



UNODC

United Nations Office on Drugs and Crime

Illustrated guide for the

Disposal of Chemicals used in the Illicit Manufacture of Drugs

(Revised edition)



UNITED NATIONS OFFICE ON DRUGS AND CRIME

Vienna

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**Disposal of Chemicals used
in the Illicit
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Background and acknowledgements

The United Nations Office on Drugs and Crime (UNODC) guidelines for the *Safe Disposal of Chemicals used in the illicit manufacture of Drugs* (the Guidelines) was first published in 2006, and was the culmination of an expert group meeting on “Environmentally safe methods for the destruction/disposal of chemicals” organized in collaboration with the Multilateral Environment Agreements Branch of the United Nations Industrial Development Organization (UNIDO) in 2005. These Guidelines were revised and updated in 2010 (ST/NAR/36 Rev.1).

The present illustrated disposal guide has been developed to support the implementation of the Guidelines and the principles of environmentally-responsible disposal for remote locations, where waste management infrastructure and expert technical support may not be available and where immediate management of seized chemicals is required to reduce unacceptable risk to people, communities and the environment.

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The preparation of this guide was coordinated by Dr. Iphigenia Naidis, Scientific Affairs Officer (UNODC, LSS).

Note

This illustrated disposal guide focuses on basic safety, handling, storage and disposal procedures for chemicals associated with the manufacture of illicit drugs. It is intended for use only in remote locations where no appropriate waste management infrastructure or expert technical support exists and where there is an immediate need for the timely management or disposal of seized chemicals or waste.

It is acknowledged that sometimes chemicals and waste may be encountered in very difficult circumstances, and the procedures detailed in this guide may represent the only available options for the disposal of seized chemicals.

The procedures in this guide are intended for use only under the circumstances outlined above and should not be interpreted as an endorsement by the Laboratory and Scientific Section of the United Nations Office on Drugs and Crime or the United Nations, of their environmental safety, or a recommendation by them, or any of their representative personnel that existing environmental protection conventions, treaties, laws or regulations be ignored or violated.

It is also acknowledged that some of the disposal procedures detailed in this guide may result in temporary environmental degradation. However, the procedures detailed in the guide, where followed appropriately, will substantially reduce or eliminate potential risks to human health, communities and the environment.

This revised edition of the disposal guide contains an important modification to the text originally published in 2017, namely to the fourth bullet point on page 68. This bullet point now reads:

The ideal pH range for composting is 6.5 to 8.5. The pH can be increased by adding lime or lowered by adding sulphur, aluminium or ferrous sulphate or by carefully adding a small amount of weak dilute acid such as acetic or phosphoric acid (diluted at least 50:1 with water).

Contents

➤	Introduction.....	1
➤	01. Overview of response and disposal process	3
	1.1 Secure location	3
	1.2 Identify immediate risks	3
	1.3 Assess types, condition and quantities of chemicals	4
	1.4 Develop a plan for management or disposal	4
➤	02. Safety.....	7
	2.1 Personal protective equipment	7
	2.2 Selecting the correct PPE level	17
	2.3 Safe handling and transport of chemicals	17
	2.4 Safe storage of chemicals	21
	2.5 Handling and disposal of unknown chemicals	25
➤	03. Identification of chemicals	27
	3.1 Understanding chemical labels	27
	3.2 Chemical and hazard warning symbols	28
➤	04. Selection of disposal location	35
	4.1 Locations for environmentally-responsible disposal	35
	4.2 Sensitive locations to avoid	37
➤	05. Disposal methods	39
	5.1 Disposal method symbols	39
	5.2 Open-air burning	42
	5.3 Evaporation	58
	5.4 Composting	61
	5.5 Burial	69
	5.6 Infiltration of non-hazardous or degradable liquids	74
	5.7 Encapsulation	75
	5.8 Rendering inert	81
	5.9 Neutralization	82
➤	Annexes	93
	I. Summary of disposal symbols	94
	II. Quick reference guide of chemical safety and disposal	95

Introduction

The operational need for the safe and environmentally responsible handling, storage and disposal of seized chemicals used in illicit drug manufacture may arise in remote locations where no waste management infrastructure or expert technical support is available to Governments or regulatory authorities. In many such cases, the management or disposal of seized chemicals is necessary to reduce or eliminate serious and immediate risks to human health, communities, the environment and critical resources such as groundwater, drinking water and agricultural land.

This Illustrated Disposal Guide supports the implementation of the UNODC *Guidelines for the Safe handling and disposal of chemicals from illicit drug manufacture* (UNODC, 2011). It is specifically intended for use in remote locations, where waste management infrastructure and expert technical support is not available and where an immediate and pressing need exists for the disposal of seized chemicals. It provides step-by-step practical instructions to facilitate basic safe handling, storage and disposal of seized chemicals.

This guide is supported by an eLearning module, which is intended to help build capacity at all levels, particularly in developing countries, to reduce the human and environmental impacts of chemicals used in illicit drug manufacture. Specifically, the guide provides a framework to ensure that disposal operations are conducted in a manner that seeks to protect and maintain clean accessible water resources, reduce pollution, protect aquatic environments, reduce or prevent land degradation, and protect local environments and their biodiversity, consistent with the United Nations 2030 Agenda for Sustainable Development.

01.

Overview of response and disposal process

The illicit manufacture of drugs may involve large quantities of chemicals. A number of these chemicals are highly toxic and have the potential to pose a significant risk to human health, communities and the environment, if not managed appropriately.

Following the identification and seizure of illicit drug laboratories and/or chemicals, the following actions should be taken.

1.1 Secure location

The location of the illicit laboratory or seized chemicals should be secured to ensure that no unauthorized personnel are able to enter the location and potentially come into contact with chemicals or other hazards which may be present. Where possible, establish an exclusion zone of 100 m around the location.

1.2 Identify immediate risks

Any immediate risk will depend on a range of factors, including whether the illicit laboratory is operating, the location (such as proximity to homes, schools, waterways, etc.) and the type, condition and quantity of chemicals present. For example, if the laboratory is operating and there are homes or schools within 100 m, people/residents should be temporarily moved away until the location is made safe or the chemicals removed.

1.3 Assess types, condition and quantities of chemicals

An assessment of the type, condition and quantity of chemicals should be undertaken to determine what resources may be required to carry out the process of removal or disposal. This assessment will also help to identify any immediate hazards and also select the type of disposal procedures that may be required. Where possible, assessment should be undertaken by personnel with a knowledge of chemicals and their hazards. Key information to note when undertaking this assessment includes:

- *Types of chemicals present*, including recording names, hazard warning information, packaging, transport or consignment information, CAS numbers or other identification details listed on any chemical containers or labels
- *Condition of chemicals and containers*, determine if containers are sealed, leaking, rusted or stable and in good condition
- *Quantities*, count or make an estimation of the quantity of each type of chemical (weight or volume)

Section 3 of this guide provides information to assist in the identification of chemicals.

Any personnel entering the location to make an initial assessment should wear the maximum level of available personal protective equipment (PPE) until such time as the identity of the chemicals is known and the hazard level has been determined. See section 2 for PPE.

1.4 Develop a plan for management or disposal

Once the type, condition and quantity of the chemicals are determined, it is important to develop a plan for the handling, transport, storage and disposal based on the procedures detailed in this guide.

It is also important to develop an emergency plan including procedures for managing spills or accidents. Identify any possible emergency medical support where available.

As part of the management plan, use the chemical information obtained from the initial assessment and look up available safety information on these chemicals.

Key information

- Identify resources and seek any available expert assistance.
- Establish an exclusion zone of 100 m if possible.
- Using the highest available level of PPE, assess site for immediate risk.
- Identify types, condition and quantities of chemicals.
- Make a plan for management or disposal, including emergency procedures.
- Management plan should minimize movement of chemicals.

Warning

- On discovery of the site, first determine if any chemical reactions are occurring.
- Chemical vapours may be present which can pose a significant safety risk. It is therefore important to establish good ventilation and air flow.

02.

Safety

The handling, storage and disposal of chemicals can pose significant dangers for personnel undertaking this work. These dangers can be minimized by using appropriate personal protective equipment (PPE) and following safety procedures.

It is recognized that all safety equipment detailed in this guide may not be available. However, the procedures illustrated should not be undertaken without the appropriate level of safety equipment indicated.

Different chemical handling, storage and disposal procedures may require different levels of PPE, depending on the risks posed by the chemicals and the procedure for disposal.

2.1 Personal protective equipment

This section focuses on two (2) levels of personal protective equipment (PPE) used for handling and preparing chemicals for disposal and a number of basic disposal procedures. It also discusses the specialized PPE recommended for undertaking open-air burning procedures.

There are four levels of PPE commonly used in managing chemical and emergency incidents depending on the level of risk posed by the chemicals present:

- Level A (extreme risk)
- Level B (high risk)
- Level C (medium risk)
- Level D (lower risk)



One piece fully self-contained chemical suit

Internal air supply (internal tank)

PPE level A

2.1.1 PPE levels A and B

PPE level A generally comprises a fully self-contained chemical suit with external or internal air supply, while level B generally includes a chemical resistant suit, boots, gloves and a breathing apparatus set, including an external air tank and full-face respirator mask. Levels A and B require specialist technical training and often emergency response support, which may be unavailable in the remote locations where it is intended that the use of this guide would apply.

Where an active chemical reaction is underway or chemicals with toxic or corrosive properties have been identified, it is likely that PPE of levels A or B will be necessary and specialist technical and emergency response support should be requested.



Chemical resistant suit

Nitrile rubber gloves

Self-contained breathing apparatus set, with mask

Chemical resistant boots

PPE level B

Key information

- This guide will focus on PPE levels C and D which involve the use of more commonly available protective equipment.
- Where the risk posed by chemicals or reactions is sufficiently high to require level A or B protection, expert technical assistance must be requested.

2.1.2 PPE level C

This is the minimum PPE level recommended for any initial assessment of locations and chemicals or any handling, preparation or disposal procedures for all chemicals listed in annex I, or any unknown chemicals. PPE level C generally includes:

- Chemical resistant suit
- Full-face air purifying respirator (APR) mask
- Chemical resistant gloves
- Chemical resistant boots



PPE level C

The following is an example of the order of use (applying) of PPE level C:

➤ STEP 1

Put on the chemical resistant disposal suit and ensure it is sealed.



➤ STEP 2

Put on the air purifying respirator (APR) mask, pulling the side and top straps to make a tight seal around the face. Once the mask is on and the straps are tight with a good seal around the face, pull the suit hood up over the head and straps.



Warning

- Ensure the APR mask is sealed tightly around the face and straps are pulled tight.
- Check the seal once the mask is on by covering the end opening of the canister and breath in. If there is a good seal, the mask should "suck" on to the wearers face.
- Ensure the cartridge is new.
- Cartridges must be changed regularly (minimum daily when in use) and be appropriate for the types of chemicals being handled.
- Generally, an "organic chemical" cartridge provides a good level of protection.
- When handling chemicals containing "cyanides", a specific cartridge appropriate for these chemicals may be required.

➤ STEP 3

Pull on chemical resistant boots, pulling the elastic leg of the suit down over the top of the boots.

**➤ STEP 4**

Pull on a cotton glove (if available), followed by a disposable chemical resistant (or nitrile rubber) glove, pulling the elastic wrist of the chemical suit down over the top of the disposable glove.

**➤ STEP 5**

Pull on a third heavy-duty chemical resistant glove over the first two (2) gloves (cotton and disposable chemical gloves), so that there are three (3) gloves on each hand, taking care to ensure that the heavy-duty glove is placed over the top of the chemical resistant suit.

**➤ STEP 6**

Once the heavy-duty chemical resistant gloves are on each hand, with the assistance of another person, tape the top of the heavy-duty glove to the sleeve/arm of chemical suit. This prevents any spilled chemicals from running into the top of the glove and down to the hands.



2.1.3 PPE level D

This PPE level is recommended for use only where there are no chemical hazards present. It provides basic protection against airborne particles (for example, dust or fine non-hazardous particles), and includes:

- Disposable suit
- Dust mask (recommended P2 type mask)
- Eye protection (wrap around with side protection)
- Gloves (depending on the work being undertaken, these can be either leather for manual handling or nitrile/latex type gloves for non-hazardous liquids)
- Appropriate safety boots
- Head protection (where there are any overhead physical hazards)



PPE level D

The following is an example of the order of use (applying) of PPE level D:

➡ STEP 1

Put on disposal suit (many different types are available).



➡ STEP 2

Put on dust mask and eye protection (eye protection *must* provide side protection).



↘ STEP 3

Put on appropriate safety boots. As a minimum these should be waterproof to prevent liquids from easily seeping into the boot. If chemical resistant boots (or disposal over-boots) are available, these should be used. Pull the elastic leg of disposal suit down over the top of the boots.

**↘ STEP 4**

Put on gloves. The type of glove will depend on the procedure being undertaken: leather or similar for manual handling and nitrile rubber or latex for non-hazardous liquids.



2.1.4 Heat/flame resistant PPE

Open-air burning requires specific PPE which protects from smoke as well as heat and flame. This varies from the PPE used for the other disposal methods, which provides protection from chemicals or airborne particles and vapours. The PPE worn during open-air burning should provide, as a minimum:

- Heat/flame resistant gloves
- Heat/flame resistant boots
- Respiratory protection (i.e. protection from toxic smoke) using an air purifying respirator (APR); heat/flame resistant clothing (for example Nomex® or Proban® treated flame resistant materials or heavy-duty 100 per cent cotton clothing, covering both upper and lower body)

There are many types of heat/flame resistant clothing available. Open-air burning procedures should not be undertaken without the minimum PPE outlined above. Where open-air burning procedures are proposed for use, assistance must be sought from local fire authorities, where available. The following is an example of recommended heat/flame resistant PPE and clothing, and the order in which it should be applied:

➤ STEP 1

Put on an APR mask with the cartridge fitted, following the process shown for PPE Level C step 2 (section 2.1.2).



➤ STEP 2

Place heat/flame resistant hood (also called a flash hood), such as a Nomex® or Proban® treated hood over the top of the mask, making sure the head and face are completely covered, with the base of the hood pulled down over the neck and/or shoulders. This would not only protect the head, face and neck, from both direct heat and flame, but also from any burning debris.



➤ STEP 3

Place a suitable heat/flame resistant jacket over the top of the hood, so the hood is beneath the jacket.



STEP 4

Pull on appropriate heat/flame resistant boots, pulling pants legs down over the top of the boot once on.



STEP 5

Pull on heat/flame resistant gloves and tighten any wrist straps over the top of the gloves.



AIR PURIFYING RESPIRATORS (APRs) AND CARTRIDGES: IMPORTANT INFORMATION

- APRs must always be fitted securely and tested regularly to make sure they retain their seal.
- Cartridges must be changed regularly and should only be used once, and never reused.
- Cartridges can become saturated when used in the presence of some strong chemicals, such as thionyl chloride, hydrogen chloride gas and many other chemicals, and will no longer provide protection for the wearer.
- A good supply of appropriate cartridges should be on hand whenever APRs are being used.



Warning

- ✎ NO SYNTHETIC CLOTHING (e.g. nylon or plastic chemical resistant suits) should be worn near to open-air burning sites or where there is a risk of fire.
- ✎ Where no treated heat/flame resistant clothing is available, multiple layers of heavy-duty 100 per cent cotton clothing, which covers the whole body, neck, torso, arms and legs can provide some protection.
- ✎ When using cotton clothing, always test the material against a small flame before using to make sure it does not ignite (catch fire) or melt.
- ✎ When using APRs in the presence of strong chemicals such as thionyl chloride, hydrogen chloride gas or other high respiratory hazard chemicals, change cartridges regularly to avoid saturation of filters and potential exposure to respiratory hazards.

2.2 Selecting the correct PPE level

The correct PPE level will depend on the risks posed by the chemicals present or the procedures being undertaken. Also, the type of illicit laboratory will also play an important role in determining risk. However, without expert technical support it is recommended to always use the highest level of PPE available, which provides the most protection for personnel.

In the presence of significant hazards, such as reacting chemicals, strong vapours/gases or other immediate physical or chemical hazards, these environments should not be entered, and expert technical support should be obtained.

2.3 Safe handling and transport of chemicals

The handling of chemicals creates the potential for reactions, spills or accidents and should be kept to a minimum. The following are some key steps for the safe handling of chemicals:

- Before moving chemicals, try to identify the type of chemical (see section 3) and any hazards. Note that on occasions, chemicals are deliberately mislabelled for smuggling or trafficking purposes, and caution should be used as hazard labels may not be reliable.
- Assess the condition of the containers. “Is it safe to move, is it rusted, leaking or damaged?” As labels may not always be reliable, it is critical that containers or drums be in good condition and securely sealed to reduce the potential for accidental reactions during handling or transport.



- Note that unsafe or damaged containers should not be transported and should be managed at the location or decanted (transferred) to another suitable drum or container. This may require expert technical advice.
- Minimize chemical movements, plan what to move, how to move it and where it is going to be moved to. Make sure the way is clear, that there are no physical obstacles and that all non-essential personnel are a safe distance away.
- To ensure prompt assistance in case of an accident during the handling and removal of chemicals, such exercises should be conducted by at least two people, equipped with the same level of PPE.

Aim to separate all chemicals into the hazard class indicated on their labels, if labels remain. Figure I below shows an example of hazard class labelling. See section 3.2 for further details.



