Environmental Health Practitioner Manual

A resource manual for Environmental Health Practitioners working with Aboriginal and Torres Strait Islander Communities

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FOREWORD

Most people living in Australia do not need to consider how to access safe drinking water and power or how waste water and rubbish are removed from their homes and managed. If their house is damaged or any water or power connections, fittings or outlets are not working, it is a straightforward process to get the problem fixed.

For many remote Indigenous communities however this is not the case. The distances from regional towns, service providers and tradespersons can be vast, making access to repairs and maintenance expensive and slow. This can and does affect the quality of the living environment and, in turn, affects the health of community residents.

Environmental Health Practitioners (EHPs) make up a workforce that targets environmental issues which affect health, particularly in Indigenous communities where mainstream services may not exist. They undertake a wide range of activities, from the level of individual households, to the community and regional levels, and make a genuine and highly valued contribution to improving Indigenous health.

This manual was originally developed to provide the teaching resources required for the Aboriginal Environmental Health Worker training program which commenced in Western Australia in 1986. Workforce development and training has evolved considerably since then, as has the sophistication of equipment used, but the core activities of EHPs continue to include work in key areas discussed in this manual.

Although this manual is no longer used as a primary teaching resource for environmental health training its significance as a reference for EHPs engaging with Indigenous communities has been nationally recognised at the 7th National Aboriginal and Torres Strait Islander Environmental Health Conference in Kalgoorlie and warranted its review and update. The Australian Government, under the auspices of enHealth's Working Group on Aboriginal and Torres Strait Islander Environmental Health, funded the revision of this version of the manual. This revision was coordinated by the Environmental Health Directorate of the Department of Health Western Australia.

Electronic copies of this publication are available free of charge from the Department of Health and Ageing website at *http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-publicat-environ.htm*, the Western Australian Public Health website at *www.public.health.wa.gov.au* and from the Indigenous HealthInfoNet at *www.healthinfonet@ecu.edu.au*. Hard copies can be ordered free of charge from *health@nationalmailing.com.au* or by phoning 02 6269 1000 or fax 02 6260 2770. You may also be able to source copies from state or territory departments responsible for Indigenous environmental health.

INTRODUCTION

This manual is designed as a field reference for Environmental Health Practitioners (EHPs) engaging with and working in remote Indigenous communities.

Health authorities recognise that many diseases experienced by Indigenous people are directly linked to poor environmental health conditions in their communities. If the overall health levels of Indigenous people are to improve, the environmental health and general living conditions that currently exist in many communities must be raised to a satisfactory standard.

It is only by keeping people, homes and communities clean, hygienic and safe that the health of community members will be significantly improved. It is considered that this manual will assist EHPs in their community environmental health work.

In this manual, EHPs are encouraged to make full use of local and regional environmental health technical expertise and specific information sources relating to community education and program management. This network includes Environmental Health Officers (EHOs), Environmental Health Supervisors, other Environmental Health Workers and Indigenous Environmental Health Practitioner training and education staff.

A DVD has been developed by enHealth entitled "*Introduction to Engaging with Aboriginal and Torres Strait Islander Communities: An Environmental Health Resource*". EHPs are encouraged to view this DVD as it showcases many of the issues that need to be considered when planning environmental health activities and meeting with community members. You should be able to get a copy of this DVD from your state or territory environmental health head office.

Editorial note

There are some positions in environmental health that are referred to in this manual. They, along with their definition, are provided below.

Environmental Health Officer (EHO): an Environmental Health Practitioner with an appropriate tertiary degree level qualification recognised by the relevant state or territory authority

Environmental Health Practitioner (EHP): a person employed to work in environmental health with some level of accredited training. This term encompasses 'Indigenous Environmental Health Worker (IEHW)' and replaces 'Aboriginal Environmental Health Worker (AEHW)'. It can also be used to collectively refer to any person with or without environmental health qualifications working in this area, such as an Environmental Health Officer, Environmental Health Coordinator, Environmental Health Supervisor, Healthy Housing Workers and Animal Welfare Workers.

Environmental Health Supervisor (EHS): a person employed to coordinate and/or provide mentoring and support to Environmental Health Practitioners. This term includes 'Environmental Health Coordinator'.

1 GERM THEORY AND PARASITES

1 The environment

the environment in which people live is everything around them—the land, their houses, their yards, other buildings, the bush, water, air, other people, other animals and all the plants.

Fig. 1.1: An environment.

2 Disease and the environment

people can get diseases or injuries from their environment. Some of the causes of these can be easily seen, for example, an injury from slipping and falling on a slippery floor, or cutting a foot by stepping on broken glass.

For some diseases the causes are not so easily seen. There are many diseases which come from animals that are so small they cannot be seen without the help of microscopes, which make them look much larger than they really are. These tiny animals are germs and parasites. They can cause diseases such as colds, diarrhoea (runny tummy), hepatitis A (liver disease), skin infections and anaemia (weak blood).

Some of these diseases or injuries can be very serious and even cause death. Some are not serious at all—they are just annoying.

3 Environmental health

Environmental health activities are those which are aimed at:

- reducing the risk (chance) of getting diseases and injuries from the environment
- promoting good health.

These activities include maintaining:

- a good water supply
- the correct disposal of (getting rid of) liquid and solid waste
- a healthy food supply
- pest control
- personal hygiene
- a healthy house
- community environmental health education.

A satisfactory environmental health standard requires developing hygienic (clean, healthy) living conditions and ensuring that these are maintained. These come with sound community planning and environmental management.

4 Germs and disease

4.1 WHAT ARE GERMS?

Germs are tiny animals which are so small they cannot be seen without the help of a special instrument called a **microscope**. The microscope allows the germs to be seen by making them look a lot bigger. Many of these germs will cause disease in humans and other animals.

There are two main types of germs which can cause disease in humans and animals. These are **bacteria** and **viruses**. Bacteria are larger than viruses.

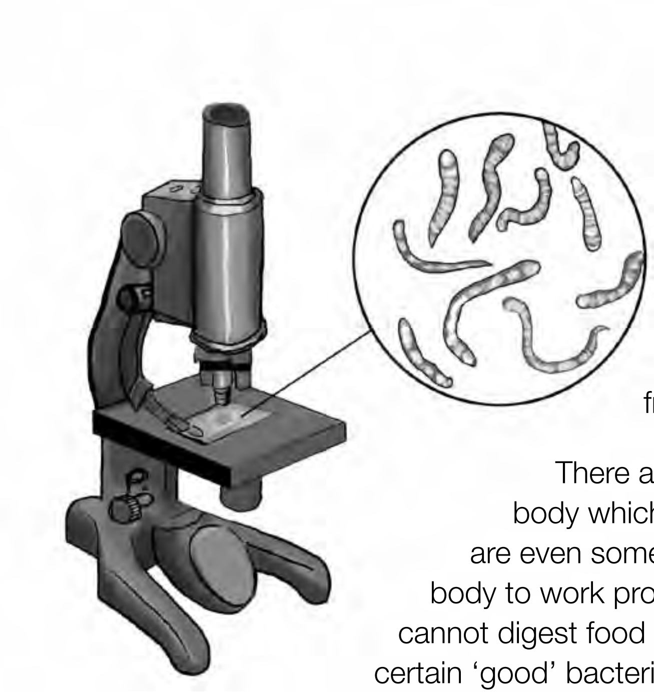


Fig. 1.2: Germs seen through a microscope.

All animals need warmth, moisture and food in order to live. Germs are no different. They can get all of these things from many places. For example, faeces (guna, shit), rubbish, food scraps and even from our bodies.

There are many germs inside the human body which may not cause disease. There are even some germs which help parts of the body to work properly. The gut, for example, cannot digest food properly without the help of certain 'good' bacteria.

There are other germs in the environment which do good things, for example, the Lactobacillus germ which turns milk into yoghurt, or the many types of germs which help break down vegetable matter into compost.

Germs and Disease

There are, however, some germs which can make people sick if they enter their bodies, for example, hepatitis A and Salmonella germs.

Other germs which usually stay in certain parts of the body where they do not cause disease, will make a person sick if they find their way to another part of the body. For example, Escherichia coli (which is also sometimes known as E. coli) lives in the gut and helps digest food. However, if it gets outside the gut, E. coli can cause sickness such as bladder infection.

Food, water or air can be made dangerous to humans and other animals by things which are living in it or mixed into it. When this happens, it is said to be **contaminated** or **polluted**. Food and water can be contaminated by disease-causing germs.

Germs can get into the body through the mouth, nose, breaks in the skin, eyes and genitals (privates). Once disease-causing germs are inside the body they can stop it from working properly. They may breed very quickly and in a very short time a small number of germs can become millions.

Germs can cause disease by upsetting the way the body works. They do this when they:

- produce **toxins** (poisons)
- increase their number greatly by breeding and they can stop parts of the body from working properly, or
- attack and damage a particular part of the body.

Sometimes the diseases caused by germs are not serious and will go away after a day or so. At other times, the disease may be very serious and may even cause the person to die. In some cases diseases caused by germs have to be treated with medicines such as tablets, injections or syrups. The medicines stop the disease by killing the germs.

Diseases caused by bacteria germs are called **bacterial diseases**, and those caused by virus germs are called **viral diseases**.

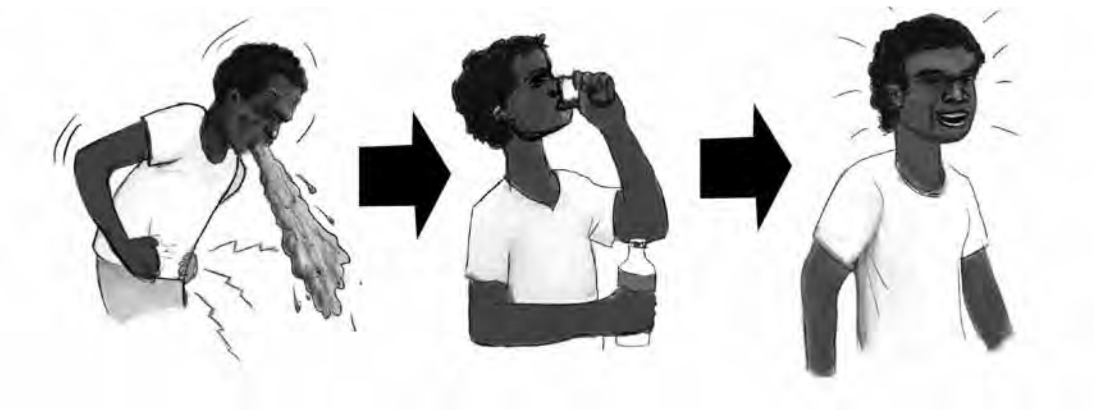


Fig. 1.3: Some medicines help the body fight germs.

4.2 DISEASES CAUSED BY GERMS

Scientists have discovered many thousands of different types of germs. However, only some of these cause sickness in humans. Some of these diseases happen because poor environmental health standards make it easy for disease-causing germs to live and breed and for humans to get the germs into their bodies. The more common of these diseases are described below.

Hepatitis A

This disease is caused by a virus germ. It may last from a few days to several months and can range from being a mild illness to a very serious illness. It causes fever, nausea and stomach cramps and sometimes death. It is a disease of the liver and can make the skin and whites of eyes turn yellow. A person with this disease may take many months to fully recover.

The germ which causes hepatitis A is commonly found in the faeces of people who are already infected. The germ can be passed directly from person to person, or indirectly, by food or water which has hepatitis A virus germs in it.

Gastrointestinal illnesses—Food poisoning, gastroenteritis and acute diarrhoea

Food poisoning is usually caused by bacterial germs. There are different kinds of bacterial germs which can cause food poisoning, for example, Salmonella, Staphylococcus, Clostridium, Shigella, Campylobacter and Bacillus. Some viruses also cause food poisoning.

Food poisoning can result from eating or drinking germ contaminated food or water. Different types of germs take different lengths of time between being ingested (taken into the body) in food or water and the onset (start) of the disease.

Gastroenteritis (gastro) is a disease caused by a virus germ in faeces. People can become infected with this germ when they eat food or lick fingers or use eating equipment, such as knives, forks, plates and cups, which are contaminated with the germ.

Acute diarrhoea (runny tummy) is commonly experienced by people with food poisoning and gastroenteritis but may also be caused by infection with the bacterial germ Escherichia coli (E. coli). It can be a useful germ when it stays in the bowel of a person because it helps to digest food.

The E. coli germ of one person may differ slightly from that of another person. This means that if the E. coli germs from one person get into the stomach and bowel of another person it could cause that other person to get acute diarrhoea. This disease is particularly dangerous to babies, very young children, the elderly or the sick because they can quickly become dehydrated.

Gastrointestinal diseases can cause all or a few of the following conditions:

- frequent watery bowel movements, known as diarrhoea or runny tummy. (This can be very serious. If it continues untreated for more than a day, the bowel movements remove too much water from the body and the person gets dehydrated. When this happens to babies, young children, the elderly or the sick it is especially dangerous because they may lose so much water that they die)
- vomiting
- nausea (person feels as though he/she wants to vomit)
- stomach cramp or pains
- fever (high body temperature)
- headache
- weakness.

Infections of the skin and ear

Bacteria germs can get into sores, cuts and broken skin and into the ears and cause pus sores. These germs can be of many different types, but not all the germs that reach these places will cause infection.

Germs can get into cuts, sores and broken skin when these places come into direct contact with things which have the germs on them, such as:

- hands
- soil
- pets
- flies and other insects
- faeces.

Serious infections can happen when sharp objects such as knives, broken glass and sharp pieces of tin with germs on them cut the skin and enter the body.

Colds and flu

These diseases are caused by virus germs which infect the respiratory (breathing) organs (nose, throat and lungs). The signs of these diseases are:

- coughs and sneezes
- dry or sore throat
- blocked and runny nose
- headache
- fever.

These diseases are highly infectious and can be easily passed directly from person-to-person. Influenza (flu) tends to be more severe than a cold and, in addition to those listed above, symptoms can include:

- fatigue
- muscle or joint aches and pains
- chills
- nausea, vomiting and diarrhoea.

Trachoma

This is a disease caused by a bacterium germ which gets into the eyes. This infection can cause scars to form on the eyelid. Reinfection by the trachoma germ can cause serious scarring which affects the eyesight and may cause blindness.

Murray Valley encephalitis (Australian encephalitis)

Murray Valley encephalitis (also known as Australian encephalitis) is caused by a virus germ which is transmitted from animals to people by a number of different types of mosquitoes. It is mainly a problem in northern Australia, but occasionally it extends further south. It is a very dangerous disease which causes inflammation (swelling) of the brain and can result in brain damage and death.

The signs (symptoms) of this disease include:

- very severe headache
- fever
- coma (unconsciousness)
- convulsions and tremors (shakes)
- paralysis (unable to move parts of the body).

Ross River virus disease

Ross River virus disease is caused by a virus germ which is transmitted from animals to people by a number of different types of mosquitoes. Ross River virus can occur in most areas of Australia. A number of different types of mosquitoes can transmit this virus, including ones that breed in marshes, billabongs, drains and backyards. This disease can cause a kind of arthritis, which affects the bone joints of the body and may last for weeks, months or even longer. It does not cause death. The signs of this disease include:

- severe joint pain
- skin rash (in some people)
- fever and headache.

Barmah Forest virus disease

Barmah Forest virus disease is caused by a virus germ similar to Ross River virus, and can occur in most areas of Australia. The mosquitoes that carry it and the animal hosts are similar to those for Ross River virus. The signs of this disease are also similar to those for Ross River virus.

Tetanus (lockjaw)

This is a serious disease caused by poison produced by the bacterial germ Clostridium tetani. This germ can be in human and animal faeces. It can get into the soil and onto other objects on the ground if faeces are left lying around. The germ and its poison can last in the soil and on objects for a long period of time.

People get this disease when the tetanus germ gets into the body through a cut, sore or other kind of break in the skin which comes into contact with something, such as a rusty tin or nail, soil, or human faeces, which is contaminated with the germ.

Tetanus is a serious disease which can cause:

- very painful muscles
- severe spasms (cramps) in the muscles of the face, neck and trunk (body) which stop a person being able to control his/her movements
- death.

Today, people can be immunised against this disease.

Melioidosis

Melioidosis is a serious disease with a high mortality rate that occurs in the Kimberley region of Western Australia, Top End of the Northern Territory and far north Queensland.

Melioidosis is caused by bacteria that usually live deep in the soil during the dry season but are found in surface water and mud after heavy rainfall.

People most at risk of developing melioidosis are those with poor health and underlying conditions that impair the immune system, like diabetes, heavy alcohol intake, cancer, advanced age, kidney or lung disease and long term steroid therapy medicines.

Bacteria enter the body directly through small cuts and sores on the hands and feet or by inhalation. This can cause a variety of symptoms such as skin ulcers or sores that fail to heal, abscesses, unexplained fevers, weight loss, fatigue, cough, shortness of breath, abdominal pain, urinary symptoms and occasionally neurological problems such as headache and confusion.

People with risk factors are advised to stay indoors during periods of heavy wind and rain. People who work with the soil such as gardeners and people in the building trade should always wear protective clothing as healthy people can get the disease if they work in or are exposed to muddy soil or water in pooled muddy areas.

4.3 THE SPREAD OF GERMS

Germs live anywhere they can find warmth, food and moisture. This could be:

- inside people's bodies or on their skin
- inside or on the bodies of other animals
- in sewage systems

- on food
- on rubbish of any kind
- on the ground
- in unclean water
- in the air.

Germs can move from place to place but require some sort of 'vehicle' to assist them. Some examples of 'vehicles' are our hands, insects, droplets in the air, wind-blown dust, water and blood, which carries germs around the body. If germs can get into the body they can make a person very sick.

Below are some of the methods by which 'vehicles' can help spread germs to people.

Hands spread germs

When a person goes to the toilet, he/she may get some germs from the faeces onto their hands. If the hands are not washed after going to the toilet, these germs will stay on them. The germs will then get onto whatever the person touches, such as food, his/her face or other people. Examples of germs spread in this way are hepatitis A and Shigella.

This way of spreading germs is called the **faecal/oral (mouth) route**.

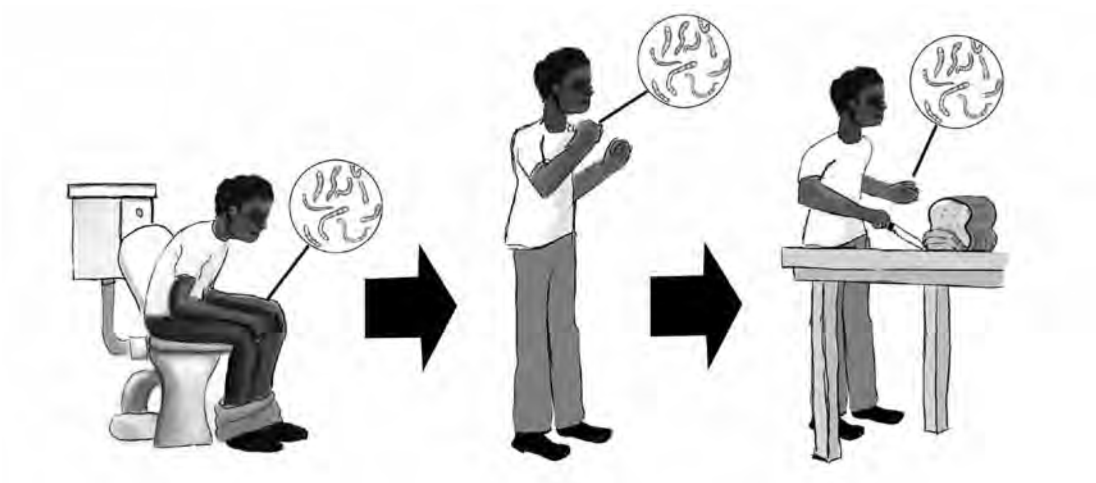


Fig. 1.4: Germs can be carried on our hands.

