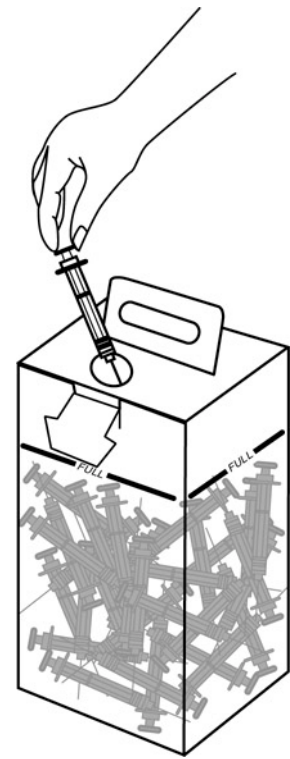


# Planning for Safe Syringe Disposal

Making Medical Injections Safer





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### Acknowledgements

Some of the information in this manual was adapted from WHO guidelines, the WHO HCWM database, and manufacturers' performance data.

Adapted from: "Designing Safe Syringe Disposal Systems for Immunization Services: A Guide for Program Managers," developed by John Lloyd with assistance from Scott Wittet and Heidi Lasher, from the Children's Vaccine Program at PATH. Additional information provided by Jessica Fleming, Nancy Muller, Carib Nelson, and Janet Vail.

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### Planning for Safe Syringe Disposal

PATH—July 2004

## **The safe syringe disposal planning process**

This guide will help you plan your sharps waste disposal system through the five important steps below. Each step is discussed in detail later in this manual.

Step 1: Review existing legislation and policy.

Step 2: Collect data and map your district. Identify incineration areas.

Step 3: Review sharps collection options.

Step 4: Review options for disposal in non-incineration areas.

Step 5: Complete map: assign disposal systems to non-incinerator health facilities.

Step 6: Create a district planning guide to calculate needs and plan implementation.

## **Step 1: Review existing legislation and policy.**

**Determine if any rules or guidelines exist about syringes and their disposal. These might include:**

- Syringes: policy governing disposable, auto-disable, and safety syringes; fixed vs. detachable needles.
- Waste segregation and color-coding guidelines.
- Legislation\* about incineration operation such as emissions standards, incinerator placement, etc.
- Guidelines about waste collection and transport.
- Sharps and infectious waste pits: guidelines on location.
- Needle removal policies.

**Use this information to:**

- Eliminate or refine certain options. Remember that all planning for safe syringe disposal systems must fit within existing legislation and policy.
- Highlight areas where legislation and guidelines must be developed as part of the national injection safety plan.

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\* Sources of legislation may include Ministry of Health, Ministry of Environment, Ministry of Water and Sanitation, etc.

## Step 2: Collect data and map your district. Identify incineration areas.

To design the right disposal system for each health facility, collect data from all incineration and health facilities in your service area.

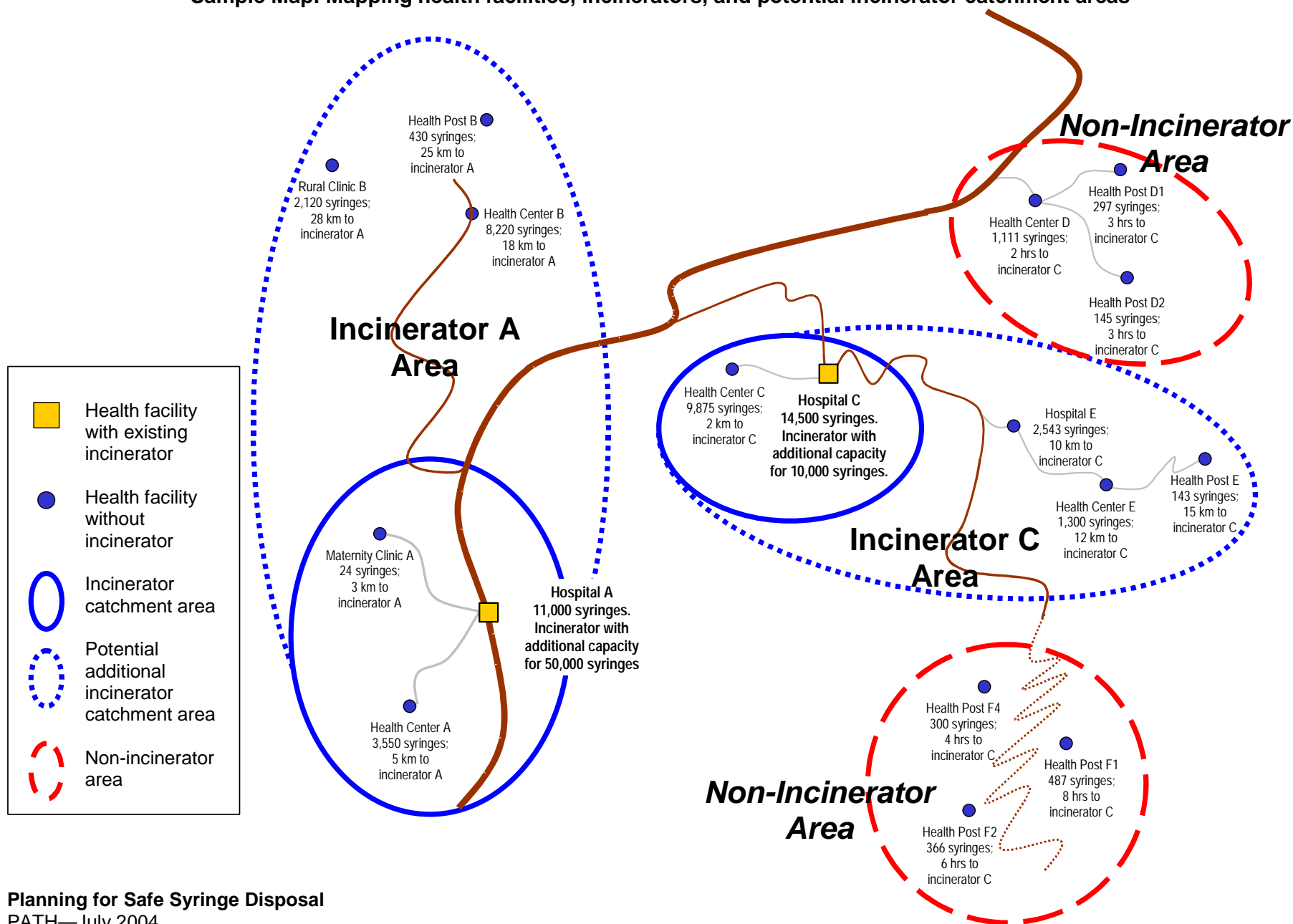
The first step in this process is to map your project area.