FIGURE I. EXAMPLE OF CHEMICAL LABEL SHOWING HAZARD CLASS

ACETIC ANHYDRIDE

CAS RN: 108-24-7
UN: 1715

Danger

H226 - Flammable liquid and vapor.
H302 - Harmful if swallowed.
H314 - Causes severe skin burns and eye damage.
H332 - Harmful if inhaled.
P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P260 - Do not breathe dust/fume/gas/mist/vapors/spray.
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray.
P264 - Wash ... thoroughly after handling.
P280 - Wear protective gloves/protective clothing/eye protection/face protection.
P301 + P312 - IF SWALLOWED: Call a POISON CENTER/doctor/... if you feel unwell.
P301 + P330 + P331 - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing Rinse skin with water [or shower].
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 - Immediately call a POISON CENTER/doctor/...
P312 - Call a POISON CENTER/doctor/... if you feel unwell.
P330 - Rinse mouth.
P363 - Wash contaminated clothing before reuse.

FLAMMABLE LIQUID

3

Hazard class

Lot: 95687436F

CHEM GLOBAL INDUSTRIAL
1598 E. Buena Vista Blvd
Ann Arbor, MI 65987



Bear in mind the following points when transporting chemicals:

- Labels can vary greatly, however the hazard class is normally the dominant, or largest warning symbol visible.
- Transport chemicals separately with only chemicals from the same hazard class transported together in any load.
- Only chemicals with containers in good condition should be transported. Rusted, unsealed or leaking chemicals must firstly be managed at the location. This may require transferring any leaking chemicals to another clean container or drum (decanting). Caution should be exercised if this is necessary, and technical assistance should be requested.
- Chemical containers or drums should be firmly secured to prevent any movement or spillage of chemicals during transport.

Key information

- Only move chemicals if necessary, and ensure drums or containers are in good condition.
- Chemical containers should always be handled by two people, wearing the correct PPE.
- Chemicals should be separated and transported according to their hazard class.
- Do not transport chemicals from different hazard classes together.
- Ensure that chemical drums or containers are secured firmly during transport to prevent movement and/or spillage.

Warning









- Mixing chemicals from different hazard classes on the same truck is dangerous. In the event of an accident or spill, chemicals can mix and react.
- Some liquid chemicals can potentially contain or form peroxides which can explode unexpectedly with movement.
- Always transport chemicals on open trucks with a heavy steel tray or floor. In the event of an explosion this will direct the force of the explosion upward.
- No personnel should travel in the back of the truck with the chemicals.

2.4 Safe storage of chemicals

Storage of chemicals for long periods of time should be avoided. In cases when long-term storage of chemicals cannot be avoided, the following steps should be followed:

- Chemicals must be stored according to their hazard class (or chemical characteristics), and separated from chemicals of other hazard classes.
- Table 1 lists the main hazard classes and chemical groups, some common chemicals which belong to those groups, and the hazard symbols which often accompany them (see section 3.2 for further information on hazard symbols and their meanings).
- Develop a chemical separation and storage plan. This plan should set out where each group (or hazard class) of chemicals will be stored and how they will be separated and stored.

TABLE 1. HAZARD CLASS, EXAMPLES AND ASSOCIATED HAZARD LABELS

Hazard class or chemical group	Examples of chemicals in group	Hazard label (transport labelling)
Flammables	Acetone Kerosene Ketones Ethers	
Halogenated organics	Chloroform Methylene chloride	
Organic peroxides	Peroxide derivatives	
Ammonia	Ammonia gas	
Oxidizing agents	Potassium permanganate Sodium hypochlorite	
Alkalis	Ammonium hydroxide Potassium hydroxide Sodium hydroxide	
Acids	Hydrochloric acid Hydriodic acid Sulfuric acid	
Solids	Iron filings Mercuric chloride Magnesium sulfate Pseudoephedrine	Various – all solids should be separated into one group
Compressed gases	Hydrogen Hydrogen chloride	

Note: Many chemicals have multiple physical hazard pictograms (see section 3.2). The above table shows only the main or most common transport class/division pictogram associated with the hazard class or common chemicals from the class or group as a guide.

Storage requirements



During storage, chemicals can react if they leak, mix or become too hot. Good airflow, separation and open space for safe handling or moving of chemicals are some essential features of a good storage location.

Chemicals of the same hazard class or chemical type must be stored together, while separate chemicals of different hazard classes must be stored separately.





Spill containment or bunding is important to prevent accidental mixing of chemicals in the event of a spill or leak.

Have spill kits available to absorb any spills or leaks. In the absence of commercial spill equipment, sand is effective for absorbing liquid spills. In the event of a significant spill, the following immediate actions must be taken:

- *Evacuate immediately*
- Re-enter using the maximum level of PPE available
- Contain and absorb spill
- Maintain ventilation

Key information

- Chemicals should only be stored for short periods of time, and only if absolutely necessary.
- Only store chemicals in containers in good condition, and inspect stored chemicals regularly.
- Chemicals should be separated into their hazard classes or groups based on their chemical and reactive properties to reduce or remove the possibility of accidental reactions.
- Chemicals are generally best stored at cooler temperatures, below 28°C (82°F).
- Chemicals should be kept out of direct sunlight.
- Storage locations must have good ventilation and airflow.

Warning

- ✎ Chemicals must be separated according to their hazard class or characteristics to avoid potentially dangerous reactions.
- ✎ Care must be taken to ensure that chemicals do not spill or accidentally mix.
- ✎ Mixing some chemicals can result in fire, explosion or the release of toxic gases.

2.5 Handling and disposal of unknown chemicals

When the identity of a chemical is not known, such as when chemical containers or drums are open or unsealed or labels are missing, a high level of caution should be used, and these chemicals should only be handled or moved if absolutely necessary.

Where possible, unknown chemicals should be identified. This can be difficult without expert technical support. However, some easy to use "presumptive" tests (tests which give an immediate visual or colour result) are available.

The following are some common presumptive test kits which are very useful in identifying some key hazard information for unknown chemicals:

- pH test strips (will indicate if chemical is acidic or basic/alkaline)
- Cyanide test strips (will indicate if cyanide is present)
- Peroxide test strips (will indicate if peroxides are present which may mean that the chemical is potentially explosive)
- Water test strips (these will identify if the chemical is water-based or not)





Colour test showing
pH 2, meaning
chemical is acidic

Should it be necessary to handle or move unknown chemicals, this should be done very slowly and always by two people (as for normal chemical handling procedures), and must be done using a minimum of PPE level C. Higher levels of PPE such as levels A or B should be used if available.

Unknown chemicals can pose a significant risk to health and the environment, and must be handled and disposed of with caution. Every effort should be made to identify unknown chemicals to determine the appropriate disposal method. However, in some cases it may not be possible to identify all chemicals or mixtures and there may be an immediate need for their disposal. In these circumstances, the safest, most conservative and environmentally-responsible disposal options, as outlined below, are recommended.

TABLE 2. RECOMMENDED DISPOSAL OF UNKNOWN CHEMICALS OR MIXTURES

Disposal of unknown chemicals or mixtures		
Chemical type	Disposal method	Disposal symbol
Unknown liquid	<p>Rendering inert (see section 5.8)</p> <ul style="list-style-type: none"> • In the case of unknown liquids, it is important to add a concrete mix very slowly. Add a small amount first and observe for any reaction. • Allow 6-10 hours to set (uncovered if possible) before sealing drum for burial. 	
Unknown solids	<p>Encapsulation (see section 5.7)</p> <ul style="list-style-type: none"> • Follow standard method for encapsulation in section 5.7. 	

Warning

- Rendering inert and encapsulation can involve combining an unknown chemical with wet cement or concrete mix.
- Some chemicals can react with either the water or the high pH cement (or lime).
- To reduce the risk of a dangerous reaction, always test a small amount of the unknown chemical with an equal amount of the wet cement or concrete mix and observe for any significant reactions.

03.

Identification of chemicals

Chemical labels can vary significantly, and unless the container or drum can be verified to bear the original manufacturer's seal, the contents should not automatically be assumed to be what is listed on the label.

Containers or drums which are labelled and retain the manufacturers seal, can generally be assumed to contain the chemical shown on the label. Note however, that on occasions chemicals are deliberately mislabelled for smuggling or trafficking purposes.

Normally, expert technical assistance is required to positively identify unknown chemicals. Where expert assistance is not available the following information may assist in the preliminary identification of chemicals.

3.1 Understanding chemical labels

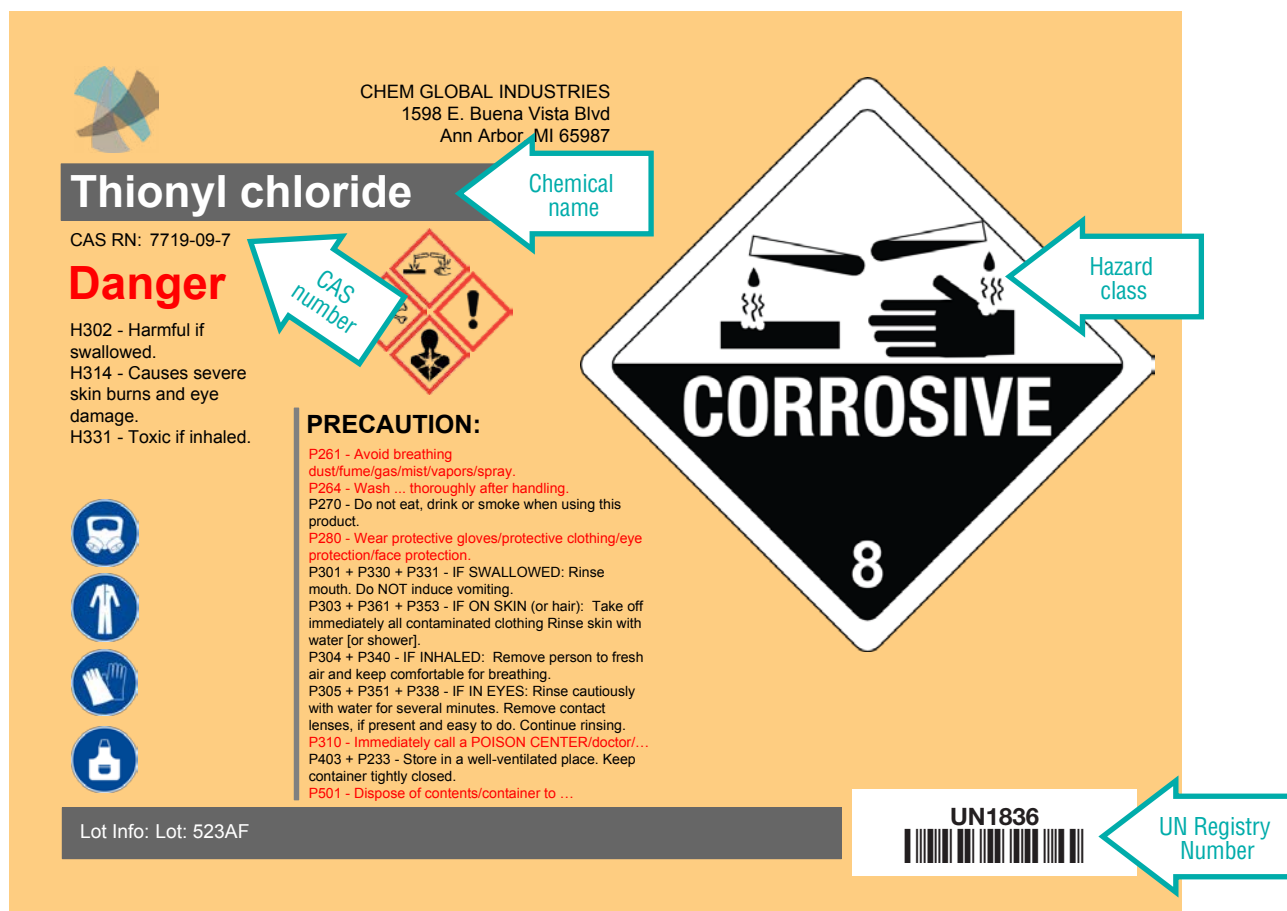
Although labels can vary, there is some basic information which can be obtained from these to help identify the chemical or class and assist in its safe handling, storage and disposal. These include:

- Chemical name
- CAS number (or Chemical Abstracts Service registry number)
- UN number (United Nations number. Transport code for identifying hazardous materials)

These three sources of information are used as the primary means of identifying chemicals, as listed in annex I.

The following is an example of a chemical label which shows the location where the above key identity information can be found.

FIGURE II. EXAMPLE OF CHEMICAL LABEL SHOWING KEY IDENTIFICATION INFORMATION



3.2 Chemical and hazard warning symbols

While labels and the information they contain can vary in both format and language, most commercial chemical containers which retain their correct labels should display some chemical or hazard warning information.








The current system of classification which indicates hazards and the warning symbols for a chemical is referred to as the “Globally Harmonized System” (GHS) for the classification and labelling of chemicals. The GHS labelling system includes two sets of hazard warning symbols (or pictograms), namely:








- *Transport pictograms for dangerous goods*
- *Health and physical hazard pictograms*

Transport pictograms identify chemicals which are classed as dangerous goods and classifies them into different groups based on, among others, their chemical properties and reactivity. As a general rule, only chemicals of the same hazard class should be transported together to minimize the risk of reaction in the event of an accident, leak or spill. This is the same principle which is used in determining separation for safe storage, as discussed in section 2.4.

Transport pictograms provide a good basic indication of a chemical’s hazard class. GHS transport pictograms and their meanings are shown in the following table:

TABLE 3. GHS TRANSPORT PICTOGRAMS, DESCRIPTIONS AND EXAMPLE CHEMICALS

Transport hazard pictogram	Description of hazard	Examples of chemicals in this hazard group
	Explosive , including “divisions” 1.1 to 1.3 which include substances which have a mass explosion, fire or blast hazards.	TNT Powergel Cordite
	Explosive , including “divisions” 1.4 to 1.6 which includes substances which are classed as an explosive but which are stable or pose no significant risk.	Ammonium nitrate
	Flammable gas (Division 2.1) , which ignite in a mixture of 13 per cent or less by volume with air.	Hydrogen
	Non-flammable non-toxic gases (Division 2.2) , including gases which can be asphyxiants (gases which displace air and affect breathing), or oxidizing substances.	Nitrogen
	Toxic gases (Division 2.3) , including gases which are toxic to humans and pose a hazard to health.	Hydrogen chloride
	Flammable liquids (Class 3) , includes liquids which have a flash point of less than 60°C and which can readily burn.	Acetone Toluene Alcohols
	Flammable solids (Division 4.1) , including self-reactive substances and solid desensitized explosives.	Aluminium powder Magnesium metal Potassium permanganate

Transport hazard pictogram	Description of hazard	Examples of chemicals in this hazard group
	Substances liable to spontaneous combustion (Division 4.2) , including substances which are liable to spontaneous heating under normal conditions during transport and can catch fire on contact with air.	White phosphorous Magnesium fines Lithium metal Sodium metal
	Substances which in contact with water emit flammable gases (Division 4.3) , includes substances which react with water to become spontaneously flammable or give off flammable gases in dangerous quantities.	Calcium carbide Aluminium phosphide
	Oxidizing substances (Division 5.1) , which may react with other material to produce oxygen resulting in, or contributing to, the combustion of other material.	Potassium permanganate Sodium hypochlorite
	Organic peroxides (Division 5.2) , are reactive chemicals often used as initiators (break down easily to form free oxygen radicals). Where peroxides form in some chemical solutions, these can become explosive.	Hydrogen peroxide (or its derivatives) MEKP Benzoyl peroxide
	Toxic substances (Division 6.1) , includes liquids and solids which are highly toxic or fatal by ingestion, dermal or respiratory exposure.	
	Corrosive substances (Class 8) , which are corrosive to skin and metal.	Nitric acid Sulfuric acid Hydriodic acid Hydrochloric acid
	Other dangerous goods (Class 9) , also referred to a miscellaneous dangerous goods, which have various hazards which do not fit into another hazard class.	Benzaldehyde Hydroxylamine HCl

Chemical labels may have multiple physical and health hazard pictograms (see figure III). These pictograms are useful as they indicate the multiple risks which may be associated with a chemical. For example, a chemical may be flammable, but also be corrosive and an irritant, such as the chemical acetic anhydride (figure III).

This information can help to determine what physical protection measure might be required, such as a chemical suit, apron and gloves as the chemical is corrosive, and respiratory and face (eye) protection as it is also an irritant.


FIGURE III. EXAMPLE OF A CHEMICAL LABEL SHOWING MULTIPLE PHYSICAL AND HEALTH HAZARD PICTOGRAMS

ACETIC ANHYDRIDE


CAS RN: 108-24-7
UN: 1715

Danger

H226 - Flammable liquid and vapor.
 H302 - Harmful if swallowed.
 H314 - Causes severe skin burns and eye damage.
 H332 - Harmful if inhaled.
 P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
 P260 - Do not breathe dust/fume/gas/mist/vapors/spray.
 P261 - Avoid breathing dust/fume/gas/mist/vapors/spray.
 P264 - Wash ... thoroughly after handling.
 P280 - Wear protective gloves/protective clothing/eye protection/face protection.
 P301 + P312 - IF SWALLOWED: Call a POISON CENTER/doctor/... if you feel unwell.
 P301 + P330 + P331 - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
 P303 + P361 + P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing Rinse skin with water [or shower].
 P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
 P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
 P310 - Immediately call a POISON CENTER/doctor/...
 P312 - Call a POISON CENTER/doctor/... if you feel unwell.
 P330 - Rinse mouth.
 P363 - Wash contaminated clothing before reuse.