Droplets in the air spread germs

When a person coughs or sneezes, small droplets of water are released into the air. If this person has a throat or lung disease, the germs will also be in these droplets. If these droplets then come into contact with or are breathed in by other people, they too can get the disease. Examples of germs spread in this way are colds and flu.

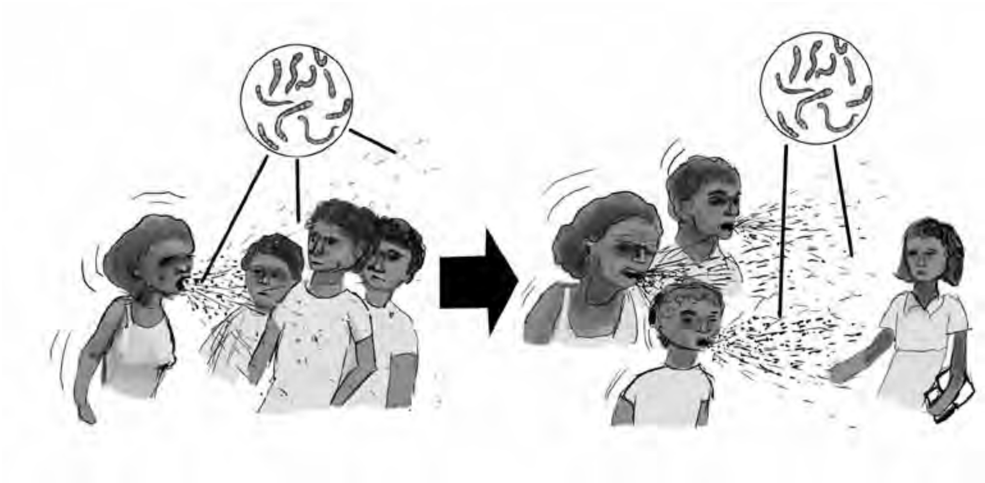


Fig. 1.5: Germs can be carried in droplets.

Water can spread germs

Some germs can be carried in drinking water. Examples of germs spread in this way are hepatitis A and Salmonella.

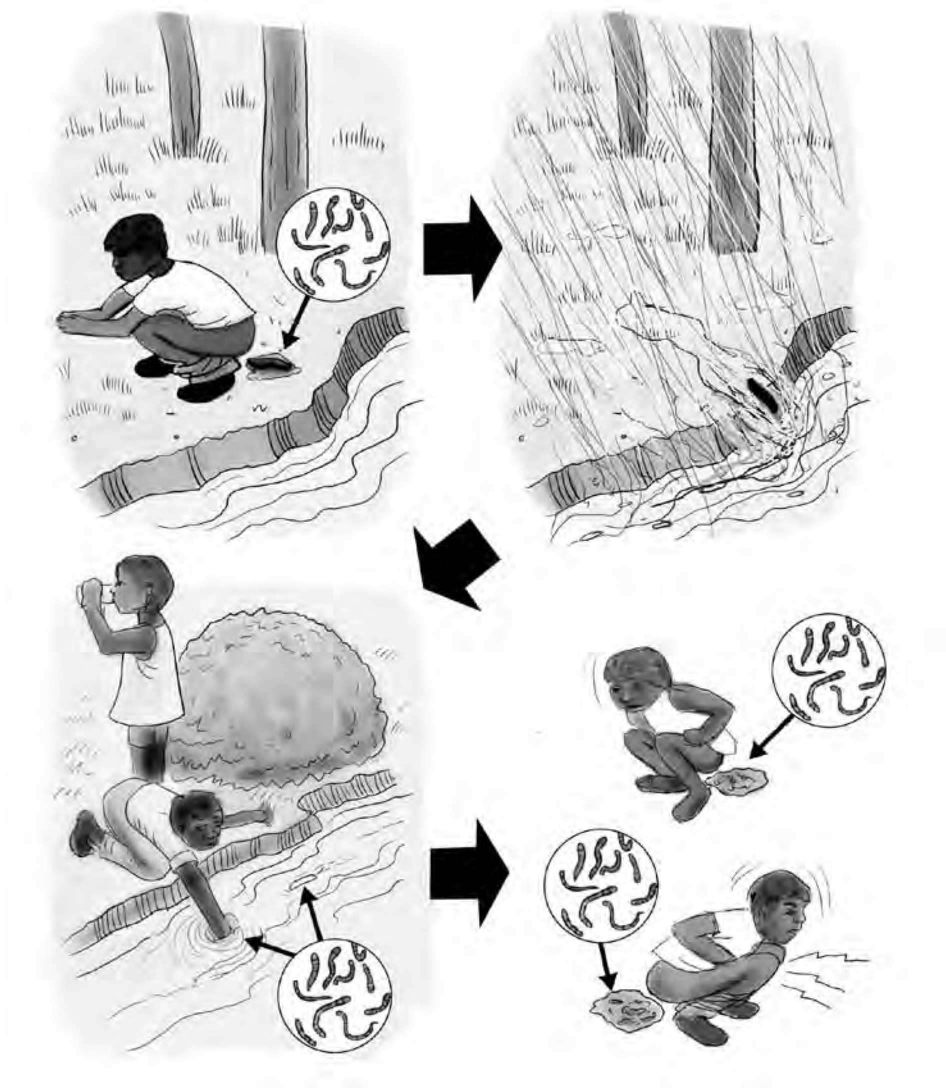


Fig. 1.6: Germs can be carried in water.

Sharing clothes and towels can spread germs

A person who has a disease such as trachoma or an infected skin rash may get these germs onto his/her clothes or towel. If that person then shares his/her clothes or towel with someone else, it is likely that the other person will catch the disease. An example of a germ spread in this way is trachoma.

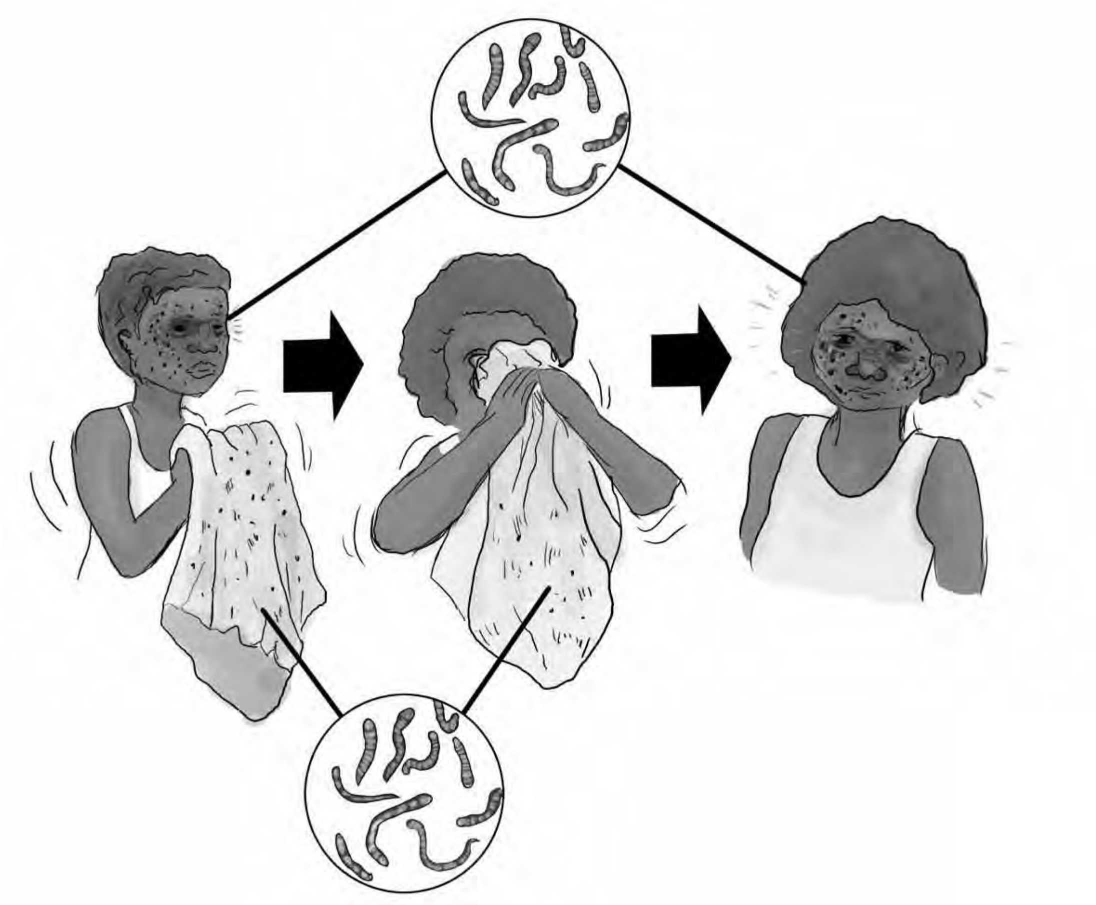


Fig. 1.7: Sharing towels can spread germs.

Insects can spread germs directly to people

Germs can be carried from one person to another by insects. Examples of germs spread in this way are Murray Valley encephalitis and trachoma.

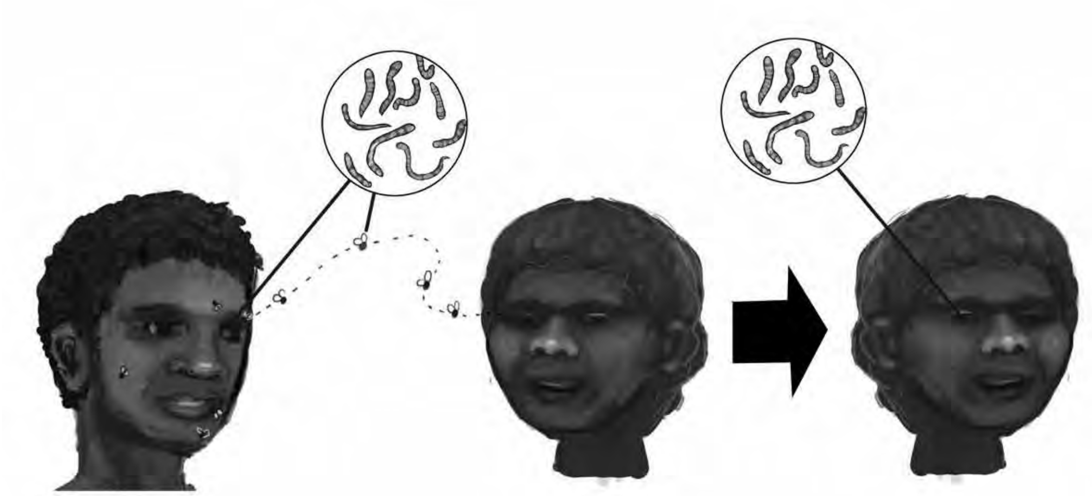


Fig. 1.8: Insects spread germs.

Insects and rodents can spread germs to food

Insects, such as flies and cockroaches, and rodents, such as rats and mice, can spread germs to food when they crawl or walk over it. If people then eat the contaminated food the germs can make them sick. Examples of germs spread in this way are Salmonella and Staphylococcus.

Animals such as rats, mice, and flies which act as 'vehicles' for carrying disease-causing germs are called vectors.

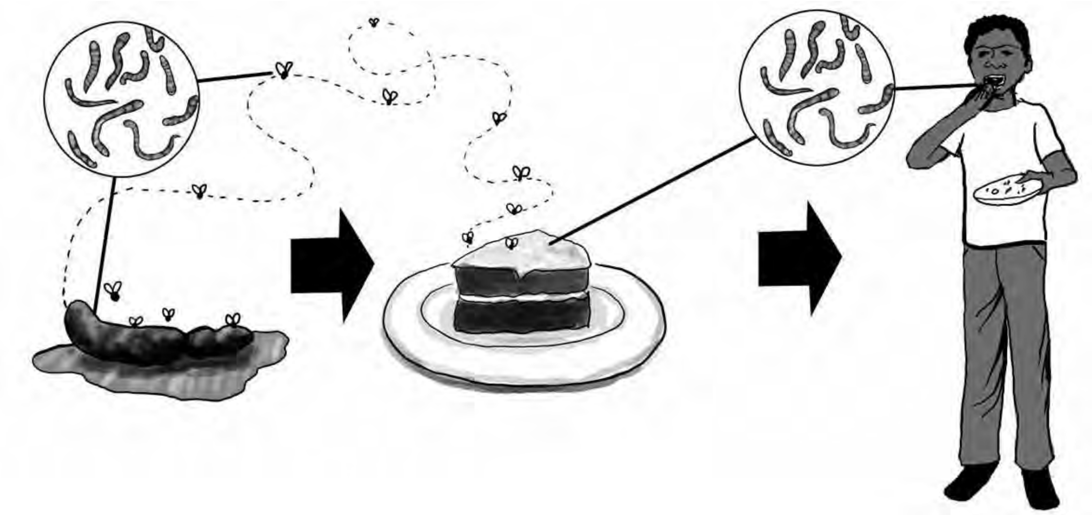


Fig. 1.9: Flies spread germs from faeces to food.

5 Parasites

5.1 WHAT ARE PARASITES?

Parasites are animals or plants which must live on or in another plant or animal to survive (go on living). There are several parasites in the environment and when they get into a person's body, his/her health can be affected. Some parasites enter the body by way of contaminated food or water and some live on the skin and the hair. Examples of parasites include:

- stomach and gut worms (threadworm, hookworm)
- skin mites (scabies)
- hair and body lice (head lice and crab lice)
- protozoa (Giardia).

Most of these parasites cannot be seen without the help of a magnifying glass. Like a microscope, this is another kind of special instrument which makes things look bigger than they really are. Some adult worms are big enough to see without the help of a magnifying glass.

It is often easy to see where parasites have been, such as when they cause rashes on the skin.

Protozoa

Protozoa are tiny single-celled animals which can move about on their own. Protozoa are so small they can only be seen with the help of a microscope and only some of them cause disease in humans. An example of one of these is Giardia lamblia.

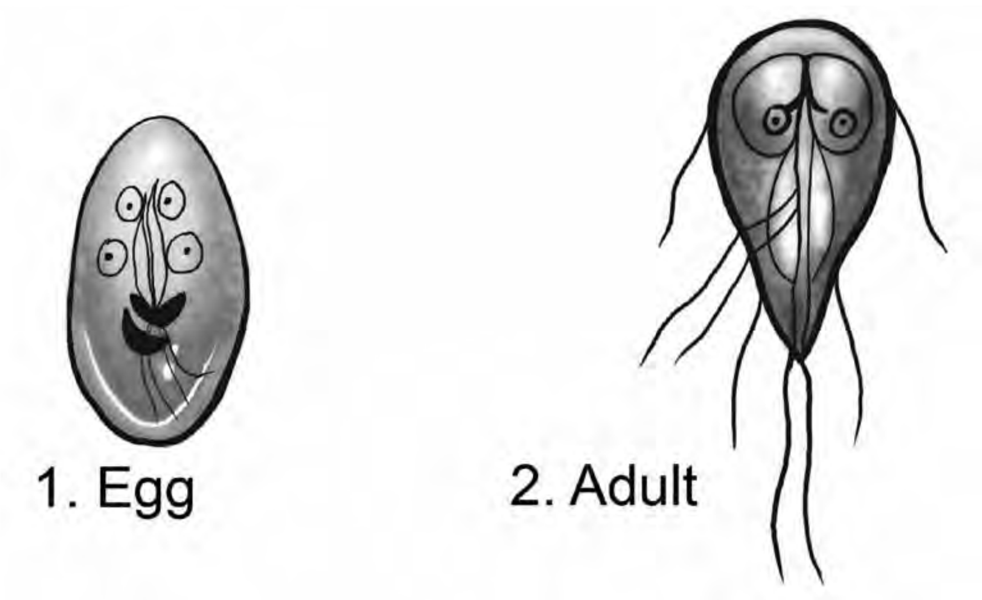


Fig. 1.10: Giardia, a disease-causing protozoan.

Worms

Parasitic worms are small animals which can live inside the body. Their eggs are taken into the body, usually by swallowing. The worms then hatch out of the eggs and live in the body. Some types of worm larvae (young worms) can also burrow their way into the body through the skin.

When the worms live in the body they can cause sickness. They may get into the stomach and gut and eat the food before the body has digested it. This means that the body does not get enough nourishment. Sometimes the worms will find their way into other parts of the body, such as the blood or liver. When this happens these parts of the body may not work properly.

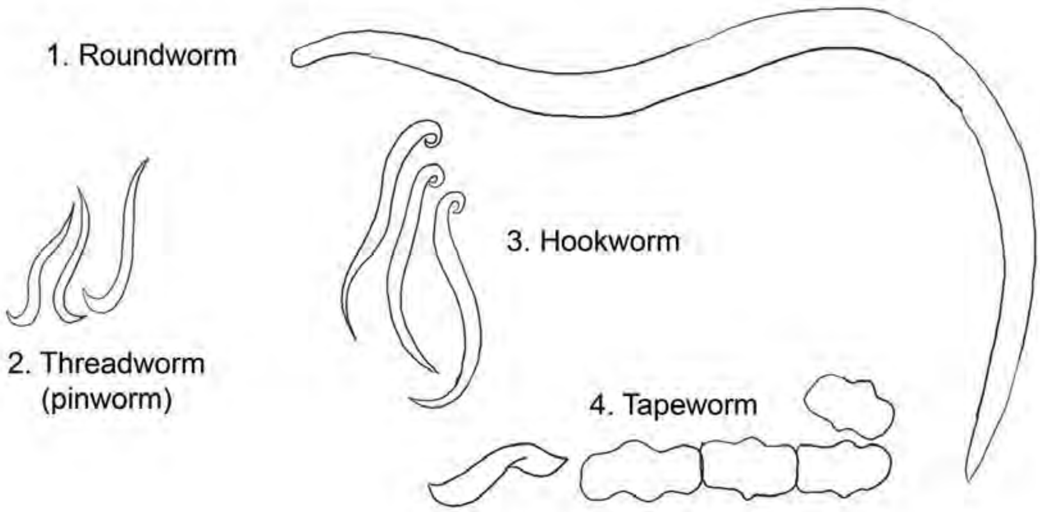


Fig. 1.11: Worms.

Mites and lice

These are small animals which affect the skin and hair of the body. They cause the skin, especially the scalp, to become very itchy.

