



4 Ensuring safe injections

About this module...

This Module discusses practices that health workers should follow to ensure that they deliver immunization injections in the safest manner.

An injection is considered safe for:

- the *mother or child*, when a health worker uses a sterile syringe and a sterile needle and appropriate injection techniques;
- the *health worker*, when he or she avoids needle-stick injuries; and
- the *community*, when waste created by used injection equipment is disposed of correctly and does not cause harmful levels of pollution and injuries.

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1 Using safe injection equipment and techniques

1.1 Types of injection equipment

The following equipment are used to administer injectable vaccines:

Equipment	Remarks
Auto-disable (AD) syringes	equipment of choice
Prefilled AD injection devices	available for some antigens only
Reusable syringes and needles	not recommended
Single use disposable (non AD) syringes and needles	for mixing purposes only

WHO – UNICEF – UNFPA joint statement on the use of auto-disable syringes in immunization services.

“The auto-disable syringe which is now widely available at low cost presents the lowest risk of person-to-person transmission of blood-borne pathogens (such as HepB or HIV) because it cannot be reused. The auto-disable syringe is the equipment of choice for administering vaccines, both in routine immunization and mass campaigns.”

1.1.1 Auto-disable (AD) syringes

AD syringes are self-locking syringes that can be used only once. AD syringes are the preferred equipment for all types of immunization sessions.

Every AD syringe is sterilized and sealed by the manufacturer. There are several different types of AD syringes. Most AD syringes have fixed needles. Others have detachable needles that fit only the specific AD syringe they accompany. These needles cannot be used with a standard syringe. Some AD syringes are individually packaged in plastic or paper packets, others are boxed in bulk. All AD syringes have plastic caps to keep the needle sterile, and some also have caps on the plungers.

There are different AD syringes to give BCG vaccine and to give the other vaccines.

Each type of AD syringe requires health workers to use a specific technique to give injections. Refer to the manufacturers' instructions.

Below are **general** steps to follow when using AD syringes. These steps must be refined depending on the specific AD syringe you are using.

General steps for using AD syringes

- 1 ▶ Remove the syringe and needle from plastic wrapping (peel open the syringe plunger end of the package) or detach the plastic caps.
- 2 ▶
 - Fix the needle to the syringe if it is not already in place.
 - Take off the needle cap without touching the needle.

! The plunger can go back and forth only once, so health workers should not move the plunger unnecessarily and should not try to inject air into the vial, as this will disable the syringe.

- 3 ▶ Insert the needle in the vaccine vial and bring the tip of the needle to the lowest part of the bottom of the vial.
- 4 ▶ Pull the plunger back to fill the syringe. The plunger will automatically stop just past the 0.05 ml/0.50 ml mark and you will hear a “click.”
- 5 ▶ Keep the needle tip in the fluid at all times, making sure to empty the full contents of the vial. Remove the needle from the vial. To remove air bubbles, hold the syringe upright and tap the barrel. Then carefully push to the close mark.
- 6 ▶ Locate the injection site.
- 7 ▶ Push the plunger forward and inject the vaccine. After injection, the plunger will automatically lock and the syringe cannot be reused. Do not re-cap the needle after use.
- 8 ▶ Dispose of the needle and syringe in a safety box: a leak-proof, puncture-resistant container for sharps waste.

! Advantages of AD syringes:

- They can only be used **once**.
- They eliminate the patient-to-patient disease transmission caused by the use of contaminated needles and syringes.
- They save time for health workers from the heavy work of sterilization.

1.1.2 Prefilled AD injection devices

Prefilled AD injection devices are single-dose packets of vaccine with a needle affixed by the manufacturer. This type of injection device can be used only once.

Hepatitis B vaccine and tetanus toxoid are currently available in prefilled AD injection devices. Some prefilled devices are also equipped with a VVM (see Module 3, Section 3.1).