Multiple physical and health pictograms











Lot: 95687436F

CHEM GLOBAL INDUSTRIAL
1598 E. Buena Vista Blvd
Ann Arbor, MI 65987

The GHS physical and health hazard pictograms and their meanings, while similar in many ways to the GHS transport pictograms, can vary slightly and are shown in the following table:

TABLE 4. GHS PHYSICAL AND HEALTH HAZARD PICTOGRAMS, DESCRIPTIONS AND EXAMPLES OF CHEMICALS FROM HAZARD GROUPS

Physical and health hazard pictograms	Description of hazard	Examples of chemicals in this hazard group
	Flammable , including: Liquids, gases, aerosols and solids	Acetone Acetic anhydride Petroleum ether Sodium metal
	Oxidizing , including: Gases, liquids and solids	Potassium permanganate Sodium hypochlorite
	Compressed gas , including: Compressed gases, liquefied gases (LPG)	Hydrogen Hydrogen chloride Ammonia gas Propane
	Corrosive , including: Corrosive to metal or skin	Hydrochloric acid Sulfuric acid Hydriodic acid Thionyl chloride
	Explosive , including: Explosives, unstable explosives, self-reactive substances or mixtures and organic peroxides	Peroxides

Physical and health hazard pictograms	Description of hazard	Examples of chemicals in this hazard group
	Toxic , including: Acutely toxic by oral, dermal (skin) or inhalation (breathing)	Catechol Sodium cyanide Sodium cyanoborohydride
	Health hazard , including: Carcinogens, respiratory hazards, mutagens, reproductive toxins, aspiration hazards or toxic to specific organs	Dichloromethane Benzyl chloride Formamide
	Irritant , including: Irritation to skin, eyes, respiratory system (airway and lungs) or causes sensitization	Anthranilic acid APAAN Calcium hydroxide Ethylamine
	Environmental hazard , including: Hazardous to the aquatic environment	Lead acetate Mercuric chloride Iodine

04.

Selection of disposal location

When undertaking any disposal procedure described in this guide, one of the most important considerations is the location in which the disposal will take place. Selecting the right location for the disposal procedure will minimize the risk to human health, communities and the environment from many of the risks associated with the disposal of the chemicals. Similarly, selecting the wrong location can potentially place human health, communities and the environment at risk.

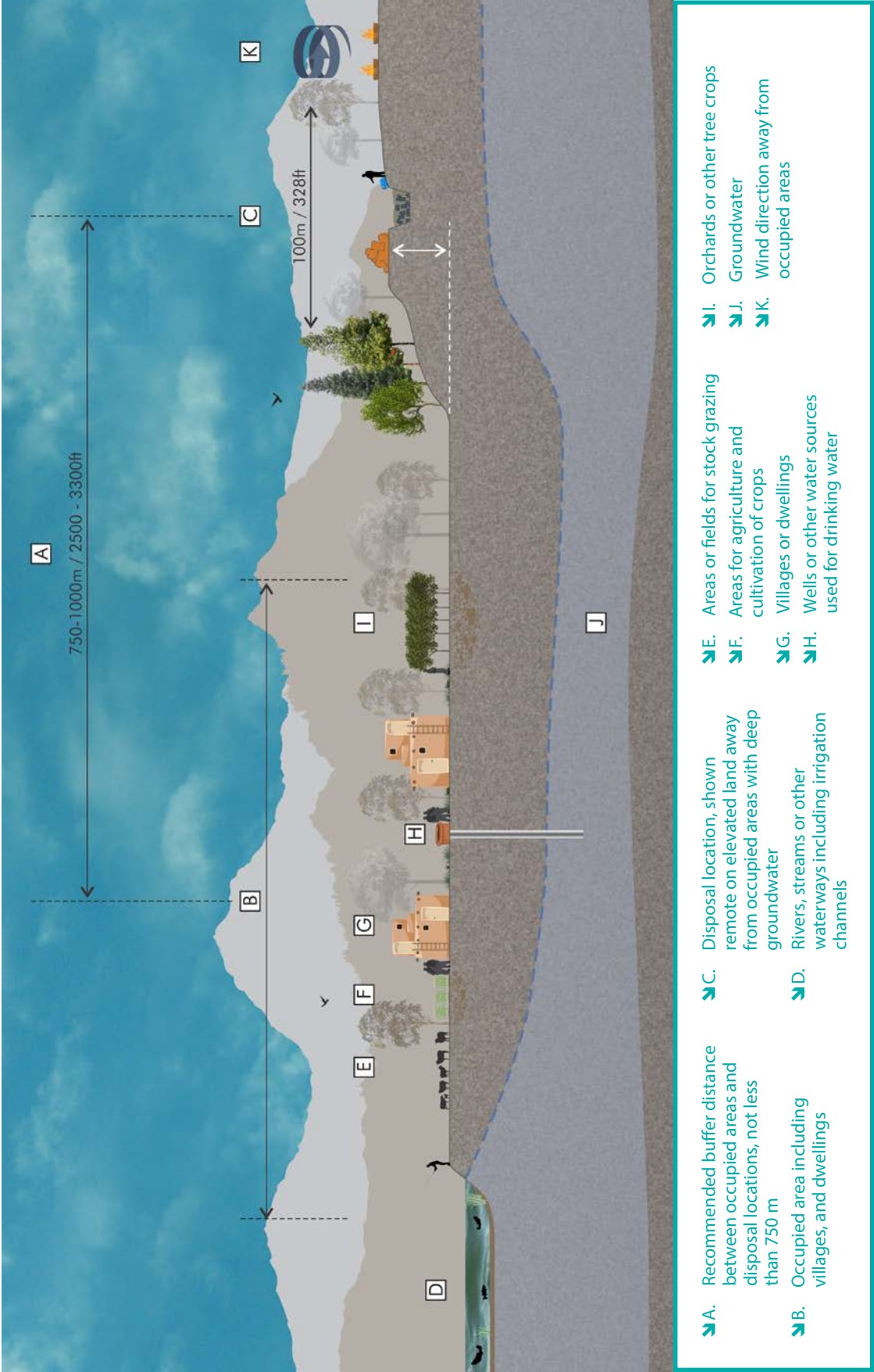
4.1 Locations for environmentally-responsible disposal

In some cases, there may be an immediate need for the disposal of chemicals. However, the principle of “environmentally-responsible disposal” should be adhered to wherever possible. The following provides critical information to assist in the identification and selection of disposal locations, and provides recommended buffer (safety) distances from dwellings or villages, waterways, wells and other sensitive environmental locations.

Figure IV shows a disposal location [C], located on elevated (high) ground, close to an “occupied area” [B], with sensitive locations including, waterways [D], grazing areas [E], crops [F], dwellings or villages [G], wells [H], orchards [I] and deep groundwater [J]. Open-air burns should be at least 100 m from trees and a safe distance from any burial pits. When undertaking open-air burns, ensure that the wind direction is away from personnel and populated areas [K].

Observing the following recommended buffer distances shown in figure IV will significantly reduce the potential risk to human health, communities and the environment.

FIGURE IV. DISPOSAL SITE MODEL SHOWING RECOMMENDED BUFFER (SAFETY) DISTANCES FROM SENSITIVE LOCATIONS



4.2 Sensitive locations to avoid





Many of the risks associated with the disposal of chemicals relate to the exposure of people to chemical hazards, either directly while performing the disposal, or by disposing of the chemicals in a manner which may result in contamination of the environment.

Figure IV illustrates a number of features, such as rivers, villages and wells which are “sensitive” locations that can all be harmed by accidental contamination when disposal procedures are not carried out correctly.

In order to protect these sensitive locations, “buffer distances” are recommended. These buffer distances are the *minimum* distances that should exist between a disposal location and any of the sensitive locations shown in figure IV, or listed in table 5 below.

The following table illustrates some of these sensitive locations which must be avoided when selecting a disposal location.

TABLE 5. SENSITIVE LOCATIONS WHICH MUST BE AVOIDED

<div>Rivers, streams and other waterways including irrigation channels</div> <div>Minimum 750 m or 500 m in remote locations</div>	
<div>Fields or stock grazing areas</div> <div>Minimum 500 m</div>	
<div>Agricultural areas or crops</div> <div>Minimum 500 m</div>	
<div>Villages, towns or dwellings</div> <div>Minimum 750 m</div>	

<p>Wells for groundwater</p> <p>Minimum 1,000 m (1 km)</p>	
<p>Orchards or other trees used for food production</p> <p>Minimum 500 m</p>	

Key information

- The buffer distance between the disposal location and sensitive receptors is critical to minimizing risk to human health and the environment. The distances indicated are minimum distances, and greater distances, where possible, provide additional protection.
- Disposal locations must be a minimum of 750 m to 1,000 m (2,500 to 3,300 ft) away from occupied areas including waterways, villages and wells.
- Disposal locations should be on elevated ground to increase the distance to groundwater.
- Disposal locations should be in remote areas where possible.
- When using an open-air burn procedure, disposal locations should be a minimum of 100 m (or 330 ft) away from any nearby trees.

Warning

- Using a disposal location in close proximity to any of the sensitive locations listed in sections 4.1 and 4.2 may result in the exposure of civilian populations to potential contamination.
- Using disposal areas close to waterways or groundwater can result in contamination of drinking water supplies.

05.

Disposal methods






The disposal procedures detailed in this guide are basic procedures intended for use in remote locations, where appropriate waste management infrastructure is not available, and where there is an immediate need for the disposal of the seized chemicals.







5.1 Disposal method symbols

Each disposal procedure has a unique “disposal symbol” which is used throughout this guide to help identify the procedure and show when a disposal procedure may be appropriate. These symbols are listed in table 6 on the following pages.

Annex I contains a list of some common chemicals associated with illicit drug manufacture. One or more disposal symbols are shown for each chemical listed in annex I. These suggest the most appropriate disposal method for that chemical in order of preference, based on physical and environmental safety factors.

TABLE 6. DISPOSAL METHODS AND THEIR SYMBOLS

Disposal method	Disposal symbol
Open-air burning of volatile solvents	
Open-air burning of combustible and semi-combustible liquids	
Open-air burying using a pit	
Evaporation	
Composting or bioremediation	
Remote burial	

Disposal method	Disposal symbol
Burial in landfill	
Infiltration (soaking into soils) of non-hazardous liquids	
Encapsulation (casing in cement)	
Rendering a substance inert	
Neutralization of acids	
Neutralization of bases	

5.2 Open-air burning

The burning of chemicals can present a number of physical hazards. Burning procedures should only be used where there are no other options for disposal or there is an immediate operational need for the rapid disposal of the chemicals.

This section outlines the procedures for:

- Drum preparation, including selecting, making the drums safe and cutting drums for the two types of open-air burning procedures (see section 5.2.1)
- Fuel blending, to allow the burning of some less flammable chemicals
- Safe ignition (lighting) procedures

Procedures for carrying out open-air burning of two different types of flammable chemicals, including *volatile solvents* and *combustible and semi- or non-combustible liquids*, using two different drum configurations, as shown below.

The two different drum configurations can be used to minimize some of the risks associated with ignition (lighting) procedures and the burning of flammable chemicals.



Open-top drum

▲ **Volatile solvents—liquid chemicals**, which are highly flammable with high vapour pressure, meaning they readily evaporate to produce a layer of gas above their surface. This gas can be poisonous or flammable and can easily catch fire or explode. This procedure uses an **open-top drum**.



Side-cut drum

▲ **Combustible and semi-combustible liquids**, which includes both flammable liquids with lower vapour pressure which ignite easily and other liquids, which may not be classed as flammable, which will burn when mixed (or blended, see section 5.2.3) with other more flammable liquids. This procedure uses a **side-cut drum**.

5.2.1 Drum preparation

Cutting drums for use in open-air burning (or evaporation), especially where the previous contents of the drums are unknown can be very hazardous. Often chemical residues or flammable vapours can remain inside a drum. Where available, new drums should be used.

Drums previously used for other chemicals should be carefully examined before cutting, as the tools used in the cutting process are likely to

produce sparks. If it is suspected that the drums might contain a residue, it is essential to carry out the safety procedures shown below.

Drum preparation has two parts:

- Drum selection and making the drum safe
- Drum cutting, depending on the type of burn procedure being used

Drum selection and making safe

The following steps show the recommended procedure for selecting a suitable drum and making it safe:

➤ STEP 1

Select drum/s which are empty, in good condition and with no holes or significant rust. Depending on the type of burning procedure, look for the drums which are most suitable for the procedure, e.g. open-top drums for burning volatile solvents, or closed-top drums for other combustible liquids.



↘ STEP 2

Carefully vent drum wearing minimum PPE level C to protect from chemicals, gases or vapours which may be released. Ensure that there are no open flames or other ignition sources nearby while venting.



↘ STEP 3

For closed-top drums, fill the drum to overflowing with water to clean and force out any gases inside the drum. For open-top drums, lay the drum on its side and rinse multiple times with water.



↘ STEP 4

Cut the drum *while it is full of water* (do *not* empty the drum). If using electrical cutting equipment, such as an angle grinder, ensure power cords and equipment remain dry and follow all safety instructions.

Warning

- ↘ For closed-top drums, it is essential that the drums are kept full of water while cutting to prevent the risk of explosion and serious injury or death.

Drum cutting procedure for volatile solvents (open-top drum)

Due to the potential for volatile solvents to give off significant flammable vapours which are in many cases not visible, an upright drum is recommended which will contain a larger proportion of the vapour.

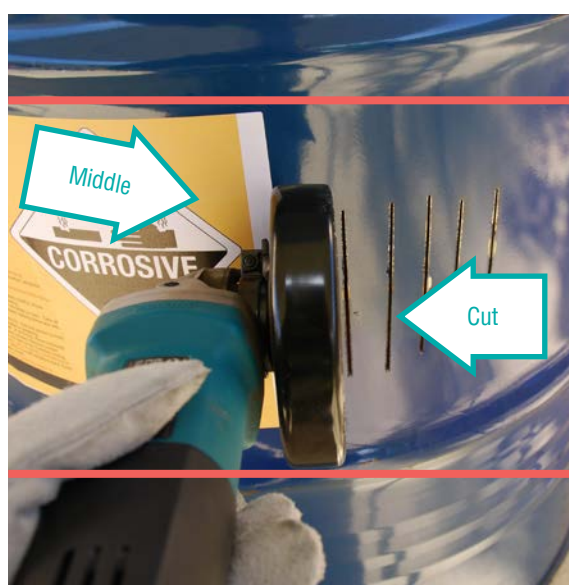
STEP 1

For closed-top drums, cut off the top of drum. Ensure that safety instructions for any cutting tools used are followed.



STEP 2

Pierce or cut holes around the middle section of the drum to allow air flow into the combustion zone within the drum, this will assist in the burning process. The drums are then ready for use.



Drum cutting procedure for combustible semi- and non-combustible liquids (side-cut drum)

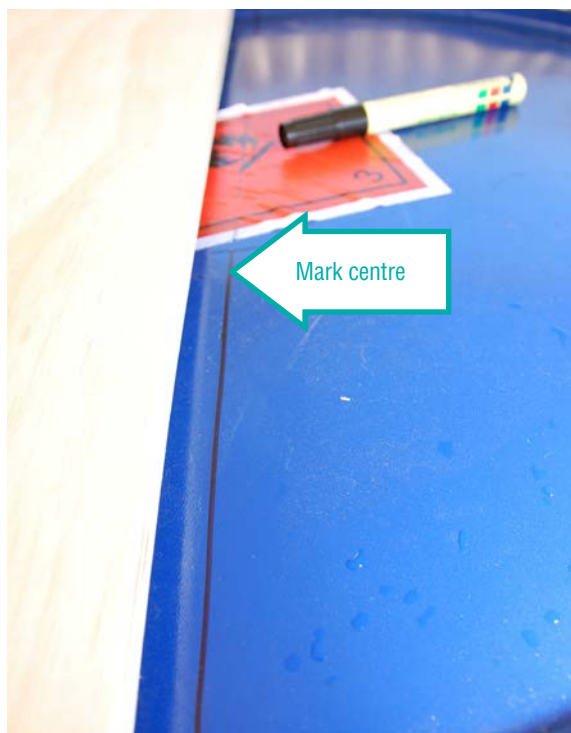
This procedure uses side-cut drums, or drums which are cut vertically in half. This allows the two halves of the drum to be used for burning and also creates a larger surface area to assist in the burning process by allowing more air directly into the fire. This procedure requires *closed-top drums*.

Warning

- For closed-top drums, it is essential that the drums are kept full of water while cutting to prevent the risk of explosion and serious injury or death.

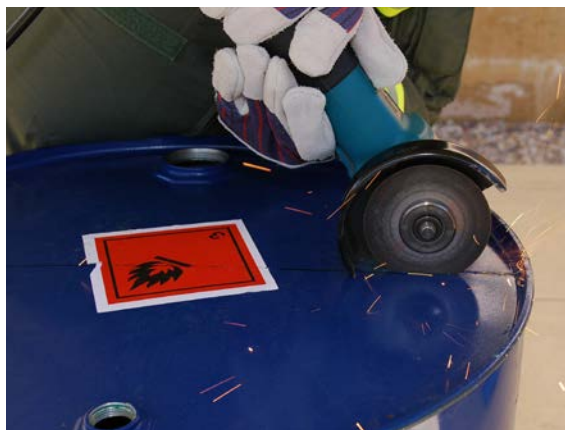
➤ STEP 1

Mark a centre (or middle) line on the drums using a straight edge.