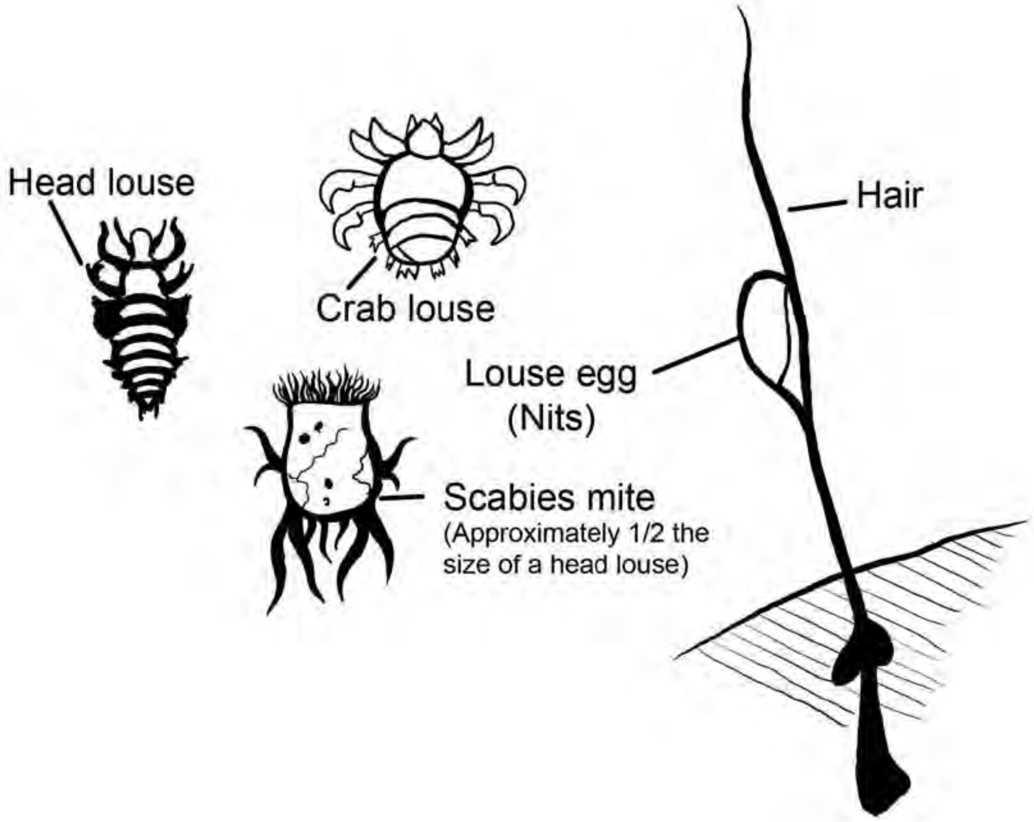


Fig. 1.12: Lice.

5.2 DISEASES CAUSED BY PARASITES

Common diseases in Indigenous communities which are caused by parasites are described below.

Giardiasis

This is a parasitic infection caused by the protozoan Giardia lamblia getting into the small intestine. Giardia is a single celled animal which is so small it can only be seen with the help of a microscope.

This disease can occur anywhere in Australia and is very common in Indigenous communities. The symptoms (signs) of this disease are:

- very severe or chronic (long-lasting) diarrhoea
- stomach cramps and pain

- fatigue (tiredness)
- weakness
- weight loss.

There is special medicine which can be taken to get rid of Giardia from the body.

Hookworm infection

This is a widespread disease in warm, tropical and sub-tropical places, especially where sewage disposal is inadequate. It is common in the Kimberley and other parts of tropical northern Australia.

Hookworm is a parasitic worm. The adult worm is about 1 cm in length and is about the thickness of a pin.

The worms suck blood from the human host. The disease becomes serious when there are many worms in the intestine sucking blood from the host. When this happens, the host loses too much blood which contains the body's important nutrients (nourishing food).

This can cause:

- the body to become anaemic (pale and weak)
- fever
- diarrhoea or constipation.

In extreme cases hookworm infestation can stop the person from thinking and moving properly. It can also slow down children's growth.

To get rid of these worms from the body, the person must be treated with special medicine.

Threadworm (or pinworm) infection

This is a disease which can occur in any part of Australia. It is another disease which is caused by a parasitic worm which lives in large numbers in the human intestine.

Threadworm causes anal (bum hole) itching. This can lead to disturbed sleep and can cause people to become grumpy. Excessive scratching can lead to broken skin which may become infected (pus sores).

Threadworms are easily passed from one person to another and frequently whole families or groups become infected.

There is also special medicine to get rid of these worms from the body.

Dwarf tapeworm infection

Dwarf tapeworm is the most common human tapeworm in Australia. It is a parasitic infection of the stomach and intestine.

Infection with this tapeworm can cause:

- diarrhoea
- stomach pain
- weight loss
- weakness.

There is special medicine which will get rid of these worms from the body.

Scabies infection

This is a skin disease caused by a tiny animal which is called a mite. It is usually about 3 mm long. The female burrows into the skin to lay her eggs and this irritates the skin and makes it very itchy. As a result, the person scratches the skin a lot.

If the skin breaks as a result of the scratching, germs can enter the break in the skin and cause an infection. When treating the infection it is important to also get rid of the mites or lice; otherwise the irritations will continue and cause more infections.

To get rid of scabies a specially medicated lotion is used.

Pediculosis (head lice infection)

These tiny bloodsucking animals live their whole life on a person's head. The lice stab an opening through the skin and suck up blood from the host. This causes irritation. The resulting scratching can lead to broken skin which can become infected.

Special shampoos are used to get rid of head lice. The eggs which are stuck to the hair need to be removed with a special fine-toothed comb.

5.3 METHODS ON HOW SOME IMPORTANT PARASITES ARE SPREAD

Giardia

Giardia occur in the intestines of humans. When Giardia are inside the body they can move about quite easily, but they often leave the body as tiny egg-like cysts in faeces.

Infection happens when these cysts are taken back into the body of someone who does not have Giardia in their intestines. Once inside the intestine they become mobile (able to move) again and start to reproduce themselves by dividing and redividing.

Giardia cysts can be passed:

- **directly** by the faecal/oral route from an infected person to one who is not infected
- **indirectly** by taking in the cysts in contaminated water or food when eating or drinking.

Hookworm

When hookworms get inside people, they lay their eggs inside the person's intestines. These eggs get into the soil or water when infected human faeces has been left on the ground or from faulty or broken sewage systems.

Tiny larvae (young worms) will hatch out. If the soil is wet the larvae will develop to a stage where they can infect people. They can survive in wet soil for several weeks and are able to burrow through unbroken skin. This happens when people's skin comes into contact with water, soil or faeces which is infected with hookworm larvae.

People can become infected with hookworm directly by the ingestion of larvae or by larvae burrowing through the skin.

People in the tropical parts of northern Australia who walk around in contaminated wet places without shoes are very likely to get infected.

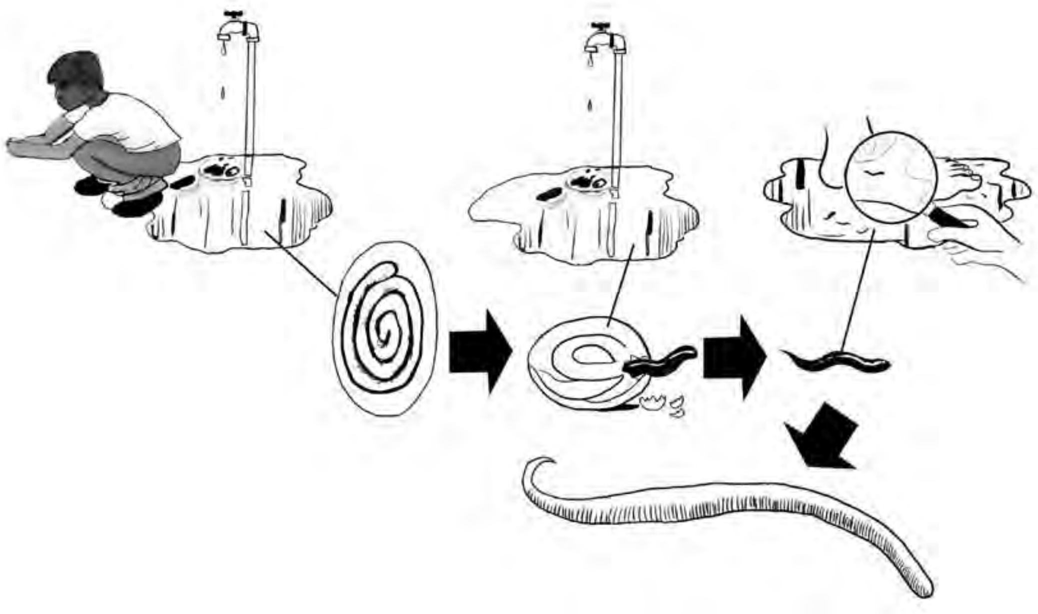


Fig. 1.13: Life cycle of the hookworm.

Inside the body the larvae travel through the blood stream to the lungs where they are coughed up and then swallowed. They finally reach the intestines where they develop into adult worms. Adult worms are able to attach themselves to the walls of the intestines. They have hooks around the mouth which allow them to do this. They live there and suck blood from the human host.

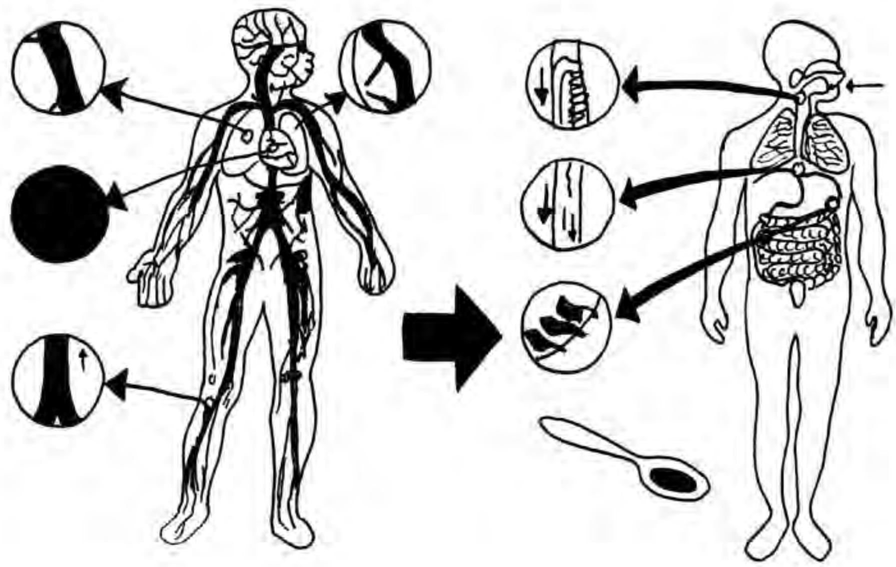


Fig. 1.14: How hookworm gets into the body and where it lives in the body.

Threadworm (or pinworm)

These worms look like tiny white threads and live in the intestine. The female worm will travel to the anal opening to lay its eggs on the skin around the anus. It is this activity which causes the itching. The eggs and the worms leave the body in faeces. The eggs hatch when they are taken into the same or another person's intestine.

The worms or their eggs can be passed from one person to another:

- **directly** through the faecal/oral route from an infected person to one who is not infected
- **indirectly** through contact with contaminated clothing, bedding or food

Dwarf tapeworm

The dwarf tapeworm occurs in the stomach and intestines of humans. The adult tapeworm lays its eggs in the body. The eggs are passed out of the body in the faeces. If these eggs are ingested by other people indirectly or directly, the eggs will hatch in the intestine. The immature worm goes through two further stages of development before it becomes an adult.

Humans become infected with dwarf tapeworms:

- **directly** by touching the mouth with fingers which are contaminated with faeces containing the egg
- **indirectly** by ingesting eggs in contaminated food or water, or by swallowing an insect which has ingested eggs which have then hatched into larvae inside the insect.

Roundworms

Roundworms are nematodes and are found in northern parts of Australia and in many tropical countries. Strongyloides stercoralis is a roundworm which causes a life threatening disease called Strongyloidiasis.

People can become infected through contact with soil contaminated by faeces containing the parasite.

People can often get sick where hygiene and sanitation are poor. Infection can be detected with a special blood test and people can be cured with special tablets.

Scabies

These small animals are a type of mite. The female burrows into the skin where it lays its eggs. When the mites hatch they climb out onto the surface of the skin and then enter hair follicles. These are the small openings in the skin which hold the hair roots. The young mites grow into adults in the hair follicles. They then climb out and mate and start the process all over again. It is the burrowing activity of the mites which causes the skin irritation associated with scabies.

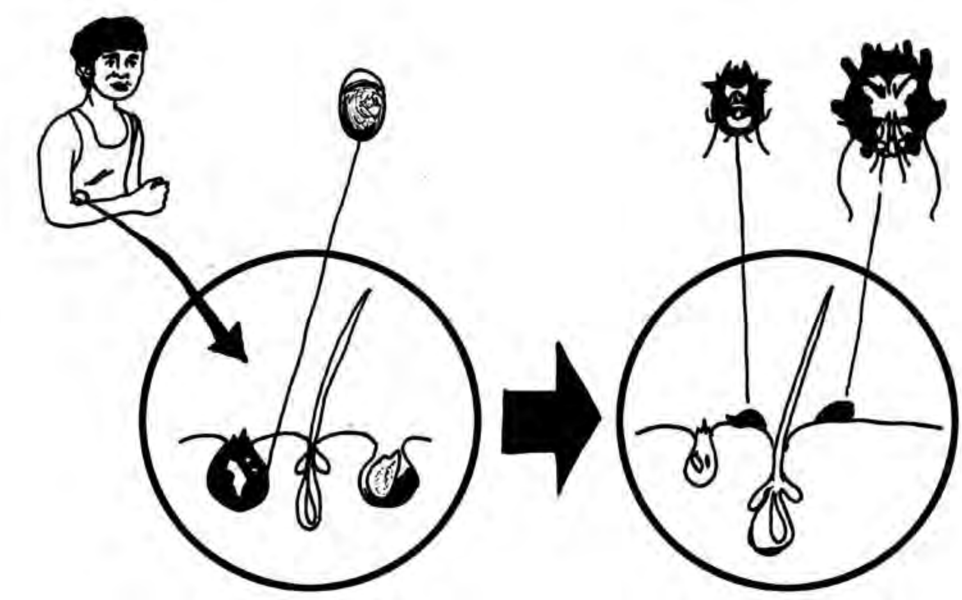


Fig. 1.15: Scabies' life cycle.

Scabies prefer to live in certain places in the body. These are body creases such as the backs of the knee and elbow and in the armpit and groin.

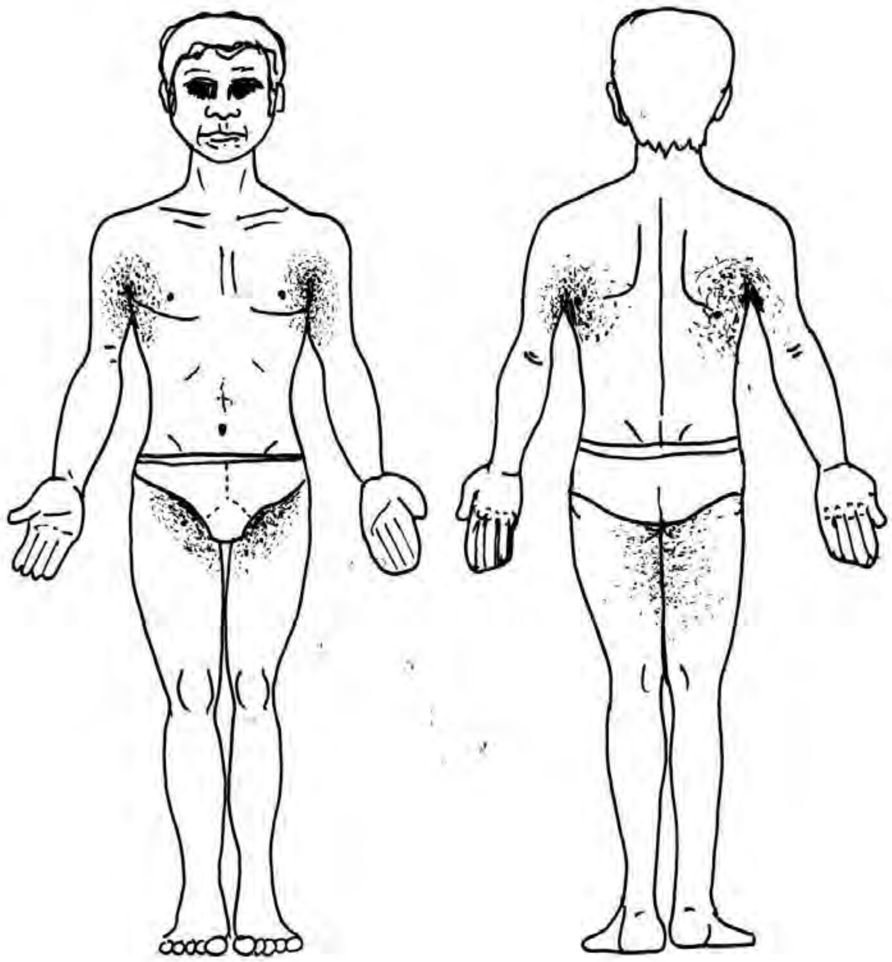


Fig. 1.16: Scabies rash on the body.

Scabies can be passed from an infected person to an uninfected person by:

- **direct** contact; or
- **indirect** contact with contaminated clothing or bedding. Infection happens more frequently when people live in overcrowded conditions.

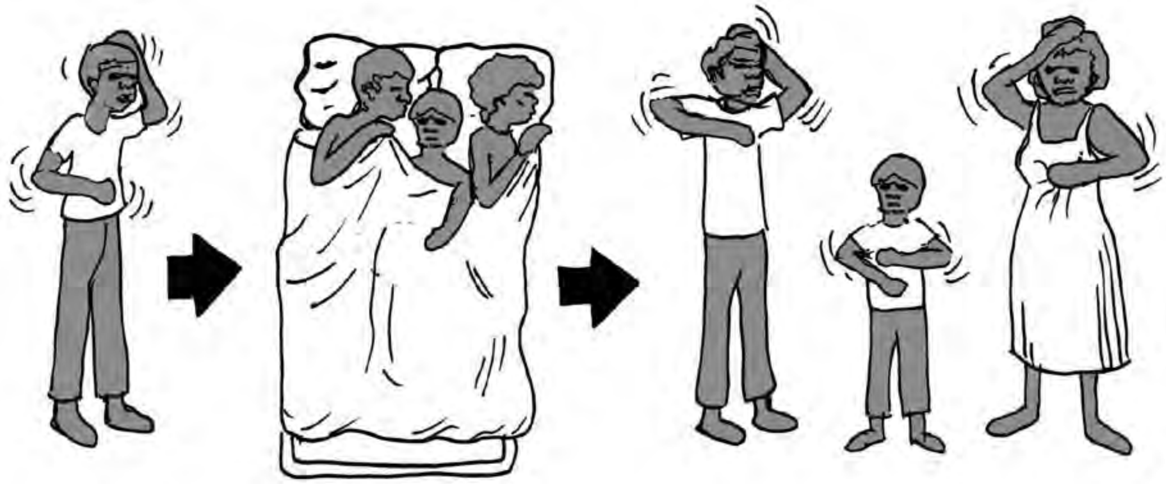


Fig. 1.17: The spread of scabies from person to person.

Head lice

Adult lice live their whole lives in the hair of a person's head. The lice stab openings in the skin to suck blood. The eggs of the head lice, which are also called nits, are glued to the hairs on the person's head. The nits are about 1 mm in size and are whitish in colour. They take about a week to hatch.

The lice can be passed:

- **directly** from person-to-person, such as when small children play or sleep together; or
- **indirectly** through the sharing of infected combs, brushes and hats.

While head lice can be killed with special shampoos, the nits are difficult to kill in this way. For this reason, nits must be removed with a special fine toothed comb.

6 Stopping the spread of germs and parasites

When people take the correct action to stop the spread of germs and parasites they are practising an important aspect of good environmental health.

