CONCEPT NOTE ON HEALTH CARE MANAGEMENT IN KIRTIPUR MUNICIPALITY

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Submitted to:

Environment and Public Health Organization

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1. BACKGROUND: SITUATIONAL ANALYSIS

Majority of Health Care Facilities(HCFs) do not have HWM plans & Committee and have not adapted standard color coding system. Even though the waste is segregated at the point of generation, the waste gets mixed during the onsite transportation leading to increased volume risk waste. There is no any database management system for maintaining the records of daily waste generation, treatment, disposal, occupational hazards and incidents. The average daily waste generation from all HCFs is 210.6 kg. Lack of timely collection of HCW and collecting mixed waste along with municipal waste from HHs waste is in practice. Almost all the HCFs are practicing the waste segregation at source but in the absence of proper transportation facility and training & awareness among waste handling staffs, all types of waste are mixed together during onsite and offsite transportation. Only Kirtpur hospital have adopted treatment facility; autoclave and Biogas. Open burning and burying of risk waste is prevalent causing environmental hazards leading to air and water pollution. Most of the HCFs lack equipment, PPE sets, vaccination provision, resulting high risk of workplace hazards and injuries.

2. OBJECTIVES OF PURPOSED ACTIVITIES

The Purpose of this note is to formulate the approaches for adoption of Health Care Waste treatment for safe management initiatives on efficient health care waste management.

3. PROPOSED ACTIVITIES

Based on the findings of the Assessment carried out in Kirtipur municipality, approaches are recommended in accordance with two broad categories of waste; Solid waste and liquid waste. HCFs should adopt treatment technologies depending on the effectiveness, environmental impacts, cost and compliance of legislation.

As per Healthcare Waste Management Standard, 2077 (2020) Draft, following standards need to be achieved for safe HCWM.

	Component	Standards
1	HCWM Planning	• Facility level HCWM implementation plan in place
2	HCWM Committee	• A designated and trained staff to overlook all the HCWM issues needs to be appointed
		• HCWM committee in place with clearly defined roles and responsibilities of the members of the committee
3	Segregation of waste at Source	• Different colored bins (for general and hazardous waste) are used from source to final disposal.
		• Standard color coding for each type of waste should be applied. • Green: Biodegradable • Blue: Non-biodegradable • Red: Infectious, Pathological, Sharps, Pharmaceutical and Cytotoxic • Yellow: Chemical • Black: Radioactive
		• Proper labeling with pictures and texts should be applied in all the bins used for waste segregation, collection and storage.
		• Medication trolley with well labelled buckets for segregation of waste during procedures.
4	Collection	• General and hazardous waste should be collected separately. • Wastes needs be collected at regular intervals and should not be more than 3/4 full.
5	Transportation	• Separate transportation trollies should be used to transport general and hazardous waste.
		• Separate and covered vehicles/trollies should be used for off-site transportation
6	Storage Area	• There is separate well-ventilated area/space designated for waste storage
		• Infectious waste should not be stored for more than 24 hours in the summer and 48 hours in the winter
		• General, Infectious, pharmaceutical, cytotoxics, chemical and radioactive wastes are stored separately
		• A designated area/space should be allocated for storage after the treatment of the hazardous and other general waste

	Component	Standards
7	Treatment	• All hazardous waste needs to be treated prior to final disposal
		• Technologies with integrated shredding system should be avoided
8	Disposal	• Integrate to municipal waste collection system after treatment
		• Send all recyclables to recycling/biodegradable to composting
		• Send all waste to Central Treatment Facility (if available)
9	Personal Protection	• Staff use cap, mask, gloves, goggles, boot, and gown while collecting waste.
		• All health care workers and waste handlers are vaccinated against Hepatitis B, Tetanus and as per protocol.
10	Liquid waste management	• Liquid waste needs to be treated before disposal
		• The effluent of the liquid waste treatment plant should be tested at regular interval for compliance with national standards
11	Recording and Reporting System	• Daily records of waste generation, treatment and disposal along with the periodic testing of technology should be recorded
		• All the occupational health hazards should be recorded after every incident
12	Monitoring and Review	• HCWM system should be periodically monitored and reviewed

As per the Solid Waste Management Act 2011, any institute which generates hazardous or medical wastes are themselves responsible for the management of the waste. So, the HCFs are responsible for the proper treatment and disposal of waste generated in their facility. HCFs can choose either onsite treatment (on the HCF premises) or an off-site treatment (in a central treatment facility) approach.