➤ STEP 2

Cut the drum across the top and vertically down each side and then across the bottom to finish, following the centre lines.



Alternative cutting methods, such as saws or gas torches can be used but the drum preparation and safety precautions must be followed. Gas torches are generally safe for cutting new (previously unused) drums but are not recommended for used drums, which must be filled with water for safety reasons.

➤ STEP 3

File the edges of the drum to remove any sharp pieces of steel (burrs) before handling.



5.2.2 Fuel blending

Fuel blending is a method of preparing a chemical, which may not ignite or burn on its own, for burning. In these cases, less flammable or semi- or even non-flammable liquids can be mixed with more flammable liquids (or other fuels such as kerosene or diesel) to allow them to burn efficiently.

Liquids with a flammability rating of 3 will normally ignite and burn on their own. These liquids can be added to other less flammable liquids or non-flammable liquids to assist in making them ignite or burn. Some solid chemicals, such as powders, can also be blended or dissolved in the flammable liquid for burning.



Key information

- When blending a flammable solvent or other fuel, such as kerosene, with a semi- or non-flammable liquid (or solid) for burning, test the blend (mixture) in a small container (approximately 0.5-1 litre container). The test should be carried out at a safe distance from other flammable chemicals to ensure that the mixture ignites and burns correctly and completely.
- If ignition or burning is slow or incomplete, increase the percentage or ratio of flammable solvent or fuel and note the ratios (or proportions) which ignite and burn effectively.
- Once a ratio or percentage of each chemical is found which burns as required, note the proportions, and mix accordingly in cut drums for burning (as shown in step 3 for small-scale burns, or step 4 for large-scale burns).

Warning

- Heat/flare resistant PPE must be worn when blending or mixing flammable chemicals, including a full-face respirator mask (APR).
- Before large-scale blending or mixing of flammable chemicals, mix a small quantity (less than 0.5 litres) of the chemicals together to test for any hazardous reactions. This should be done at a safe distance from any other flammable chemicals.
- If the chemicals appear to react, do not continue. Either test an alternative flammable liquid or use an alternate disposal method.
- If using kerosene, diesel or other fuel for blending, test for any reaction in the same manner as above.
- Ensure that chemicals to be burned mix together and do not form separate layers as this may prevent complete burning (combustion).

5.2.3 Safe ignition procedures

Open-air burning procedures pose a number of hazards which can be managed or minimized through the use of PPE, as outlined in section 2.1.3. Both open-air burning procedures require the manual ignition (or lighting) of the solvent or chemical mixture for burning. This is a hazardous

procedure due to the potential for flammable vapours to be present which can ignite (catch fire) in the air surrounding, and some distance away from the disposal drums.

The following steps show the minimum requirements and procedures for safe remote (at a distance) ignition of chemicals for open-air burning:

➤ STEP 1

Obtain a long pole (a suitable length of bamboo works well if available. If only shorter poles are available, these can be lashed or tied together securely), several fibre sacks (hessian, jute, burlap or coffee sacks), and some wire (steel or fencing wire). Do not use woven plastic sacks.



➤ STEP 2

Wrap the fibre sack tightly around the end of the pole.



➤ STEP 3

Tie the fibre sacking firmly in place with the wire.



➤ STEP 4

Place the fibre sack in a small tray, away from the disposal area or any other flammable chemicals or solvents, douse with petrol (or kerosene) and carefully ignite (light).



➤ STEP 5

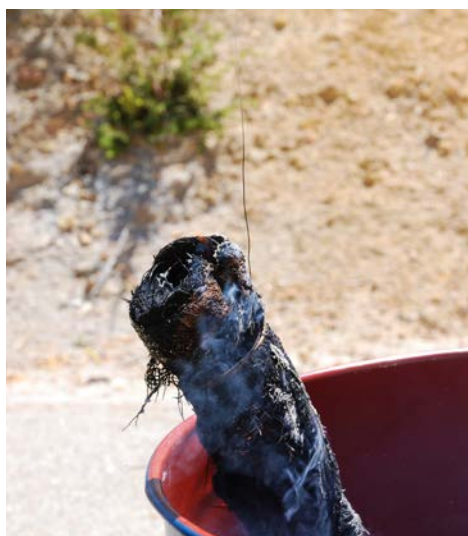
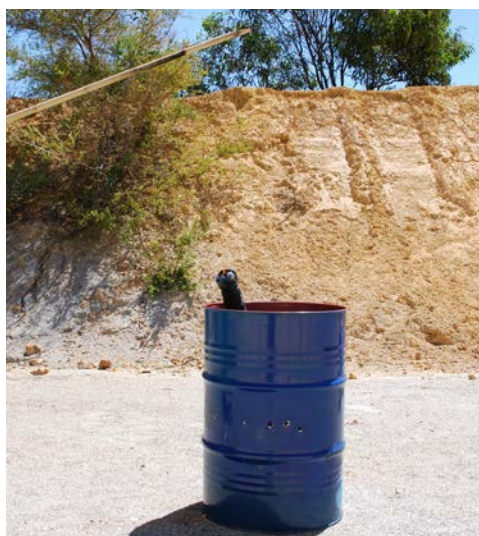
Approach the prepared drum containing solvents or flammable chemicals carefully, keeping low and with the pole extended at arm's length.



For side-cut drums, ignite directly as shown in *large-scale burns, step 5*. For open-top drums, light the solvents or flammable chemicals by placing the burning sack against the open holes in the side of the drum or at the top of the drum.



If volatile solvents in an open-top drum are difficult to ignite, the fibre sack can be tied at the end of a length of wire, which is attached to the end of the pole (like a fishing rod) and lowered into the drum.



STEP 6

Once the chemicals in the drum are burning, move away from the drums, place the pole on the ground and smother the burning sack with another wet fibre sack. This will allow the reuse of the pole and fuel soaked sack.

**5.2.4 Burning volatile solvents**

This procedure should only be used where there are no other viable options for disposal or there is an immediate operational need for the rapid disposal of the chemicals. See annex I for chemicals which may be disposed of using this procedure.

Warning

- ⚠ This disposal procedure should only be undertaken during daylight hours, to reduce or eliminate the possibility of an ignition source (light with a flame or spark) being brought into the disposal area.

STEP 1

Take note of any wind and the direction it is blowing (wind must be blowing away from personnel or populated areas). Using an open-top drum prepared in accordance with section 5.2.1, position the drum in an open area, away from trees and other material or chemicals which could potentially catch fire. For the burning of volatile solvents, it is not recommended to burn more than two drums at any time for safety reasons.



STEP 2

Wearing PPE outlined in section 2.1.3, pour the solvent into the drum, filling it *no more than one third (1/3)* full (to the bottom ridge on the drum), and as close to the level of the lowest ventilation hole as possible to assist in lighting of the solvent.

**STEP 3**

At a safe distance, and wearing PPE outlined in section 2.1.3, light the remote ignition pole/sack and ignite the chemicals within the drum as shown in section 5.2.3.

**5.2.5 Burning combustible and semi- or non-combustible liquids**

This procedure should only be used where there are no other viable options for disposal or there is an immediate operational need for the rapid disposal of the chemicals. See annex I for chemicals which may be disposed of using this procedure.

Unlike the burning of volatile solvents, the burning of general combustible and semi- or non-combustible liquids can be carried out using more than the two drums recommended for the burning of volatile solvents. This is due to the lower volatility (lower vapour pressure) of these combustible liquids (or blends of flammable and semi- or non-flammable chemicals).

Warning

- ⚠ This disposal procedure should only be undertaken during daylight hours, to reduce or eliminate the possibility of an ignition source (light with a flame or spark) being brought into the disposal area.

For this reason, the procedure is divided into two sizes:

- Small-scale burning, using a single line of no more than 10 half drums
- Large-scale burning, using more than 10 drums in multiple lines

In some cases, the chemicals which must be burned may not burn by themselves or may require the addition of another flammable

chemical (or other fuel, such as kerosene or diesel) to allow them to burn. This is called fuel blending or mixing (see section 5.2.2).

Small-scale burns

Small-scale burns will use a *single line* of no more than 10 half drums. No more than the contents of 10 full drums should be burned at any one time regardless of the contents.

➤ STEP 1

Dig a shallow trench or ditch to hold the drums in place with a space of at least 1 m (3 ft) between each drum.



➤ STEP 2

Position drums in the trench, with a 1 m (3ft) spacing between each drum. Then fill in soil around each drum to keep the drum in place and prevent movement or tipping.



➤ STEP 3

Using the PPE outlined in section 2.1.3, pour the chemicals into the drums ready for blending (mixing) or burning. If blending flammable and semi- or non-flammable chemicals, pour into the cut drum in the proportions tested for burning, as described in section 5.2.2.



➤ STEP 4

Ignite drums as shown in section 5.2.3 and from the up-wind direction only.



Lighting from
up-wind

Wind direction taking smoke and flame
away from officer lighting drums

Warning

- Before igniting, check wind direction is away from personnel and any populated areas.
- If wind is blowing towards personnel or populated areas, do not undertake the burn procedure.

Large-scale burns

When undertaking a large-scale burn using more than 10 half drums, there are a number of safety precautions which need to be taken. The drums should be arranged into a square grid pattern. This results in the creation of a concentrated column of heat, which pushes the smoke high into the air to maximize dispersion and minimize risk to personnel on the ground or nearby.

➤ STEP 1

Five shallow trenches are dug to hold 10 drums in each trench, with a space of at least 1 m (3 ft) between each drum. A gap of 4 m (13 ft) should be left between rows.



Shallow trench

➤ STEP 2

Arrange drums in a maximum of 5 rows of 10 half drums, set in a square or grid pattern as shown below. A gap of 4 m (13 ft) should be left between rows.



➤ STEP 3

Position drums in the trench, with a 1 m (3 ft) spacing between each drum and 4 m (13 ft) between rows. Then fill in soil around each drum to keep the drum in place and prevent movement or tipping.



➤ STEP 4

Using the PPE outlined in section 2.1.3, pour the chemicals into the drums ready for mixing or burning. If blending flammable and semi- or non-flammable chemicals, pour into the cut drum in the proportions tested for burning, as described in section 5.2.2.



➤ STEP 5

Ignite drums as shown in section 5.2.3 and from the up-wind direction only, moving systematically along each row.



Lighting from up-wind

Wind direction taking smoke and flame away from officer lighting drums

Key information

- The use of steel drums is recommended for open-air burning because it will prevent the chemicals from entering the ground and will withstand the high temperatures produced when burning without breaking and potentially spilling burning chemicals.
- However, it is not essential to use only steel drums for burning. Other materials such as concrete or steel water troughs can be used for burning in the same way to prevent the chemical from entering the ground, and also withstand the high temperatures.

Warning

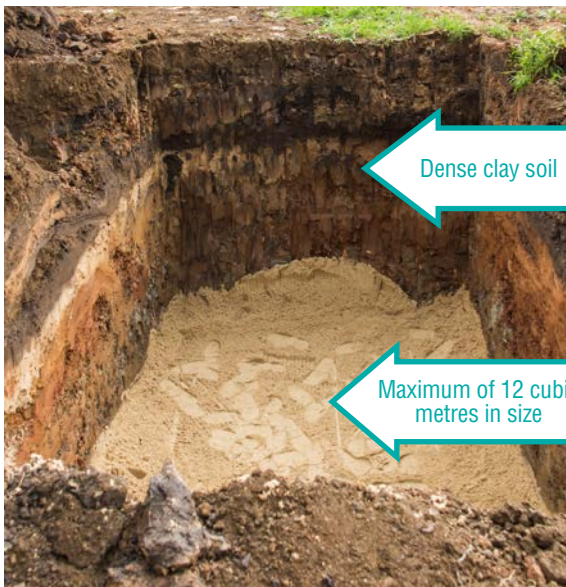
- Before igniting, check that the wind direction is away from personnel and any populated areas.
- If wind is blowing toward personnel or populated areas, do not undertake the burn procedure.
- All personnel should be kept at a safe distance up wind and at a minimum of 100 m from burn area.
- Open-air burning should not be undertaken in still conditions (no wind) or in high wind conditions.
- Smoke may be toxic and respiratory protection must be worn by all personnel.
- All personnel undertaking chemical handling and blending, involving pouring chemicals into drums prior to burning, must wear heat/flame resistant PPE and full-face respirators, as shown in section 2.1.3, in case of accidental ignition.
- Advise the local fire authorities of a planned burn and where available, have emergency firefighting equipment and medical support available at the location.
- Smoke generated from large-scale burn procedures, such as outlined above, can be significant.



5.2.6 Pit burns

Pit burns (or trench burns) are an alternate method of performing an open-air burn procedure in remote locations where drums (either upright or cut) or other suitable containers such as concrete troughs are not available.

The use of pit burns should always be a last option, where immediate disposal by burning is required, and there are no other viable options for disposal. This is due to the fact that some chemicals will soak into the soil, which has the potential to degrade the local environment, or contaminate groundwater.

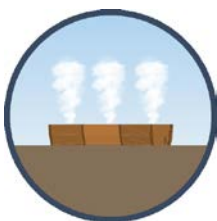


The following are requirements for undertaking a pit burn:

- Select a location for the pit or trench, ideally in an area of clay soil.
- Location should be on elevated ground (with deep groundwater).
- Location must be a minimum of 500 m from any waterway (river or stream).
- Pits should not be more than 12 cubic metres in size.
- Multiple trenches can be used, but should be a minimum of 10 m apart.
- Use the ignition procedures outlined in section 5.2.3.

Warning

- ✎ No more than the contents of 10 full drums should be burned at any one time, regardless of the contents.



5.3 Evaporation

The process where a liquid solvent changes to a vapour is called evaporation. One of the most common chemicals found at illicit drug manufacture operations are solvents. Many of these solvents are volatile (evaporate easily). This means that they might also produce flammable vapours in significant quantities as they evaporate. While evaporation can be a useful method for the disposal of volatile solvents, there are potential risks as some chemical vapours can easily catch fire.

Wind speed and direction are critical factors to consider when using an evaporation procedure. The wind will significantly speed up the rate of evaporation, and it is recommended that evaporation is not undertaken on days with no wind. Wind direction must always be away from populated areas or personnel.

The following steps outline the procedure for evaporation:

STEP 1

Prepare one or more side-cut metal drum/s (as shown in section 5.2.1). Plastic drums are not suitable.



STEP 2

Make sure there are no open flames or other ignition sources within 50 m of the evaporation disposal area.



STEP 3

Ensure that emergency firefighting equipment, such as a fire extinguisher and a fire blanket are positioned at a safe distance of at least 25 m from the evaporation area, and additional personnel equipped with correct PPE as outlined for open-air burning in section 2.1.3, are ready to respond in the event of an accidental ignition or other hazard.



➤ STEP 4

Position the drums in an open area with a distance of at least 2 m between drums. Note that if drums are not available, other containers or vessels made of steel or concrete, such as a water trough can also be used. Note that if a water trough is used, it must be cleaned and destroyed after use for safety and contamination reasons.



➤ STEP 5

Stabilize the drums with sand bags to prevent them from tipping or moving. Alternatively, drums can be placed in a shallow trench. See section 5.2.5.



➤ STEP 6

Add approximately 20 litres of water to each drum. In the case of some solvents this will increase the rate of evaporation (such as allyl chloride or other chlorinated solvents). However, water does not need to be used and the solvent alone can also be poured into the drums (see step 7).

Most solvents will evaporate more quickly or safely when combined with water and a large surface area. However, this may reduce the rate at which some solvents evaporate. It is recommended to test in a single drum first, noting the levels in the drum and timing the rate at which the levels drop. If evaporation does not occur, that is no visible reduction in level after 4 hours with good wind conditions and temperature, use the solvent on its own without water.



➤ STEP 7

Using the correct PPE as outlined for open-air burning in section 2.1.3, arrange for one person to pour between 10 and 15 litres of the volatile solvent into the drums containing the water. All other personnel should remain at a safe distance of at least 25 to 50 m.



Evaporation using straw

The rate (speed) of evaporation depends on a number of factors including the temperature, wind, drum size and the type of chemical. The purpose of using a side-cut drum is to increase the surface area, which is *the amount of solvent exposed to the air*.

Surface area can be increased using an alternate method as shown below using loose hay or straw (as an inert material), which creates a large surface area and allows air flow through the material to increase the rate of evaporation.

STEP 1

Repeat steps 1 to 5 as detailed above (for normal evaporation procedures), then pull apart some hay or straw and *loosely* place in a pile within the drum.



STEP 2

Pour approximately 10 to 15 litres of the volatile solvent slowly over the hay or straw and allow to stand until no liquid remains in the base of the drum, or the volume is substantially reduced. Do not overfill or saturate the straw. Most of the liquid should be retained within the straw and only a minimal quantity of solvent should be present in the drum.



Key information

- The rate of evaporation depends on a number of factors including the type of solvent and its "vapour pressure", the temperature, surface area and wind.
- Evaporation procedures should only be used on days when there is air movement (breeze or wind) to assist with dispersion of vapour and evaporation.
- Evaporation may not be a rapid method of disposal, but where time permits it is effective, low risk and environmentally responsible.
- See annex I for volatile solvents suitable for evaporation procedures.
- It is recommended that no more than 200 litres of any chemical should be evaporated at any one time or location when using the evaporation procedure.