Parasites and germs need three things. These are:

- an environment or source (this is where the germ or parasite lives)
- a vector or route (this is the animal or person that carries the germ or parasite in or on its body)
- a host or destination (the person or animal that gets infected with the germ or parasite and gets sick).

If people control the environment by keeping it clean, this makes it harder for germs and parasites to live and breed.

Here are some examples of things that can be done to stop the spread of germs and parasites:

- Pick up all rubbish and put it in the bin.
- Keep yourself, your family and your house clean.
- Wash hands after going to the toilet and before preparing food.
- Make sure all pests are controlled properly by washing your dog and keeping it off the bed.
- Wash your hands after touching animals.
- Make sure that taps, toilets and bathrooms are kept in clean and good working order.
- Store cooked and uncooked food correctly.
- Don't defecate near waterways or in puddles. Water spreads germs and is a part of the life cycle of some parasites. If you have to defecate in the bush, make sure that you bury it. Don't walk in dirty puddles.
- Try to keep children from areas in which animal faeces may be present or near taps which can contain young parasites which can enter through your skin.

Stopping Worms

The eggs of worms are very small and live in some people's faeces. The worm eggs hatch in damp soil or water.

The worms get into your body through cuts or sores in the skin, or burrow through normal skin. This happens when people with no shoes on tread in water, on wet soil or on faecal matter.

You can stop the spread of worms by:

- wearing shoes
- using a toilet
- making sure that everyone understands the importance of using a toilet and wearing shoes
- wash your hands, especially after going to the toilet, to stop germs and parasites being passed on to another person
- making sure that the taps at your house don't drip
- not letting babies and children sit in damp or wet places, particularly without clothes on
- getting treatment if you are sick.

How to get rid of scabies

If someone has scabies, the only way to get rid of them is to give that person a special cream or lotion to put all over their body. If there are other people who live in the house, they may need to use the cream too.

Before someone puts on the lotion they need to have a shower and wash all over with soap. They must not wash again for 24 hours.

Fig. 1.18: Wash before putting on the lotion.

Put the lotion on as shown by the health worker, nurse or doctor. Soon the itch will go away. It may take a day or two.

Fig. 1.19: Putting on the lotion.

To stop scabies coming back, wash all clothes, towels, blankets, in pillow cases in hot soapy water.

Fig.1.20: Washing clothing.

After the clothes and bed clothes have been washed they should be hung out in the sun to dry. Put the pillows and mattress outside in the hot sun all day.

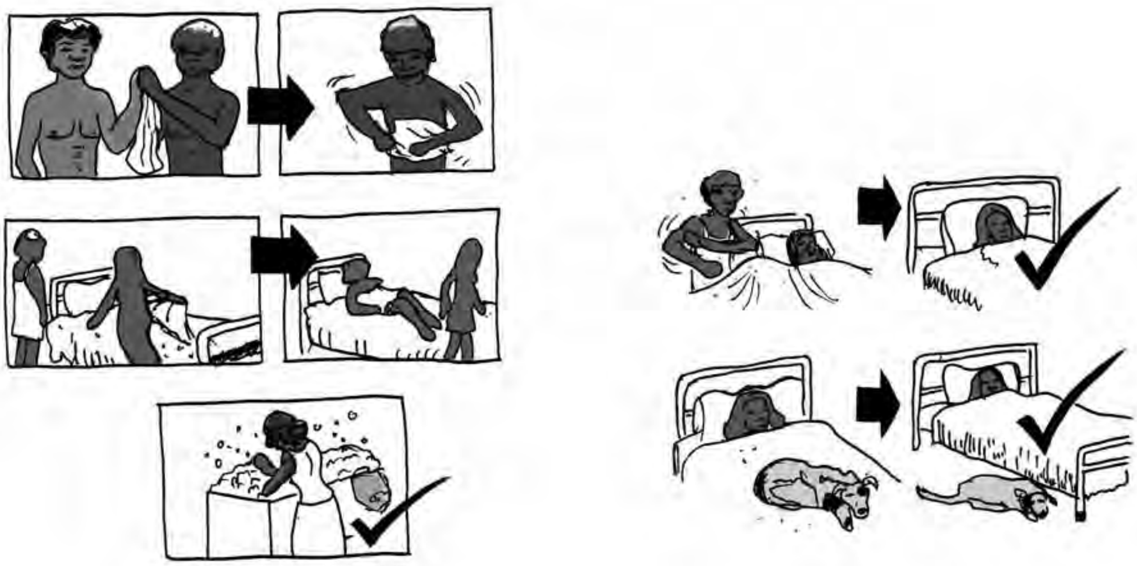


Fig.1.21: Hanging out clothes and bedding

You can avoid getting scabies by not using clothes, sheets or blankets which have been used by someone else, unless they have been washed in hot soapy water first. You should also not share a bed with someone that has an itch.

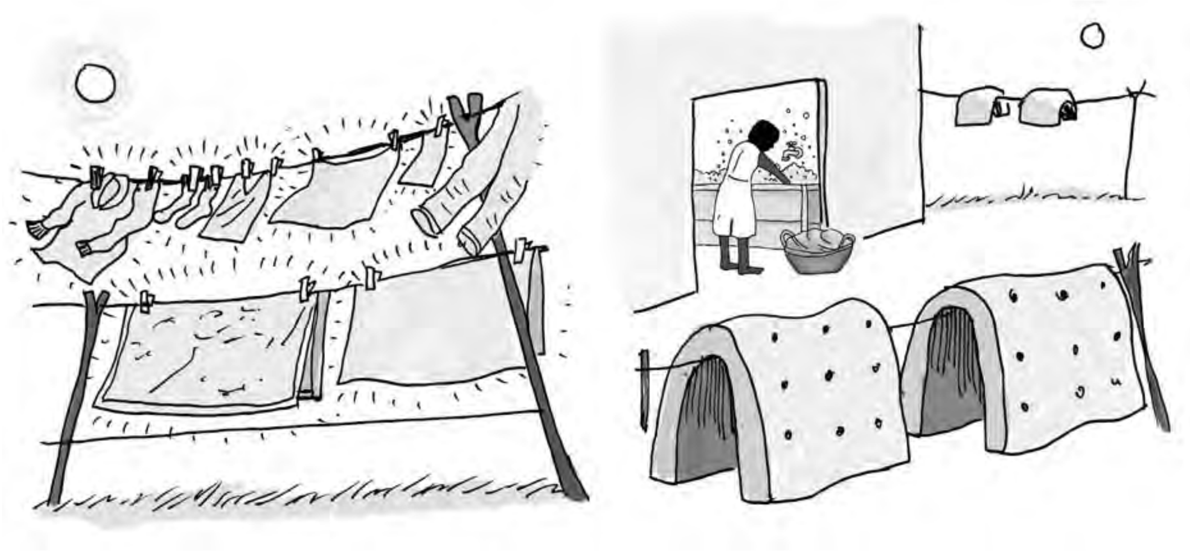


Fig.1.22: Don't share infected clothing.

How to stop flies causing sickness

People can get germs from flies which can give them diarrhoea and make them vomit. To stop flies passing on germs, follow these rules:

- Always put rubbish in the bin and make sure the lid is on properly.
- Always cover food and store it properly so that flies can't get to it.
- Always use the toilet.
- Keep flies away from your ears, eyes, nose and mouth.
- Keep flies away from babies' and young children's ears, eyes and mouth.
- Keep the ears, eyes and mouth as dry as possible.
- When they are old enough, children should be taught to wipe their nose with a tissue or piece of cloth. Then they should be taught how to put the dirty tissue in a rubbish bin or a fire.
- Cover all sores with a cloth or bandaid dressing. Dirty dressings should be put in the bin.

2 SEWAGE SYSTEM MANAGEMENT

1 Sewage

Sewage is the mixture of liquid, faeces, toilet paper and food wastes produced by people. The liquid in sewage includes urine (piss) and wastewater which comes from the toilet, the kitchen, bathroom and laundry.

Sewage contains lots of disease-causing germs and parasites. Sewage is treated to get rid of as much of the solid matter as possible. The remaining liquid is called effluent.

2 Sewage disposal

Getting rid of sewage and effluent is called sewage disposal. If sewage is not disposed of or contained correctly people may come into contact with it and get very sick.

There are different ways to dispose of sewage. Whichever method is used, it is important to make sure that it does not:

- cause dangerous conditions which allow people to come into contact with disease-causing germs
- cause pollution of a water supply
- allow the breeding of insects such as mosquitoes or cockroaches which can carry disease-causing germs inside or on their bodies as a result of eating or walking in sewage
- produce bad smells.

3 Disease from sewage

Disease-causing germs can be spread from sewage if it is not disposed of properly or if people do not practise proper toilet hygiene (cleanliness). If a sewage disposal system is not **properly maintained** it will not be able to get rid of the sewage safely. For a sewage system to be properly maintained, all faulty (blocked, damaged, broken or worn-out) parts must be mended as soon as possible after they stop working correctly.

Diseases caused by germs:

Bacterial:

- salmonellosis
- shigellosis
- diarrhoea
- trachoma
- melioidosis.

Viral:

- gastroenteritis
- hepatitis A.

Diseases caused by parasites:

- giardiasis
- dwarf tapeworm infection
- threadworm infection
- hookworm infection
- strongyloidasis.

These disease-causing germs and parasites can be spread:

- **directly** by people coming into contact with sewage or toilet waste (this can happen, for example, when people walk through sewage which has leaked onto the ground from broken sewage pipes)
- **indirectly** by people:
  - » coming into contact with animals such as flies and cockroaches which carry the germs and parasites in or on their bodies. Dogs and cats can carry germs and parasites too
  - » drinking water which has been contaminated by sewage.

This is a list of some of the conditions which make it easy for direct or indirect spread of germs and parasites from sewage:

- Not washing hands after going to the toilet.

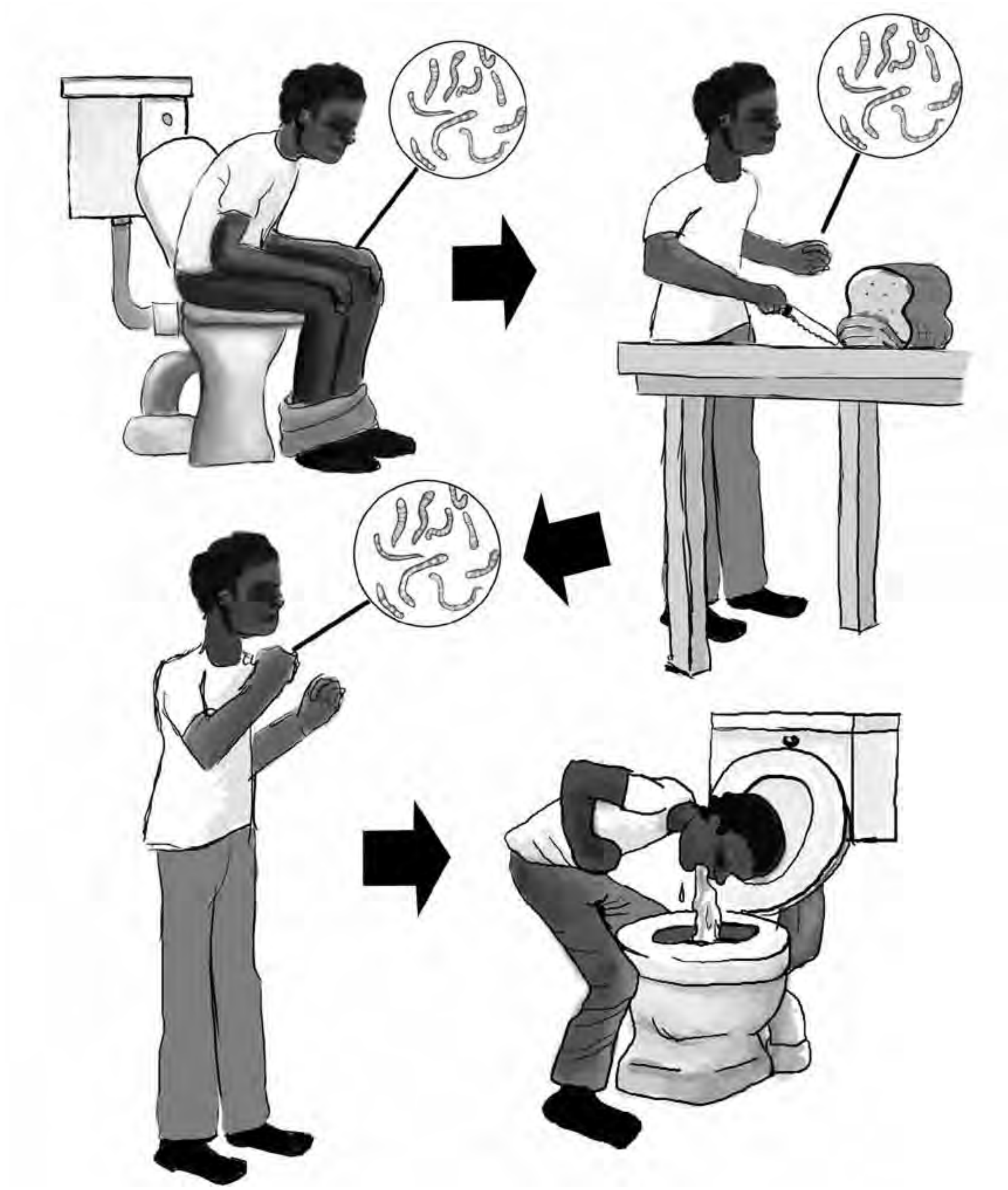


Fig. 2.1:
Not washing your hands after going to the toilet helps spread germs to food.

- Sewage or effluent collecting in pools as a result of an overflowing sewage lagoon or broken sewage pipes. This sewage and effluent contains disease-causing germs and parasites and allows mosquitoes to breed.
- Uncovered or broken septic tanks which allow effluent to escape, meaning that people or pets can directly be exposed.

- Blocked, overflowing toilets which make it easy for children to come into contact with germs.
- Leach drains from septic tanks which are too close to drinking water supplies so that effluent soaks through the soil into the water supply.

4 Pit, bucket and chemical toilets

4.1 PIT TOILETS

Any toilet in which the faeces and urine go directly into a hole in the ground is called a **pit toilet**. Pit toilets are also called **latrines**, **drop-hole toilets** and **bore-hole toilets**.

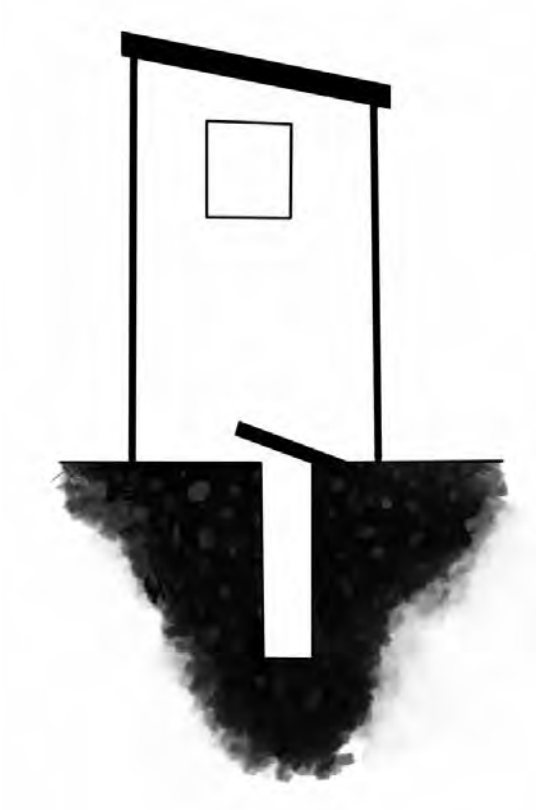
Toilets of this type are still in use in Australia, particularly in remote areas where water is in short supply. These toilets are always located away from the main dwelling and should always be located away from community water sources to prevent contamination of the water supply. To give privacy they are usually inside a properly constructed building. However, they are sometimes surrounded by roughly constructed walls and may not have a roof.

There are different kinds of pit toilet. The most common ones are described below.

Dry drop-hole toilets

This type of toilet is a hole in the ground which is only a few feet deep. There may or may not be a seat over the hole.

Fig. 2.2: Dry drop-hole toilet with roughly constructed seat and walls.



As the hole fills with sewage, bacteria will break down some of the materials into effluent. If the hole fills up too quickly, there is not enough time for the bacteria to break down any of the sewage.

Drop-holes can fill up quickly if a lot of people are using them. This is because they are not deep enough. When they are nearly full they must be filled up with soil. A new hole then needs to be dug, and the seat and walls transferred to the new site.

Fig. 2.3: Dry drop-hole toilet with properly constructed walls and roof but without a seat.

Bore-hole latrines

This type of toilet has a seat on top of a deep hole. These toilets can be used for a long time because they are slow to fill up. The sewage slowly breaks down because of the action of germs and any wastewater soaks into the ground.

When the hole is nearly full, a new one is dug and the old one filled up with soil.

The breakdown process can be assisted by adding half a bucket of water to the pit once a week.

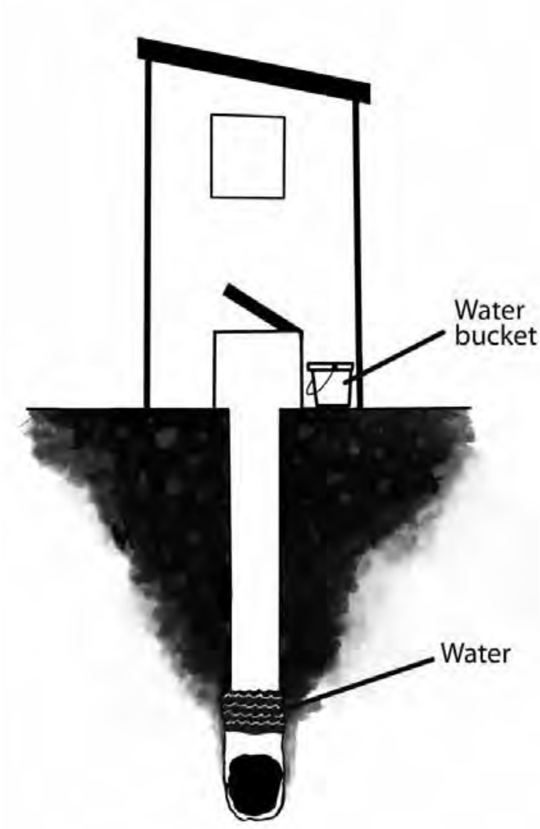


Fig. 2.4: A bore-hole toilet with a bucket for adding water to the disposal pit.

VIP latrines

An enhanced version of the pit is the **vented improved pit (VIP) latrine**. This is a dry drop-hole toilet which has been specially designed so that any flies which enter the hole and crawl over the sewage cannot escape and carry disease-causing germs to people and food. Odours (smells) are reduced and any that do occur are directed away from the community by choosing the right site for the toilet.

The VIP latrine has a special snail-shape design. The walls meet the roof and the floor allowing no light into toilet area except through a special air-vent pipe which lets some light into the pit under the seat.

This light attracts flies up into the vent pipe. The top opening of the vent is covered by a fly-proof mesh and this prevents the flies from escaping. Attracted by the light they will stay here until they die. The darkness in the toilet area discourages them from returning back up through the hole in the seat.