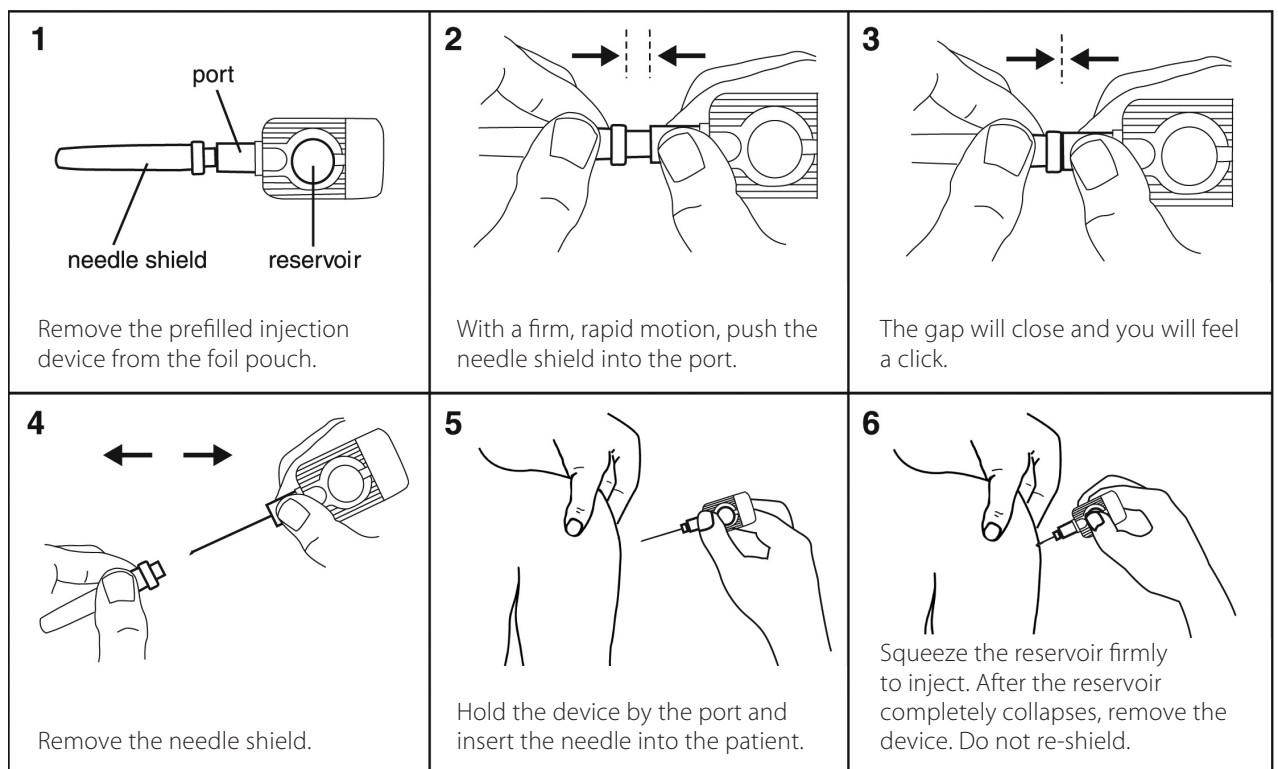
Hepatitis B prefilled AD injection devices are used primarily to provide hepatitis B vaccine to newborns in their homes. Tetanus toxoid prefilled AD injection devices are used to provide TT vaccine to women of childbearing age in their homes and during mass campaigns.

Every prefilled AD injection device is sterilized and sealed in its own foil package by the manufacturer. The vaccine is contained in a sealed, bubble-like reservoir that prevents it from coming in contact with the needle until the administration.

To prepare or “activate” the prefilled AD injection device, push the needle shield (or cap) into the port (see Figure 4A). This opens the fluid path between the needle and the reservoir that contains the vaccine. Then, remove the needle shield, insert the needle into the injection site, and deliver the dose by squeezing the reservoir until it is empty.

After use, the prefilled AD devices should be collected in a safety box for final disposal.

Figure 4A: Activation and use of prefilled auto-disable device





Advantages of prefilled AD injection devices:

Prefilled AD injection devices have the same advantages as AD syringes. In addition:

- They prevent vaccine contamination.
- They ensure an accurate dose.
- They deliver vaccine and syringe together in the same set.
- Syringe and vaccine can be ordered with a single request.
- They contain less plastic than a syringe, so waste is reduced.
- The unit-dose device reduces the vaccine waste that occurs when using multi-dose vials.

1.1.3 Sterilizable syringes and needles

Sterilizable syringes and needles are no longer recommended for use in the EPI however they are still used in some countries, but should be phased out while AD syringes are being phased in. For countries where they are still being used, but phased out, their sterility must be guaranteed by complying with the following:

- The health workers can be sure to comply with cleaning and sterilization procedures between each use.
- The health workers will routinely use time, steam and temperature indicators (TSTs) for each sterilization.
- Supervisors can verify these procedures.