Warning

- ✎ This disposal procedure should only be undertaken during daylight hours, to reduce or eliminate the possibility of an ignition source (light with a flame or spark) being brought into the disposal area.
- ✎ Evaporation must only be used on days when there is air movement or wind, and never on days with no air movement or wind.
- ✎ Accidental ignition is always a risk when exposing or handling volatile solvents, and correct PPE must be worn.
- ✎ Heat/flame resistant PPE should be worn when undertaking this procedure.
- ✎ Always ensure that there are no open or naked flames or other ignition sources nearby when undertaking an evaporation procedure.
- ✎ Do not dispose of more than 200 litres of solvent at any one time using the evaporation procedure.
- ✎ Once the evaporation is completed, the hay/straw is *not* suitable for use as feed for animals or on gardens and should be ideally composted, but may also be buried or burned within an appropriate area.



5.4 Composting

The composting process can be used as a type of bioremediation, or chemical disposal using natural biological processes.

The two basic parts of any composting are referred to as green (material) and brown (material). In order for a compost to work correctly, the ratio or proportion of green to brown is very important. Generally, the ideal ratio should be approximately:




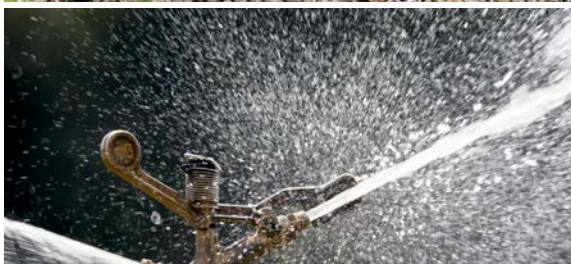


1 part green : 2 parts brown

In very basic terms, this means that you should make your compost using twice as much brown material as green material.

Many petroleum-based solvents, including some chlorinated solvents and other chemicals can be broken down naturally through the composting process, where naturally occurring microorganisms in the mixtures of organic matter and manure/straw consume and break down the chemicals. See annex I for a list of chemicals suitable for disposal by this method.

Composting is not a rapid disposal method and thus unsuitable for circumstances where immediate disposal is required. However, where time is available to allow the composting process to be undertaken, this can be a very simple, safe and low-cost disposal method. It is both environmentally responsible and easily achievable in remote locations where agricultural activities occur, and requires only commonly available materials. Once the composting process is complete, the compost can be added to soils or gardens to add nutrients and improve soil quality. The composting process requires these basic materials.

TABLE 7. BASIC MATERIALS FOR THE COMPOSTING PROCESS

<p>GREEN material, such as green waste or mulched plant material, vegetable or fruit scraps, fresh tree prunings or fresh (green) grass cuttings.</p> <p>1 Part</p>	
<p>BROWN material, or dry material such as straw, wood chip and manure (chicken, sheep or cattle) or mixtures of all of these. Manure should comprise no more than half of the total brown/dry material.</p> <p>2 Parts</p>	 
<p>Water; moisture content should ideally be about 40 per cent, but this can be hard to measure in the field. As a guide, the material should be watered to keep it just slightly moist to the touch. It is important not to over water.</p> <p>40 per cent</p>	
<p>A concrete or other compacted hardstand area or dense clay ground. If a hardstand area is not available, several layers of plastic sheeting can also be used.</p>	
<p>Sand bags (used with high-density polyethylene plastic sheeting (HDPE) to create a bunded, pool-like area to contain chemicals and run-off water).</p>	

The following steps and illustrations show the basic procedures for establishing a composting disposal area:

➤ STEP 1

If there is no concrete pad, hardstand or area of dense clay ground for the composting, lay sand bags in a large square on the ground, laying plastic sheeting over the top of the sand bags, leaving extra sheeting space to allow a second row of sand bags (see step 2).



➤ STEP 2

Lay a second square of sand bags on top of the plastic sheeting and outside the first square of sand bags to create a bundled area or pool-like area to contain any excess chemicals and water. Also see section 5.9.3 for a similar example.



➤ STEP 3

Pile the green material (e.g. green waste), and brown material (e.g. straw/manure) together, on a concrete pad or plastic sheeting.



➤ STEP 4

Mix green and brown material together and form piled rows, then add water until all compost is moist (damp) without saturating. Try to build or pile the material in the rows into a triangular shape at least twice as wide at the base as at the top. This will help the composting process.



STEP 5

Mix green waste and brown material (straw/hay/manure) together until well combined.



STEP 6

Moisten during mixing if dry.



Warning

- Manure can contain microorganisms which may be harmful to human health, particularly by breathing in dust from the manure.
- Always wear a dust mask for respiratory protection, as shown in section 2.1.2.
- Always wash hands and change clothing after handling manure.

STEP 7

Pour the solvent or chemical to be disposed over the compost evenly, but do not saturate the compost. As an approximate guide, application should be no more than 10 to 15 litres of chemical per cubic metre of compost. Once added, mix through the compost again.

Mix and turn the compost over, moving outside material into the middle, every 2 to 3 days to allow air into the composting mixture for at least the first four to six weeks. Maintain moisture as close to 40 per cent as possible.



STEP 8

Pile compost in tall rows, similar to the shape shown below. These are called “wind rows” and should be a triangular shape and at least twice as wide at the base as they are at the top.



Note

Mix and turn the compost over every 2 to 3 days to allow air into the composting mixture for at least the first 4 to 6 weeks. This is called aeration and along with moisture is a critical part of the composting process. As the compost starts to break down, the appearance will change, similar to the image on the right.



Figures V and VI below illustrate the basic layout or plan for a composting disposal area.

FIGURE V. AERIAL OR BIRD'S-EYE VIEW OF A BASIC COMPOSTING DISPOSAL AREA

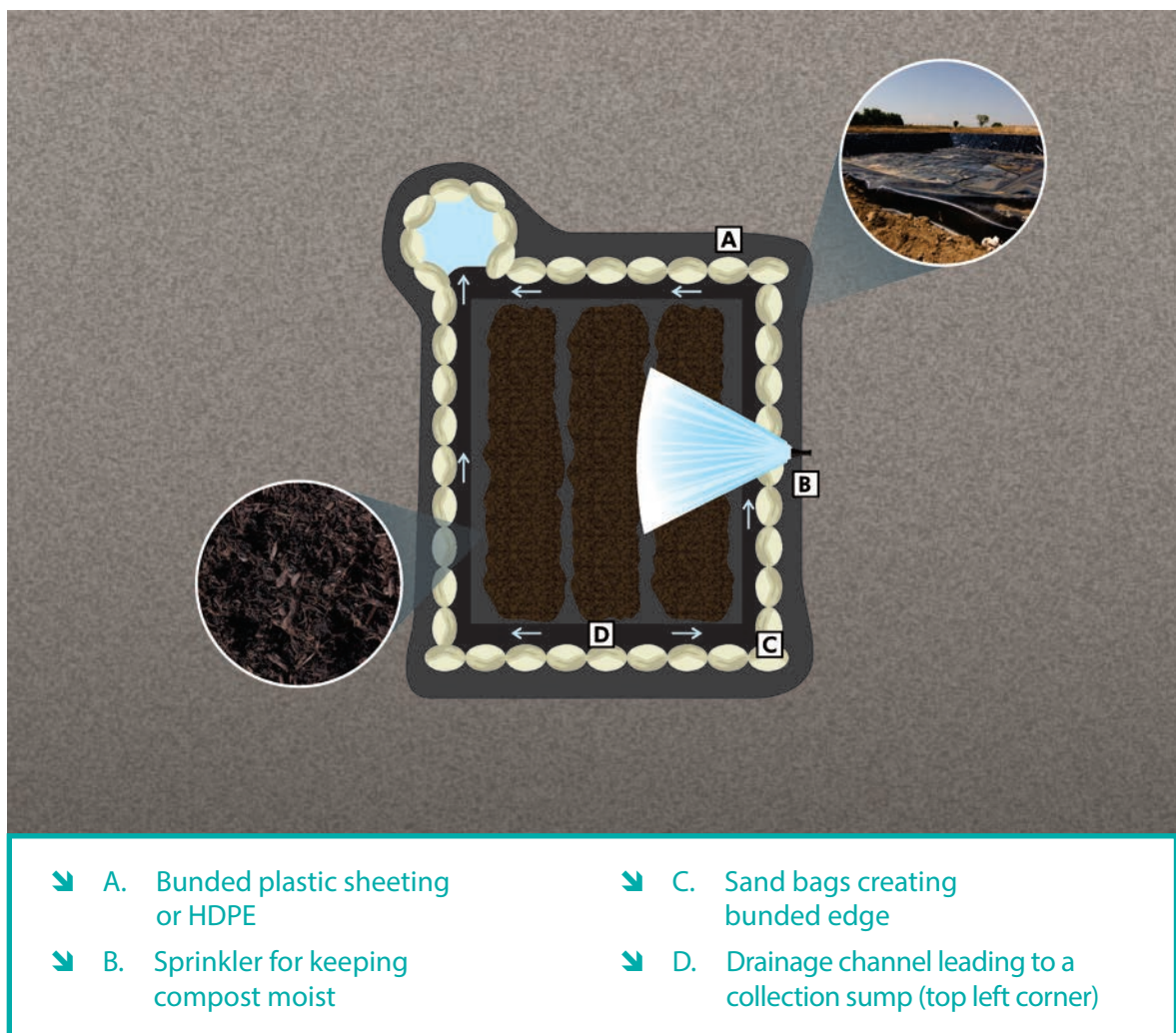
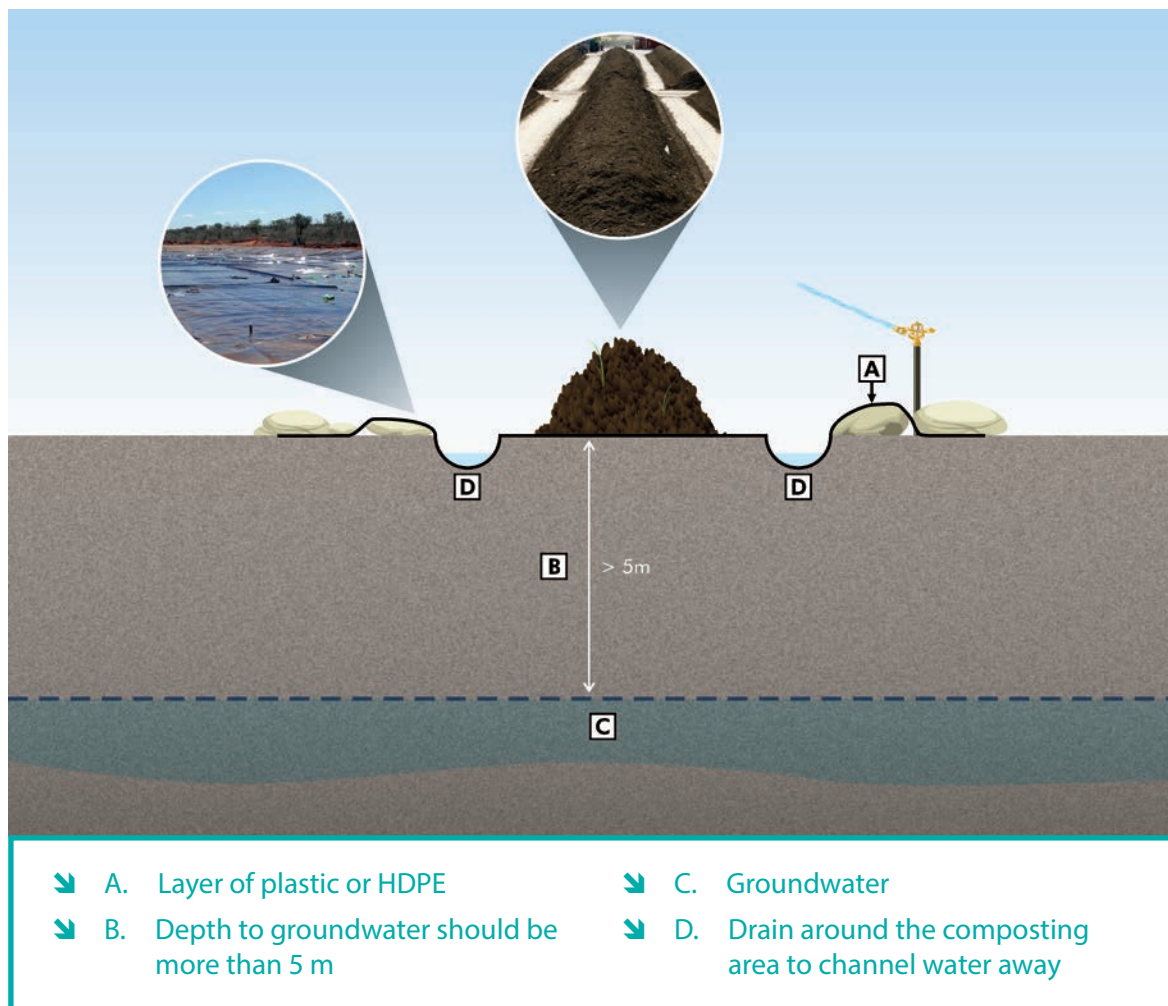


FIGURE VI. CROSS SECTION OF THE COMPOSTING DISPOSAL AREAS, AS SHOWN IN FIGURE V



Composting can be undertaken on a small scale or large scale and is technologically simple. Larger composting sizes allow the disposal of larger volumes of chemicals more quickly. The example below shows a large composting operation, located on a hardstand or concrete pad, with drains. Note that captured run-off water can be recycled and re-applied to the compost.

FIGURE VII. LARGE COMPOSTING OPERATION



Key information

- It is important to use a sealed area to prevent any excess chemicals from penetrating into the ground, where they could contaminate groundwater.
- This can be achieved using common plastic sheeting if no concrete pad is available.
- Composting time will depend on a range of factors including temperature, moisture and the effectiveness of microorganisms present. Time can vary from 3 to 6 months (under ideal conditions) for most chemicals listed as suitable in annex I.
- A minimum 6 months composting time is recommended and 12 months is an ideal safe composting time if no testing is available or conditions are not ideal.
- Manure is highly recommended as this adds additional microorganisms, which significantly assist in the composting process.
- Ideal temperature range for compost (in the pile) is between 60°C and 70°C (130°F to 160°F), and compost piles should be positioned in full sun.

- In colder climates, compost can be covered with black plastic to increase temperatures.
- Maintain an ideal moisture content of 30 to 40 per cent by ensuring that the compost remains only slightly damp.
- Compost should be turned and mixed (aerated) regularly, every 2 to 3 days, allow air into the compost mixture, for at least the first four to six weeks.
- The ideal pH range for composting is 6.5 to 8.5. The pH can be increased by adding lime or lowered by adding sulphur, aluminium or ferrous sulphate or by carefully adding a small amount of weak dilute acid such as acetic or phosphoric acid (diluted at least 50:1 with water).
- Add solvents or chemicals sparingly, no more than 3 per cent by weight, e.g. approximately 10 to 15 litres of solvent or chemical per cubic metre of compost as an approximate guide.
- Composting can be done on a small or large scale, depending on the volume of chemicals to be disposed.
- Composting may be accelerated by the addition of a small amount of nitrogen and/or phosphorous-based fertilizers.

Warning

- Composting is only suitable for chemicals listed in annex I which are indicated as being suitable for composting by the symbol shown on the right.
- Do not saturate the compost with the solvent or chemical to be disposed of, as this may prevent the microorganisms from working.
- Do not use manure from meat-eating animals or pigs. These manures may contain harmful bacteria.
- Regular aeration (turning or mixing) of the compost is important to maximize the degradation rate and allow oxygen to penetrate. Low oxygen levels allow reactions, which can lead to the formation of harmful chemical by-products.
- Manure can contain microorganisms, which may be harmful to health, particularly by breathing in dust from the manure.
- Always wear a dust mask (as shown in section 2.1.2) for respiratory protection,
- Always wash hands and change clothing after handling manure.
- When composting is complete, the compost should be tested to ensure that no toxic chemicals or breakdown products (metabolites) remain before it is used on gardens or other soil areas. If testing is not available, the compost should not be used on food crops as a precaution.



5.5 Burial

Chemicals are sometimes seized in remote areas, which may lack waste management infrastructure, suitable transportation or readily available disposal or treatment equipment. In these situations, remote burial may present the only practical disposal option. Under certain circumstances, some non-hazardous chemicals may also be buried in landfills.

This section focuses on two types of burial procedures, namely:

- Remote burial—for use in isolated locations, where no other disposal options exist
- Landfill burial—for non-hazardous chemicals.

The disposal of hazardous chemicals in non-engineered landfills is not recommended. Burial of chemicals should only be undertaken in

situations where there are no alternative means of treatment and there is an immediate need for the disposal of the chemicals. Local laws and waste regulations should be followed and all necessary approvals obtained.

Burial of chemicals may cause localized environmental harm. However, potential risk can be significantly reduced by following the guidance on selection of disposal locations in section 4.1.

Burial of some chemicals, particularly non-hazardous solids and several other chemicals listed in annex I, pose a low environmental risk. Burial therefore provides a suitable option for these chemicals. Solid chemicals, subject to the warning below, should always be removed from packaging when being buried. The mixing of solids with soil during burial will also generally render them very difficult to recover.

Warning

- ✎ Most chemicals indicated as being appropriate for burial in annex I are listed based on their potential or ability to safely break down in the environment, and can be tipped or poured directly into a burial pit or trench.
- ✎ Only one chemical should be placed in each pit to avoid potential reactions.
- ✎ There are some hazardous chemicals, which must *not* be removed from their packaging, including any substance showing the following hazard warning labels:



- ✎ These chemicals are listed in annex I.