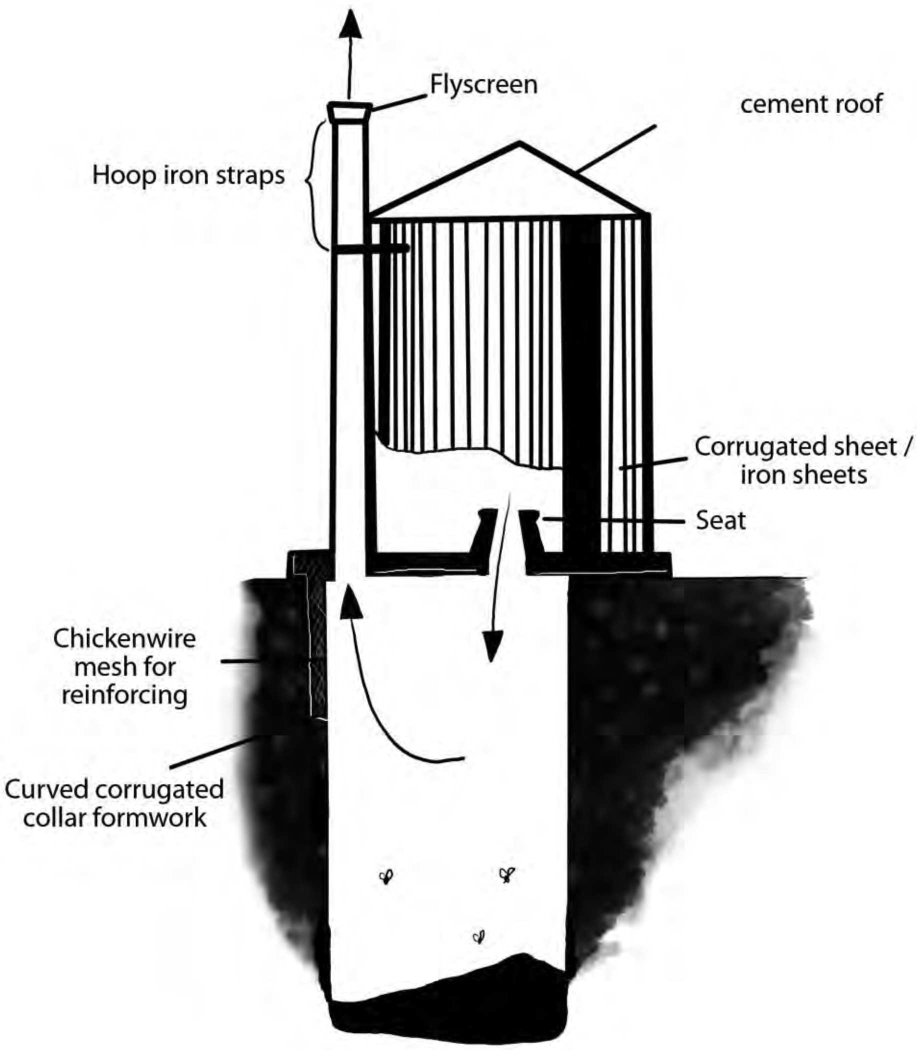


Fig. 2.5: A VIP latrine.

Careful siting of VIP latrines is particularly important so that odours are blown away from nearby houses as much as possible. It is also important to site the latrine so that the doorway faces in the direction from which most of the prevailing wind comes. All light should be kept out of the toilet area when not in use.

4.2 PAN CLOSET TOILETS

Pan closet toilets were once common in Australian towns. However most, if not all, have been replaced by septic tank and leach drain or full sewage or effluent systems.

Pan closet toilets had a bucket under the toilet seat. These toilets were also called **bucket latrines**. The buckets containing the sewage (nightsoil) were taken away once a week, or more often if necessary, and a clean, empty bucket put in its place. Special contractors were employed by local authorities to do this work in towns. To stop flies getting into the bucket the toilet seat had a lid on it.

To keep the contents in the buckets during transport, lids were put on them. The buckets were then emptied into a special trench at the local rubbish tip. They were washed immediately with phenol or some other disinfectant ready for use again.

4.3 CHEMICAL TOILETS

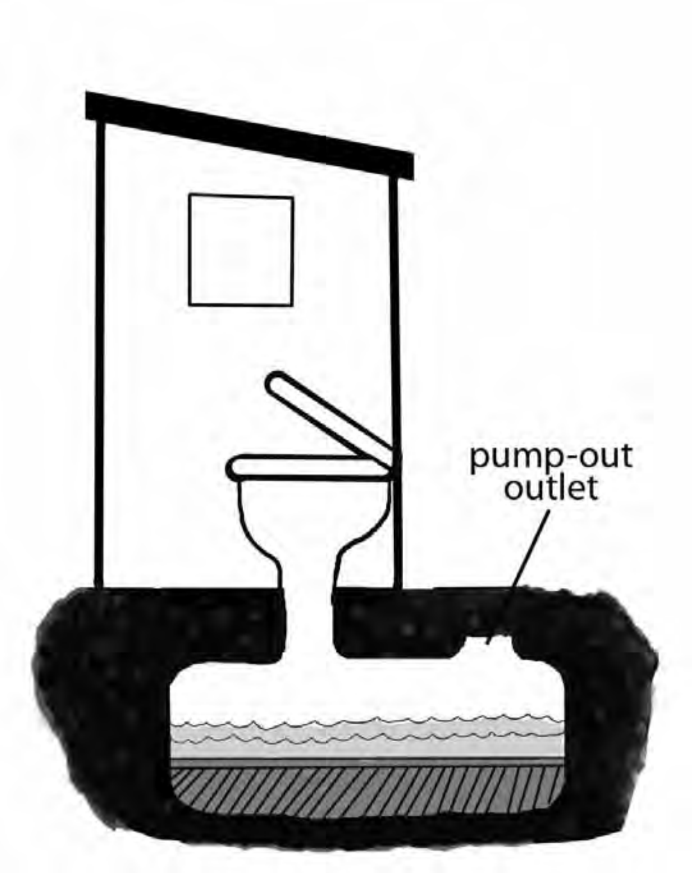
This is a special type of toilet in which chemicals are used to break down the faeces and urine. It is not often used in dwellings, but is common in caravans and small leisure boats.

Chemical toilets are also used in portable (able to be moved) facilities, for example, in toilets on construction sites or at special public events, such as outdoor music festivals.

The chemical toilet has a tank attached to it to which chemicals are added. Where small capacity tanks are required, such as in caravans, the tanks are usually under the seat. However, where a number of toilets with a large capacity are needed, such as on a large building construction site, one large tank may be placed under the ground to receive the sewage from all of the toilets.

The chemicals treat the sewage to break down the solid materials to a liquid. When the tank is full, the effluent is pumped out and disposed of at an appropriate site, such as a rubbish tip. The tank is rinsed out and more chemicals are added before it is used again.

Fig. 2.6: Chemical toilet.



5 Flushing toilets

Over the years the toilet has developed into its present form, the **flushing toilet**. It has a flushing mechanism to wash the urine, faeces and toilet paper away with water. This type of toilet requires a constant and sufficient (enough) water supply.

The flushing toilet provides a comfortable, safe and hygienic method of sewage disposal. The force of the water from the flushing mechanism, which is called the **cistern**, washes the urine, faeces and toilet paper out into the septic tank or sewage system.

The flushing toilet consists of a seat on a **pedestal pan** made of vitreous china or metal and a cistern. Most modern cisterns are dual flush, so a bigger flush can be provided to get rid of faeces and a smaller flush can be given to get rid of urine and liquid wastes.

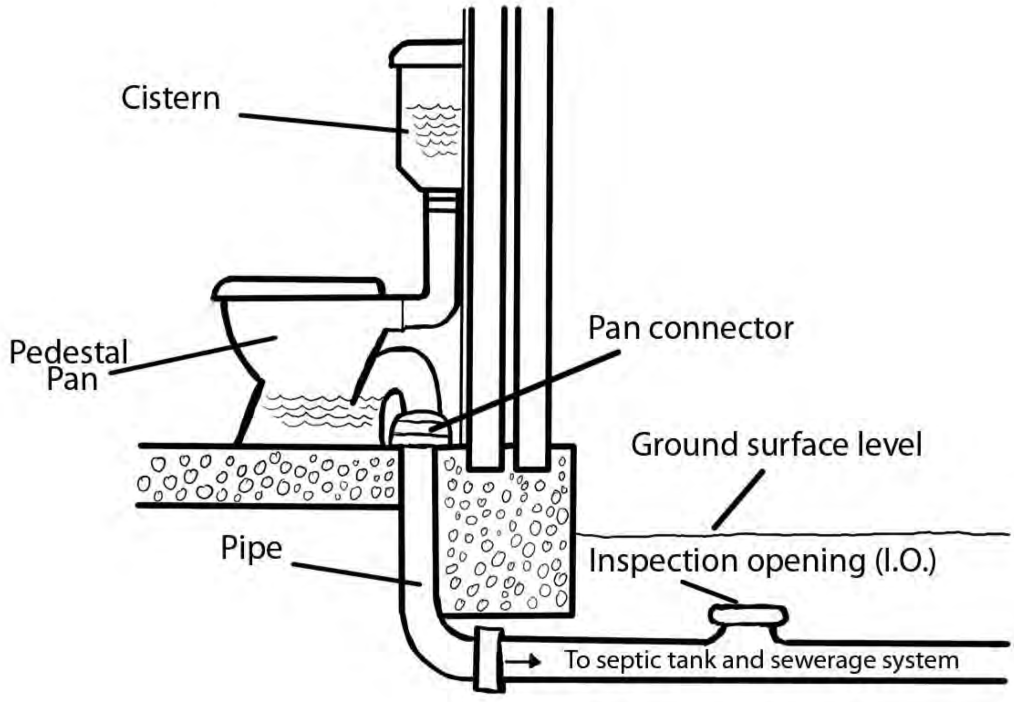


Fig. 2.7: Diagram showing the parts of the flushing toilet.

It is important that toilet cisterns work properly all the time. If they do not work, the sewage is left in the toilet pan. Sewage left in toilets will smell bad and will bring flies which can carry disease-causing germs to people. If people keep using the toilet without flushing it, the toilet pan will fill up with faeces and paper and will block.

If the cistern does stop working it must be repaired as soon as possible. However, the toilet can be flushed by pouring a bucket of water into the pedestal pan. This should be done every time the toilet is used until the cistern is fixed.

The most important part is the cistern. This begins the flushing process. Sometimes the cistern is set behind the wall in a duct or cavity to protect it from vandals.

5.1 PROBLEMS WITH CISTERNS

Cisterns can develop leaks which are caused by blockages or broken or worn parts. The parts which usually become worn or broken are the **ball float**, the **inlet valve** or the **outlet valve.**

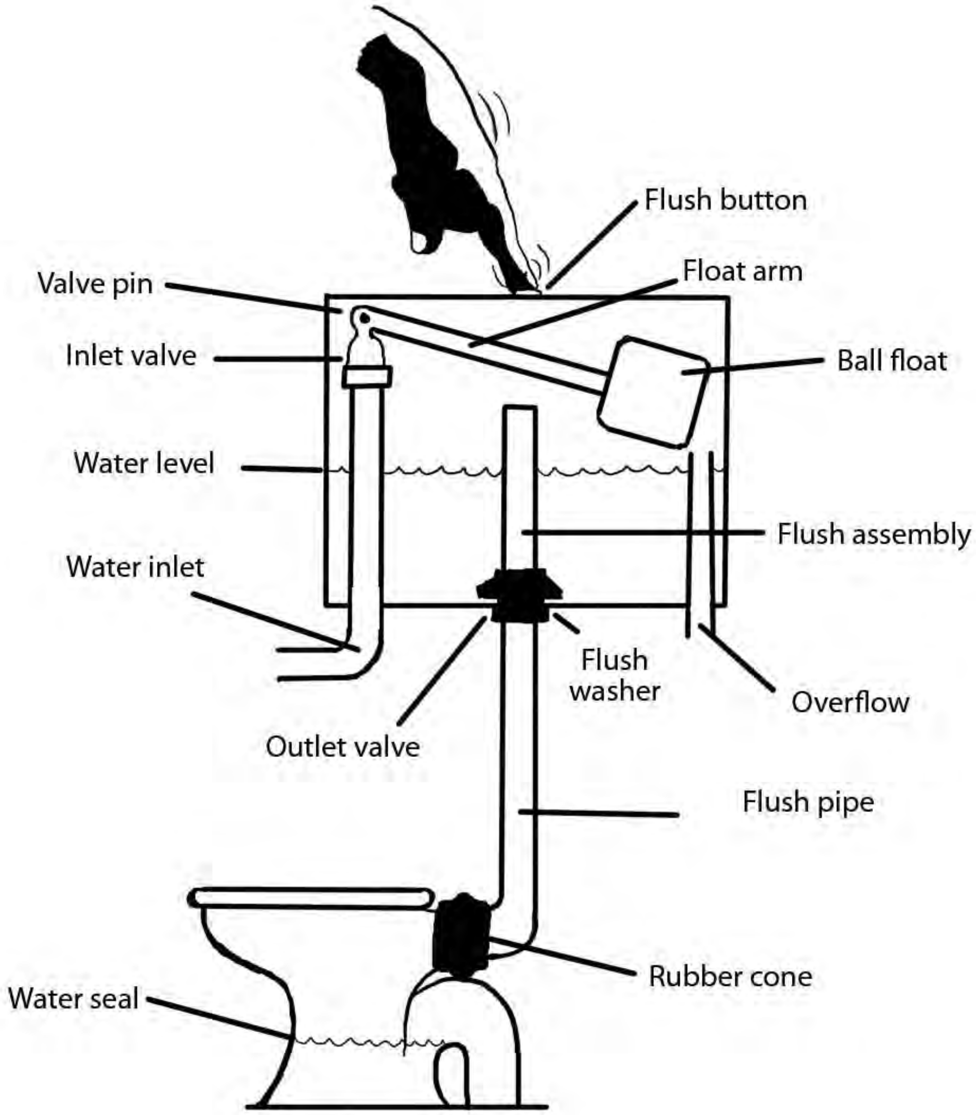


Fig. 2.8: Diagram showing the parts of the cistern.

When frogs or rubbish find their way into the cistern they can stop parts, such as the ball float or the outlet valve, from working properly. For example, frogs sitting on the ball float arm can prevent the inlet valve from closing and cutting off the water when the cistern is full. All rubbish and frogs should be cleaned out of the cistern.

Fig. 2.9: Frogs and rubbish in the cistern can stop it from working properly.

Any of these problems in the cistern can cause an **overflow of water**. Modern toilet cisterns are made in such a way as to get rid of the overflow water without making a mess.

In some older cisterns this overflow of water drains to the toilet floor and is disposed of through a **floor waste**. This is a drain that will allow any overflow or other small amounts of water which-get onto the floor, such as when it is washed, to flow outside the building. However, more modern cisterns are designed to allow the overflow to drain down the flush pipe into the pedestal pan.

If there is water leaking from the outlet drain or there is water continuously flowing into the pan, this means there is a problem with the cistern.

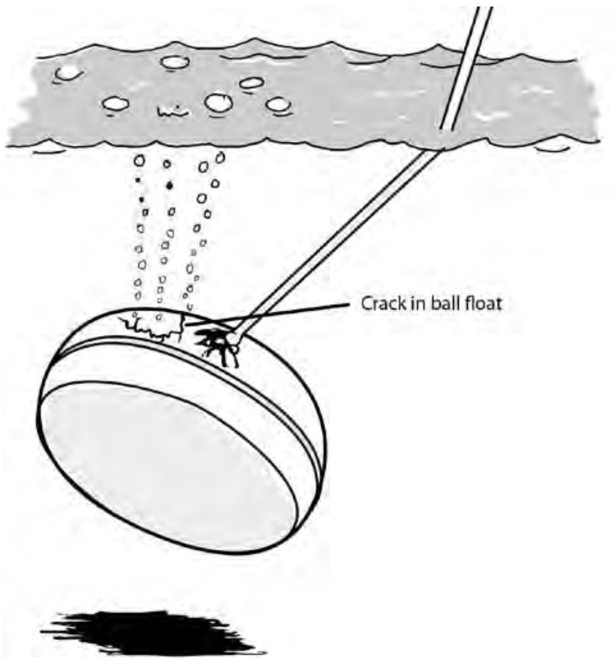
Fig. 2.10: Water continually flowing into the pedestal pan means there is something wrong with the cistern.

Some possible reasons for this continual flow of water into the pedestal pan or overflow of water on to the floor are:

The inlet valve stays open and allows the water flow because:

- the ball float is leaking and sinks
- the float arm is not correctly adjusted to cut off the inlet valve
- frogs are sitting on the float arm holding the float down
- the inlet valve rubber is worn.

Fig. 2.11: A crack in the ball float will cause it to fill up with water and sink. A leak in the ball float can often be fixed by filling the hole with a special glue.



When the ball float arm is not adjusted to cut off the inlet valve properly the water overflows into the cistern. The float arm can be adjusted so that it cuts off when the cistern is full.

- The inlet valve is faulty, such as when it is worn, and allows water to flow continuously
- The outlet valve is faulty, such as when rubbish stops it closing properly, and allows water to leak down the flush pipe
- The outlet valve becomes coated with mineral deposits from hard water and will not close
- The outlet valve becomes covered in slime and will not close

Fig. 2.12: A faulty inlet valve.

The inlet and outlet valves need to be checked occasionally. They sometimes need cleaning, adjusting or replacing.

5.2 LEAKING FLUSH PIPES

Behind the toilet pan is a pipe which joins the pan to the cistern. It is called the flush pipe and brings the water down to the pan when the toilet is flushed. This pipe can sometimes leak at the pipe/pan connection. This wets the floor and wastes water. If there is a wet patch on the floor behind the pan and the cistern is working properly, check the **rubber cone connection.**

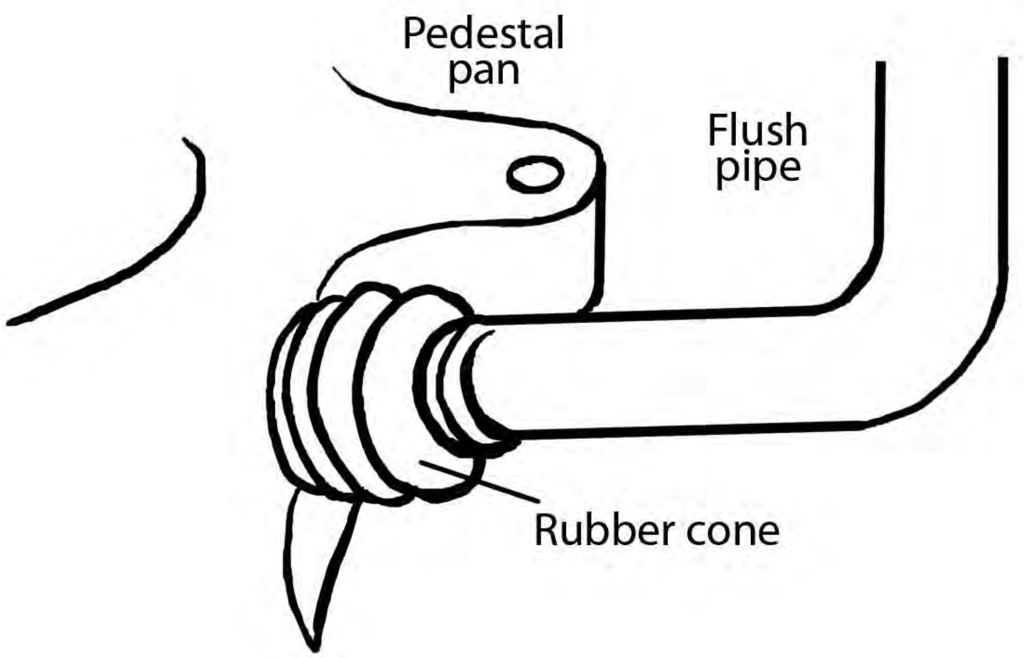


Fig. 2.13: Rubber cone connection.