1. On a map or piece of paper, indicate the location of every health facility in your service area (see example on next page).
2. For each health facility, determine the number of injections given each month. Write the facility name and number of injections given each month on the map. We are using “injections given” instead of “syringes used” because we are assuming that some syringes are presently being used more than once.
3. Identify each incinerator in the district (Note: “incinerator” refers to a double chamber, medium- to high-temperature incinerator (>700°C operating temperature)). Determine the number of safety boxes that can be burned each month by the incinerator (assume 100 injections = 100 syringes = 1 5-liter safety box) and indicate this on the map. Indicate the distance (km or hours) from each health facility to the nearest incinerator.
4. Indicate on the map those facilities that are currently using existing incinerators by drawing a circle around the incinerator and all facilities using it.
5. Indicate on the map all health facilities that could be served (with improvements to collection, transport, and storage systems) by existing incinerators. Note that collection and transport systems will have to be organized and included in your overall planning.

**All facilities with access or potential access to an incinerator should use incineration as their primary destruction method. Note: If better centralized disposal options exist, they should be prioritized over incineration. Better options include centralized hydroclave, autoclave, or shredding systems, or commercial medical waste services such as Dispositek in Tanzania.**

For more information, see Annexes 1 (Overview of disposal options), 2 (Designing a collection system), 3 (Transporting filled safety boxes), 4 (Syringe safety boxes), and 5 (Incinerating filled safety boxes).

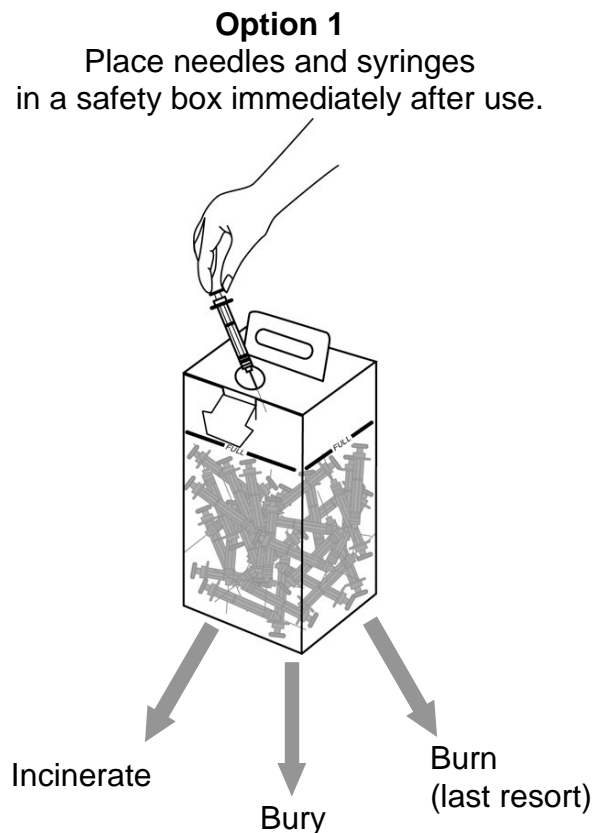
## Sample Map: Mapping health facilities, incinerators, and potential incinerator catchment areas



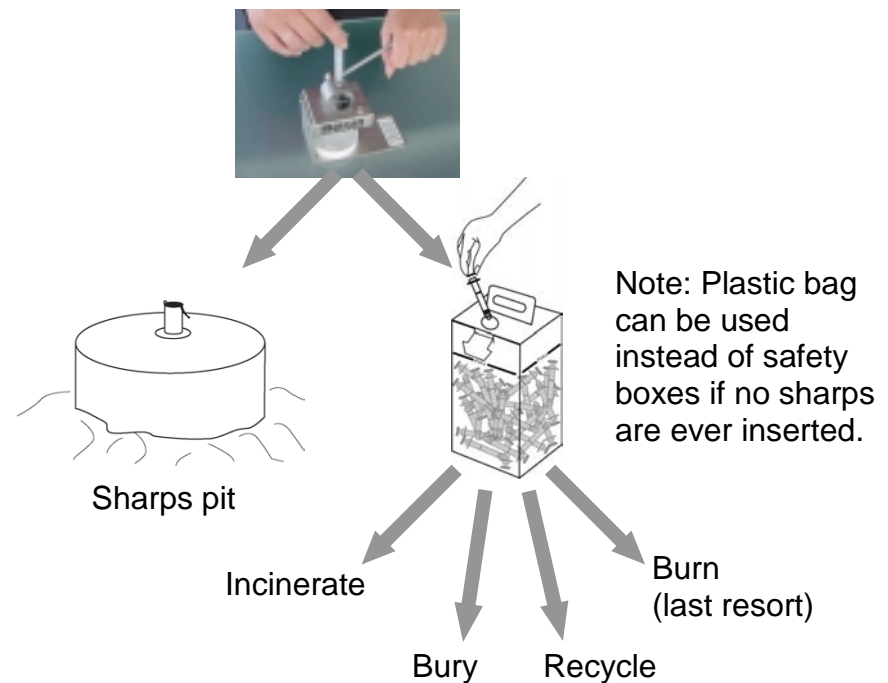
### Step 3: Review sharps collection options.

#### Options for collecting used syringes immediately after injection

Health waste can be dangerous! It is important that all waste is segregated at the point of use by the health worker. Waste handlers should never be involved in separating mixed waste. There are two generally accepted methods of segregating and collecting used syringes in a safety box immediately after the injection:



**Option 2**  
Using a needle remover, separate needles from syringes before placing the syringe in a safety box. Put the separated needles in a secure sharps pit.