5.5.1 Remote burial

In remote locations, moving or transporting chemicals may not be possible. The recommended buffer distance for most sensitive locations from a disposal location, such as a burial pit or trench, is between 750 and 1,000 m. However, if this is not possible due to the nature of the terrain or safety considerations, a minimum of 500 m from any river, stream or waterway is required. Also, when selecting the disposal location, look for elevated (high) ground, which is likely to have a greater depth to groundwater.

➤ STEP 1

Select a suitable location for the remote burial pit or trench, following buffer distances shown in section 4.1 where possible. The example below shows two possible disposal locations, location 1 (bottom left) on elevated ground 750 m from the river and away from the village and farm land, and location 2 (top right) on high ground away from the valley floor.



➤ STEP 2

Dig a pit or trench between 2 and 3 m deep, or to a depth that allows at least 1 m of soil over the top of the buried chemicals. For safety reasons, do not dig below 3 m as earth walls may collapse. If necessary, dig more than one pit or trench to accommodate all the chemicals requiring burial. Only one type of chemical should be placed in each pit or trench.



➤ STEP 3

Remove chemicals from packaging, bags or drums and pour into the hole (*except those listed in the warning provided in section 5.5*). At the same time, add soil back into the pit, allowing the chemical and soil to mix. Only fill with chemicals to within 1 m of the surface, then fill the remainder with soil only.

➤ STEP 4

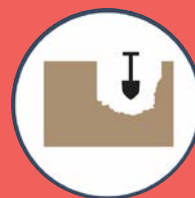
When the chemicals are within 1 m of the surface, refill the pit or trench with soil and make a mound (small hill) out of the remaining soil over the top of the pit or along the trench line. This will help rainwater run away from the burial area and reduce pooling of water and infiltration (or soaking) of water, which can speed up transport of the chemicals to groundwater.

Key information

- Select locations on elevated ground. For remote locations, this should be at least 500 m from any waterway.
- Pits or trenches should be between 2 and 3 m deep.
- When disposing of solid chemicals, pour in a layer of chemical followed by a layer of soil on top, then more solid chemical, and repeat this process.
- Ensure at least 1 m of soil covers the buried chemicals.
- Mound soil over the pit or trench to reduce infiltration or pooling of rainwater.
- If plastic sheeting is available, placing a layer of plastic sheeting over the chemical and soil mix, with 1 m of soil mounded over the top, will reduce leaching of chemicals.

Warning

- Only chemicals showing the remote burial symbol in annex I are considered suitable for remote burial.
- There should be no groundwater or seepage of any water into the pit.
- If water or seepage is visible in the pit, abandon and seek an alternate location on higher ground (see section 4).



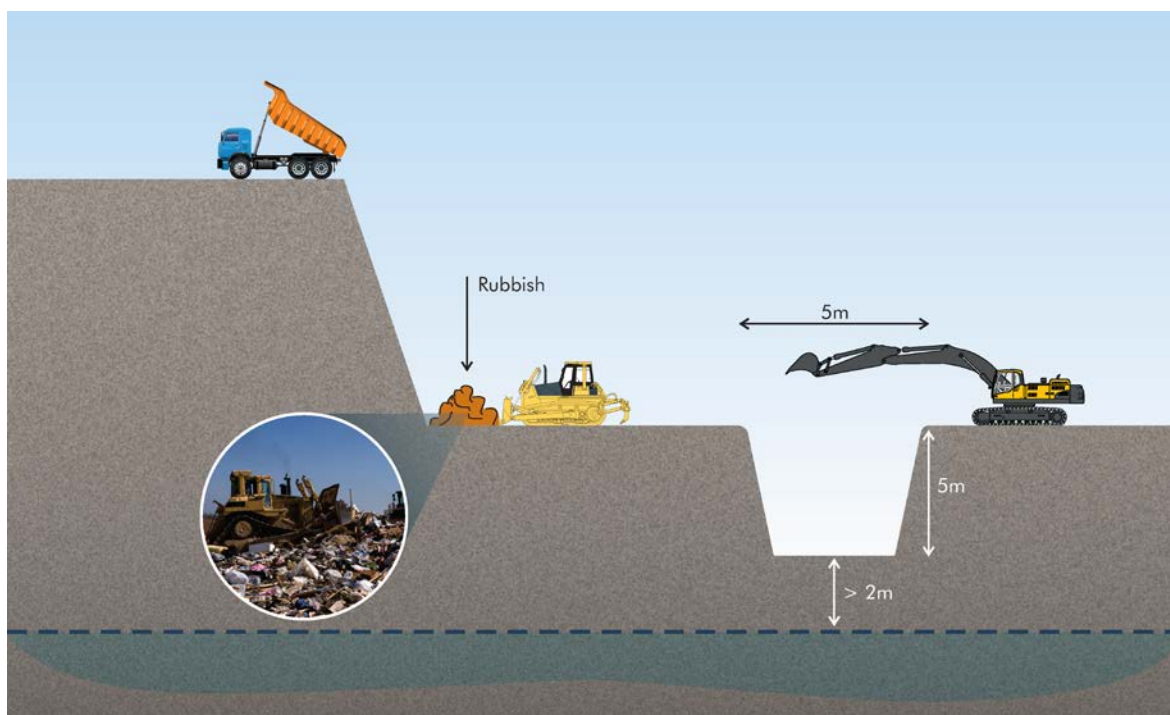


5.5.2 Landfill burial

The disposal of hazardous chemicals in non-engineered landfills is *not* recommended. Only non-hazardous chemicals listed in annex I, showing a landfill burial symbol, should be disposed in landfills. Chemicals including unknown chemicals and controlled substances which have been rendered inert in accordance with the "rendering inert" procedure in section 5.8 of this manual, may also be safely disposed to landfills using the following procedure. Local laws and waste regulations should be followed.

➤ STEP 1

Excavate a burial pit that is approximately 5 m deep and 5 m wide. The pit must be at least 2 m above the groundwater table.

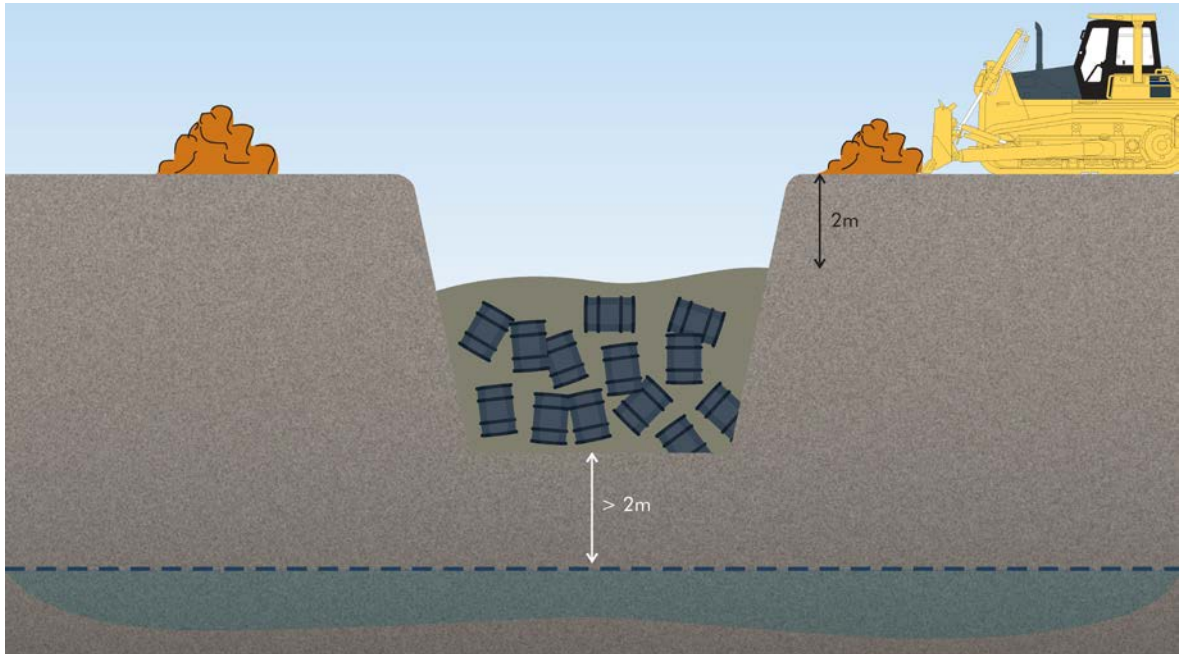


Warning

- Only non-hazardous or inert chemicals should be disposed of by burial in landfill. The disposal of chemicals *must comply* with local laws or regulations pertaining to the classes of waste that can be lawfully disposed in landfills.
- Check local regulations before undertaking a landfill burial.
- A layer of crushed or recycled concrete, building rubble or rock will normally consolidate (or harden) over the buried waste, and is important to provide a barrier to reduce the likelihood of people digging up the buried chemicals.

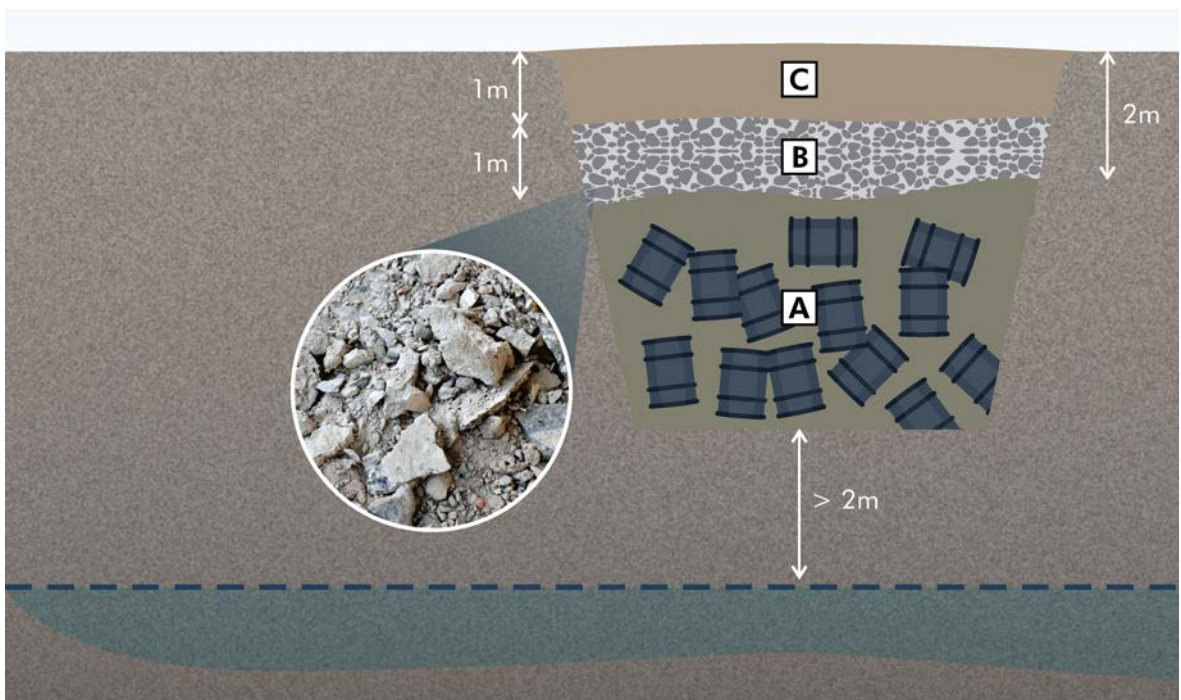
STEP 2

Place non-hazardous or inert chemicals into the pit, filling to a maximum of 2 m from the surface.



STEP 3

Place a 1 m layer of crushed or waste concrete, building or demolition rubble or rock over the top of the chemicals. Cover with 1 m of soil and finish or compact to ground level.



➤ A. Non-hazardous chemicals

➤ B. Concrete or rubble

➤ C. Soil fill



5.6 Infiltration of non-hazardous or degradable liquids

Infiltration is a process where non-hazardous liquid chemicals and some weak or neutralized acids, can be disposed of by pouring them directly into a trench, and allowing them to simply soak into the ground or volatilize (evaporate).

This simple process provides an effective and rapid disposal method only for those chemicals listed in annex I, which show the infiltration symbol. Some non-hazardous or readily biodegradable liquid chemicals and neutralized acids pose a very low risk to the environment and will be broken down or further neutralized by the soil's natural neutralizing properties (or buffering capacity).

Any acids listed in annex I showing an infiltration symbol are only suitable for this disposal procedure once they have been neutralized in accordance with the procedure set out in section 5.9.1. Neutralization must not be carried out in the trench.

To provide an additional level of protection for the environment, it is recommended that no more than 1,000 litres of any chemical, listed as suitable for infiltration, should be disposed at any one location.

➤ STEP 1

Follow the selection of a suitable disposal location outlined in section 4 and dig a shallow trench 30 cm (12 inches) deep and approximately 10 m in length. Multiple trenches can be dug where necessary depending on the volume of chemicals. The trenches should be at least 10 m apart.

➤ STEP 2

Once all non-hazardous or degradable chemicals have been poured into the infiltration trench, and have mostly soaked away, the trench can be filled in.



Shallow trench, 30 cm or 12 inches in depth

Key information

- No more than 1,000 litres of any chemical, listed as suitable for infiltration, should be disposed at any one location.
- Depending on the soil type, the chemicals will infiltrate (soak away) at different rates.
- Sandy soils will allow non-hazardous chemicals to soak away at a much higher rate than dense clay soils.
- If water is available, chemicals may be diluted at a rate of 1:10 with water, to assist or speed up the infiltration.

Warning

- Even where chemicals are non-hazardous, it is still recommended that the selection of disposal location procedures, as outlined in section 4, is followed.
- Only non-hazardous or degradable chemicals showing the infiltration symbol in annex I are considered suitable for disposal by infiltration.
- Acids that show an infiltration symbol must be neutralized before disposal in accordance with section 5.9.1.
- Acids should not be neutralized within the infiltration pit.



5.7 Encapsulation

Encapsulation is a form of waste immobilization that renders the material to be disposed of unreactive and unable to escape into the environment to cause contamination. This guide focuses on two procedures for encapsulation, namely:

- Drum encapsulation—a relatively simple procedure for small- to medium-scale disposal
- Pit encapsulation—also referred to as a “containment cell”, for large disposals

Drum encapsulation can be undertaken in most environments requiring only drums and concrete.

Containment cells are more complex to construct and require a number of materials such as plastic (high-density polyethylene, HDPE) sheeting and a ready supply of concrete and equipment. However, a containment cell provides a high level of long-term protection for the environment.

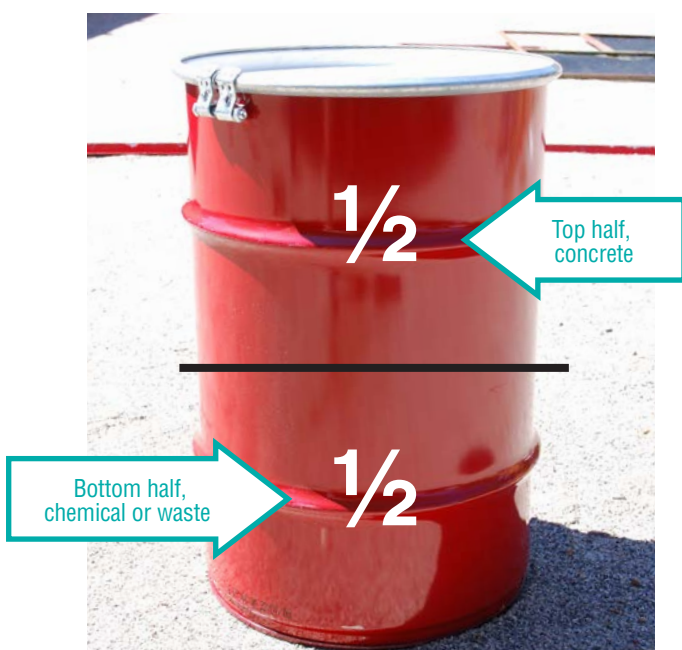
Drum encapsulation

STEP 1

Prepare drums (steel or plastic drums can be used) in accordance with the procedure in section 5.2.1.

STEP 2

Half fill drum with chemicals or waste (for unknown waste, see section 2.5), and fill remaining half with concrete (leave 8 cm (3 inches) at top). Then mix together with a wooden pole or other stirring device, until a consistent mixture is achieved. Add more water if necessary.



STEP 3

Allow to stand uncovered for 6 to 10 hours for the concrete to set (harden), then reseal the drum.



STEP 4

Bury the drums using a similar procedure to that of landfill burial (see section 5.5.2). There is no need for a layer of recycled concrete or rubble to be used during burial.

Warning

- Before mixing any chemicals or wastes with concrete, combine a small quantity of the chemical or waste to be encapsulated and a small amount of concrete, in a separate container. Observe for any reactions, such as production of vapour or heating. If any gases or vapour are released or significant reactions occur, use an alternative disposal method. Acids should not be neutralized within the infiltration pit.

Pit encapsulation

Pit encapsulation is a more complex disposal method. However, the materials required are relatively simple and are likely to be available in larger towns. The main materials required are:

- High-density polyethylene (HDPE) plastic sheeting—a thick heavy (usually black) plastic sheeting. If HDPE is not available, use multiple overlapping layers of normal plastic sheeting.