Immediately after use, the syringes and needles must be flushed with clean water and soaked in clean water. They must be carefully cleaned at the end of the session. Before use, they must be steam-sterilized for 20 minutes at a temperature between 121°C and 126°C.

You must dispose of sterilizable needles and syringes when you can no longer read the scale on the syringe, or if the needle is barbed. To test for barbs, carefully draw the needle across some cotton wool or gauze. If the needle is barbed it will catch in the cotton wool or gauze. In that case, dispose of the needle immediately.

1.1.4 Disposable syringes and needles

Disposable single-use syringes and needles are **not recommended** for injections in immunization programmes. Because reuse of disposable syringes and needles carries a high risk of infections, in 1999 WHO, UNICEF, and UNFPA issued a joint policy statement recommending against their use for immunization.

Vaccines that must be reconstituted, such as measles vaccine, require a large syringe to mix the diluent with the vaccine. While auto-disable reconstitution injection devices are the equipment of choice in these situations, they may not always be available. If this is

the case, you may use disposable syringes and needles to reconstitute vaccine. Do not reuse the disposable syringe and needle for reconstitution.

1.2 Estimating AD syringes needs

It is important to ensure that you have a sufficient stock of AD syringes to conduct planned fixed and outreach sessions (see Module 5 for estimating your vaccine and supply needs).

1.3 Giving the right vaccine safely

As well as using the injection equipment safely it is equally important to give the right vaccine which has been kept properly in the cold chain, appropriately reconstituted, and safely administered (Module 6, Section 3, deals with these issues in detail).

Table 4.1: Examples of incorrect immunization practices and possible severe reactions following immunization

Incorrect practice	Possible severe reactions following immunization
<p><i>Non-sterile injection</i></p> <ul style="list-style-type: none"> • Reuse of disposable syringe or needle • Improperly sterilized syringe or needle • Contaminated vaccine or diluent 	<p>Infection such as local abscess at injection site, sepsis, toxic shock syndrome, or death Blood-borne infection transmitted such as hepatitis, HIV</p>
<p><i>Reconstitution error</i></p> <ul style="list-style-type: none"> • Inadequate shaking of vaccine • Reconstitution with incorrect diluent • Drug substituted for vaccine or diluent • Reuse of reconstituted vaccine at subsequent session 	<p>Local abscess Vaccine ineffective^a Negative effect of drug, e.g. insulin, oxytocine, muscle relaxants Death</p>
<p><i>Injection at incorrect site</i></p> <ul style="list-style-type: none"> • BCG given subcutaneously • DTP/DT/TT too superficial • Injections into buttocks 	<p>Local reaction or abscess Local reaction or abscess Sciatic nerve damage</p>
<p><i>Vaccine transportation/storage incorrect</i></p> <ul style="list-style-type: none"> • VVM changed colour • Clumping of adsorbed vaccine 	<p>Local reaction from frozen vaccine Vaccine ineffective^a</p>
<p><i>Contraindications ignored</i></p>	<p>Avoidable severe reaction</p>

^a vaccine being ineffective is an "effect", it is not strictly an adverse event

1.4 Simple ways to improve injection safety

1. Prepare injections in a clean designated area where blood and body fluid is unlikely. Prepare each dose immediately before administering, do not prepare several syringes in advance.
2. Never leave the needle in the top of the vaccine vial.
3. Follow product-specific recommendations for use, storage and handling of vaccines.
4. Follow safe procedures to reconstitute vaccines.
 - a) Make sure you have the CORRECT diluent for each freeze-dried vaccine – check that both diluent and vaccine are produced by the same manufacturer.
 - b) When reconstituting, both the freeze-dried vaccine and the diluent must be at the same temperature (between 2°C and 8°C).
 - c) Use a sterile syringe and needle to reconstitute each unit of vaccines. Use all the diluent provided for the vial. After use, place the syringe into a safety box.
 - d) All reconstituted vaccines should be discarded at the end of the session or after six hours, whichever is the sooner.
5. Use a new syringe and needle for every child – preferably an auto-disable syringe.
 - a) Use a new, quality controlled auto-disable syringe and needle.
 - b) Inspect the packaging very carefully. Discard a needle or syringe if the package has been punctured, torn or damaged in any way.
 - c) Do not touch any part of the needle. Discard a needle that has touched any non-sterile surface.
6. Hold the child firmly. Anticipate sudden movement during and after injection.