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## Collection option 1: Place needles and syringes in a safety box immediately after use.

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The most common method of collecting used syringes is to place the syringe and needle in a safety box immediately after use, without recapping.

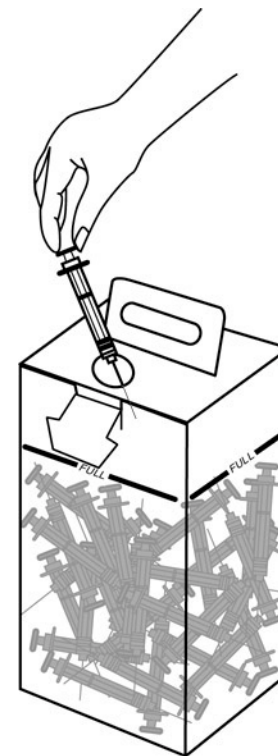
The needle is **not** separated from the syringe.

### Advantages:

- The safety box is designed so that the needle should not penetrate the box wall.
- Once safety boxes are purchased, no additional equipment is necessary.
- The safety box arrives packed flat, so it is easy to transport empty. It is assembled at the point of use.
- The outside wall of the box presents an opportunity for the Ministry of Health to print messages about injection safety.

### Disadvantages:

- Needle-stick injuries remain a hazard during waste handling and transport.
- Syringes with needles are bulky to store and transport because the needles prevent close packing (only about 100 syringes fit in each 5-liter box).
- There is a needle-stick risk if too many syringes are packed in the box (if it is more than  $\frac{3}{4}$  full).
- In situations where many injections are given, safety boxes accumulate very quickly.
- Most boxes are water resistant, but they disintegrate if they become wet.



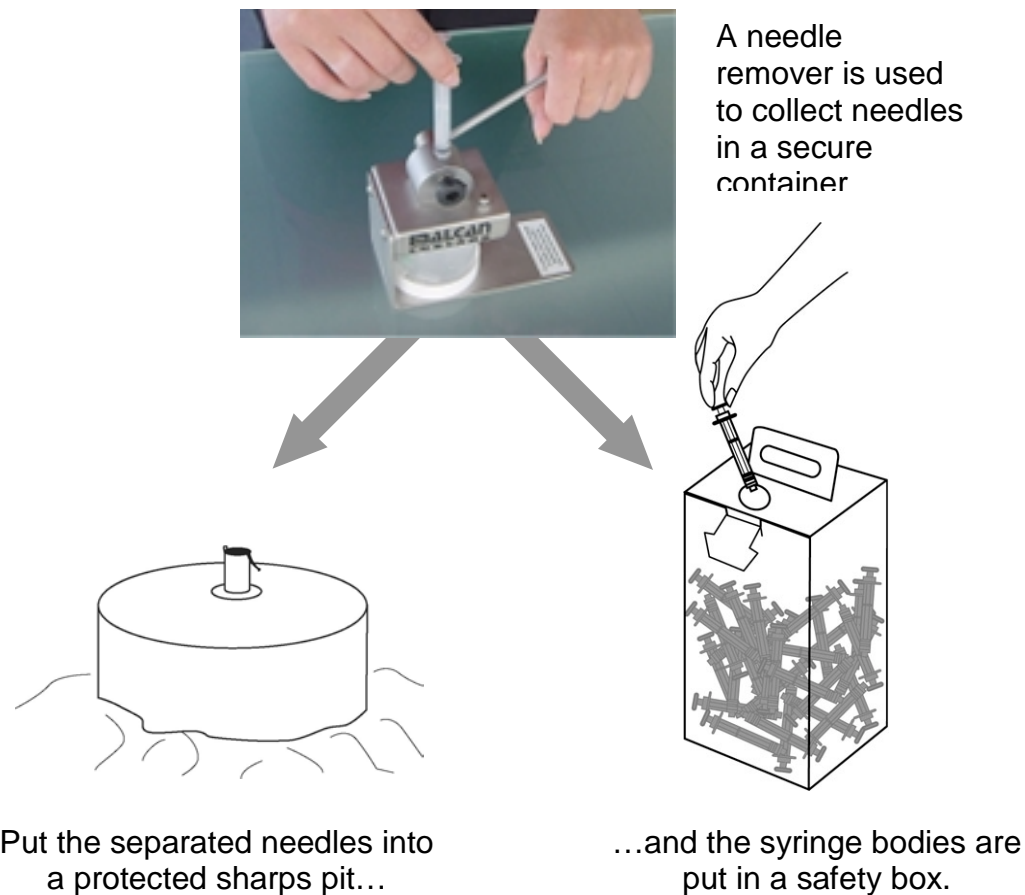
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**Collection option 2: Separate needle from syringe with a needle remover before placing the syringe in a safety box. Put the separated needles in a secure sharps pit.**

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This option encourages the health worker to safely remove the needle from the syringe before disposal. Immediately after the injection, the health worker uses a needle removal device that cuts the needle from the syringe (see Annex 6). After removing the needle from the syringe, the body of the syringe is discarded in a safety box or plastic bag (see Annex 4) and the needles are disposed of in a protected sharps pit (see Annex 7).

Advantages:
<ul style="list-style-type: none"><li>• Prevents improper reuse</li><li>• A syringe without the needle is no longer a hazard so there is less risk of needle-stick during handling and transport.</li><li>• The volume of sharps waste is reduced by 20%-60% when needles are removed.</li><li>• Many years worth of needles will fit in a protected sharps pit.</li><li>• Without needles, more syringes can be put in each safety box.</li></ul>
Disadvantages:
<ul style="list-style-type: none"><li>• The needle remover costs between US\$14-\$70 per device.</li><li>• A specially constructed, protected sharps pit must be built (see Annex 7).</li><li>• A needle remover is needed for each person giving injections, wherever the injection is given.</li></ul>



Note: Plastic bag can be used instead of safety boxes if no sharps are ever inserted.

