

Managing health care waste disposal

Operator's manual

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**How to use the waste disposal unit
(incorporating the De Montfort incinerator)**

Operator's manual

**How to use
the waste disposal unit
(incorporating the
De Montfort incinerator)**

Documents on the *Waste disposal unit (incorporating the De Montfort incinerator)* include:

- Operator's manual
- Guidelines on how to construct, use and maintain a waste disposal unit
- Trainer presentation materials

Copies of these documents may be obtained from:

World Health Organization

Africa Region

Harare, Zimbabwe

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Operator's manual

How to use the waste disposal unit (incorporating the De Montfort incinerator)

1. Introducing the waste disposal unit

The *Operator's Manual* is one of three documents providing guidelines on the introduction of the waste disposal unit (WDU) for the disposal of infectious waste from primary health facilities. The WDU incorporates the De Montfort small-scale incinerator.

Three separate documents explain the WDU: Operator's Manual; Guidelines on how to construct, use, and maintain a WDU; and Trainer presentation materials.

The *Operator's Manual* provides guidelines and explanations on the use of the WDU for operators. It describes the components of the WDU, the tasks and decisions facing the operator, the procedures in loading and burning the waste, and the requirements for record-keeping. It also stresses a discipline of instructions – “best practices” to ensure the safety of operators, other personnel and the community at large, and to minimize emissions from the incinerator that are harmful to the environment.

The two other documents are:

1) *Guidelines*, divided into four sections:

- **Section I** is an overview of the WDU. This overview provides information for anyone who has an interest in the principles of the operation of the WDU, as well as the associated environmental considerations, management and economics.
- **Section II** covers the technical specifications of the WDU components, the construction process, tendering and quality-control issues. This section is for consulting engineers, contractors and procurement officers.

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- **Section III** addresses the issues of planning and conducting training programmes and includes a guide for trainers of WDU operators.
 - **Section IV** addresses maintenance planning and procedures, providing information for ministry of health managers and maintenance contractors/personnel.
- 2) *Trainer presentation materials* for the use of trainers who are responsible for training of the WDU operators.

Prior to examining the tasks and responsibilities of the operator it is necessary to become familiar with the WDU.

1.1 ***The waste disposal unit and its components***

The WDU has been designed to enable trained operators to safely process and dispose of infectious waste. It is made up of several elements, housed within a sheltered enclosure. These elements are:

- A **De Montfort incinerator** to burn and reduce waste. The incinerator destroys 6–7 kg per hour if used correctly (i.e. approximately six safety boxes per hour).
- An **ash pit** where residual ash, glass and metallic parts – including needles – are safely deposited *after* incineration. The ash pit is large enough to store incinerated residues for at least 10 years without being emptied. Residue from one incineration session weighs approximately 0.5 kg. A pit of 3.25 cubic metres stores ash from the burning of approximately 300 safety boxes per month, over a period of 12 years. The ash pit has access trap doors to allow the pile of ash to be redistributed from time-to-time.
- A **waste store** to securely accumulate waste that is to be incinerated. The store has the capacity to stock at least 200 neatly-stacked safety boxes.
- A **fuel store** to stock the fuel, such as agro residues or wood, required to preheat the incinerator. The fuel store has enough capacity to stock fuel for at least five incineration sessions, both for pre-heating and supplementing medical waste.
- A **storage box** to keep tools, protective clothing and records.
- An **enclosure** with a lockable door to prevent access by children and unauthorized persons, as well as scavenging animals and birds.

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- A **shelter** to provide protection from the weather, particularly rain, for the incinerator, the operator and the waste to be incinerated. The shelter also protects the fuel, the operator's tools, protective clothing and records. The shelter supports a 4-metre high chimney.
 - An **access hatch** through the wire-mesh wall of the WDU to allow waste to be deposited when the WDU is locked and the operator is not present. This hatch opens into a **safety-box deposit** which provides a protected area where the safety boxes (and containers from needle-cutters) can be deposited temporarily.

1.2 *How the De Montfort incinerator works*

The incinerator is made of firebricks and prefabricated metal components which can either be manufactured locally or imported. The structure is assembled and built at the site using Portland or refractory cement. No specialized tools are required.