Refer to Annex 1 for unsafe immunization practices that must be avoided.

2 Preventing needle-stick injuries and infections

Needles can be dangerous.

Needles frequently injure health workers. Small but dangerous amounts of blood infected with hepatitis B, hepatitis C, HIV, or other viruses can be transmitted by needle-stick injuries.



Needle-sticks may occur:

- when health workers recap needles or walk while carrying used syringes and needles;
- if patients – especially children – are not positioned securely while they receive injections;
- if unsafe disposal practices leave people or animals exposed to used syringes and needles.

This section presents how to prevent needle-stick injuries by:

- minimizing the need to handle needles and syringes;
- handling syringes and needles safely;
- setting up the immunization work area to reduce the risk of injury;
- positioning children correctly for injections; and
- practising safe disposal of all medical sharps waste.

2.1 Minimizing the need to handle needles and syringes

Needle-stick injuries can occur at any time, but they happen most frequently during and immediately after an injection is given. In general, the more injection equipment is handled, the greater the risk of needle sticks. But needle sticks are preventable. There are simple steps health workers can follow to reduce the risk of needle-stick injuries.

Minimizing the need to handle injection equipment is crucial to preventing injuries. Here are some tips to minimize handling.

- Place a safety box close to the person giving vaccinations so used syringes and needles can be disposed of immediately.
- Avoid recapping the needle. If recapping is necessary (for example if the injection is delayed because the child is agitated), use a single-handed scoop technique.
- Do not manually remove the used needle from the syringe.

- Do not carry used syringes and needles around the immunization area or work site.
- When ready to vaccinate draw up the vaccine, inject the vaccine, and put the syringe in the safety box without putting it down between steps.
- Close the safety box securely when it is three-quarters full.
- Do not manually sort needles and syringes.

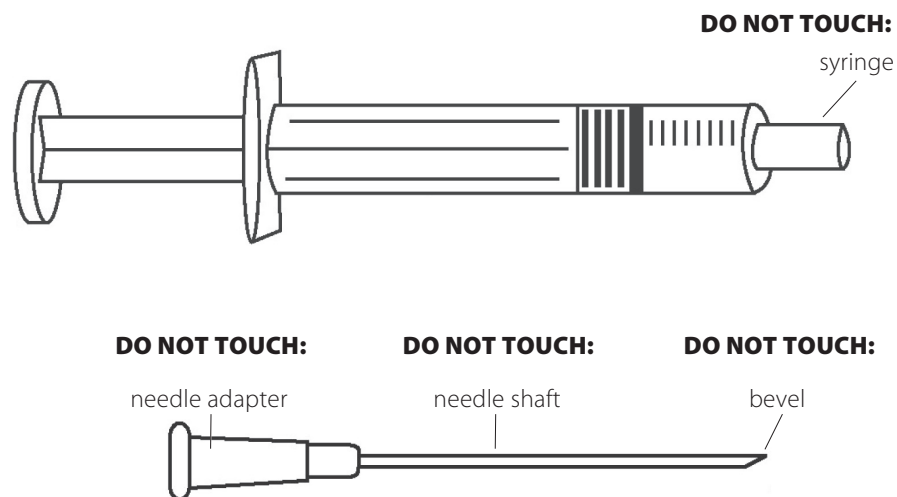
2.2 Handling syringes and needles safely

You have to hold a syringe to give an injection. Any part of the syringe that you touch becomes contaminated, so you should not touch parts that come into contact with the vaccine or the child.

Do not touch:

- the shaft of the needle;
- the bevel of the needle;
- the adaptor of the needle;
- the adaptor of the syringe; and
- the plunger seal of the syringe.

Figure 4B: Parts of a syringe and needle that must not be touched

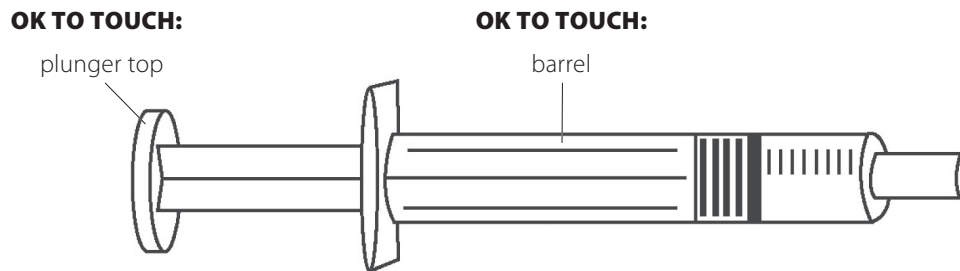


IMPORTANT: If you touch any of these parts, discard the syringe and needle and get new sterile ones.