## Step 4: Review options for disposal in non-incineration areas

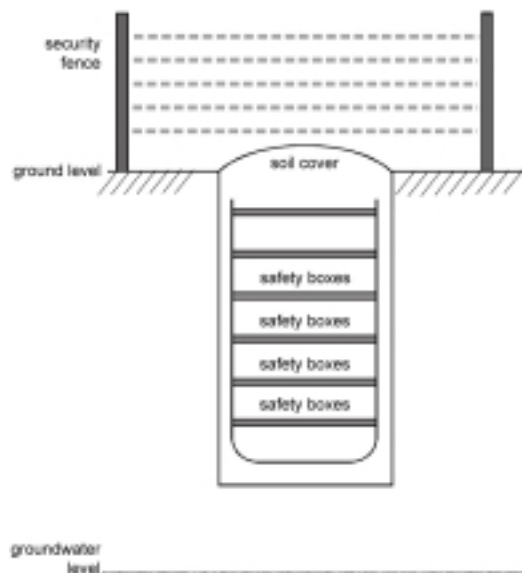
### Options for method of final destruction of syringes

Filled safety boxes should be brought back to the health facility and kept in a secure, well-ventilated, dry storeroom until they can be destroyed. Safety boxes should be destroyed within a week, if possible, and should never be stored longer than a month.

Sometimes companies buy waste plastic for recycling. This is the best environmental option for destroying used syringes without needles but is not always available or affordable. Fortunately you have other options:

#### Option 1:

Burying safety boxes in the ground in infectious waste burial pit



#### Option 2:

Shred and disinfect syringes (needles must be removed)

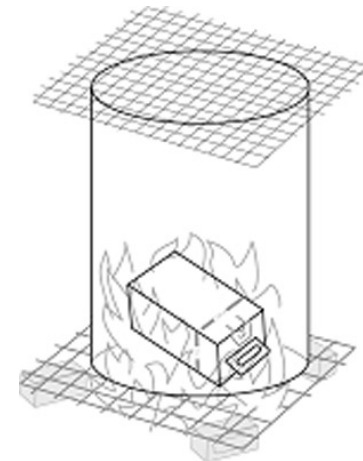


Recycle

Municipal waste

#### Option 3:

Protected burning (last resort)



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## **Destruction option 1: Burying safety boxes in the ground.**

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See Annex 8.

### **Advantages:**

- No additional equipment required.
- No smoke.
- No fuel is required.
- No maintenance is needed.
- Low cost.

### **Disadvantages:**

- Digging deep pits and covering them places enormous burden on staff.
- Syringes can be unearthed accidentally (or on purpose).
- Pits cannot be used when the water table is near the surface because liquids leak into ground water and syringes may surface over time.
- Hard ground may make digging difficult.
- Safety boxes are bulky (5 meters<sup>3</sup> per 100,000 syringes) and syringes never degrade—much land is needed.
- The environmental cost is high.



**This option should only be used when:**

- ❑ **No incinerator is available and**
- ❑ **Suitable land is available:**
  - **The land should be securely protected and not accessible to children and the community.**
  - **The water table should be at least 1.50 m below the base of the pit, even during the wet season.**
  - **The ground must not be too hard.**

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## **Destruction option 2: Shredding and disinfection.**

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Shredding and disinfection of syringes can kill microorganisms and prepare the plastic for recycling or disposal in a municipal landfill. Some expensive systems are available that do both operations, but smaller scale approaches to shredding and disinfection may be available.

### **Shredding:**

Shredding and/or milling of waste is usually necessary before disinfection; the shredder is often the weak point in the treatment chain, being subject to frequent mechanical failure or breakdown.

### **Disinfection:**

- Disinfectants may be hazardous and should be used only by well-trained and adequately protected personnel.
- Disinfection efficiency depends on operational conditions.
- Only the surface of intact solid waste will be disinfected.
- Disinfection options:
  - Autoclave
  - Chemical
  - Boiling

### **Advantages:**

- Successfully used for decades to treat sharps and non-immunization health-care wastes (hospital staff may be familiar with autoclave technology)
- Range of models (simple to complex) and capacities available.
- Disinfects used injection equipment.
- Less hazardous air emissions than incineration or burning (no dioxins or heavy metals).
- Reduced waste volume when used with shredder.
- Plastic may be recycled for other uses after separation.

### **Disadvantages:**

- High capital cost (but may be less than high temperature incinerators with pollution control devices).
- May require electricity and water.
- High operational costs.
- High maintenance.
- May emit volatile organics in steam during depressurization and opening of chamber.
- Requires further treatment to avoid reuse (e.g. shredding)
- Resulting sterile waste still needs to be disposed.
- Disposal of chemical disinfectants are detrimental to the environment.

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### **Destruction option 3: Protected burning (as a last resort).**

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If syringes in safety boxes cannot be taken to an incinerator, buried, or shredded, as a last resort they may be burned in a drum, protected hearth, or pit. Drum burning is preferred to open pit burning because combustion is better and temperatures are higher.