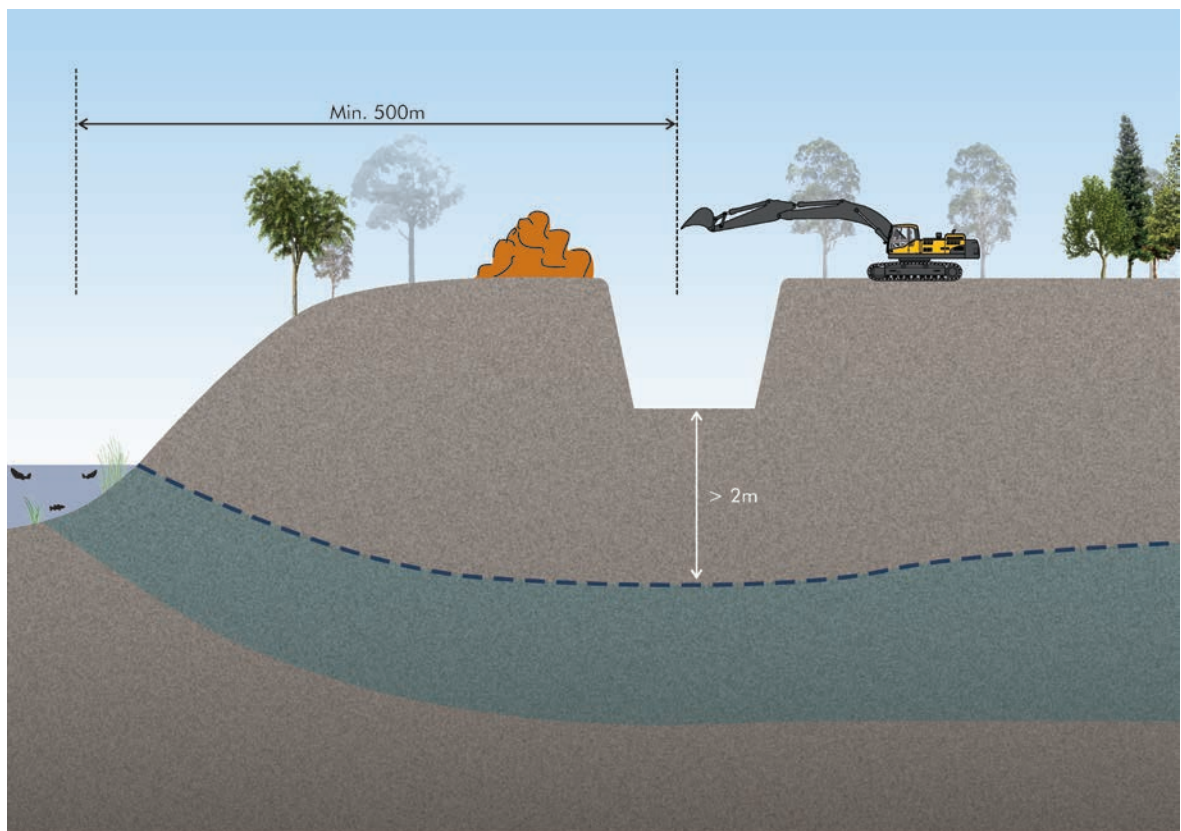
- A supply of concrete—depending on the size of the encapsulation, a large quantity of concrete may be required.
- Heavy equipment such as an excavator may be required.

Pit encapsulation is a useful disposal method as it can be done on a small or large scale.

The following images outline the basic procedures for, and principles of pit encapsulation:

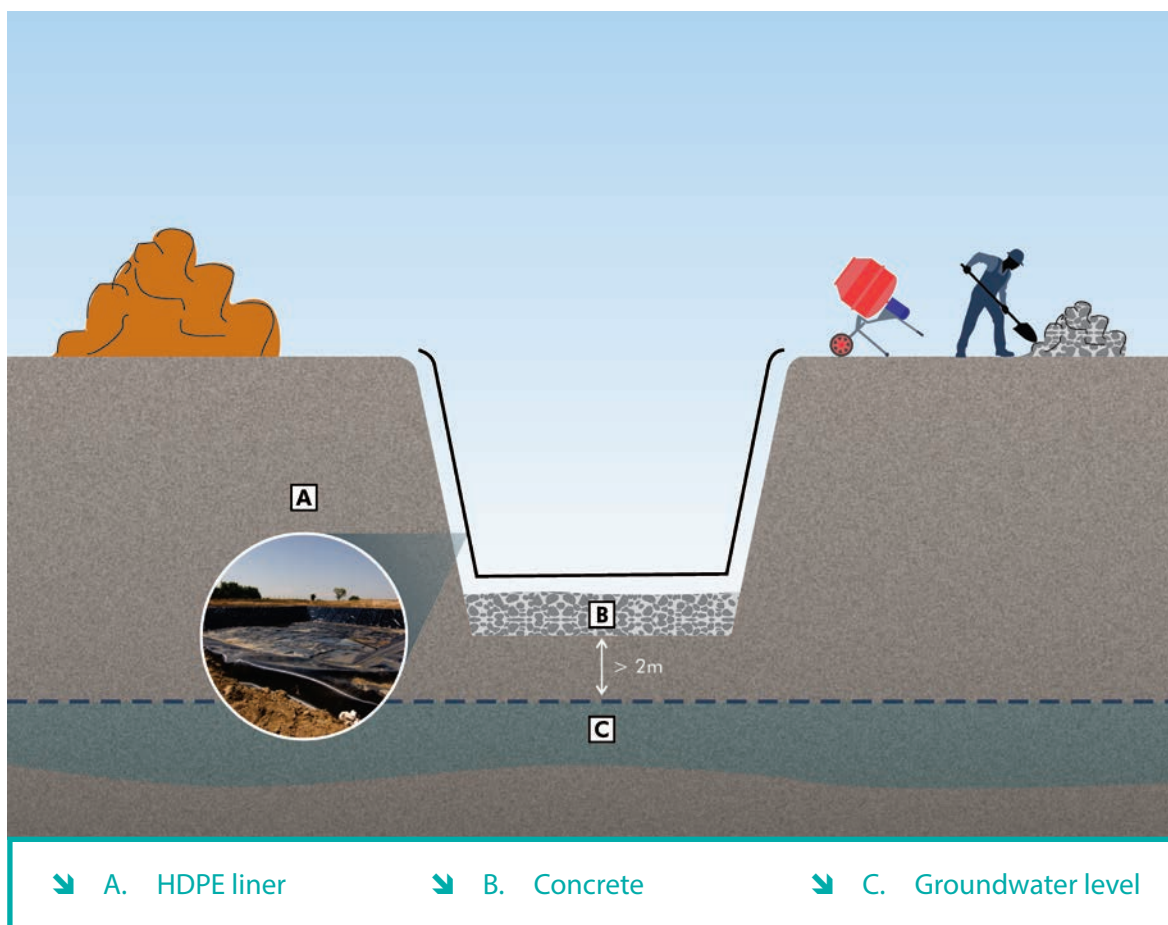
STEP 1

Select a suitable disposal location in accordance with section 4. The encapsulation pit must be a minimum of 500 m from any waterways and at least 2 m above groundwater. The size and depth of the pit may vary but should allow for 1 m of fill on top.



STEP 2

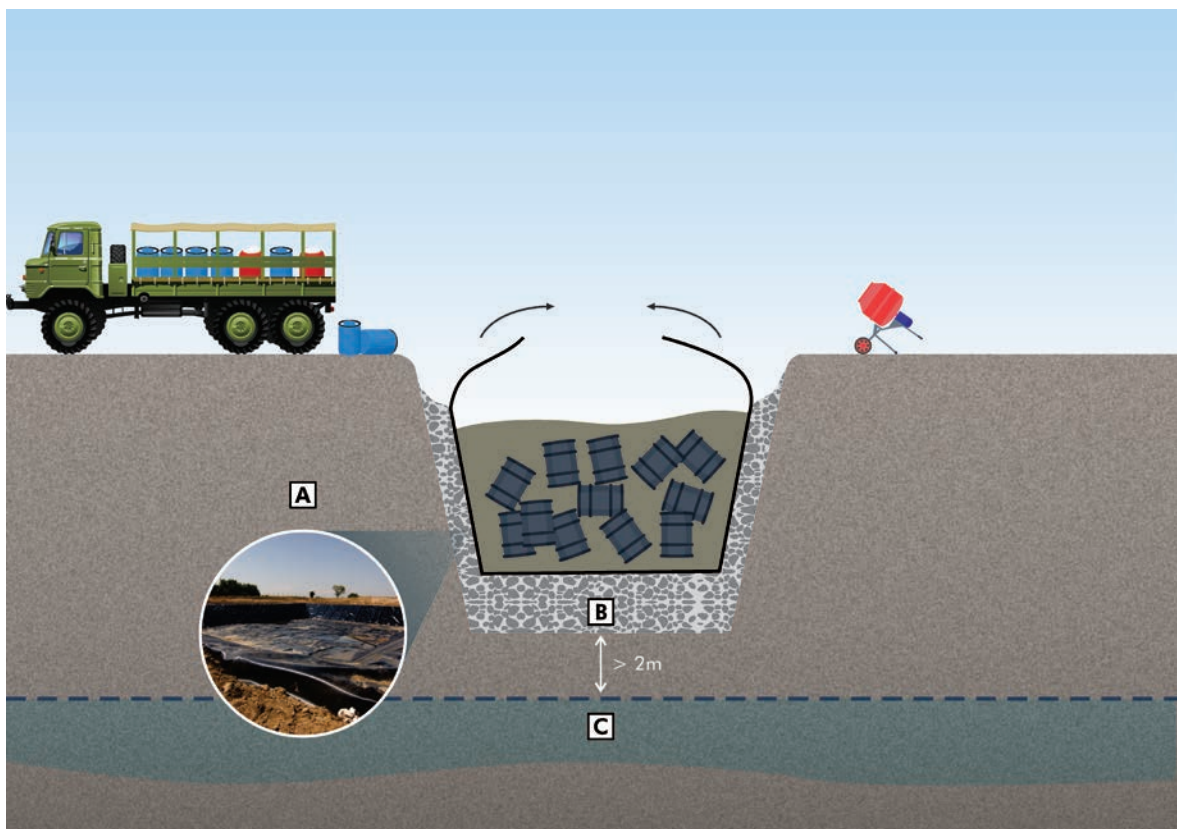
Place a layer of half a metre of concrete in the base of the pit. Once the concrete is dry, line the pit with the HDPE or multiple overlapping layers of plastic sheeting. Where possible use 25 to 32 MPa concrete (hardened concrete).



STEP 3

Follow numbered steps below:

1. Place the chemicals into the middle of the plastic liner.
2. Pull the liner up around the drums or other containers and ensure that a minimum of 0.5 m of clear space is left between the liner and the sides of the pit.
3. Working around the pit, slowly fill concrete into the 0.5 m gap between the liner and the side of the pit.
4. It is recommended to do one layer of between 0.5 m and 1 m at a time, working around the edge of the pit, instead of trying to fill one side at a time.
5. Once outside concrete is at the top of the drums or containers, and 1 m below ground level, fold or close the plastic liner over the top of the drums or containers and seal closed, and allow the concrete at the side time to set (harden).



➤ A. HDPE liner

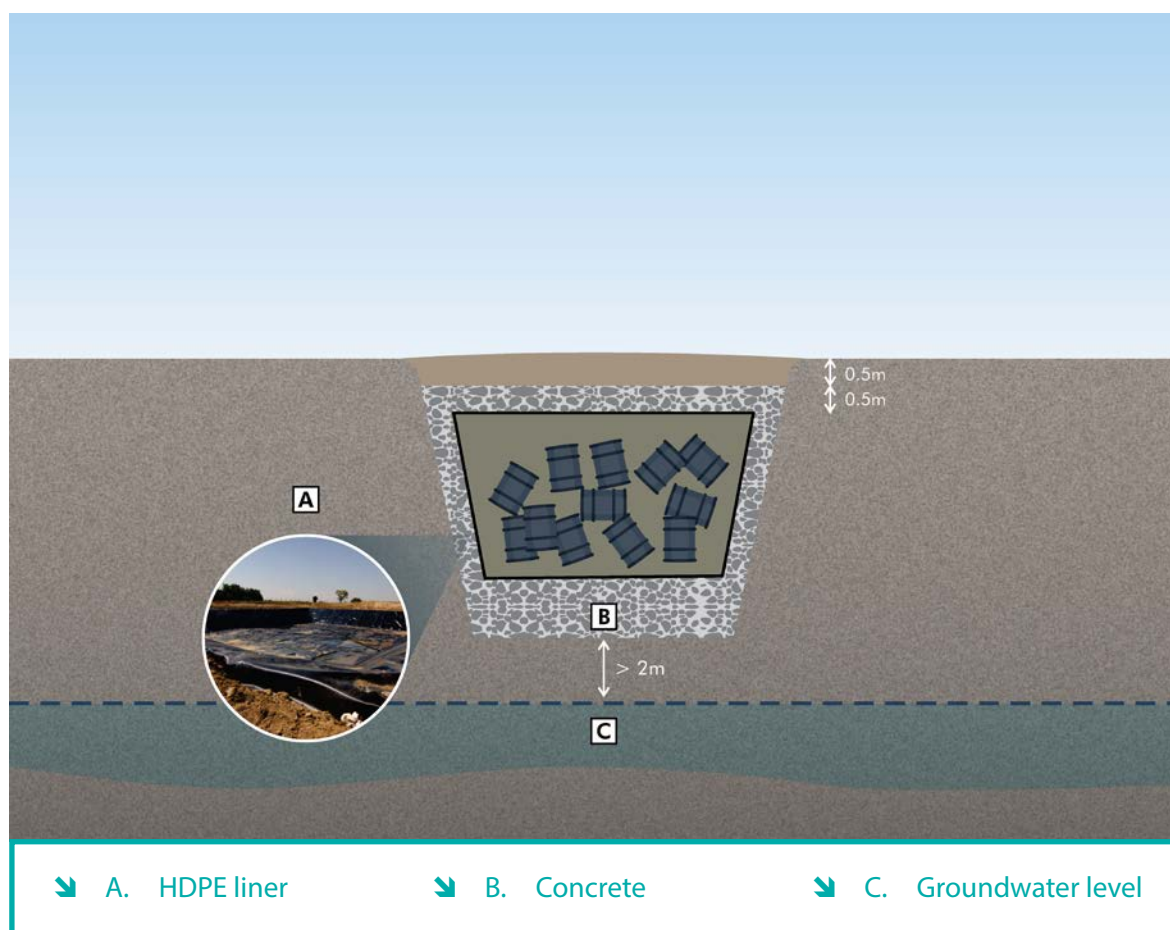
➤ B. Concrete

➤ C. Groundwater level

➤ STEP 4

Follow the numbered steps below:

1. Place a further 0.5 m of concrete over the top of the drums or containers, sealed under the HDPE or plastic liner.
2. Allow 1 to 2 days for the concrete to set (harden).
3. Fill in the remainder of the pit with soil and contour the top in a slight mound (hill) to direct any surface rainwater away from the pit area.
4. Once completed, the construction is referred to as a containment cell.





5.8 Rendering inert

Rendering inert is the process of making a chemical inert or unreactive, so it cannot be reused. As this makes the substances unuseable, it is one of the main disposal methods recommended for precursor chemicals or controlled substances.

The process is similar to drum encapsulation in section 5.7 and is simple and easily achieved as shown in the following procedure:

➤ STEP 1

Select and prepare drums in accordance with section 5.2.1. It is recommended to use steel drums. Smaller 60-litre drums are easier to handle and move once filled with concrete, and are recommended for use, where available.

➤ STEP 2

Remove any tablets (controlled substances) from packaging and crush. However, if there is a large number or volume of tablets, and it is not practical to crush them, place them directly into the drums.



Remove any packaging

➤ STEP 3

Fill drum to the half-full mark with chemical, precursor or controlled substances.



➤ STEP 4

Mix concrete and fill the remaining half drum with concrete. Stir with a wooden pole to ensure a consistent mixture is achieved. Add additional water if necessary.



↘ STEP 5

Fill to within 8 cm (3 inches) of the top of the drum and allow to stand uncovered for 6 to 10 hours for the concrete to set (harden), then reseal the drum.



Reseal drum

↘ STEP 6

Bury the drums using a similar procedure to landfill burial, section 5.5.2 (there is no need for a layer of recycled concrete or rubble to be used during burial).

5.9 Neutralization

Neutralization of acids and bases involves combining either an acid with a base (or basic solution) or the base with an acidic solution to change the pH (the measure of acidity) to a neutral (unreactive) level (around pH 7).

- Acidic = pH 0 to less than 7
- Neutral = pH 7 (relatively unreactive)
- Basic or alkaline = pH greater than 7, e.g. between 7 and 14-16

pH indicator strips (or a correctly calibrated pH meter) are necessary for determining the pH of a mixture in the field. pH indicator strips (sourced from common domestic pool testing kits) are a cost effective and easy method of determining pH. These use colour changes on the test strip with a reference chart on the kit to determine the pH.