You may touch:

- the barrel; and
- the plunger top.

Figure 4C: Parts of a syringe and needle that may be touched



2.3 Setting up the immunization work area to minimize risk of injury

Health workers should plan the layout of their work-space so that:

- The vaccine carrier is in the shade.
- Tally sheets can easily be used.
- The person giving doses of vaccine is between the child and all needles or sharp objects.
- The person giving doses of vaccine can see the entrance hole of the safety box when discarding needles. Some people may stand when giving doses of vaccine. Those who sit may want to place the safety box on the floor.
- The health worker can dispose of used needles without setting them down or moving too far.
- Only one child at a time is in a health worker's work-space.
- Each person giving doses of vaccine has his or her own safety box, especially at busy sites.

See Module 6 Figure 6C: Set-up for an immunization session.

2.4 Positioning children correctly for injections

Unexpected motion at the time of injection can lead to accidental needle-sticks.

To prevent this, position the child securely before giving the injection.

- Have the mother sit and place the child on her lap. Make sure one of the mother's arms is behind the child's back, and one of the child's arms wraps around the mother's side.
- The mother may tuck the child's legs between her own to secure them, or she may hold the child's legs.
- Health workers cannot hold the child because they need both hands for the injection.
- Always tell the mother when you are about to give the injection.

Figure 4D: Correct position for child receiving injection



2.5 Practising safe disposal of all medical sharps waste

Used sharps must be placed in a safety box and then disposed of in a safe manner. Follow the procedures for safe disposal outlined in the next section of this module to safely dispose of all sharps waste.

3 Disposing of used syringes and needles

Injection equipment should be discarded immediately after use once. The exception to this rule is sterilizable injection equipment which should be disposed of after about 50 uses.

3.1 Why is it important to handle sharps waste properly?

Sharps waste can cause serious health and environmental problems. Unsafe disposal can spread some of the very same diseases you are working so hard to prevent.

Dangers to health

Leaving used syringes and needles in the open or on the ground puts the community at risk. Most frequently, children are the unfortunate victims of needle-stick injuries from haphazard disposal of needles.

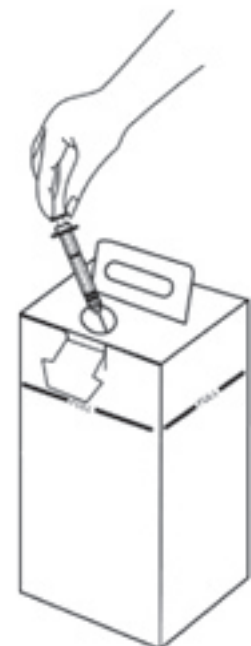
Dangers to the environment

Throwing used needles and syringes in a river spoils water used for drinking and washing.

3.2 Using a safety box

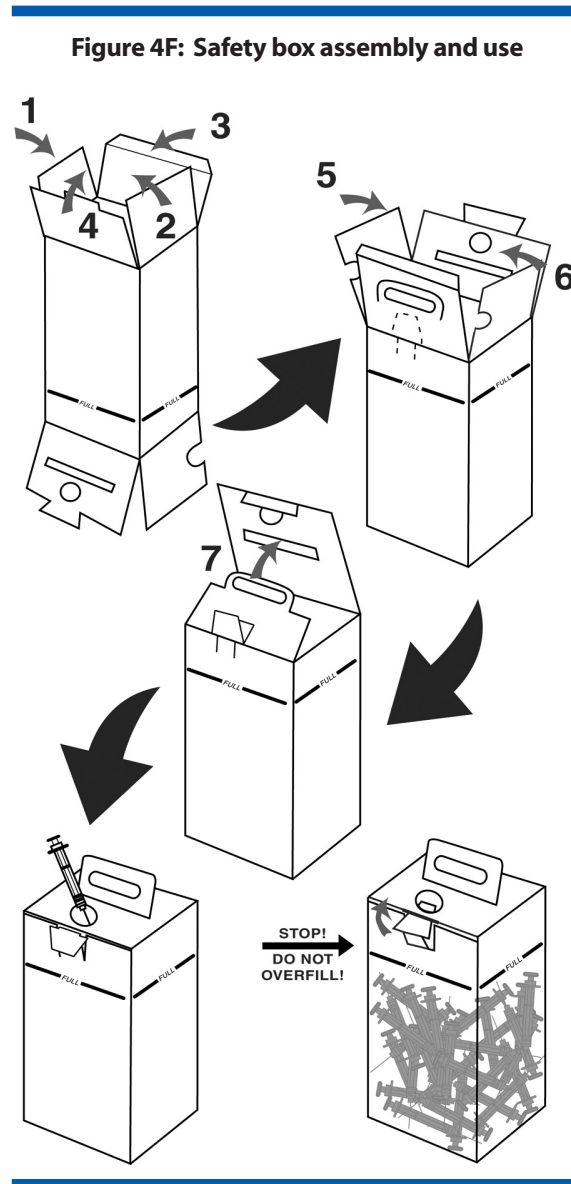
All used injection equipment except reusable syringes and needles should be placed in a **safety box** (see Figure 4E) immediately after use. These containers are waterproof and tamper-proof and needles cannot easily pierce them. If a safety box is not available, you can use locally available materials to create a functional and safe sharps container (see Figure 4G).