5.3 THE DO'S AND DON'TS OF TOILET USE

Flush toilets need to be used and looked after properly so that they are healthy places. Here are some do's and don'ts for the toilet:

- **Do** push the flush button after the toilet has been used.
- **Do** clean the toilet regularly.
- **Do** use toilet paper.
- **Do** wash hands after using or cleaning the toilet.
- **Do** get the toilet fixed if it is not working properly.
- **Don't** use the toilet if it is blocked.
- **Don't** put anything down the toilet except faeces, urine and toilet paper. Things like food scraps, cooking fat, bottles, cans, clothes, newspaper, and towels block the toilet.

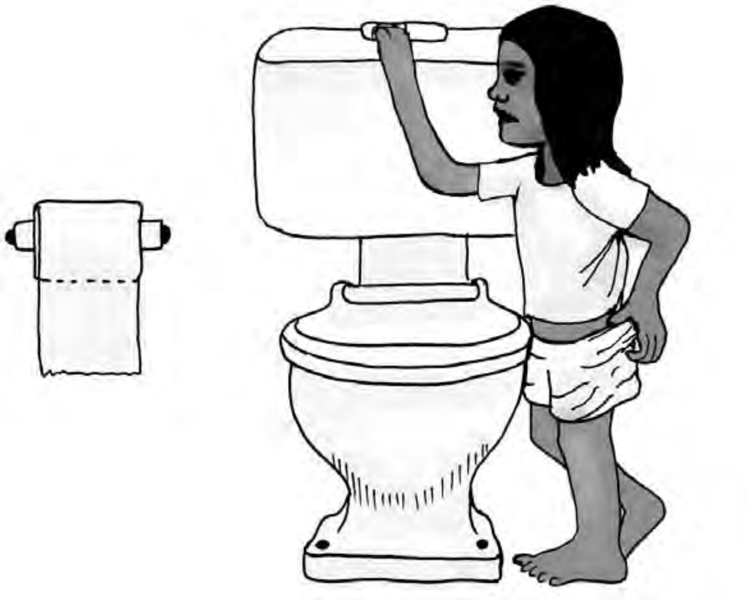


Fig. 2.14: Push the button.

Fig. 2.15: Clean the toilet.

Fig. 2.16: Use toilet paper.

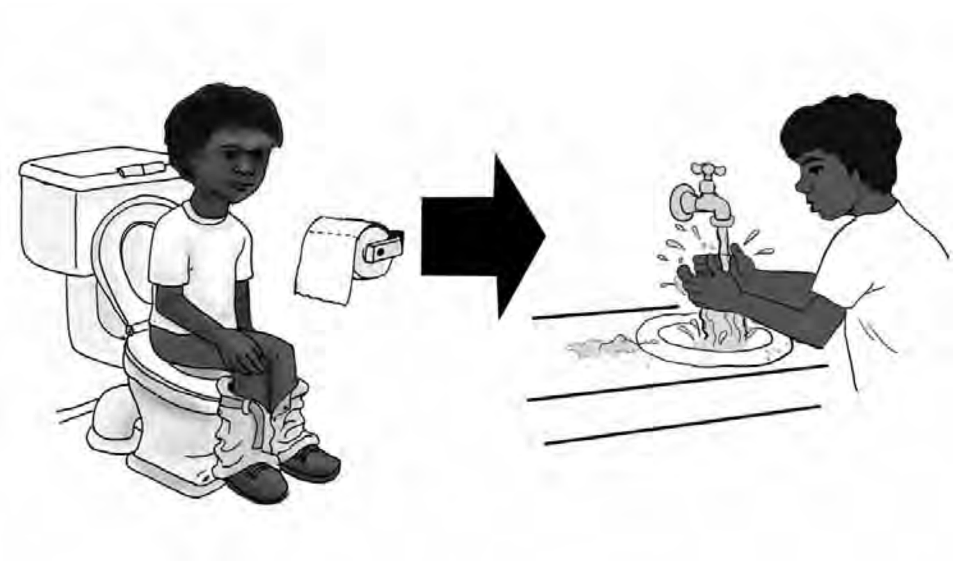


Fig 2.17: Wash hands after going to the toilet.

SEWAGE SYSTEM MANAGEMENT

Fig 2.18: Toilets which are not working properly must be fixed.

Fig. 2.19: Never use a blocked toilet.

Fig 2.20: These things block the toilet.

6 Plumbing

Nowadays, most houses and other buildings have some **plumbing**. Plumbing consists of the pipes which bring water to the building and take the sewage away.

The pipes cannot always be seen as they are often put between walls or under the ground.

Sinks, showers, hand basins, laundry tubs and toilets have metal or plastic pipes joined to them which go outside and connect into the sewage system under the ground. Older plumbing systems may have earthenware (clay) pipes.

The **sewer pipe** is the pipe which carries the sewage to the disposal system.

6.1 INSPECTION OPENINGS

Inspection openings (IOs) are covered holes in sewer pipes which allow access to the inside of the pipe so that blockages can be cleared. IOs are usually placed in the pipe where it comes out of the building, where the pipe changes direction, or at regular points in a straight length of pipe. One is also placed just before the septic tank if there is one.

If there is a problem with the plumbing and the pipes get blocked these IOs must be found. IOs are usually marked on the plumbing plan for the building, however, several holes may need to be dug before the IO is found. The best place to start is outside the wall near the blocked **fixture**. (The toilet, handbasin, bath, laundry tub and kitchen sink are called fixtures because they are firmly fixed to the building.)

The local Environmental Health Practitioner can assist you in locating IOs.

6.2 TRAP WATER SEAL

Nearly all sewer pipes and fixtures in a building will have a trap water seal. These seals are very important as they stop the gases which form in sewer pipes from coming into the building. Fixtures sometimes will have an IO at the base of the water seal pipe which allows it to be cleaned.

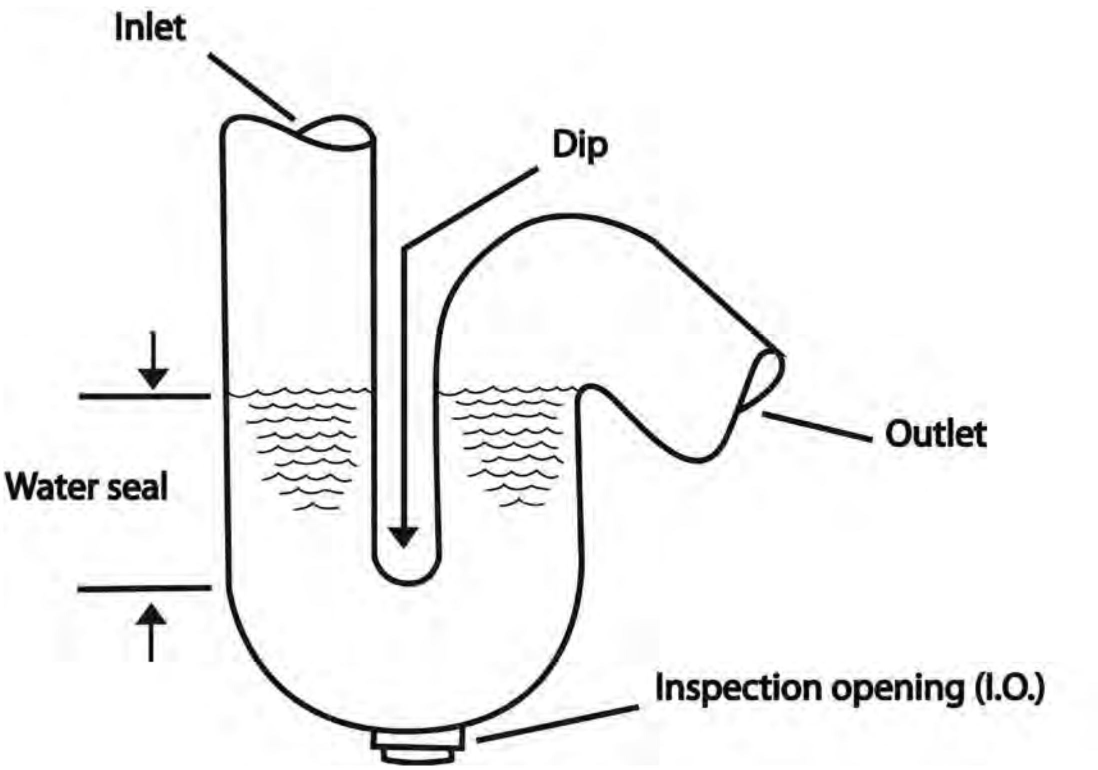


Fig 2.21: Water seal.

There are several different types of trap water seal design. Here are two of them.

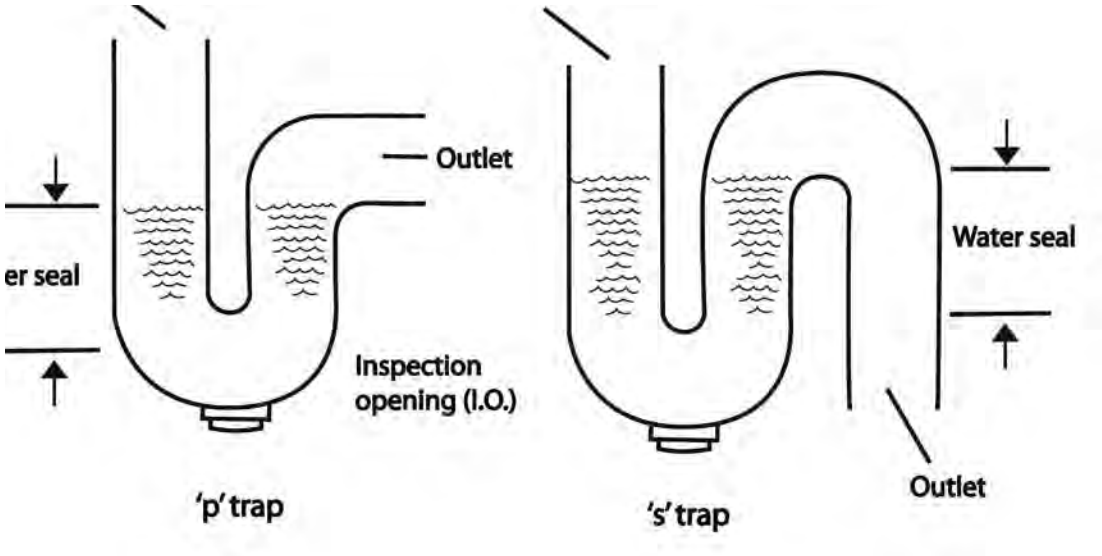


Fig 2.22: Trap designs.

6.3 DISCONNECTOR TRAP

The **disconnector trap (DT)** is a pipe coming out of the ground which is sealed off with a grate to stop rubbish getting into it.

It is a very important pipe as it allows the wastewater to escape if the plumbing system gets blocked. It is always found outside the house, so that any overflow water would be released outside the building.

It is also very important to make sure that the people in the building know that they must not put anything down the DT. For example, children must not drop sand or rubbish into it, and people must not pour cooking fat or other food waste into it.

It is very important to know where the disconnector trap is.

Fig 2.23: The disconnector trap.

Wastewater pipes coming from the tub, hand basin or kitchen sink may go directly to the DT. They will join the DT below the level of the grate. Toilet waste **never** goes into a DT and this means that a DT is never on the pipe coming from the toilet.

6.4 HOUSE PLUMBING DESIGN

This is an example of a house plumbing design showing the fixtures, inspection openings, disconnector trap, “S” or “P” traps and the sewer pipe.

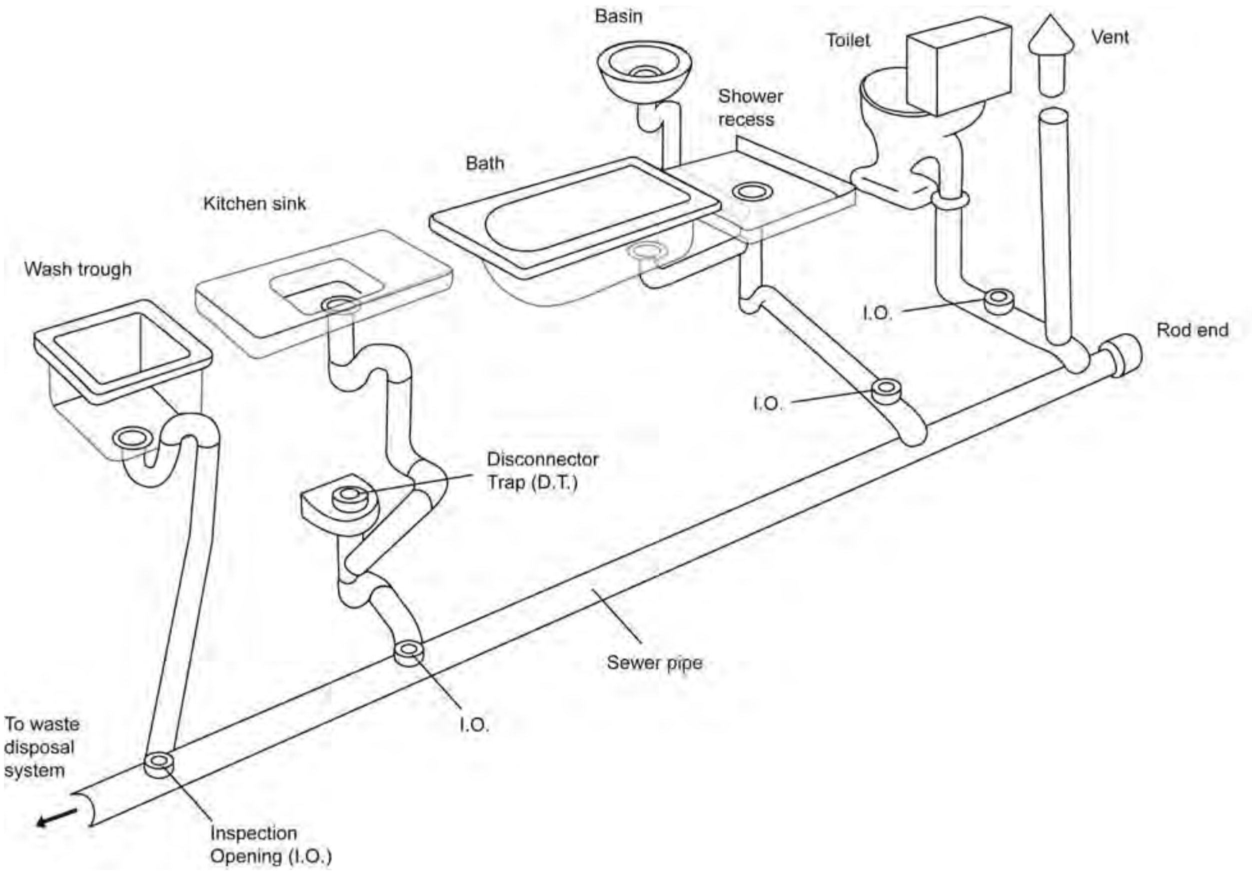


Fig. 2.24: A house plumbing design.

Sometimes in a bathroom the wastewater from the shower, hand basin, and bath can flow to a central drain. This drain may be the shower drain or a separate gully set in the bathroom floor, commonly called a **floor waste gully**.

A bathroom floor waste gully taking all the wastewater from the bathroom fixtures must go to the sewer pipe. This central drain will have a grate at floor level. The bathroom floor must be sloped towards the shower recess drain or the central gully so that water cannot pool.

Another way of taking away water on the floor is a dry floor waste. These can be placed in other rooms containing plumbing fixtures, such as the laundry or toilet, to assist in draining water from the floor.

A dry floor waste discharges the water directly into the ground just outside the room, because the amount of wastewater, usually from floor washing, should not be large and cause pooling.

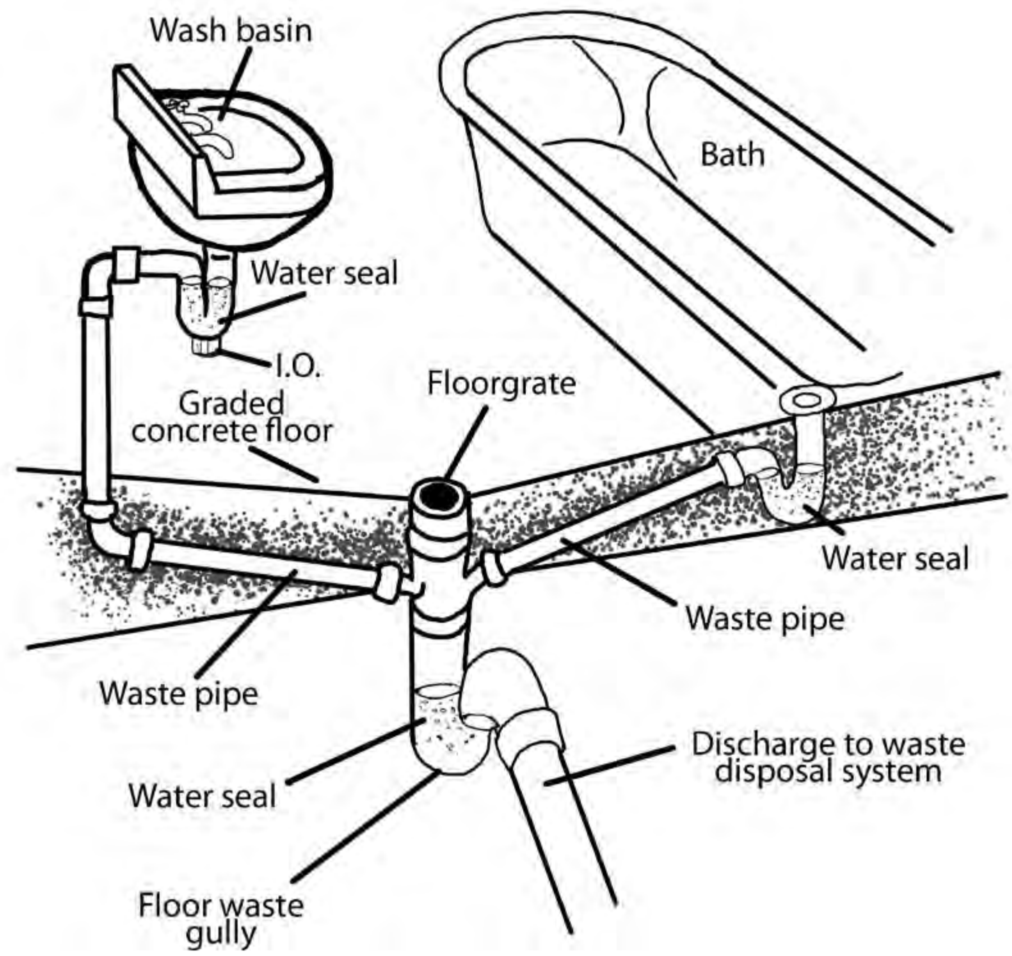


Fig 2.25: Typical floor waste gully.