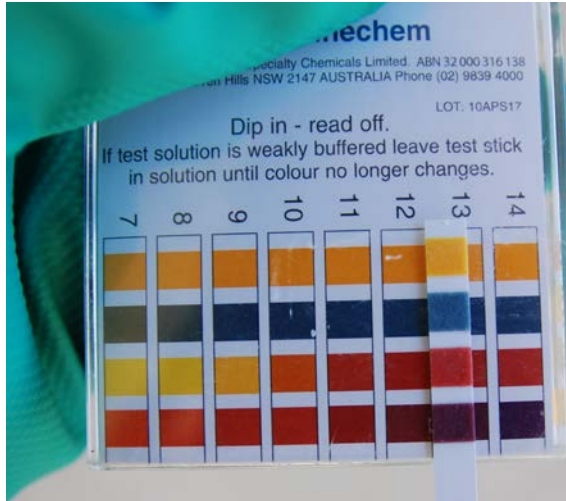
FIGURE VIII. PH INDICATOR STRIP SHOWING AN ACID PH OF 2

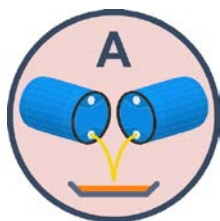


FIGURE IX. PH INDICATOR STRIP SHOWING AN ALMOST NEUTRAL PH OF 6-7



FIGURE X. PH INDICATOR STRIP SHOWING A BASIC (ALKALINE) PH OF 14





5.9.1 Acid neutralization

Warning

- A minimum of PPE level C (see section 2.1.2) must be worn for this procedure.
- Care must be taken, as this procedure will generate heat and can cause the water to boil.
- Face shields and chemical aprons should be worn as additional protection, if available.

The following procedure outlines the basic steps for the neutralization of common acids:

➤ STEP 1

Dilute acids 1:10 by volume with water. As an approximate guide, use a 10-litre bucket and fill with approximately 9 litres of water. Then *slowly* add approximately 1 litre of acid to the water, *never the other way around* (i.e. never add the water to the acid).



STEP 2

Three quarters fill a cut plastic drum, prepared in accordance with section 5.2.1, with water. It is highly recommended that an ice-water solution is used (as shown below, if ice is available, as the neutralization of acids can generate significant heat).



Water or
ice-water solution

STEP 3

Add a base material such as lime (calcium hydroxide or calcium oxide, or standard agricultural lime), to the ice-water solution, and mix to obtain a saturated base solution. As a guide, add approximately 10 kg of lime to 100 litres of water or ice-cold water.



STEP 4

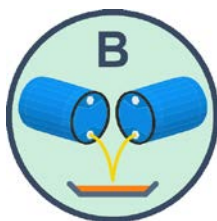
Stir the water or ice-water/base solution *constantly* while a second person *very slowly* pours the diluted acid into the base solution.

**STEP 5**

Test the pH regularly until a pH between 6 and 9 is reached. Note: more lime can be added if necessary.

**STEP 6**

When an approximately neutral pH is reached of between 6 and 9, pour into an infiltration trench or pit in accordance with section 5.6 and allow to permeate into the soil.



5.9.2 Base neutralization

A minimum of PPE level C must be worn. The following procedure outlines the basic steps for the neutralization of common bases:

➤ STEP 1

Add the base (*solid or liquid*) to a half or cut drum (or other large vessel, e.g. a concrete trough) filled with water in a ratio of 1:10 (one part base to 10 parts water). Plastic drums are recommended if possible (ensure the drum is prepared in accordance with section 5.2.1).



➤ STEP 2

Dilute hydrochloric acid approximately 1:10 with water, as shown in section 5.9.1 (Acid neutralization), step 1. Always add acid to water *slowly, never reverse the order of mixing, i.e. never add the water to the acid*.



➤ STEP 3

Slowly add the diluted hydrochloric acid to the drum or vessel containing the base solution.

**➤ STEP 4**

Test the pH regularly until a pH between 6 and 9 is reached.

**➤ STEP 5**

When an approximately neutral pH is reached between 6 and 9, pour into an infiltration trench or pit in accordance with section 5.6 and allow to soak away.

Key information

- Always add acids to water very slowly.
- When neutralizing acids and bases, particularly uncontaminated or concentrated acids and bases, bubbling and steam may occur. This is not uncommon.
- Heat may also be released and the drum or vessel may become hot.
- Lime is the preferred base for acid neutralization as it forms less water soluble salts, making them safer and easier to dispose of.

Warning

- ✎ The use of a minimum of PPE level C (see section 2.1.2) is essential during acid and base neutralization.
- ✎ Always add acid to water *slowly*, never reverse the order of mixing, i.e. never add the water to the acid.
- ✎ If undiluted acids are accidentally added to water, or water is accidentally added to an acid, a vigorous (violent) reaction can occur resulting in the splashing of acids onto the personnel undertaking neutralization.
- ✎ Splashing and bubbling are also not uncommon even using diluted acids. Therefore where available, chemical aprons and face shields should be used to provide additional protection.
- ✎ Acids should not be neutralized within the infiltration pit.

5.9.3 Large-scale acid base neutralization and evaporation

Where significant (bulk) volumes of acids or bases require neutralization and disposal, the following bulk neutralization and evaporation procedure may be used. This procedure is based on the neutralization procedure for acid and bases outlined in sections 5.9.1 and 5.9.2.

However, these are carried out in large tanks, usually 500 litres (if available), positioned at the edge of a bunded area, where the neutralized acids and/or bases can be drained into after neutralization and allowed to evaporate.

Key information

- ✎ In this procedure, the same neutralization procedures shown in sections 5.9.1 and 5.9.2 are used on a larger scale, using an evaporation dam.
- ✎ Neutralization is carried out in large tanks, usually 500 litres, with a tap or valve to allow the neutralized acids or base to drain directly into the evaporation dam.
- ✎ Any residue remaining after evaporation is normally a simple or non-hazardous salt, and can be disposed of using either remote or landfill burial procedures shown in section 5.5.

➤ STEP 1

Prepare a flat and level area on firm ground, clearing away any vegetation or other objects (rock or branches). Remove any sharp object/protrusion that might puncture or pierce the sheeting. Then arrange sand bags in a large rectangular shape as shown below. The size of the rectangle will depend on the size (width and length) of the available plastic, rubber or HDPE sheeting. (Note, for this procedure HDPE sheeting or durable plastic/rubber sheeting such as a pool-liner, with high burst strength, should be used).



➤ STEP 2

At one end of the rectangular area, position drums or tanks (cut open at the top), for the neutralization process. It is easiest to position the plastic sheeting at one end and roll out to cover the area and sand bags, to create a bunded (pool-like) evaporation area.



➤ STEP 2 (cont.)

It is recommended to use drums or chemical tanks with a valve or tap, which can be opened to allow neutralized acid or bases to drain directly into the bunded evaporation area. Heat generated may also cause safety and equipment issues or failures, such as melting any taps or valves, which may be screwed into the tanks.



If using a chemical tank, ensure it is clean and cut open for easy mixing of chemicals

Valve or tap for draining directly into evaporation area

Sand bags

➤ STEP 3

Sand bags are arranged in a rectangle appropriate in size to allow the plastic, rubber or HDPE sheeting to completely cover the area. Allow at least 1 m of overhanging plastic or sheeting (held down with additional sand bags). Then fill with water to a depth of approximately 2.5 cm (1 inch).



➤ STEP 4

Once the bunded evaporation area is filled with water, inspect to ensure that the plastic liner is lying flat and no leaks are visible.



Bunded (pool-like) area

➤ STEP 5

The evaporation area is now ready for use.







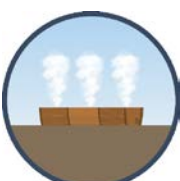


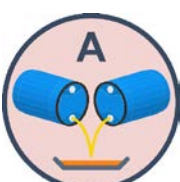


The neutralized acids or bases can be drained directly into the evaporation area by opening the valve or tap on the neutralization or mixing tank. Personnel performing this should use the correct PPE and all other personnel should be kept at a safe distance of at least 25 to 50 m (80 to 160 ft).

Warning




















































- A minimum of PPE level C must be used (see section 2.1.2). However, if PPE level B is available, this is highly recommended.
- Neutralization of acids, particularly sulfuric acid, can generate a significant amount of heat and can even cause the water within the neutralization tank to boil.
- Heat generated may also cause safety and equipment issues or failures, such as melting any taps or valves, which may be screwed into the tanks.
- Equipment should be checked between each batch/neutralization to ensure it is safe.













































Annexes













































Annex I. Summary of disposal symbols























































Disposal method	Disposal symbol	Disposal method	Disposal symbol
Open-air burning of volatile solvents		Burial in landfill	
Open-air burning of combustible and semi-combustible liquids		Infiltration (soaking into soils) of non-hazardous liquids	
Open-air buring using a pit		Encapsulation (casing in cement)	
Evaporation		Rendering a substance inert	
Composting or bioremediation		Neutralization of acids	
Remote burial		Neutralization of bases	

















































Annex II. Quick reference guide for chemical disposal














































Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
Acetic acid	64-19-7	2789	 					   
Acetic anhydride	108-24-7	1715	 					  
Acetone	67-64-1	1090						  
N-Acetyl-anthranilic acid	89-52-1							  
Activated carbon	7440-44-0	1362						 
Allyl chloride	107-05-1	1100	 			 		  
Aluminium (metal)	91728-14-2							 
Aluminium powder	7429-90-5	1309						 
Aluminium chloride	7784-13-6	1726						

















































Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
				1st	2nd	3rd	4th	
Aluminium chloride (anhydrous)	7446-70-0	1726						
Ammonium carbonate	506-87-6							 
Ammonium formate	540-69-2							  
Anthranilic acid	118-92-3							  
Benzaldehyde	100-52-7	1990						 
Benzene	71-43-2	1114						  
Benzoquinone	106-51-4	2587						 
Benzyl chloride	100-44-7	1738	 					  
Benzyl cyanide	140-29-4	2470						  










































Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
1st	2nd	3rd	4th					
Bromobenzene ⁽²⁾	108-86-1	2514						 
N-Butanol	71-36-3	1120						   
N-Butylamine	109-73-9	1125	 					  
Calcium bicarbonate	3986-19-5							 
Calcium carbonate (limestone)	471-34-1							 
Calcium hydroxide (Slake lime)	1305-62-0							 
Calcium oxide (Quick lime)	1305-78-8							 
Catechol	120-80-9							 
Charcoal	7440-44-0							 















































Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
				1st	2nd	3rd	4th	
O-Chloroacetanilide	533-17-5							 
Chloroacetone (1-Chloro-2-propanone)	78-95-5	1695	 					  
2-Chloroaniline	95-51-2	2019						 
Chloroephedrine	25394-33-6							 
Chloroform	67-66-3	1888						 
Diacetone alcohol	123-42-2	1148						 
Dichloromethane ⁽²⁾	75-09-2	1593						  
Diethylamine	109-89-7	1154	 					   
Dimethylformamide	68-12-2	2265						   
































Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
1st	2nd	3rd	4th					
Ephedrine	134-71-4							 
Ethyl acetate	141-78-6	1173						  
Ethyl alcohol	64-17-5	1170						  
Ethyl ether ⁽¹⁾ (Diethyl ether)	60-29-7	1155						 
Ethylamine	75-04-7	1036						Expert technical support required
Ferric chloride	7705-08-0	1773						 
Formamide	75-12-7							  
Formic acid	64-18-6	1779	 					  
Glacial acetic acid	64-19-7	2789	 					  











































Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
				1st	2nd	3rd	4th	
Hexane	110-54-3	1208						  
Hydriodic acid	10034-85-2	1787						
Hydrobromic acid	10035-10-6	1788						
Hydrochloric acid	7647-01-0	1789						
Hydrogen bromide gas ⁽³⁾	10035-10-6	1048	 					Expert technical support required
Hydrogen chloride gas ⁽³⁾	7647-01-0	1050	 					Expert technical support required
Hydrogen gas ⁽³⁾	1333-74-0	1049						Expert technical support required
Hydrogen peroxide	7722-84-1	2014	 					
Hydroxylamine HCl	7803-49-8	3082						










































Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
1st	2nd	3rd	4th					
Hypophosphorous acid	6303-21-5	3264						
Iodine	7553-56-2	3495	 					 
Iron filings	7439-89-6	1378						 
Isopropyl alcohol	67-63-0	1219						  
Isosafrole	120-58-1							 
Kerosene	8008-20-6	1223						 
Lead acetate	6080-56-4	1616						
Lithium aluminium hydride ⁽⁴⁾	16853-85-3	1410						  
Lithium metal ⁽⁴⁾	7439-93-2							  









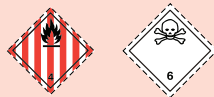
















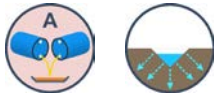







Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
				1st	2nd	3rd	4th	
Magnesium bromide (anhydrous)	7789-48-2							 
Magnesium metal ⁽⁴⁾	7439-95-4	1869						 
Magnesium sulfate	10034-99-8							 
Mercuric bromide	7789-47-1	1634						
Mercuric chloride	7487-94-7	1624						
Mercuric nitrate	10045-94-0	1625						
Mercury metal	7439-97-6	2809	 					
Methyl alcohol	67-56-1	1230	 					   
Methyl ethyl ketone ⁽¹⁾	78-93-3	1193						 






























Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
1st	2nd	3rd	4th					
Methylamine (40 per cent solution in water)	74-89-5	1235	 					  
Methylamine gas ⁽³⁾	74-89-5	1061						Expert technical support required
Methylamine HCl	593-51-1							  
Methylene bromide ⁽²⁾	74-95-3	2664						 
Methylene chloride ⁽²⁾ (see dichloromethane)	75-09-2	1593						 
3,4-Methylene-dioxy-phenyl-2-propanone (3,4-MDP-2-P)	4676-39-5							  
Methylformamide	123-39-7							 
Methyl isobutyl ketone	108-10-1	1245						  
Nitroethane	79-24-3	2842						 

Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
				1st	2nd	3rd	4th	
Norephedrine	154-41-6							
Norpseudoephedrine (Phenylpropanolamine)	36393-56-3							
Palladium chloride	7647-10-1	3288						 
Palladium black	7440-05-3	3089						  
Palladium on barium sulfate	7440-05-3							 
Petroleum ether	8032-32-4	1268						  
P2P (1-phenyl-2-propanone)	103-79-7							 
Phenylacetic acid	103-82-2							
alpha-Phenylacetoacetonitrile (APAAN)	4468-48-8	3439						

Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
1st	2nd	3rd	4th					
Phosphorous, red	7723-14-0	1338						 
Phosphorous trichloride	7719-12-2	1809	 					 
Piperonal	120-57-0							  
Platinum (IV) dioxide	1314-15-4	1479						 
Platinum metal	7440-06-4							 
Potassium carbonate	584-08-7							  
Potassium cyanide	151-50-8	1680						 
Potassium hydroxide (caustic potash)	1310-58-3	1813						 
Potassium manganate	10294-64-1	1479						 

Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
1st	2nd	3rd	4th					
Potassium metal ⁽⁴⁾	7440-09-7	2257						 
Potassium permanganate	7722-64-7	1490						 
Pseudoephedrine	90-82-4							
Rainey nickel	7440-02-0	1378						 
Safrole	94-59-7							  
Sodium acetate	127-09-3							 
Sodium bicarbonate	144-55-8							 
Sodium bisulfite	7631-90-5							 
Sodium borohydride ⁽⁴⁾	16940-66-2	1426						 

Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
1st	2nd	3rd	4th					
Sodium carbonate (soda ash)	497-19-8							
Sodium cyanide	143-33-9	1689						
Sodium cyano-borohydride	25895-60-7	3179						
Sodium hydroxide (caustic soda)	1310-73-2	1823						
Sodium metal ⁽⁴⁾	7440-23-5	1428						
Sodium sulphate	7757-82-6							
Sulfuric acid	7664-93-9	1830						
Tartaric acid	87-69-4							
Tetrahydrofuran ⁽¹⁾	109-99-9	2056						

Chemical name	CAS number	UN code	GHS transport hazard class	GHS hazard pictograms				Disposal options
				1st	2nd	3rd	4th	
Thionyl chloride	7719-09-7	1836						
Thorium nitrate	13823-29-5	1477						Expert technical support required, substance is radioactive, requires specialist disposal
Toluene	108-88-3	1294						  
O-Toluidine	95-53-4	1708						  
Xylene	106-42-3	1307						  

- (1) Peroxide forming chemical (do not burn).
- (2) Halogenated organic solvents, may form toxic gases during burning.
- (3) Hazardous or flammable gases. The disposal of these gases pose significant hazards. If identified, seek expert assistance and do not attempt to dispose.
- (4) Reactive metals listed in this manual may react with water or air (some violently), and should never be removed from their packaging, containers or drums. They should be encapsulated or buried, ensuring that they do not come into contact with water. If necessary, place the unopened package directly into another water-tight container or drum.

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➤ This illustrated disposal guide supports the implementation of the UNODC *Guidelines for the Safe handling and disposal of chemicals used in the illicit manufacture of drugs* (ST/NAR/36/Rev.1). It is specifically intended for use in remote locations, where waste management infrastructure and expert technical support are not available and where an immediate and pressing need exists for the disposal of seized chemicals. It provides step-by-step practical instructions to facilitate basic safe handling, storage and disposal of seized chemicals.

➤ This guide is supported by an eLearning module that is intended to help build capacity at all levels—particularly in developing countries—to reduce the human and environmental impacts of chemicals used in illicit drug manufacture. Specifically, the guide provides a framework to ensure that disposal operations are conducted in a manner that seeks to protect and maintain clean accessible water resources, reduce pollution, protect aquatic environments, reduce or prevent land degradation, and protect local environments and their biodiversity, consistent with the United Nations 2030 Agenda for Sustainable Development.