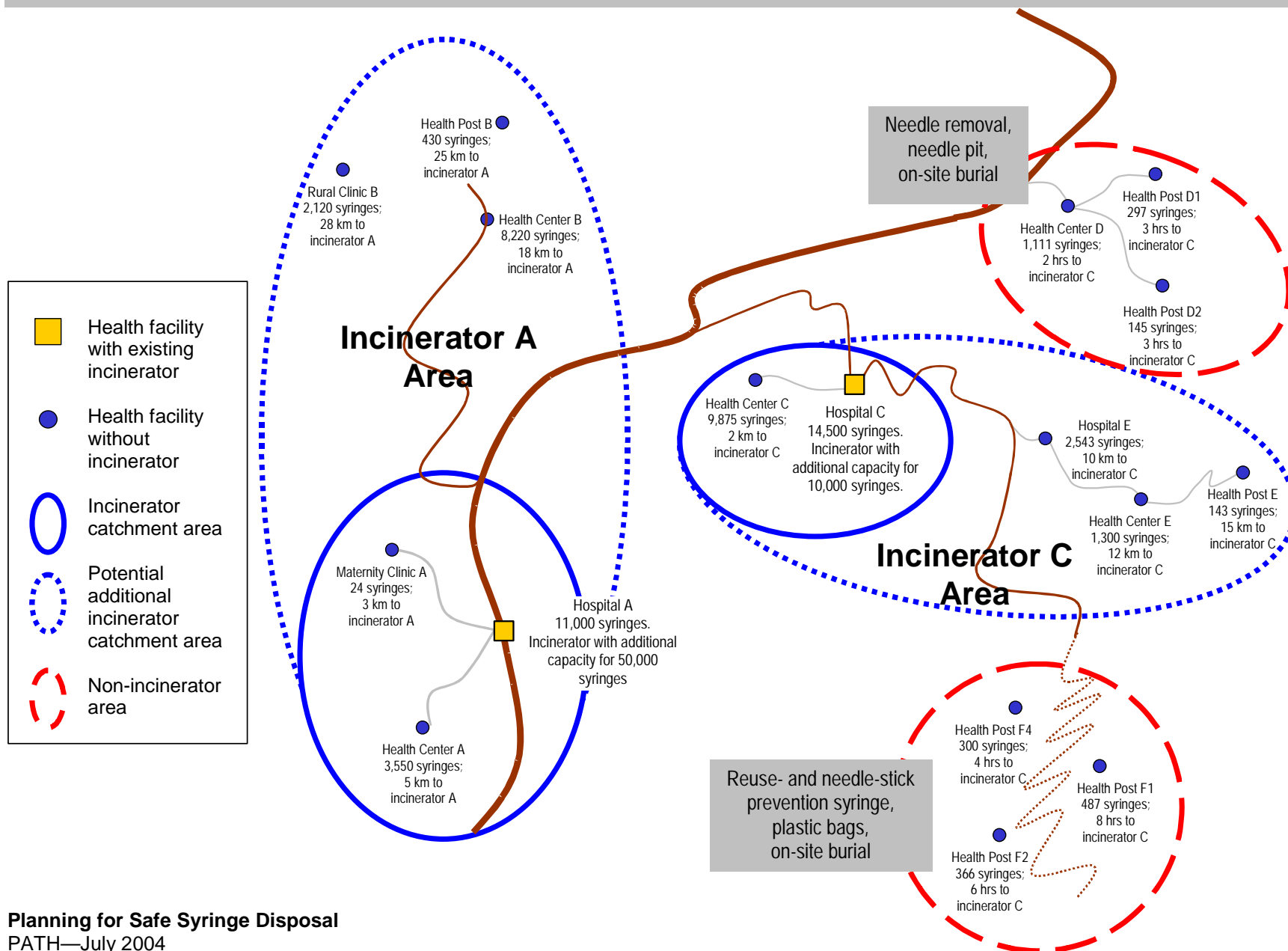
#### **Advantages:**

- Relatively inexpensive.
- Reduces waste volume
- Reduces infectious material.

#### **Disadvantages:**

- Incomplete combustion.
- May not completely sterilize material.
- Results in heavy smoke and potential fire hazard.
- May require fuel to start burning.
- Waste may need to be dry to start burning.
- Toxic air emissions (i.e. heavy metals, dioxins, furans, flyash) which may violate environmental or health regulations.
- Produces hazardous ash containing leachable metals, dioxins, and furans.
- Potential for needlestick injuries since needles are not destroyed.
- Ash needs to be buried.

## Step 5: Complete map: assign disposal systems to non-incineration health facilities.



## Step 6: Create a district planning guide to calculate needs and plan implementation.

Using your map, make two tables of your health facilities. The first table should include incinerator-based health facilities and the second table should describe non-incinerator health facilities and the syringe and disposal approach chosen for each (see example below). These tables should be the basis of your safe syringe and disposal plan.

### Incinerator-based health facilities

Safety box and incineration						
Facility using syringes	Maximum syringes per month	Safety boxes per month	Syringe waste transport trips per month	Incinerator burns per month	Fuel per month	Action Plan
Hospital A	11,000	110	0 (incinerator located at hospital A)	4	150 liters	Develop schedule with hospital.
Health Center A	3,550	36	4	Combined with hospital A syringes		Use existing transport system, negotiate fees with hospital A.
Maternity Clinic A	24	1	4	Combined with hospital A syringes		Establish transport system to hospital A.
Health Center B (HC B)	8,220	83	4	4	150 liters	Strengthen existing transport system to hospital A.
Health Post B	430	5	Combined with HC B	Combined with HC B syringes		Add transport to existing system serving HC B.
Rural Clinic B	2,120	22	4	Combined with HC B syringes		Add transport to existing system serving HC B.
Hospital C	14,500	145	0 (incinerator located at hospital C)	8	250 liters	Provide funding to repair incinerator.
Health Center C	9,875	100	4	4	125 liters	Strengthen transport system to hospital C.