7 Unblocking pipes and fixtures

7.1 COMMON BLOCKAGE MATERIALS

Toilets and toilet pipes get blocked when people put the wrong things down the toilet. Some of the things which should never be put down the toilet are foodscraps, paper, rags, cans, bottles, grease and fat.

Wastewater pipes from sinks, basins and laundry tubs can get blocked if people put food waste, especially tea leaves, hot fat and other rubbish down them. If hot fat is poured down an outlet pipe, it will set in the pipe when it cools and cause a blockage.

In addition to blockages caused by these materials, main sewer pipes can get blocked in other ways, for example, tree roots growing into the pipe joints and soil blocking the pipe when it is broken by vehicle traffic.

7.2 PLUMBING RODS

Plumbing rods are pieces of equipment used to remove most blockages from sewer pipes. However, when sewer pipes are broken plumbing rods are not effective and the damaged pipe must be replaced.

The rods screw together so that they can be made as long as needed. They have different kinds of endings to help remove the blocking objects.

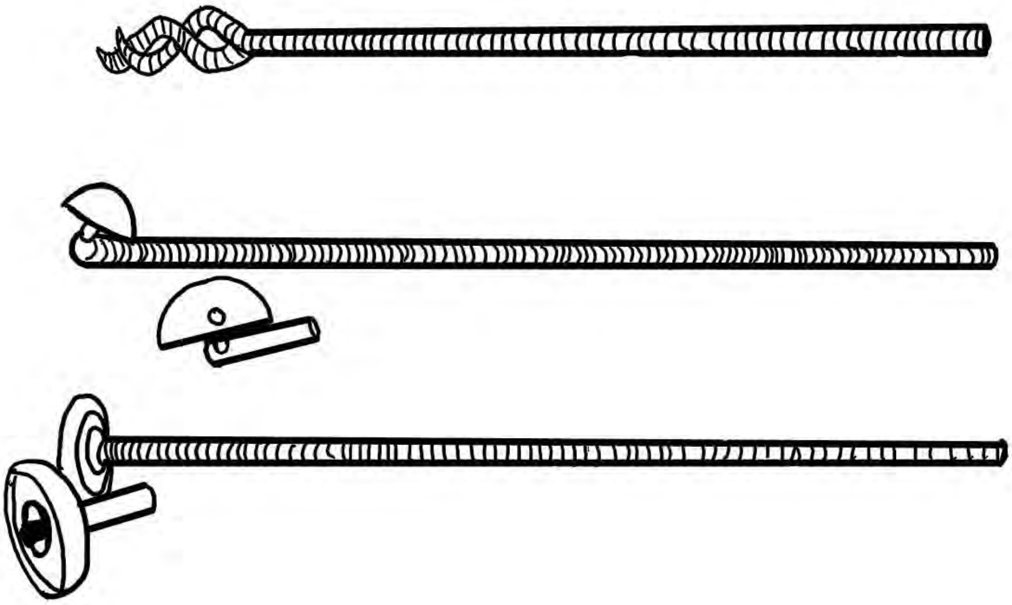


Fig 2.26: Plumbing rods.

To unblock the sewer pipe it is important to find an inspection opening (IO) **below** the blockage and push the rods **up** the pipe to the blockage.

Always remember which way the rods and endings have been screwed together and always twist the rods in the same direction.

If this is not done, the rods are likely to become unscrewed and be left in the sewer pipe. This will create a worse problem because the rods will also block the pipe. If this happens it will probably be necessary to dig up the sewer pipe and break it to unblock the pipe and get the rods back. This would have to be done by a licensed plumber.

7.3 UNBLOCKING SEWER PIPES

The larger sewer pipes have manholes set in them allowing access to the pipe. They are often about a metre underground and are large boxes which usually have walls made of concrete. The pipe opens into the box on one side and starts again on another side.

The lids, which are made of metal, can be lifted to allow someone to look down into the sewer to see if there is evidence of a blockage, for example, wastewater build-up in the manhole.

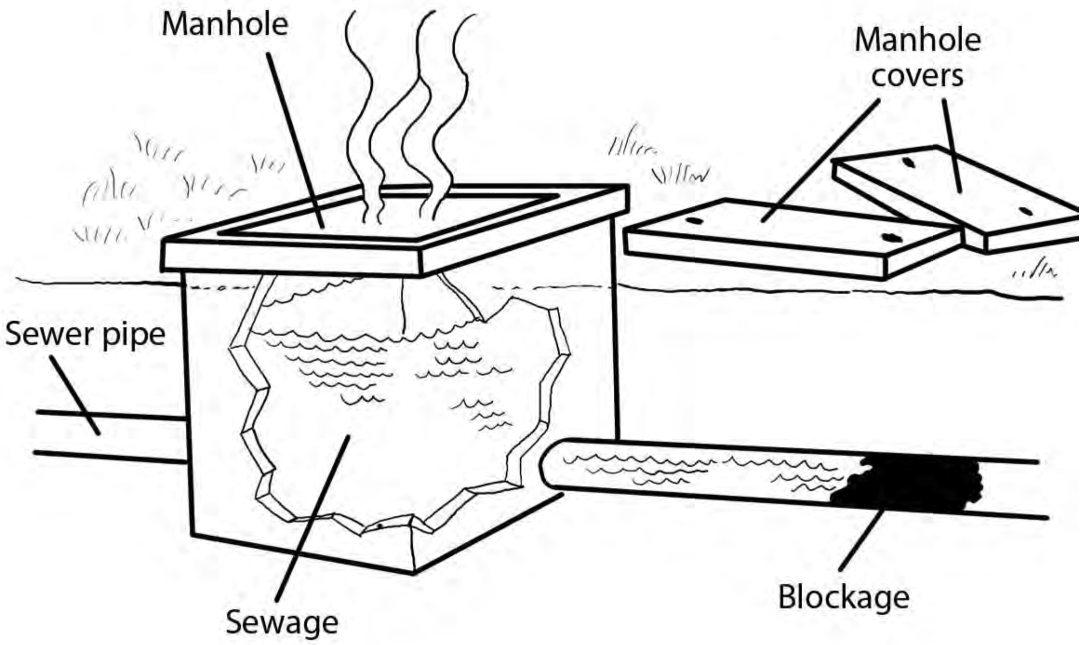


Fig. 2.27: A blockage in the sewer pipe can cause the wastewater to build-up in the manhole.

Extreme care must be taken when opening the lids of sewer pipes as poisonous and explosive gases can build up in these pipes.

Before attempting to unblock a sewer pipe it is important to remember:

- Before making an inspection, always wait several minutes to allow any poisonous or explosive gases to escape.
- Never smoke while doing this work.
- Never do this work alone.
- Never enter a manhole without proper safety measures. It may be necessary to wear breathing equipment or to **ventilate** (add fresh air) to the manhole and sewer pipe. **The gases in it can kill.**

SEWAGE SYSTEM MANAGEMENT

It is always safest to check with the Water Authority, the local government EHO or supervisor before opening the lid or entering the manhole.

If there are no manholes, then there will be IOs with cement or plastic caps on the pipes. There may be a concrete box around the inspection opening. Sometimes these are below the ground and are not easy to find. It may be necessary to dig to find them.

It is a good idea to get the sewer pipe plans for your community so that you can refer to the plans before starting to dig.

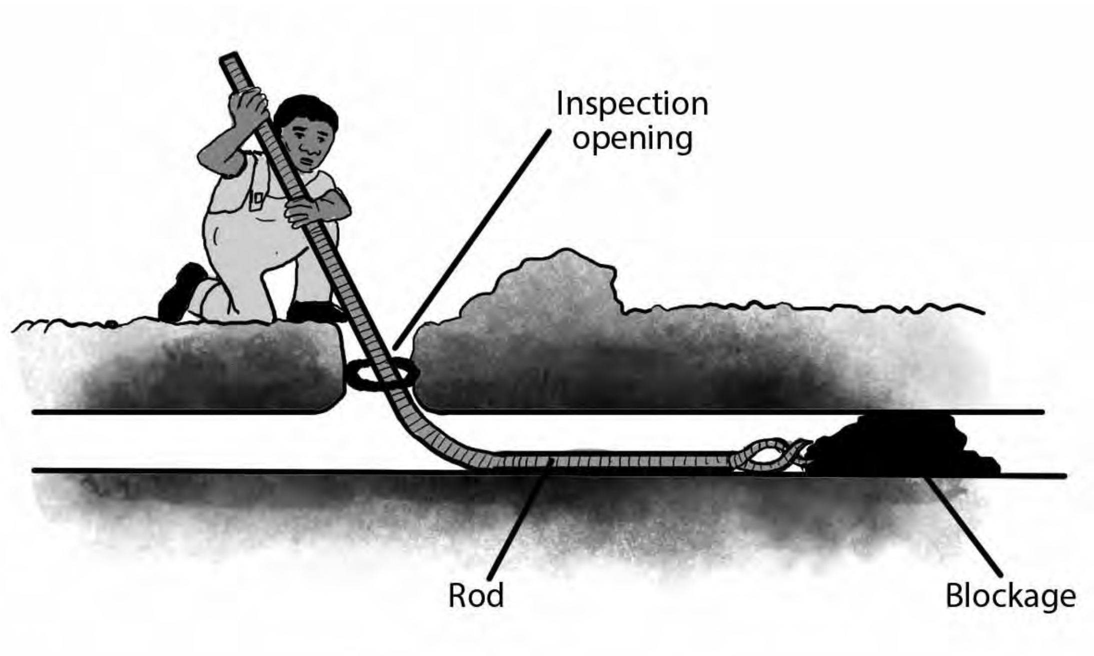


Fig. 2.28: Unblocking a sewer pipe.

7.4 UNBLOCKING FIXTURES

For the plumbing system to work, the pipes must be free of blockages. If the pipes are blocked, the toilet, shower, laundry tubs and/or the kitchen sink will not carry the wastewater away properly.

If a fixture is blocked, the wastewater may flow onto the floor of the house. If the sewer pipe is blocked, the wastewater may flow from the DT onto the ground outside. Contact with this wastewater may cause disease.

To unblock a sink, shower recess or any tubs, first remove any larger pieces of rubbish and then try using a **plunger** or a mop to finish unblocking the pipe. Pipes from sinks, basins and tubs and the small waste pipes leading to the larger sewage pipes outside the building will have small IOs.

These may be sealed with a screw plug, either close to the fixture or on a bend. The plugs on these IOs can be removed to allow access to blockages.

A plunger consists of a heavy rubber cup which is attached to a handle on the closed side. It is used by placing it over the opening to the blocked outlet pipe and then thrusting it up and down quickly over the hole. The suction caused by this action will help to move the blockage.

A mop can be used to unblock a pipe in the same way. It is best to use a mop to unblock a toilet pan.

If using a plunger or a mop does not work, the pipes will need to be examined through IOs or a manhole to find the blockage. This can then be removed with plumbing rods. If these are not available, a hose may work.

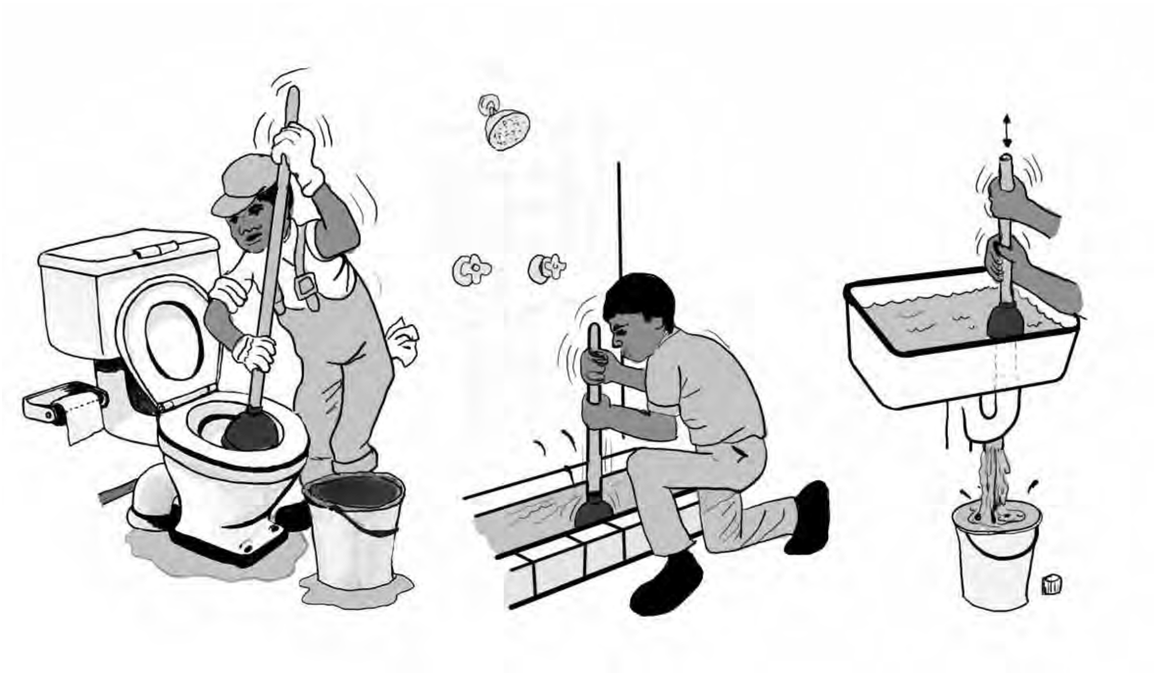


Fig 2.29: Unblocking fixtures.

8 Methods of sewage treatment

Every community should have a way of disposing of sewage so that people, animals and flies cannot touch it. This is called a **sewage system**.

There are different types of sewage systems which can be described as **on-site systems** and **sewage** or **effluent systems**.

An on-site system is one which treats the sewage in a septic tank so that most of the sewage becomes effluent and is disposed of in an area close to the house or buildings. An example of an on-site disposal system consists of a septic tank and leach drains.

A sewage or wastewater system disposes of the effluent from a community at a central place usually called a **sewage lagoon** or **effluent pond**. The sewage can be treated:

- in a septic tank at each building
- just before the lagoon in a large septic tank or macerator system, or
- in the lagoon itself.

8.1 ON-SITE DISPOSAL SYSTEMS

All the liquid waste from the toilet, bathroom, laundry and sink goes into pipes which carry it to a **septic tank**. The effluent from the tank is then disposed of through effluent disposal drains often referred to as **leach** or **French drains**. Both of these methods of disposing of liquid waste are **on-site disposal systems**. They must be installed and maintained properly.

In these systems, the effluent is soaked into the surrounding soil. Some soils don't allow good soakage such as clay or similar soils; if there are any problems with this disposal system a local government EHO should be consulted to talk about the problem.

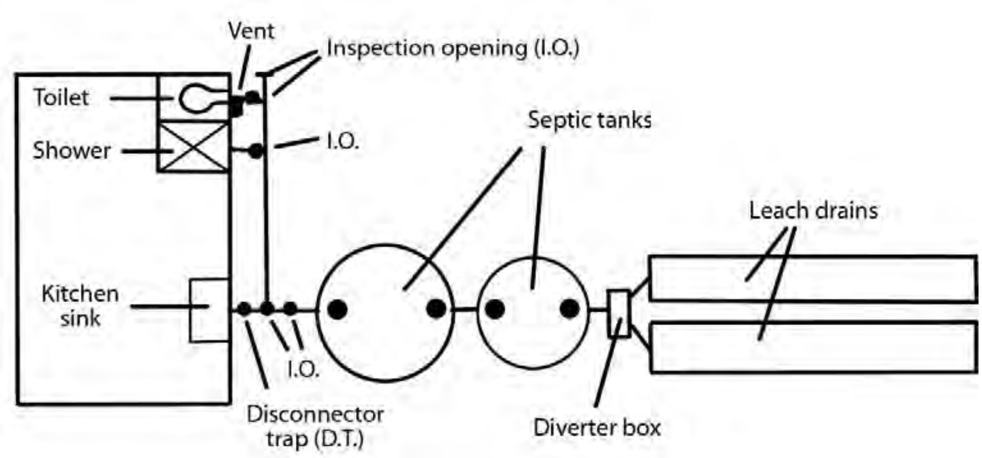


Fig. 2.30: Plan view (top) of an on-site sewage disposal system.

On-site disposal systems cannot be installed in all situations. For example, they cannot be installed:

- in areas that flood regularly
- in areas that have a high water table (that is, where the underground water is close to the surface)
- where the amount of wastewater to be disposed of is large
- near to drinking water supplies.

8.2 EFFLUENT (WASTEWATER) DISPOSAL SYSTEM

In this method the effluent from the community is carried by large pipes to the lagoon. These pipes serve all the houses and other buildings in the community. The sewage may be either be treated in septic tanks at the houses or buildings or at the lagoon. There are no leach or French drains.

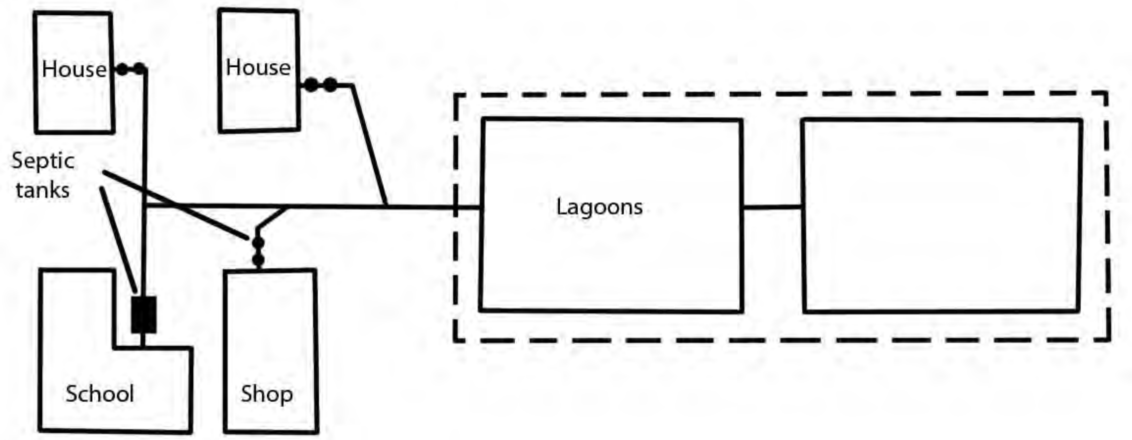


Fig. 2.31: Plan view of a wastewater disposal system.

8.3 FULL SEWAGE SYSTEM

All the sewage from the toilet, shower, laundry and other areas enters waste and sewer pipes directly and is pumped to a lagoon. There are three types of full sewage system:

- The sewage enters the lagoon without treatment.
- The sewage goes through a series of cutting blades which help break up the solid matter before it enters the lagoon. These blades are called macerators.

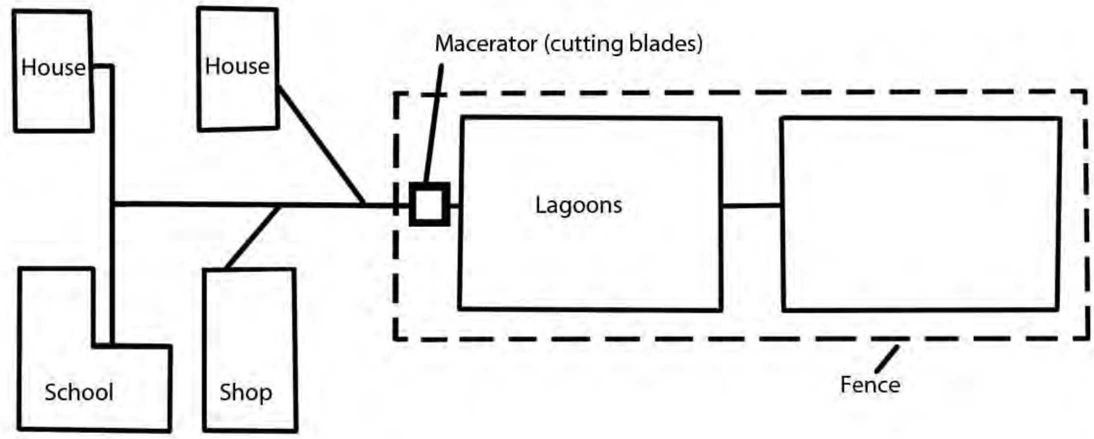


Fig. 2.32: Plan view of full sewage system and macerators.