The incinerator comprises primary and secondary combustion chambers. The burning zone of the primary chamber is accessible through a door at the front. This door lets in air, allows the operator to light the fire and also to remove the ash. The medical waste is dropped in through a loading door above the primary chamber. The secondary chamber – which is inaccessible to the operator – is separated from the primary chamber by a brick column with an opening at the bottom to induce a cross-draught during operation. Additional air is drawn into the secondary chamber through a small opening in the lower section of the rear wall of the secondary chamber. This air mixes with the partially-burnt flue gas from the primary chamber and causes secondary combustion. A self-adjusting draught control for regulating heat output and burn time is mounted in the lower section of the chimney and controls the flue gases in the chimney. A stove-pipe thermocouple mounted at the neck of the chimney indicates when the medical waste should be loaded. A 4-metre high chimney, mounted above the secondary combustion chamber, releases the flue gases into the atmosphere.

2. Safety

The safety of the WDU operator is assured by following the instructions below:

Important:
Always wear protective clothing when handling any waste.

- 1) Wear the protective clothing provided to all operators.
- 2) Wash hands regularly.
- 3) Be vaccinated against Hepatitis B virus (HBV).
- 4) Have regular medical checkups (every six months).

3. Operator's tasks and responsibilities

- 1) Adhere to the instructions in this *Manual* to destroy medical waste deposited at the WDU.
- 2) Establish a regular routine to burn waste.
- 3) Minimize personal risk, as well as risk to other health workers and the local community.
- 4) Report achievements and problems to the supervisor.

4. Receiving health-care waste at the WDU

4.1 *When operator is present at the WDU*

When waste is deposited at the WDU, the operator will:

- 1) Receive the waste and record the required details in the *Waste-Deposit Record* (See Annex 1).
- 2) Verify that any waste received is appropriately packaged – that is:
 - sharps in safety boxes,
 - other waste in plastic bags,
 - needles in needle-cutter containers.
- 3) If the waste is not packaged correctly, report this to the supervisor.



4.2 *When the operator is not present at the WDU*

If the operator is not present at the WDU, the person delivering the waste at the WDU should:



- 1) Make sure that the safety boxes and plastic bags are properly closed.
- 2) Deposit the safety boxes and plastic bags through the access hatch that is clearly labelled and designed for this purpose. The waste deposited here drops into the safety-box deposit that is accessible only to authorized persons.
- 3) At locations where a needle-cutter is used, deposit the needle containers through the access hatch that is used for the safety boxes and plastic bags.

On returning to the WDU, the operator will arrange the safety boxes or plastic bags of waste which have been deposited through the waste-store access hatch in the waste store. The operator will also complete the *Waste-Deposit Record* for the newly arrived waste.

5. **Conditions for incinerating waste**

Use the incinerator to burn waste only if:

- 1) Six or more safety boxes of waste have been deposited at the WDU for disposal.
- 2) The wind is not blowing towards the health facility, other buildings near the incinerator, or across cultivated agricultural land.
- 3) No large groups of people are present in the immediate area.
- 4) The wind is not strong and likely to cause a fire.
- 5) The safety precautions are adequate (*as defined below*).
- 6) The incinerator is in good working order (*as defined below*).

For safety precautions to be termed adequate, the following conditions must be met:

- Tools and protective clothing are available and in good condition.
- A container full of sand is available at the WDU.
- The appropriate tools are available to operate the incinerator.

For the incinerator to be considered in good working condition, the following conditions must be met:

- The ash door and the loading door close correctly, i.e. they must not be broken.
- The strainer cables to the chimney should be tight, and there should be no risk that the chimney will fall down.
- The metal parts (front door, loading door, spigot, chimney, etc.) should not be badly corroded and/or likely to break.
- The masonry should not be badly cracked and/or likely to cause injury.

6. Preparation



**DO NOT REMOVE
WASTE FROM ITS
BAGS OR BOXES!**

Important:

Do not sort and/or mix the waste prior to incineration. This is hazardous. Needle-stick can be fatal!