Figure 4E: Safety box



How to assemble the safety box

Safety boxes require proper assembly before use. Many come with picture instructions printed on the side.



! When the box is not in use, close the opening on the top.

What to do if safety boxes are not available

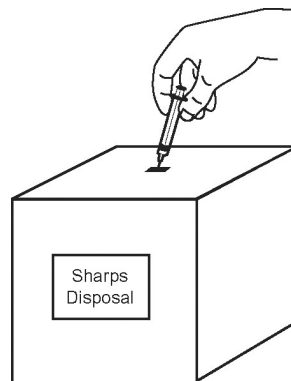
Health workers can use strong cardboard boxes, thick plastic containers, or metal cans to collect syringes and needles and transport them to a site where they can be buried or burned. Do not reuse the same can or container after filling it once. Instead, destroy the container when it is three-quarters full and find a new container for your next session.

Emptying and reusing safety boxes increases the risk of accidental needle-stick injuries and infection. Since it is recommended that all sharps waste be buried or burned, it is a good idea to use a disposal container made of cardboard if safety boxes are not available.

! How to create a good sharps container:

- Find a strong cardboard box (your local shop may be able to help). If possible, the walls of the box should be strong enough that needles will not easily pierce the cardboard and prick someone handling the box.
- If necessary, strengthen the walls of the container by placing one box inside another. If the box is too thin, needles may stick through the sides of the box.
- Close the box securely, top and bottom.
- Cut a small hole in the top just big enough for a syringe and needle to enter.
- When the box is three-quarters full, seal the opening.
- Destroy the box carefully and completely.

Figure 4G: Homemade safety box



! To ensure safe handling of the safety box:

- Don't handle or shake the safety box more than necessary. Never squeeze, sit or stand on safety boxes.
- Take extra care when you are carrying the box to the disposal site. Hold the box by the top (by the handle provided) above the level of the needles and syringes.
- Keep safety boxes in a dry, safe place out of the reach of children and the general public, until they have been safely disposed of.
- Train everyone who will handle the box how to do it safely. Do not ask untrained staff to handle the box.

3.3 Procedures for disposing of sharps waste and injection equipment

All injection equipment must eventually be destroyed. **Auto-disable or disposable mixing syringes and needles** are used once and then destroyed.

Used syringes and needles must **NEVER** be dumped in open areas where people might step on them or children might find them. They should never be disposed of along with other kinds of waste.

- 1 Place the safety box within reach of the health worker. After each injection, immediately place the syringe and needle in the safety box or sharps container. Do not recap the needle.

If your country supplies needle removers or needle cutters, safely separate the used needle and syringe immediately after each injection. After removing the needle with a device, immediately place the syringe in the safety box. The needle is placed in a separate safe container. When the needle container is full, close it and dispose of it by burying, depositing in a protected sharps pit, burning in a pit, burning in a container, or incinerating.

- 2 Following the immunization session or when the safety box is three-quarters full, close the container.

Do not transfer used syringes and needles from safety boxes to other containers.

A five litre safety box can hold about 100 syringes and needles. When three quarters full, it should be destroyed as close as possible to the immunization session site, and as soon after the session as is practical.

- 3 Find a safe place to bury or burn the box (see next section).