3.1 SOLID WASTE MANAGEMENT

According to the types of waste generation in Kirtipur municipality, HCFs may adapt following onsite treatment technologies for Solid Health Care Waste generated or they may opt for the different phases as presented in Figure 1.

3.1.1 TREATMENT OPTIONS

Table 1 Suggested Treatment Options for HCW

Waste Type	Suggested Treatment (as per National HCWM standards and Operating Procedures – 2020)
Infectious Waste	Auto Clave
	Chemical Disinfection
	Other non-burn technologies like microwave, frictional heat based, integrated steam based technologies
Sharp Waste	Autoclave
	Encapsulation
	Septic Concrete Vault
Pathological Waste	Placenta Pits
	Anaerobic Digestion
Pharmaceutical Waste Disposal	Return back policy
	Procurement policy
	Encapsulation/ Inertization
	Sanitary Landfill Disposal
	Discharged to a sewer
Chemical Waste	Return back policy
	Encapsulation/ Inertization
	Discharged to a sewer
	Burial Pit

With regard to the assessment findings, all the Health Care Facilities should adapt national standards for the effective and efficient Health Care waste management system. Then, the treatment facility will be adopted accordingly, among the three given options presented in Figure 1.

3.1.2 CALCULATION OF RISK WASTE FROM HOSPITALS WASTE

Hospitals	Capacity	
Ayurveda Hospital	50	bed
Bishnudevi	15	bed
Kirtipur Eye Hospital	15	bed
Kirtipur Hospital	100	bed
National Ayurveda Research Centre	20	bed
(TOTAL)	**200**	**bed**
Risk waste generation rate *(0.44 kg /bed/day as per the national assessment conducted by DoHS in 2015.)*	0.44	kg/bed/day
Total Risk waste generation	**88**	**kg/day**

3.1.3 DIFFERENT PHASES AND OPTIONS FOR SOLID HEALTH CARE WASTE MANAGEMENT IN KIRTIPUR MUNICIPALITY

PHASE I- Establishment of Facility based Healthcare waste management system

- ✓ Formulation and implementation of HCWM Plans and Committee
- ✓ HCW Collection and Segregation according to standard color coding, Green & Blue: non-hazardous waste, Red: Infectious, Pathological Sharps, pharmaceutical & Cytotoxic waste, Yellow; Chemical, Black: Radioactive
- ✓ Separate Trolleys should be used for transportation of waste.
- ✓ Hazardous Health Care Waste should be treated prior to final disposal.
- ✓ After treatment, Recyclable, disposable waste should be segregated and manage accordingly.
- ✓ HCFs should be well equipped with necessary equipment and PPE sets.
- ✓ Regular training for the capacity building of staffs.

PHASE II- 3 OPTIONS

- ✓ OPTION II-A

  Private Operator: Operation and management of Common treatment facility by Private entity (with Expertise in HCWM) in collaboration with Existing Municipal Waste Collector

- ✓ OPTION II-B

  Private Operator: Operation and management of Common treatment facility (CTF) by Private entity (with Expertise in HCWM)

- ✓ OPTION II-C

  Public Operator: Operation of Common Treatment Facility (CTF) by Government Hospital as a public entity under Municipal ownership with Technical Assistance of HCWM Experts

Figure 1: Different phases and options for Health Care Waste Management in Kirtipur Municipality

3.2 LIQUID WASTE MANAGEMENT

Since none of the HCFs have adopted wastewater treatment facility, the HCFs may opted for two treatment options for Liquid waste treatment.

i) Small Hospitals, Health post and Urban Health Centre may opt for the Chemical disinfection as an onsite treatment.
ii) The liquid waste from small HCFs (with liquid waste generation of < 100 litre/ day) can be collected and treated in a large hospital. For this option, municipality should coordinate and create the enabling environment by formulating the legal documents incorporating liquid health care waste management.

Regarding the technologies for Liquid waste management, larger HCFs may adopt following technology:

3.2.1 MOVING BED BIOFILM REACTOR (MBBR) TECHNOLOGY

Moving bed biofilm reactor (MBBR) technology refers to a technology used for wastewater treatment process which was first invented at Norwegian University of Science and Technology. The technology consists of an aeration tank (similar to activated sludge tank) with special plastic carriers i.e. polythene. It utilizes number of polythene biofilm carriers to provide a protective area for the microorganisms to grow. These microorganisms consume organic material and are effective for treating the wastewater. It is a biological technology used for wastewater treatment.