Prior to start-up:

- 1) Make sure that more than 10 kg of renewable fuels (wood, coconut shells or other combustible agro waste) and 1 litre of kerosene are available at the WDU.
- 2) Make sure that the medical waste stored in the WDU is dry. If it is wet, place it in a well-ventilated spot inside the WDU to dry.
- 3) Ensure that all tools and equipment are in working order (*see Annex 3*).
- 4) Wear protective clothes (gloves, goggles, overalls and masks).
- 5) Remove the ash from the incinerator and place it in the ash pit.
- 6) Clean the area around the WDU.
- 7) Weigh the medical waste to be incinerated and count the boxes and/or packages. Record these quantities in the *Waste-Disposal Record* (*see Annex 2*).

7. Getting started

7.1 Lighting and warm-up



Important:

Do not attempt to burn wet medical waste in the incinerator.



Lighting and warm-up will take 20-30 minutes.

To light the incinerator and achieve the temperature required to load medical waste, follow the procedure outlined below.

- 1) Fully open the ash door and keep the loading door closed.
- 2) Place paper, kindling wood (approximately 1.5 kg) or other readily burnable (non-polluting) materials on the grate. Pour a small quantity of kerosene or diesel over the materials if necessary.
- 3) Light the fire through the ash door. Use a taper of burning paper rather than a match or cigarette lighter. Avoid looking directly into the grate when lighting the fire in case any explosive or volatile gas remains in the primary combustion chamber.
- 4) After steady burn is achieved (approximately 5 minutes), add approximately 1–2 kg of combustible material (not medical waste) to the burning fire through the ash door.
- 5) Observe the temperature gauge mounted on the chimney until the temperature stabilizes (approximately 5 minutes).
- 6) Place additional fuel on the fire (approximately 2 kg).
- 7) Repeat this procedure until the temperature gauge displays a temperature of, at least, 600° C and then close the ash door.

8. Loading and destroying medical waste

Important:

Do not open and/or sort waste into separate bags and safety boxes.

Load according to the instructions given in this *Manual* to reduce smoke levels and emissions of harmful gases.

- 1) Prior to loading the packaged waste for burning, store it temporarily in the designated waste store.
- 2) Load the safety boxes and the plastic bags for burning through the loading door at the top of the incinerator.
- 3) If the needle-cutter containers are disposable, deposit them in the needle chute; if the needle-cutter containers are not disposable, empty the needles into the needle chute and save the containers for re-use.

8.1 *Rate of loading waste and fuel*

"Rate of loading" is a key factor in reducing smoke levels. Loading one full safety box approximately every 8–10 minutes gives the cleanest burn. However, this rate of loading cannot be maintained too precisely because the amount of waste in the safety boxes varies. The best "rate of loading" is determined by observing the temperature gauge.

8.2 *Operating without a temperature gauge*

Some incinerators are not fitted with a temperature gauge so the operator has to judge the adequate operating temperatures, based on experience. Inexperienced operators should not be assigned to operate incinerators that do not have a working temperature gauge fitted.

A good visual guide is to look through the secondary air inlet and check the colour of the smoke from the chimney.

Visual guide to judging temperature:

- If a good strong flame is visible through the secondary air hole, the temperature should be more than 600°C at this point.
- If the smoke is dense white, grey or black, poor combustion is occurring because the temperature is either above or below what is required.
- If temperatures are too high, the chimney glows red.

8.3 Loading



Do not load medical waste if the temperature is below 600°C or above 900°C.

- 1) Load only waste that has been weighed and recorded in the operator's record.
- 2) Load through the loading door on the top and not through the ash door at the front.
- 3) Open the loading door just prior to depositing medical waste and close it immediately afterwards in order to avoid being exposed to toxic gases.
- 4) Load *safety boxes* only when the temperature on the gauge is above 600°C but below 900°C.
- 5) Load *bags of waste* only when the temperature on the gauge is above 700°C.
- 6) If the temperature drops below 600°C, only load fuel (wood, coconut husks, etc.) and not health-care waste.

8.4 Mixtures and proportions of waste to be loaded

- 1) Do not load very wet safety boxes or bags of waste. Place them in a dry, well-ventilated, warm place to dry (e.g. on the concrete slab next to the top of the incinerator).
- 2) Fuels with high heating values (e.g. plastics, paper, card and dry textiles) are useful in maintaining the correct temperatures for burning bags of health-care waste.