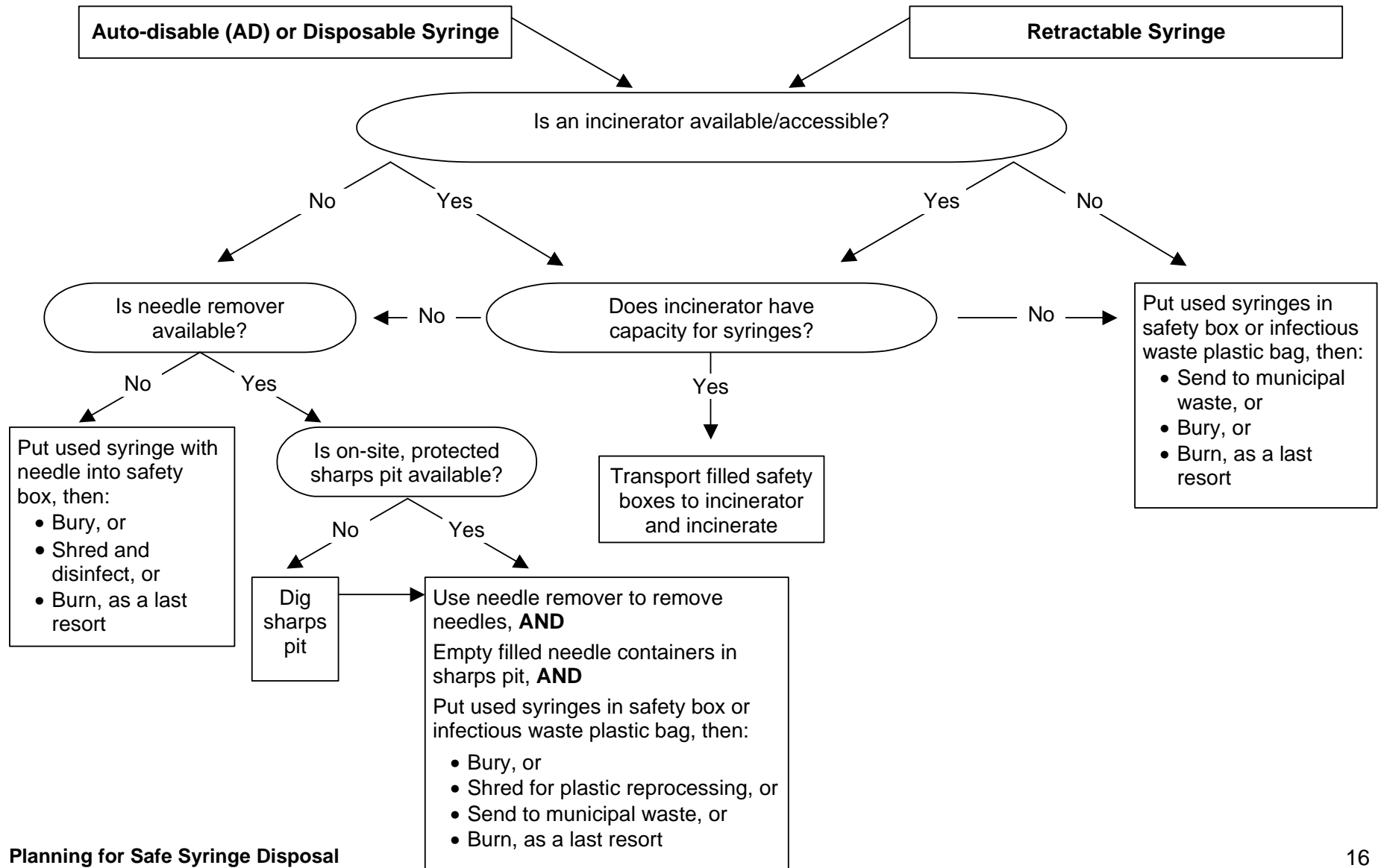


Hospital E	2,543	26	4	4	125 liters	Establish transport system to hospital C.
Health Center E	1,300	13	4 (combined with hospital E)	Combined with hospital E		Establish transport system to hospital C.
Health Post E	143	2	4 (combined with hospital E)	Combined with hospital E		Establish transport system to hospital C.

### Non-incineration health facilities

Facility using syringes	Maximum syringes per month	Safety boxes per month	Needle removers required	Sharps pits required	Waste disposal bags per month	Action Plan
<b>Needle removal + on-site burial</b>						
Health Center D	1,111	6	12 (12 injection stations)	1	-	Build sharps pit. Fence area for burying syringes.
Health Post D1	297	2	1	1	-	Build sharps pit. Fence area for burying syringes.
Health Post D2	145	1	1	1	-	Build sharps pit. Fence area for burying syringes.
<b>Retractable syringe + waste bags + bury</b>						
Health Post F1	487	-	-	-	5	Identify burial site
Health Post F2	366	-	-	-	4	Identify burial site
Health Post F3	300	-	-	-	3	Identify burial site

## ANNEX 1: Overview of disposal options for needles and syringes



## **ANNEX 2: Designing a waste collection and transportation system for incineration.**

The most appropriate sharps waste collection and transport system will depend on the local situation. Important factors to consider are:

- Storage of filled boxes prior to transport and destruction
- Distances and road conditions
- Staff (collection of safety boxes from injection rooms, secure storage, tracking waste volumes, driver for vehicle, incinerator operator, supervisors...)
- Volume and resupply of safety boxes
- Vehicles
  - Use of an existing vehicle on its return trip vs. dedicated waste collection trips
  - Motorcycle vs. car (see Annex 3)
  - Covered, protected bin or area for filled safety boxes
- Frequency of collection
- Storage of boxes at incinerator prior to burning
- Agreements among health facilities and incinerator for pick up and delivery of safety boxes
- Monitoring and recording systems
- Supervision

### ANNEX 3: Transporting filled safety boxes

Safety boxes are designed for safely storing, carrying, and transporting syringes. Once filled to the maximum fill line these boxes may be transported by:

1. Hand carrying.
2. Bicycle or motorcycle.
3. Dedicated vehicle (eg. a truck used only for waste collection).
4. Dedicated trailer towed by a vehicle (i.e. a trailer used only for waste collection).
5. A supply vehicle (eg. a truck used both for supply and waste collection).
6. A personnel-carrying vehicle.



#### IMPORTANT!!

If safety boxes are transported by a supply vehicle or a personnel-carrying vehicle, the following precautions should be observed:

- The safety boxes should be **kept dry** (otherwise they become weak and burst open, spilling contaminated syringes).
- The safety boxes should be **stacked upright**, standing on their bases, not on their sides (they are not strong enough to resist weight and they collapse when stacked on their sides).
- The safety boxes should be **loaded by their handles**, not held by their sides (there is a risk of needle-stick if the box has been punctured).
- The safety boxes should be stored in **vehicles without direct contact with drugs, vaccines or other medical supplies** (they may contaminate the packaging of clean supplies).
- After each journey carrying safety boxes, the vehicle interior should be **cleaned with surface disinfectant**, such as 1:20 diluted household bleach.



## ANNEX 4: Syringe safety boxes

Safety boxes (also known as “sharps containers”) are puncture- and water-resistant containers for the safe and convenient disposal of used syringes and needles and other contaminated sharps.

- Health workers must be trained to correctly assemble and use safety boxes.
- Different safety boxes are assembled in different ways—instructions are usually printed on each box.
- Safety boxes should be filled only once (to the fill line, if needles are attached).
- Filled safety boxes should be transported and stored upright. When they are used correctly, safety boxes can help prevent disease-spreading needle-stick injuries.