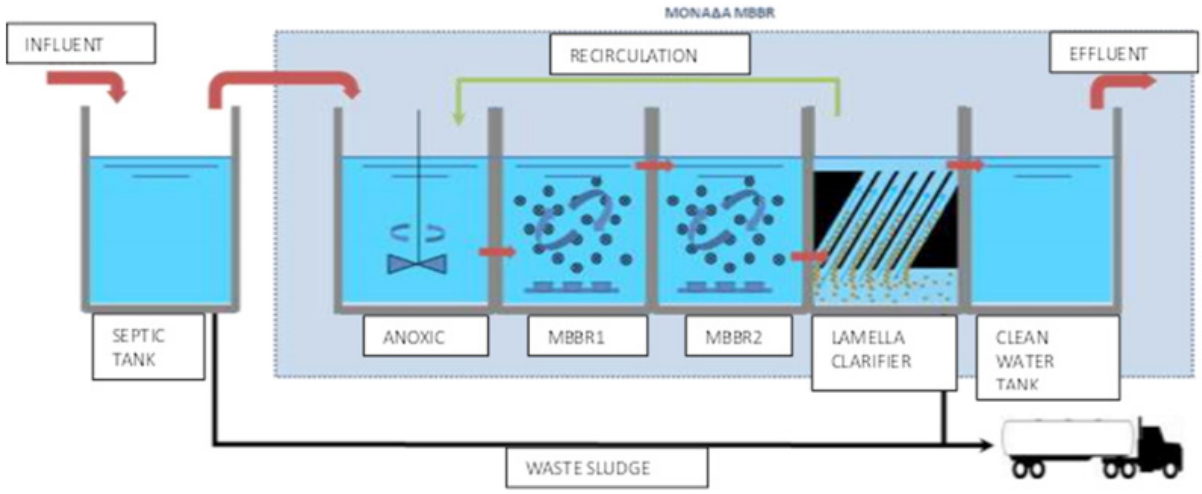

Figure 1: Schematic diagram of MBBR treatment plant

3.2.2 ELECTROCOAGULATION

Electrocoagulation is an effective method used for wastewater treatment, wash water treatment, industrially processed water and medical treatment. Electrocoagulation system consists of pairs of conductive metal plates which acts as monopolar electrodes, direct current power supply, a resistance box and a multimeter to read the current values. The electrocoagulation process involves the passing of electric current through water, the current provides the electromotive force causing the chemical reactions which results in destabilizing suspended, emulsified or dissolved containments in the water. The process can remove heavy metals, oils, fats, grease, complex organic matters and also destroys and removes bacteria, viruses and cysts.