Important:

Do not look directly into the incinerator while it is in operation. Glass vials (frequently placed in waste containers) explode when exposed to extreme heat.

Do not burn PVC plastics. They give off harmful environmental emissions.

- 3) Burn a mixture of safety boxes and bags of non-sharps waste if both types of waste are available (sorting and labelling the waste in separate bags must be done at the place where the waste is generated).
- 4) As a general rule: burn safety boxes in order to *increase temperatures* in the incinerator, and bags of other waste in order to *reduce temperatures* in the incinerator.

9. Burn down/cool down



When all the health-care waste has been burned and the temperature indicated on the temperature gauge falls below 600°C, proceed to *burn down/cool down*.

After the waste has burned down, leave sufficient time for the fire to die down and the embers to cool. This allows the "fixed carbon" in the waste bed to burn, reducing toxic emissions and ensuring that all the waste is totally destroyed.

9.1 Procedure

- 1) Add 1-2 kg of fuel (wood, coconut shell, or other combustible agro waste) when the temperature falls below 600°C.
- 2) Do not leave the WDU until the temperature on the gauge falls below 400°C (if there is no temperature gauge, wait until the fire is reduced to a bed of red embers) to avoid any possible accidents.
- 3) Allow the incinerator to cool down for at least three hours after use before removing the ash.

9.2 Cleaning – including ash removal

When burning is complete a residue is left. This residue is a mixture of ash from the fuels used to pre-heat the incinerator, ash from the safety boxes of syringes and non-burnable materials such as needles, scalpels, etc. and glass from vials. It is important to dispose of this ash carefully since it is toxic and it contains sharp objects.

If the load of health-care waste has been burned in accordance with "best practices", needles are sterilized and annealed. There is, therefore, no risk of infection from needle-stick. Observe the instructions below:



Important: Ash is contaminated. Always use gloves and a face mask when moving it to the ash pit.

- 1) Always wear gloves and a face mask when removing the ash.
- 2) Never handle the ash or other solids with bare hands. Always wear protective clothing, including gloves. Use the rake provided as part of the WDU tool kit to rake the ash and other non-burnable waste directly into the ash pit.
- 3) If the incinerator is operated every day, remove the ashes and other non-burnable waste the following day, prior to operating the incinerator again.
- 4) If the incinerator is not used every day, remove all the ash on the same day after several hours or remove it the following morning. Do not leave ash in the incinerator for long periods of time.
- 5) Carefully sweep the area around the incinerator to ensure that all the needles and non-combustible waste are placed in the ash pit.
- 6) Always replace the trap door of the ash pit to avoid accidents.
- 7) Two additional trap doors are provided in the concrete slabs at ground level on either side of the incinerator. Open these from time-to-time and distribute the ash evenly within the pit.

10. Record-keeping and reporting

WDU activities are recorded on three different forms:

- 1) The **Waste-Deposit Record** shows the amount and type of waste deposited at the WDU when the operator is present, and provides a monthly record of the waste to be burnt (*see Table 1 and Annex 1*).
- 2) The **Waste-Disposal Record** shows the amount of waste destroyed at each burn session (*see Table 2 and Annex 2*).
- 3) The **Tools and Equipment Record** lists the equipment available and its condition, as well as problems and defects encountered with any of the elements of the WDU. (*See Annex 3 for an example of this form.*)

The operator is responsible for maintaining these records in accordance with the steps below:

- 1) Submit each record monthly to the waste-management supervisor.
- 2) Keep a carbon copy of all records at the WDU. These records must always be available for inspection at the site.
- 3) Prepare monthly/quarterly reports of the waste-management activity on the basis of the information in the daily records.

10.1 Record of waste deposited

The purpose of the *Waste-Deposit Record* is to trace the quantities and origins of waste deposited. This record does not provide complete information since the waste deposited during the operator's absence is not recorded.

Table 1 shows how this form should be completed.

- 1) Complete the *Waste-Deposit Record* for every delivery of waste deposited at the WDU.
- 2) Get the signature of the person who deposits the waste for the record.

