. Every two years, the autoclaves are examined by licensed technicians who test and repair parts crucial for pressure safety.

Each hospital has created a Safety and Quality Committee that manages HCWM and related activities in the facility. The committee periodically reviews HCWM procedures, develops the budget, monitors activities, and implements training workshops. The infection control specialist and epidemiology specialist function as HCWM advocates within the hospital.

3.2.2 Extent of coverage

By the end of 2013, 126 hospitals were transformed through the implementation of the new system. This includes all general treatment hospitals in the country with more than 25 beds, except for those in the capital city of Bishkek. The hospitals covered account for 67.3% of all hospital beds in Kyrgyzstan. All 45 primary care centres in towns (excluding Bishkek), as well as 32 other facilities (dental clinics, blood centres etc.) are also covered. In addition, 29 private ambulatory clinics have made arrangements with the covered hospitals to use the autoclave system for their waste treatment on a fee-paying basis. As a result, the overall national coverage exceeds the original implementation plan. The model, however, does not yet cover primary health care facilities in villages.

3.2.3 Costs of the HCWM system

The average investment costs amounted to 16’156 USD per hospital for a typical 100-bed general hospital (with surgery, gynaecology/obstetrics, medicine, and paediatric departments). For bigger hospitals of about 500 beds, the costs amounted to 42’549 USD (**table 1** gives the breakdown of these costs).

The pro-rated investment cost is about 0.61 USD per covered population, which compares favourably with HCWM systems installed in comparable contexts. In situations where transport is not an issue, a trailer does not need to be provided and the investment costs will be even less (13’776 USD for a 100-bed hospital).

Table 1: Costs by component of the HCWM model installation for hospitals with 100 and 500 beds

Components of the HCWM system	Price per unit in USD	Quantity per 100 bed hospital	USD per 100 bed hospital	Quantity per 500 bed hospital	USD per 500 bed hospital
Mechanical needle cutter	34.6	20	692	65	2’249
Enamel-coated metal buckets	9.9	80	792	260	2’574
Autoclaves (purchase, transport, installation, site preparation)	5’000	1	5’000	3	15’000
Set of spare parts for the autoclaves	840	1	840	3	2’520
Trailers for hauling regular and treated waste	2’380	1	2’380	2	4’760
Weighing scale	24	1	24	3	72
Fenced enclosure with metal roof for the trailer and waste collection area plus 3 cement pits for anatomical waste	5’800	1	5’800	2	11’600
Personal protection equipment and other protective measures (coveralls, gloves, glasses, warning signs, paint, etc.)	58	1	58	3	174
Training			570		3’600
Total			**16’156**		**42’549**

Table 2 presents an example of the costs before and after installation of the new HCWM system for a secondary level hospital with about 500 beds. It shows that the cost savings were mainly due to reduced expenditures on chlorine disinfectant and lower transport costs for waste due to composting and use of an own operated trailer. Overall transport costs decreased less than expected because of increased petrol prices and fees introduced by the landfill. Revenues are generated from the sale of the sterilised plastic and metal parts to recyclers. On average, the HCWM costs accounted for 0.68% of the operating budgets of the hospitals.

Table 2: Yearly HCWM expenses and income for Naryn Oblast Merged Hospital before and after the implementation of the new HCWM system

Expenses				
Items	**2005 (before)**		**2012 (after)**	
	Units	**USD**	**Units**	**USD**
Disinfectants	446 kg	1’175	227 kg	204
Sharps safety boxes	816 boxes	330	0 boxes	0
Waste removal	416 tonnes	425	90 tonnes	257
Plastic bags for class A waste	0 bags	0	9’125 bags	372
Plastic bags for autoclaved waste	0 bags	0	1’715 bags	70
Electricity	0 kWh	0	8’694 kWh	271
Total expenses		**1’933**		**1’174**
Income				
Items	**2005**		**Current**	
	Units	**USD**	**Units**	**USD**
Sale of plastics	0	0	2300 kg	563
Sale of broken needles	0	0	140 kg	31
Total income		**0**		**595**