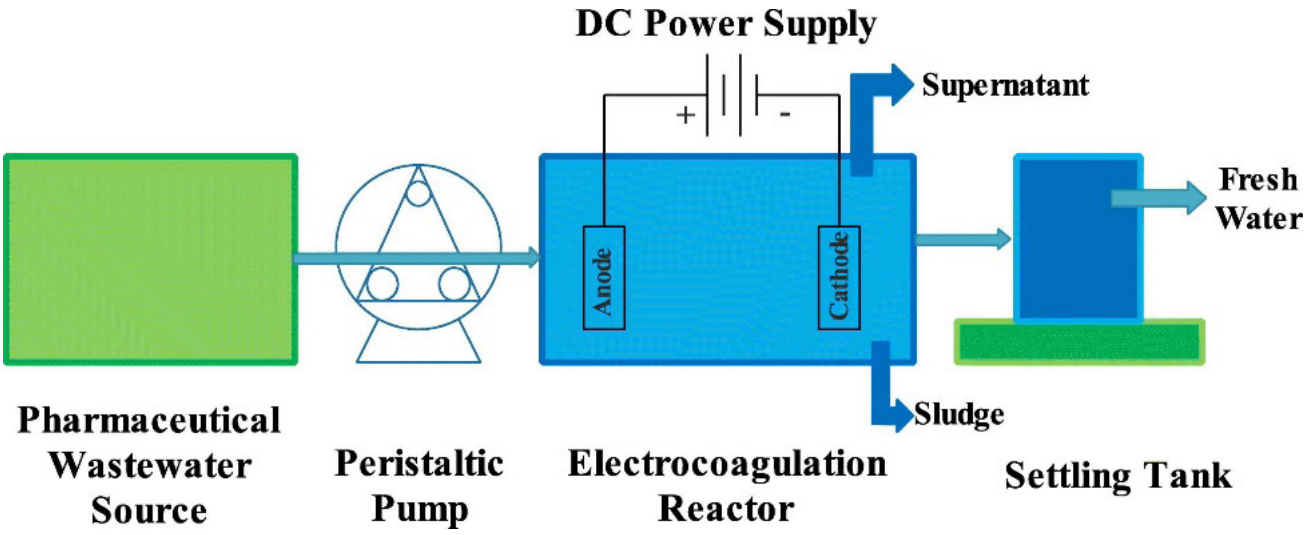

Figure 2: Conceptual flow diagram for HC Wastewater by electrocoagulation

3.2.3 CALCULATION OF LIQUID WASTE GENERATION

Hospitals	Capacity		Water Requirement per bed including laundry (NBC 208:2003), litre/ bed/day	Total Water Requirement per day	Conversion Factor	Wastewater Generation, Litre/day	Proposed Size of MBBR (KLD/day)
Ayurveda Hospital	50	bed	450	22,500.00	0.9	20,250.00	20
Bishnudevi Hospital	15	bed	450	6,750.00	0.9	6,075.00	5
Kirtipur Eye Hospital	15	bed	450	6,750.00	0.9	6,075.00	5
Kirtipur Hospital	100	bed	450	45,000.00	0.9	40,500.00	40
National Ayurveda Research Centre	20	bed	450	9,000.00	0.9	8,100.00	10

4. Cost Estimates

4.1 COST ESTIMATION for different proposed treatment technologies and options

IMPLEMENTED COST FOR PHASE –I

PHASE -I	Implementation HCF based Waste Management System				
HCFs	**COMPONENT**	**No. of Facilities**	**Estimated Cost / Facility**	**Estimated Cost, NPR**	**Remarks**
Formation of HCWM committee, plan, Initiate HCWM system, Sensitize and provide trainings	Health posts and Urban Health Centres	11	78,125.00 [C]	859,375.00	
	Hospitals	5	343,750.00 [D]	1,718,750.00	
Infrastructure component	Healthposts and Urban Health Centres	11	399,500.00 [A]	4,394,500.00	If HCFs have any of the proposed equipment, cost will be reduced.
	Hospitals	5	1,551,500.00 [B]	7,757,500.00	

IMPLEMENTATION COST FOR PHASE –II

PHASE -II-A	Operation and management of Common treatment facility by Private entity (with Expertise in HCWM) in collaboration with Existing Municipal Waste Collector		
Waste collection vehicle along with driver and helper will be used from the Private waste collector			
Infrastructure	Shade for waste collection, treatment, segregation and storage	1,600,000.00	
	Segregated waste collection compartments	300,000.00	
	Autoclave	800,000.00	
	Autoclave Testing Indicators (Autoclave Tape, Strip integrator, Biological Spores and Incubator)	300,000.00	
	PPE	25,000.00	
	Weighing Scale	25,000.00	
	Unforeseen cost	100,000	
	Biogas Digester	220,000.00	
	Placenta Pit	500,000.00	
	TOTAL	**3,370,000.00**	with Bio digester
		3,650,000.00	with Placenta Pit
Operation cost ***(Per month)***	Vehicle operation cost	60,000.00	
	Staff Salary		
	Driver	25,000.00	
	Helper	15,000.00	
	Waste segregator	15,000.00	
	Office staff (for overall management)	25,000.00	
	Electricity Cost	10,000.00	
	Office operation cost	10,000.00	
	TOTAL	**160,000.00**	

Cost for PHASE II-B and PHASE II-C is also same as that of PHASE-IIA, but there will be additional cost for vehicle (Can be purchased new or hired). Salary for driver and helper will be also more than that of PHASE II-A.