Table 1: Example of waste deposit record						
Health facility: <i>PIMS</i>			Month/year: <i>September 2004</i>			
Type of Incinerator: <i>Small scale DeMont fort incinerator</i>			Name of incinerator operator: <i>Raja</i>			
Day of the month	Waste deposited		Origin of waste		Name of person depositing waste	Signature of person depositing waste
	Sharps (kg)	Other (kg)	Means of transport to WDU	Service or place		
<i>10/4/04</i>	<i>3</i>	<i>1.5</i>	<i>Bicycle</i>	<i>Timbuctou</i>	<i>Ghandi</i>	<i>****</i>
<i>17/4/04</i>	<i>2</i>	<i>1</i>	<i>None</i>	<i>EPI room</i>	<i>Jyoti</i>	<i>****</i>

10.2 Record of waste destroyed

- 1) Complete this record for every burn session.
- 2) Sign in the last column for each entry.

Table 2 shows how how to complete *Waste-disposal Record*.

Table 2: Example of incineration/waste-disposal record						
Health facility: <i>Pondicherry</i>				Month/Year: <i>January 04</i>		
Type of Incinerator: <i>De Montfort Mark 8A</i>				Name of incinerator operator: <i>Raja</i>		
Day of the month	Waste incinerated		Auxiliary fuel		Time spent at WDU	Operator's signature
	Sharps (kg)	Other (kg)	Type	kg/litres		
<i>1</i>	<i>2.5</i>	<i>0.5</i>	<i>Wood</i>	<i>12Kg</i>	<i>4</i>	<i>Raja</i>

10.3 Record of tools and equipment, reported problems and WDU defects

- 1) Complete the *Record of tools and equipment, reported problems and WDU defects* every month.
- 2) Include in this record a note of any absence of basic consumable supplies (e.g. fuel, soap, etc.). Submit requests for supplies of such items according to the standard operating procedures of the primary health facility.
- 3) Submit the *Record of tools and equipment* at the end of each month to the waste-management supervisor.

The *Record of tools and equipment, reported problems and WDU defects* documents:

- the presence/lack and condition of tools, equipment and protective clothing;
- any breakages or problems in the WDU;
- improper waste segregation; and
- incorrect waste-management practices of incoming waste.

11. Operator's maintenance responsibilities

- 1) Maintenance of the WDU:
 - Keep the area around the WDU clean; do not allow it to become littered.
 - Store safety boxes and other medical waste in an orderly manner in the WDU waste store.
 - Store fuel stocks in the WDU fuel store.
 - Keep the concrete slabs on either side of the incinerator clean; do not use them as permanent storage zones. Space on the concrete slabs at the top of the incinerator may, however, be used temporarily to store waste that is being dried prior to burning.
 - Keep tools, records and protective clothing in the storage box provided in the WDU.
- 2) Handle tools and protective clothing carefully and keep them clean.
- 3) Immediately report to the waste-management supervisor any damage to the WDU that affects operation or performance.
- 4) Perform simple repairs but avoid makeshift solutions.
- 5) Systematically complete and submit monthly reports for all three records.

12. Security of the WDU

The operator will be held responsible if an accident occurs.

- 1) Keep the WDU locked at all times.
- 2) Do not allow unauthorized persons to enter the WDU area during periods of incineration.
- 3) Ensure that the waste-management supervisor has a key to the WDU.
- 4) Immediately report any vandalism, theft or unauthorized entry to the waste-management supervisor.

Annex 3

Tools and equipment record for WDU operator

Health facility:		Month:	
Type of incinerator:		Name of incinerator operator:	
Tools and equipment			
Category	Item	Available	Condition
Tools	Hand brush/dustpan		
	Hard broom		
	Ash rake		
	Shovel		
	Chimney cleaning brush and cord		
Safety	Sand bucket		
	Fire retardant gloves		
	Eye protection/vace mask		
	Overalls or suitable clothing to cover the upper body, including the lower arms		
	Lock for WDU door		
	Safety first kit		
Records & measurement	Weighing scale		
	WDU records for recording (3 types)		
Problems:			
Packaging or segregation of deposited waste			
Fuel and consumables for operating incinerator			
Other			
DeMontfort waste disposal unit defects			
Date	Description	Present status	