Safety boxes are usually made in 5-liter or 10-liter sizes with the following syringe capacity and weight (figures are approximate as they depend on syringe type).



### Approximate Capacity of Safety Boxes

	<u>5 liter</u>	<u>10 liter</u>
Number of syringes with needles	100	200
Number of syringes without needles	235	470
Weight, syringes with needles	0.5 kg	1.0 kg
Weight, syringes without needles	1 kg	2 kg

## ANNEX 5: Incinerating filled safety boxes

Whenever possible, syringes in safety boxes should be completely destroyed in a special incinerator. Incinerators should be double chambered and able to reach temperatures of at least 700°-800°C, so the plastic is destroyed completely and the smoke emission is less. Large hospital incinerators should be used if they are available.

Minimum requirements for proper use of an incinerator are the following:

1. Operation procedures manual
2. Maintenance schedule
3. Ash pit
4. Trained operator



De Montfort small-scale incinerator, 600°-800°C



Hospital incinerator, 1,000°-1,300°C



SICIM district incinerator 700°-900°C



### Waste types not to be incinerated:

- ❑ Pressurized gas containers.
- ❑ Large amounts of reactive chemical waste.
- ❑ Silver salts and photographic or radiographic wastes.
- ❑ Halogenated plastics such as polyvinyl chloride (PVC).
- ❑ Waste with high mercury or cadmium content, such as broken thermometers, used batteries, and lead-lined wooden panels.
- ❑ Sealed ampoules or ampoules containing heavy metals.

Source: Safe management of waste for health care activities, WHO, 1999.

**Advantages:**

- Provides complete and efficient destruction of syringes because temperatures are high (600°-1300°C).
- Consistent with standard hospital policy and practice.
- Can be used to destroy other infectious waste.
- Lower environmental emission hazard than open burning.
- Less smoke during operation than open burning.

**Disadvantages:**

- Cost is between US\$1,000-\$12,000 installed.
- If the incinerator is not close to the place where injections are given, the filled safety boxes must be transported to the incinerator.
- Training and supervision is required for proper use and maintenance.
- Small-scale incinerators require fuel or wood. Large incinerators need electricity.
- Small-scale incinerators are only feasible if they are placed far from buildings. Smoke and noxious emissions may not be tolerated in urban areas.
- Potential exists for needle-stick injury if needles are not removed.
- To avoid toxic emissions, the health worker needs to carefully control the kinds of waste incinerated.

## ANNEX 6: Needle removers

Needle removers separate used needles from their hubs (or from syringes if they are directly fixed). There are different kinds of needle removers, but usually the needle drops into a small container after separation, then the syringe is discarded in a safety box. When the needle container is full, it is released from the needle remover and emptied into a sharps pit (see Annex 7).

Needle removers must be used immediately after each injection to minimize risk of needle-stick injuries. The needle remover must therefore be in direct reach of the person giving the injection, whether the injection is given in a clinic or at an outreach site. Thus, each “injection station” must have its own needle remover.

Once the needle has been removed from the syringe, the syringe must immediately be placed in a safety box or safety bag.



There are many kinds of needle removers on the market. This is the “Balcan Mini.”



### **WARNING!**

**If the used syringes are collected at point of use and later carried to the needle remover as a batch, there is a high risk of needle-stick injury!**

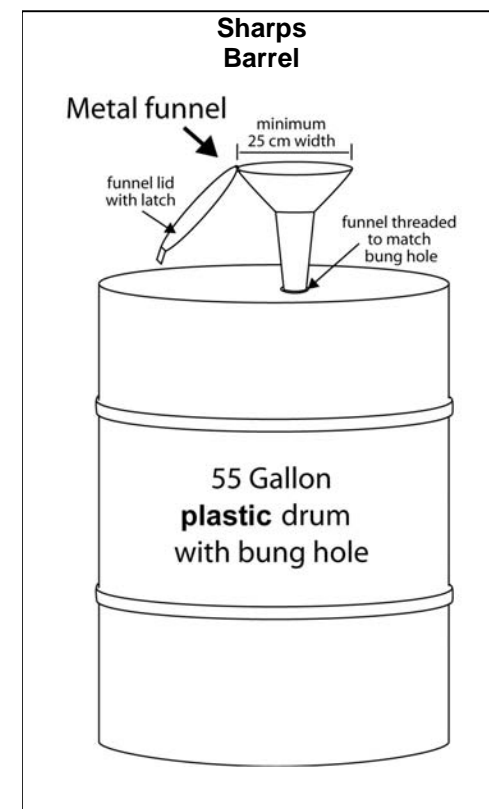
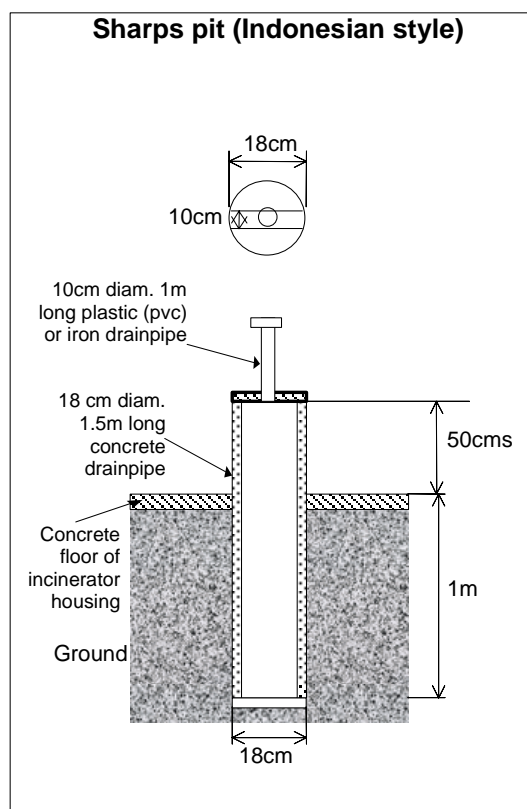
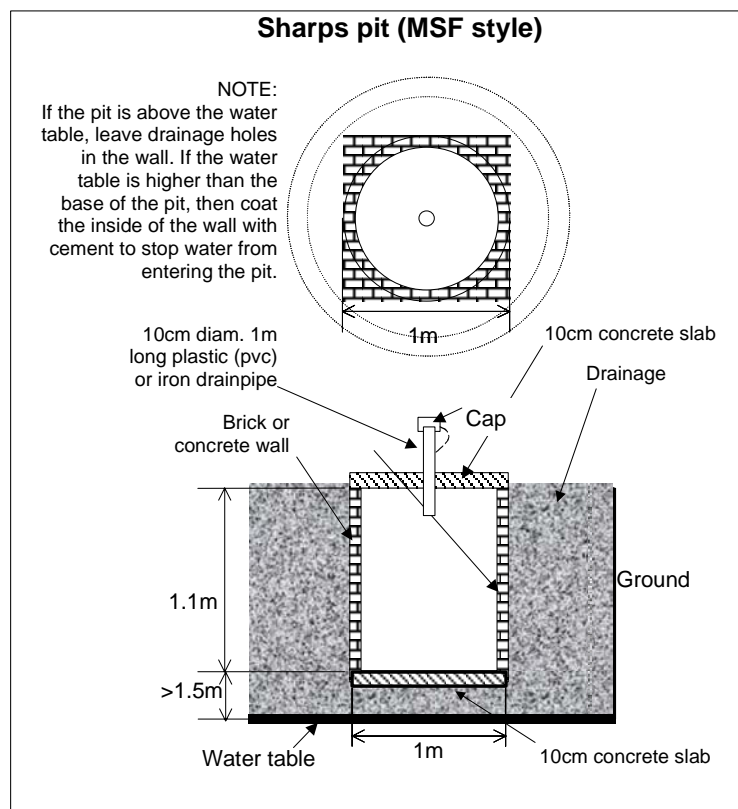
**For safety reasons, needle removal must take place at the time and place of injection, every person giving injections should have their own needle remover close at hand.**