COST BREAKDOWN

A. Cost - Infrastructure for Health post or Urban Health Centre (Per Facility)

SN	Items	Estimated Cost (NPR))
1	Coloured Bins Different Size and Colour	20000
2	Segregation Trolley Stand	30000
3	Needle Cutter	27000
4	Sharp Bins	2500
5	PPE	25000
6	Labels/ Visibility (For Bin and Walls)	5000
7	Polythene Bags (Different Size)	5000
8	Autoclave Testing Indicators (Autoclave Tape, Strip integrator, Biological Spores and Incubator)	200000
9	Weighing Scale	15000
10	Autoclave (40 L)	50000
11	Segregation Compartment	20000
TOTAL*(VAT not included)*		**399500**

B. Cost - Infrastructure for Hospitals (Per Hospital)

SN	Items	Estimated Cost (NPR)
1	Colored Bins Different Size and Color	50,000.00
2	Segregation Trolley Stand	50,000.00
3	Needle Cutter	54,000.00
4	Sharp Bins	7,500.00
5	PPE	50,000.00
6	Labels/ Visibility (For Bin and Walls)	15,000.00
7	Polythene Bags (Different Size)	10,000.00
8	Autoclave Testing Indicators (Autoclave Tape, Strip integrator, Biological Spores and Incubator)	300,000.00
9	Weighing Scale	15,000.00
10	Autoclave	800,000.00
11	Segregation Compartment	200,000.00
	TOTAL *(VAT not included)*	**1,551,500.00**

Implementation of Facility based Healthcare waste management system

MAJOR ACTIVITIES
Form HCWM committee
Develop healthcare waste management (HCWM) plan
Design and setup HCW treatment center
Test treatment technology and Initiate HCWM system
Sensitize and provide trainings
Suggest monitoring and supervision plan

C. Cost for Implementation of Facility based Healthcare waste management system -HPs and UHC (Per facility)

Details	Man-days	Rate	Amount, NPR
HCWM Expert	5	10000	62,500.00
HCWM Officer	5	2500	
Other cost(Local Transportation, communication, logistic support, overhead)- 25%			15,625.00
TOTAL (VAT – not included)			78,125.00

D. Cost for Implementation of Facility based Healthcare waste management system –Hospitals (Per Hospital)

Details	Quantity	Unit	Rate	Amount, NPR
HCWM Expert	14	Mandays	10000	175,000.00
HCWM Officer	14	Mandays	2500	
Training Cost	1	No	100000	100,000.00
Other cost (Local Transportation, communication, logistic support, overhead)- 25%				68,750.00
			TOTAL	**343,750.00**

4.2 LIQUID WASTE

4.2.1 OPTION I- MBBR Technology

Cost estimation for MBBR

Size, KLD/day	Capital Cost, (000 NPR)	Power Cost, (@250 NPR/m3)	Chemical Cost, (@10 NPR/m3)	Maintenance Cost, (@35 NPR/m3)
5	700.00	1250.00	50.00	175.00
10	1,200.00	2500.00	100.00	350.00
20	1,500.00	5000.00	200.00	700.00
40	2,500.00	10000.00	400.00	1400.00

4.2.2 OPTION II- Electrocogulation

For treating liquid waste from pathology lab, operation theatre and radiology department elctrocoagulation is proposed. The estimated cost for this technology is estimated as NPR 150,000.00 per KLD liquid waste generated.

4.3 ESTIMATED COST FOR PREPARATION OF DPR

4.3.1 FOR THE PROPOSED WASTE WATER TREATMENT

SIZE (KLD)	Estimated Cost (NPR)
For facility with 5 – 10 KLD waste water	300,000.00
For facility with 20 KLD waste water	400,000.00
For facility with 40 KLD waste water	500,000.00

4.3.2 FOR THE PROPOSED TREATMENT Phase–I (Facility Based Treatment System)

PARTICULARS	QTY	UNIT	Rate	AMOUNT, NPR
TEAM LEADER	30	days	11,000.00	330,000.00
HCWM EXPERT	45	days	9,000.00	405,000.00
Enumerators	56	days	2,000.00	112,000.00
PROJECT ASSISTANT	56	days	1,500.00	84,000.00
Local Transportation				50,000.00
Meetings	2		30000	60,000.00
Stationaries	1		15000	15,000.00
Communication	1		15000	15,000.00
PPE/Weighing Balance / Polythene bag				25,000.00
			SUB -TOTAL	1,096,000.00
			Overhead- 15%	164,400.00
			TOTAL	1,260,400.00

4.3.3 FOR THE PROPOSED TREATMENT Phase–II

Additional NPR 500,000.00 is estimated for the Phase II (for any of the three options).

Proposed Options for Implementation can be any of the following combinations:

Phase I + Phase II-A
Phase I + Phase II-B
Phase I + Phase II-C

So, estimated cost for preparation of DPR for any of the options (from 3 combinations) is estimated as NPR. 1,760,400.00.