3.3 Results

3.3.1 I-RAT scores of the new HCWM system

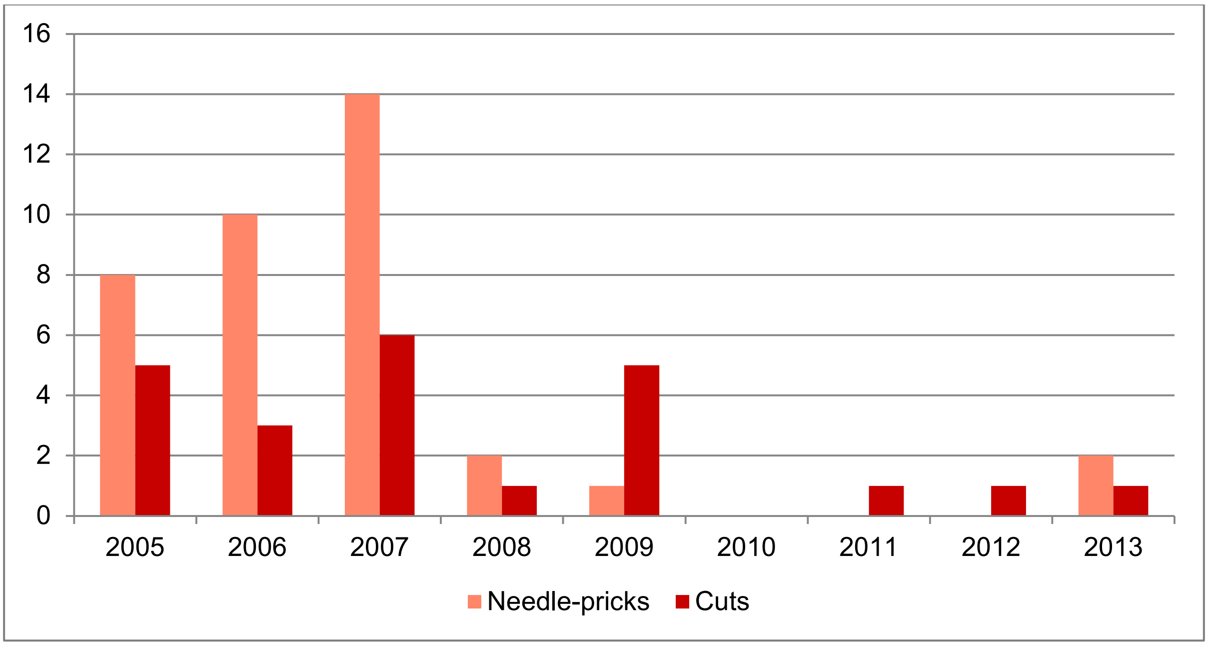
An external evaluation was conducted in September-October 2013 that entailed an assessment using a slightly modified version of the UNDP-GEF-WHO individualised rapid assessment tool (I-RAT). The I-RAT is an Excel-based scoring tool. Its weighted scoring system takes into account, among other things, HCWM organisation, policy and planning, training, occupational health and safety, monitoring, periodic evaluation and corrective action, financing, segregation, waste generation, collection, handling, labelling, posters or signage, transport inside the facility, storage, treatment, waste disposal and wastewater management. Six Kyrgyz hospitals covered by the evaluation had an average of 95 points (out of a maximum of 100), indicating that almost all of the aforementioned topics in the I-RAT tool had been properly addressed.

3.3.2 Staff acceptance and staff safety when using the new HCWM system

The evaluation also interviewed hospital directors, waste workers, autoclave operators, nurses, doctors, and other hospital staff. A high level of satisfaction with the new HCWM system was found. The nursing staff consistently pointed out that the new system eliminated the time they had to spend preparing multiple hypochlorite solutions for disinfecting the waste, thereby giving them more time to spend with patients. The infection control specialists reported a change in the mind-set of health workers and a greater appreciation of the hazards of health care waste and the importance of HCWM among the staff.

Staff also commented on their decreased exposure to hypochlorite. Many felt that the use of the needle cutters reduced needle-prick injuries and cuts. Data from one hospital from 2005 to 2013 give a preliminary indication of this (**figure 5**). After the needle cutters were introduced in 2006, there was an increase in injury data but the hospital felt that this was due to improved documentation coupled with a shift in approach from a punitive system to one of safety improvement. Once the hospital had fully implemented the new HCWM system, needle-prick injuries and cuts declined significantly.

Figure 5: Needle-prick injuries and cuts documented in Naryn Oblast Merged Hospital



3.3.3 Cost-savings

Hospital directors were especially pleased with the cost savings. The cost of chlorine disinfectants placed a heavy burden on their limited budget, as would have the introduction of coloured bags. Being in full compliance with state regulations was another benefit mentioned, especially by hospital directors who in the past had to pay penalties for burning waste in violation of the law. Many also commented on the fact that hospital premises no longer had waste piles scattered about, and that they no longer had to deal with complaints from neighbours about smoke and odour from the burning of waste.

4 Sustainability

Hospitals have been able to sustain the HCWM system without further financial and technical support from the project. The first five hospitals have successfully maintained their systems on their own for the last seven years. The broad acceptance of the new system by the hospital staff and directors, the cost savings, the added revenues from the sale of plastics and metals for recycling, improved safety for the workers and a decreased burden on the nursing staff are important benefits that enhance the sustainability of the new system. Hospitals participating in the project signed Memoranda of Understanding that stipulated that cost savings from the new HCWM system would be used to improve infection control and occupational safety, such as the purchase of hand sanitizers and gloves. The Safety and Quality Committees, regular trainings, capacity building and periodic monitoring helped to institutionalise the new system and further increased its sustainability. The lessons learned from the SDC project are being used to extend coverage to the urban hospitals in Bishkek in the near future by another project.

5 Conclusions

Key elements for the successful transformation of HCWM in Kyrgyzstan included an initial analysis of the problem, finding innovative solutions with stakeholder participation, pilot testing and demonstrations at a few hospitals to evaluate and refine the new system, a well-planned, phased implementation, development of national regulations to support the implementation and continuous monitoring and improvement. As a result, the new system serves 67.3% of all hospital beds in Kyrgyzstan as of end of 2013.

The new HCWM system has all the major components of a good system: waste minimisation (including reusable containers, recycling, and composting), segregation, use of leak-proof and puncture-proof containers, labelling and signage, safe collection and transport, use of personal protection equipment, emergency kits for accidental exposure to infectious waste, proper storage of waste, safe management of sharps and anatomical wastes, clear hospital policies, written HCWM guidelines, a committee and advocates to promote HCWM, regular training, documentation, record-keeping, monitoring and continuous improvement, and the allocation of human and financial resources.

Low investment costs made the nationwide expansion affordable for one donor and attracted other donors to cover the gaps from 2014 on. Acceptance of the new system by the staff, its economic benefits, its improvement of occupational safety, capacity building and institutionalisation bodes well for the future sustainability of the Kyrgyz HCWM system.

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