CAUTION:

Never put the following material in a safety box. Discard them with other medical waste:

- empty vials;
- discarded vaccine vials;
- cotton pads;
- compressors;
- dressing material;
- IV bags or extension tubes;
- latex gloves; or
- any kind of plastic materials or waste products.

3.4 Disposing of safety boxes

Five methods are commonly used to destroy filled safety boxes or to keep them away from people.

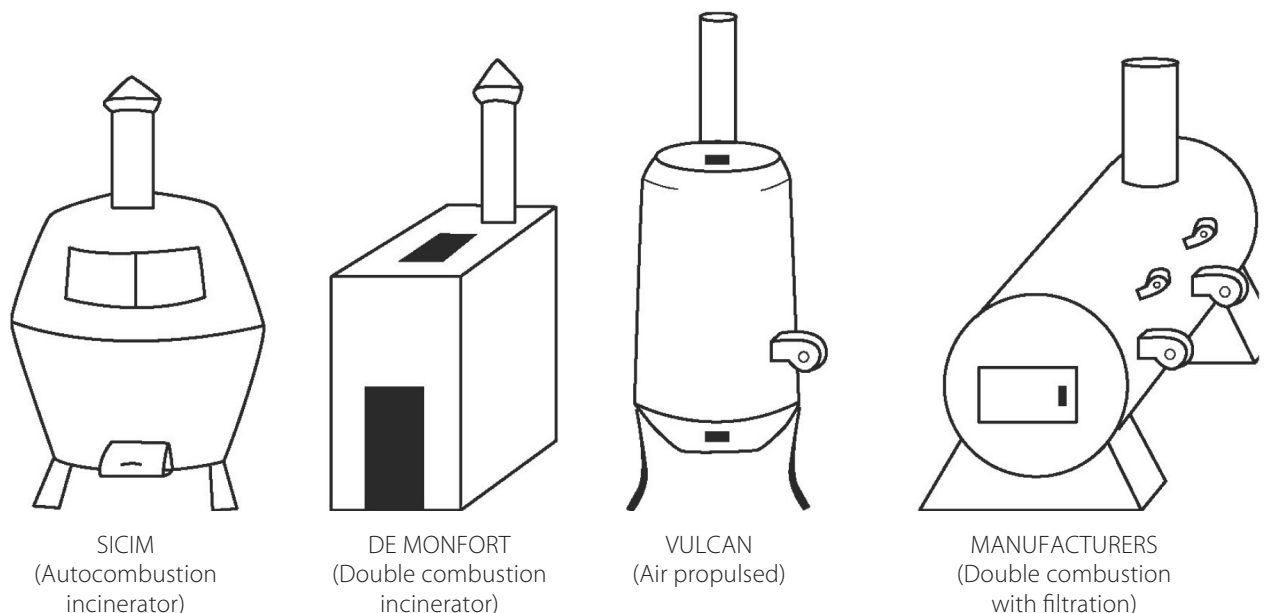
Any selected method of waste disposal must comply with national and subnational environmental regulations and with specific Ministry of Health instructions for your health centre.

1. Incineration:

Incineration can completely destroy syringes and needles. Fires burning at temperatures higher than 800°C kill microorganisms and reduce the volume of waste to a minimum. Properly functioning incinerators ensure the most complete destruction of syringes and needles. They produce less air pollution than fires burning at lower temperatures. Some hospitals have on-site incineration. Others use incinerators at facilities such as cement factories (see Figure 4H).

The compound in which incineration takes place must be secure. Staff members conducting the incineration should wear safety glasses and heavy gloves.

Figure 4H: Types of incinerators (not an exhaustive list)

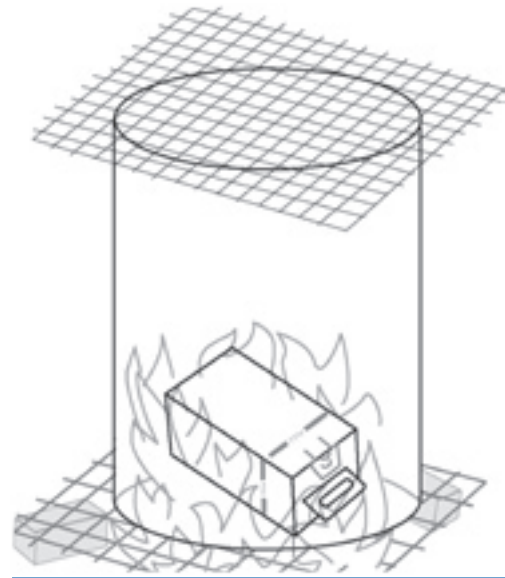


2. Burning in a metal drum

To burn in a metal drum or container (see Figure 4I):