## ANNEX 7: How to build a sharps pit and sharps barrel

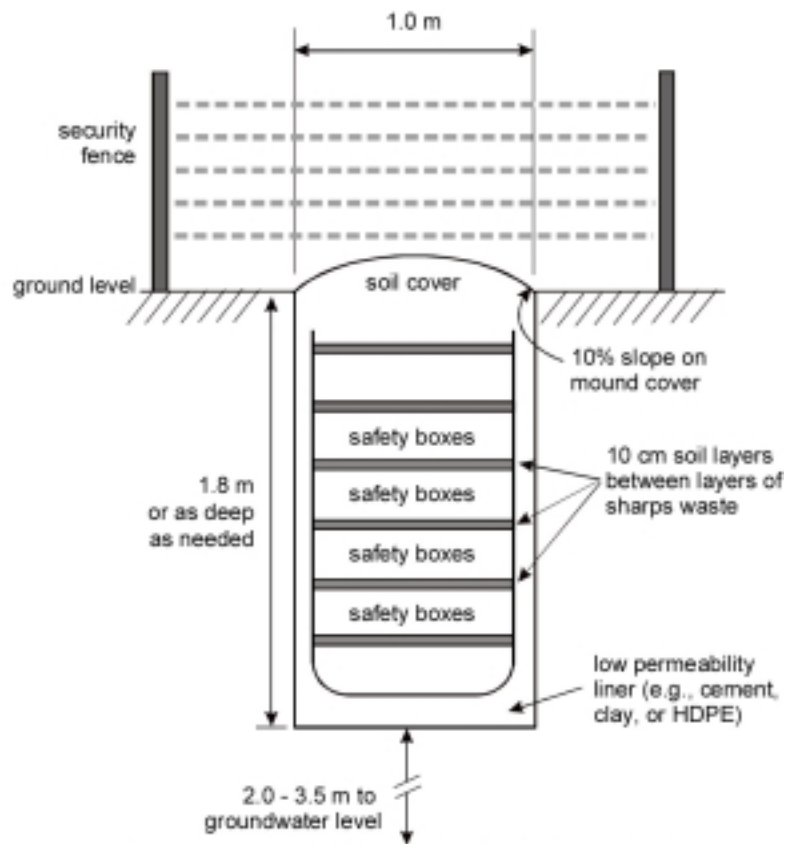
A sharps pit is a covered and lined pit used only for needles and other small sharps—not for bulky sharps such as syringes.

- One hundred needles occupy  $106 \text{ cm}^3$ , so a pit of about  $1 \text{ m}^3$  internal volume can hold about 1 million needles.  
The drawing below shows how to construct such a pit.
- A health center providing 200 immunization injections per month would provide at least 24,000 injections for all purposes in one year (assuming immunizations are 1/10 of all injections given).
- In that facility, a pit of  $1 \text{ m}^3$  used exclusively for needles, would be sufficient for at least 42 years.



## ANNEX 8: How to build an infectious waste burial pit

An infectious waste burial pit is easy to use and maintain, but there are some disadvantages. A pit of this size can be difficult to dig if the ground is hard, and waste pits are not appropriate where heavy rains or floods are common or where the water table is near the surface. And unlike incineration or burning, burying safety boxes in a pit does not reduce the volume of waste. However, if a burial pit is the best solution for your situation, this is the best way to construct the pit:



### Materials needed for construction

- Tools (shovels, pickaxe).
- Concrete or corrugated iron rings.
- Fencing material.

### Building the pit

- Select a proper site for the pit:
  - Do not dig the pit close to water sources such as wells or spring water.
  - The ground should be of low permeability.
- Dig a hole approx. 1 m diameter x 2 m deep.
  - Insert rings if necessary to reinforce the hole.
  - A fence should be put round the burial pit to avoid accidents and unauthorized access by humans or scavengers.
- Line the bottom of the pit with a material of low permeability, such as clay.

### Using the pit

- Dump only non-anatomical waste in the pit.
- Seal the pit with soil and concrete **before** it is full of waste. Leave approximately 50 cm to properly seal off the pit.
- The abandoned pit must be marked with a warning so that it is not used in the future.

Source: Waste management and disposal during the Philippine follow-up measles campaign 2004: a joint report by Health Care Without Harm and the Philippine Department of Health. June 17, 2004.

## NOTES