- Choose a burning site in an unused area as far from buildings as possible. The area should be fenced and cleared.
- Place four bricks on the ground in a square pattern.
- Put a metal screen or grate on top of the bricks.
- Remove both ends of a 210-litre (55-US gallon) steel drum. This will allow air to flow through the drum and contents will burn better. If a metal drum is not available, you can build a cylinder from sheet metal, bricks, or clay. A chimney may be added to the removable top of the drum or container.
- Place the drum on top of a metal screen or grate.
- Put the filled safety boxes into the metal drum. Mix paper, leaves, or other flammable material in among the safety boxes to help them burn.
- Sprinkle a small amount of kerosene, if available, on the boxes and other material in the drum.
- Place a fine metal screen over the top of the drum to reduce flying ashes.
- Put wood, paper, or other flammable material under the drum and ignite the material.
- Warn people to stay away and to avoid smoke, fumes, and ash from the fire.
- Allow the fire to burn until all of the safety boxes have been destroyed.
- Once the fire is out and the residue at the bottom of the drum has cooled, carefully collect the residue. Bury it in an unused location. Cover with at least 13 cm of soil. If possible, seal the residue pit with cement once it is full.

Figure 4I: Metal drum



! IMPORTANT:

The remains of the needles and safety box should be buried after burning, whether burning is done in a metal drum or in an open pit. Bury them deeply in a pit latrine, controlled landfill, or a similar location where people do not have access to them.

3. Open burning in a pit

Open burning in a pit is not always recommended because burning plastic is not good for the environment. If you burn waste in the open (see Figure 4J):

- Choose an unused area for the burning site, as far from buildings as possible. The area should be fenced and cleared.
- Choose a qualified staff person to supervise the burn.
- Dig a pit at least one metre deep, but make sure it is not so deep that you will have to crawl into it to start the fire.
- Place the filled safety boxes in the pit. Mix paper, leaves, or other flammable materials among the boxes to help them burn.
- If available, sprinkle a small amount of kerosene and ignite the materials.
- Warn people to stay away and avoid smoke, fumes, and ash from the fire.
- Burn until all boxes are destroyed, and then follow the instructions above to bury residue.

Figure 4J: Open burning in a pit



4. Encapsulation:

A specially made **safety pit** is another option to dispose of used syringes and needles that are loose. A safety pit is usually two metres deep and one metre in diameter so that it can be lined with a locally made concrete pipe. The pit has a concrete lid with a capped metal pipe set in it. Used syringes and needles are dropped through the metal pipe and into the pit (see Figure 4K).

Figure 4K: Safety pit



5. Buried in a disposal pit:

Used injection equipment may be buried in a disposal pit. Choose the site carefully and dig a pit large and deep enough for bulky boxes (see Figure 4L). If contaminated AD syringes somehow escape from the box and are carried into streams or fields, people may step on them or children may play with them.

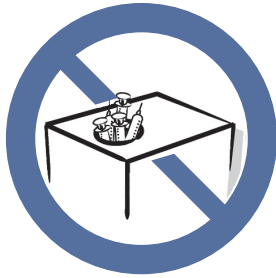
- Choose a site where people will not dig or establish latrines in the future.
- Fence off and clear the area.
- Dig a pit at least two metres deep. Make sure that the material will not escape from the pit, for example, during the rainy season.
- Take the filled safety boxes to the pit site just before burying. Do not open or empty the boxes.
- Place the filled safety boxes in the pit.
- Cover the boxes with at least 30 cm of soil. If possible, cover the site with concrete when the pit is full.

Make sure a qualified staff member supervises the process. Do not leave this vital task to unqualified people.

Figure 4L: Disposal pit



Unsafe immunization practices



Do not overfill the safety box



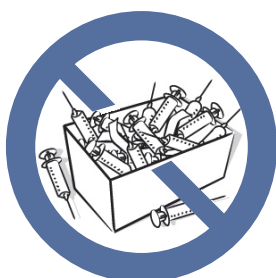
Do not recap the needle



Do not leave the needle inside the vial



Do not touch the needle



Do not dispose of used needles in an open cardboard box