- The sewage may be treated in a large septic tank just before it enters the lagoon.

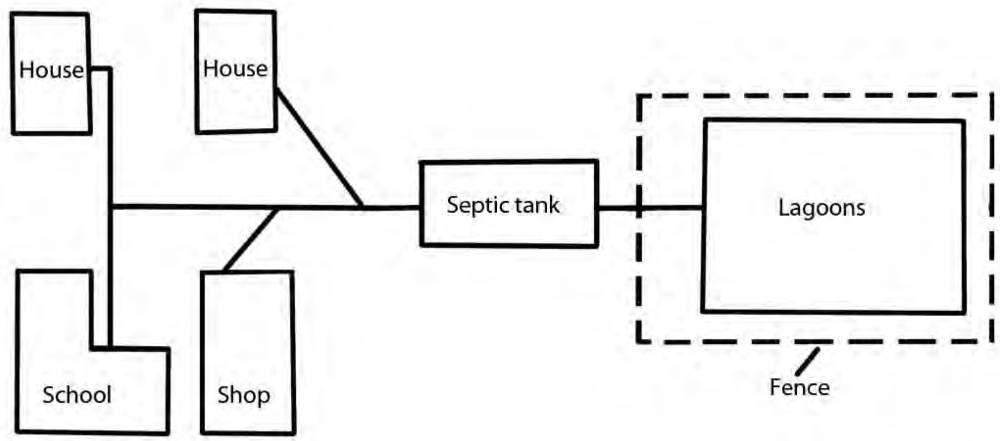


Fig. 2.33: Plan view of a full sewage system with a large septic tank.

9 The septic tank

A septic tank can be used to treat the sewage from individual buildings at the building itself or for the whole community, at the lagoon. The sewage will pass through sewer pipes to the septic tank either at the house or at the lagoon.

The septic tank is a sealed round or rectangular container which is used to break down the sewage so that it becomes effluent through the action of bacteria living on the waste matter.

9.1 SEPTIC TANK DESIGN

A household septic tank usually consists of two round concrete tanks with lids placed close to each other. They are connected by a pipe. This type of septic tank is designed to be used by up to 10 people. Round tanks are constructed (built) at a factory and transported to the site (place) where they are to be used.

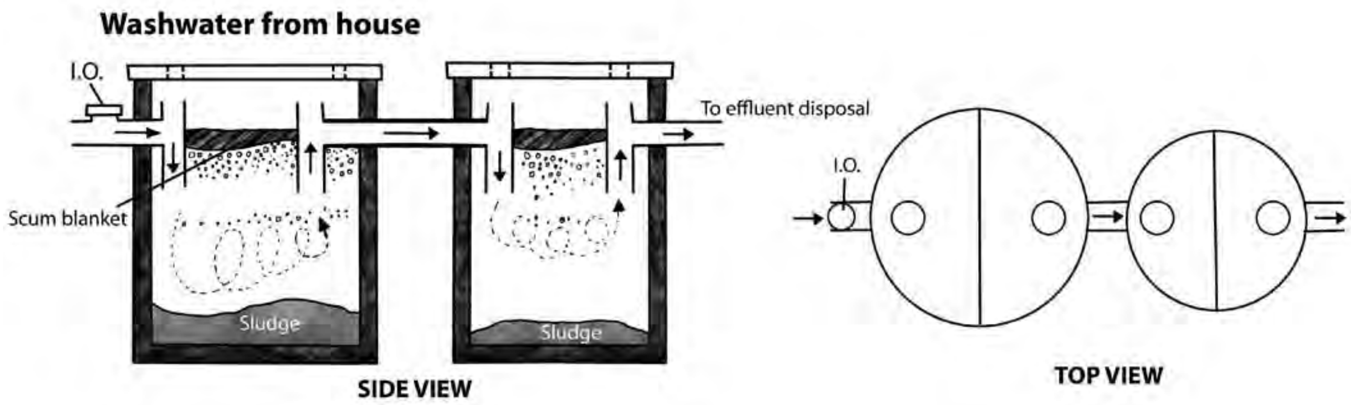


Fig. 2.34: A round septic tank system.

A septic tank can also be a single rectangular concrete tank with a dividing wall in it. A rectangular septic tank is designed to be used by more than 10 people and is often used for sewage treatment at a lagoon. The tank is constructed on the site where it is to be used.

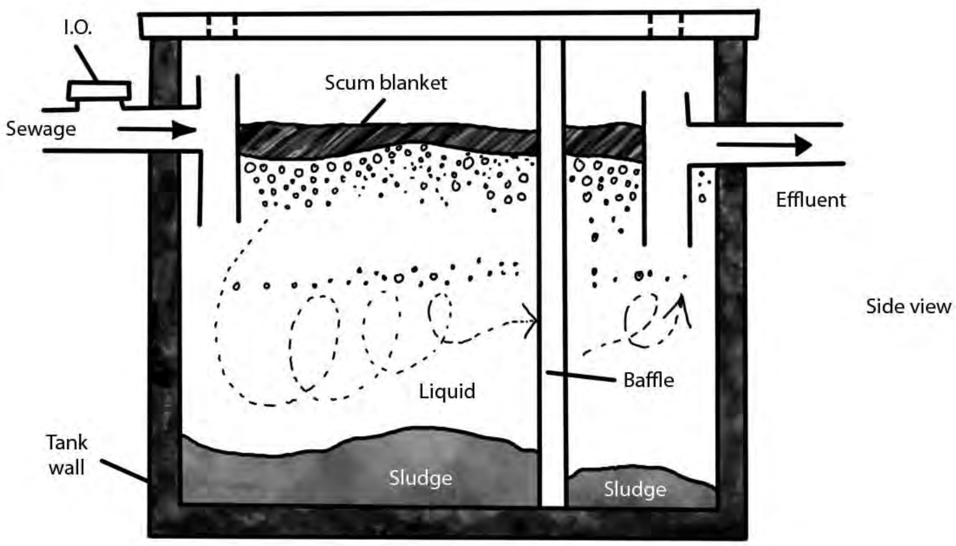


Fig. 2.35: A rectangular septic tank system.

Septic tanks are always divided into two sections, the first being twice the size of the second. In round septic tanks, the separation into two tanks provides this division. In rectangular tanks the dividing wall provides the division. This wall will have a hole in it below the level of the sewage to allow effluent to pass from the first to the second section.

Round septic tanks have concrete bottoms and lids. Rectangular tanks usually have concrete bottoms and lids, but some may have metal lids. The lids can be lifted off for maintenance and will have IOs in them.

There are many regulations (rules) which require septic tanks to be constructed, positioned and installed in a particular way. These rules are controlled by local authorities.

It is very important to find out if the regulations are being followed by contractors or anyone else installing (putting in place) new septic tanks in the community. It is a good idea to contact the local EHO to check that the necessary approval has been given to construct and/or install the septic tank disposal system.

If anyone wants to know anything about septic tanks, including the rules relating to their construction, or there are any problems with these tanks in the community, contact the EHO or Environmental Health Practitioner.

9.2 HOW A SEPTIC TANK WORKS

A septic tank must be filled with water before it is used. The water helps start the treatment of the sewage by the bacteria.

The sewage treatment by the bacteria turns the waste matter into **effluent** (wastewater) and a solid substance called **sludge**. The effluent gets carried to the leach drain, French drain or lagoon.

The material in the septic tank gets covered by a hard crust known as a **scum blanket**. This blanket acts as an **air seal** keeping air away from the sewage. The lack of air helps in the breakdown of the sewage by the bacteria.

The sludge gathers at the bottom of the tanks. Eventually there will be too much sludge in the tank and it must be pumped out and the sludge disposed of correctly.

By having two tanks or a rectangular tank divided into two sections, most of the sludge stays in the first tank or section. In the second tank or section, the sewage undergoes further treatment to remove solid matter.

The effluent is then piped to the effluent disposal system, such as the lagoon. **This water still contains germs and parasites.**

9.3 PROBLEM SIGNS IN SEPTIC TANKS

The septic tank will need to be checked if there are signs that it is not working properly.

Some signs that a septic tank is not working properly are:

- The sewage in the toilet or the liquid waste from other fixtures flows away very slowly.
- Liquid waste overflows from the disconnector trap.
- Wet areas are seen at the top of the septic tank.
- There is a strong unpleasant smell near the septic tank.
- The grass around the tank is very green and growing well.

In the case of on-site disposal systems, it is important to remember that some of these signs may indicate problems with the leach or French drain. Therefore, these drains will need to be checked at the same time as the septic tanks are checked.

If the septic tank and the leach or French drain need to be pumped out, both should be done at the same time.

9.4 PUMPING OUT SEPTIC TANKS

Septic tanks should be pumped out every five years to keep the disposal system working properly. However, this may need to be done more often, for example, if they overflow or become blocked.

If there are any signs of a problem with the septic tank (see Section 9.3), it will need to be checked.

The inside parts of the tank system which will need to be checked are:

- the scum blanket (as it may become too thick and block the inlet pipe)
- the inlet or outlet pipes (as they may be blocked by solid matter)
- the sludge (as it may have accumulated so that it fills most of the tank)
- the tank's bottom, sides or lids (as one or more of these may have been cracked or broken. For example, vehicle movements over septic tanks are likely to damage the lids and sides).

For the first few times an EHP pumps out a septic tank, it is important to always check with the local EHO or Environmental Health supervisor before any pump-out work is commenced.

These people will provide information on disposal sites and the correct pump-out methods as well as technical help in assessing the inside parts of the septic tank.

Emptying a septic tank

<u>Before commencing Pump-out</u>

(a) Find out if the community has or can obtain a pump-out tank or tanker. Make sure the sludge pump (pump-out equipment) is available and working.

(b) Locate an appropriate disposal site.

If a tank or tanker is used, the disposal site must be a place which is suitable for getting rid of the dangerous sludge and effluent and be able to take all the pumped out materials. For example, the site must be well away from water supplies, children's play areas, camp places, rivers and streams, and downwind if possible. Often this place will be a hole dug in a separate part of the community rubbish tip.

If there is no tank or tanker available, the pumped-out material must be disposed of in a hole near the septic tank.

The distance between the septic tanks and the disposal hole will depend upon the length of the pump-out hose. The hole must be away from water supplies.

(c) Where possible, remove any tins, bottles, rags, newspaper and other rubbish that may be in the septic tank. This material can either be disposed of in the pump-out hole at the site or at the rubbish tip.

All sewage material which is to be taken to the tip should be transported in sealed drums.

Fig. 2.36: Removing solid materials.

When pumping out the septic tank:

(a) Pump out the sludge into the tanker or the hole.

If using a tanker the sludge can be deposited at the appropriate site away from the community.

If the disposal site is near the septic tank and the pump-out has commenced, the hole must be guarded at all times even if the pump-out stops for some reason, for example, for a lunch break or because of an equipment breakdown. The sewage must be covered with soil if the pump-out is not finished by the end of the day.

After covering the sludge with this layer of soil there may still be space in the hole to complete the pump-out the next day.

When covering the sludge with soil, remember that some time must allowed for the liquid to soak away before putting soil in the hole.

(b) When the job is finished the hole should be filled with a thick layer of soil.

(c) Once the septic tank has been completely emptied, it must be filled with water before it is used again.

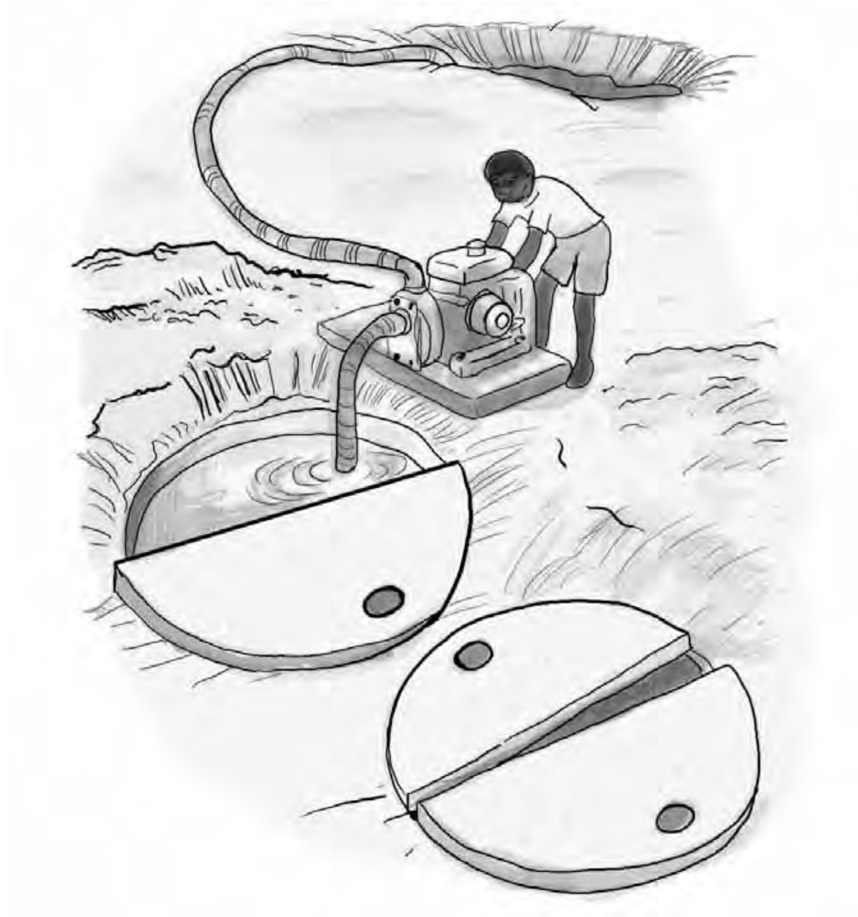


Fig. 2.37: Pumping out a septic tank.

Note: When pumping out a septic tank using this method, great care must be taken and it is suggested that a local EHO should be consulted.

10 Effluent disposal drains (leach and French drains)

Effluent disposal drains such as leach drains and French drains are used to get rid of effluent that comes from the septic tanks. It is better to have these disposal systems put in two at one time (dual), so that one can be in use while the other one is rested. Resting one drain system lets oil and grease that has collected in the surrounding soil be broken down. These dual systems also last longer than a single system the same size.

10.1 LEACH DRAINS

A **leach drain** is a tube-like structure which is made of concrete or plastic and buried in the ground. There are holes in the sides. Its width can vary and its length depends upon the size of the leach drain being used, the amount of liquid waste to be disposed of, the type of soil (dirt) around it, and how it is built.

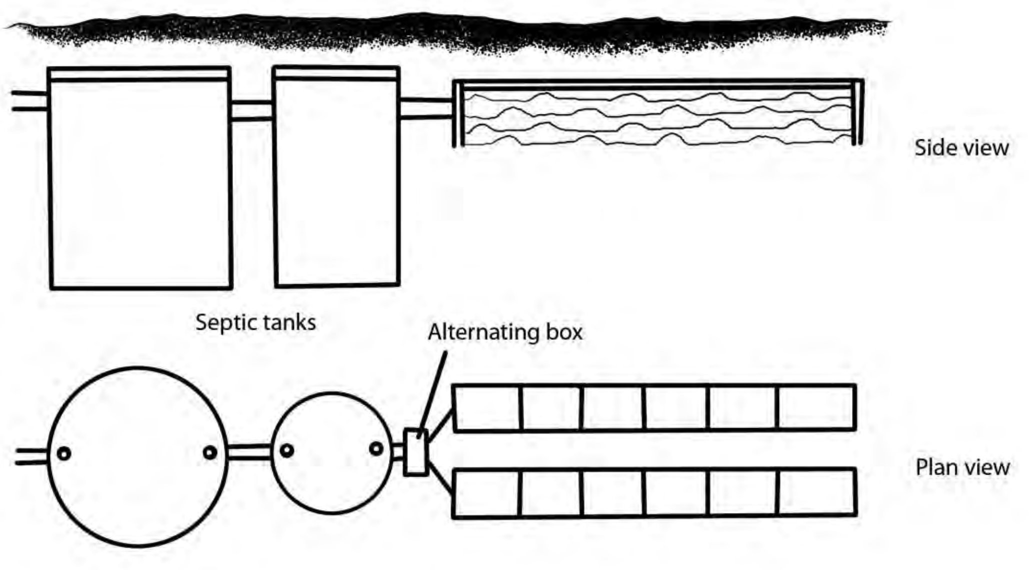


Fig. 2.38: Septic tanks and brick leach drain.

The liquid waste enters the leach drain at one end then slowly seeps down through the open base and out the sides through holes into the surrounding soil.

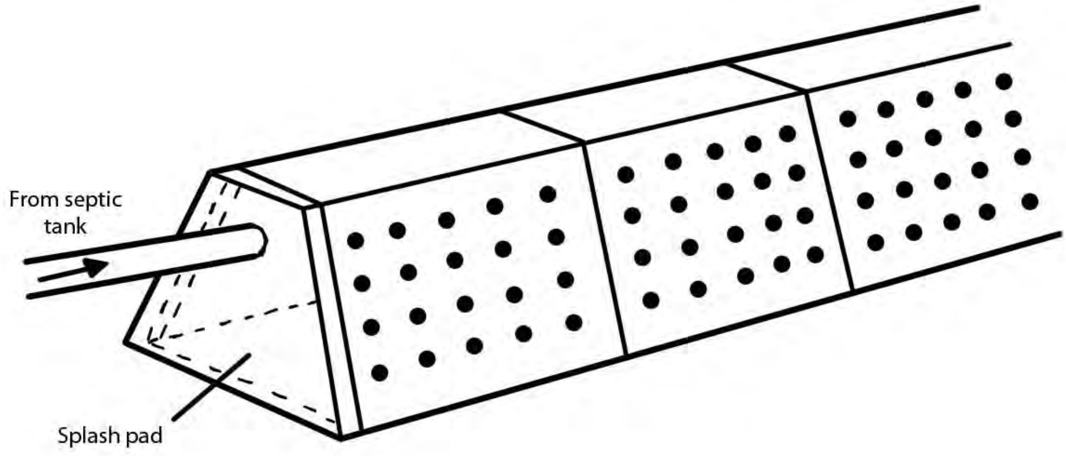


Fig. 2.39: Concrete segment leach drain.

10.2 FRENCH (RUBBLE) DRAINS

The **French drain** is also used to dispose of the liquid waste coming from the septic tank. It is a pipe with holes or slits cut in it, laid on a bed of round rocks. The holes or slits in the pipe face downwards. It is usually about 20 m long but the length depends upon the amount of effluent to be disposed of and the soil type around the drain.

The drain is covered with plastic or some similar material and is then covered with a protective layer of sand or gravel. This helps prevent the pipe holes or the gaps between the rocks from blocking up with the protective sand or gravel.

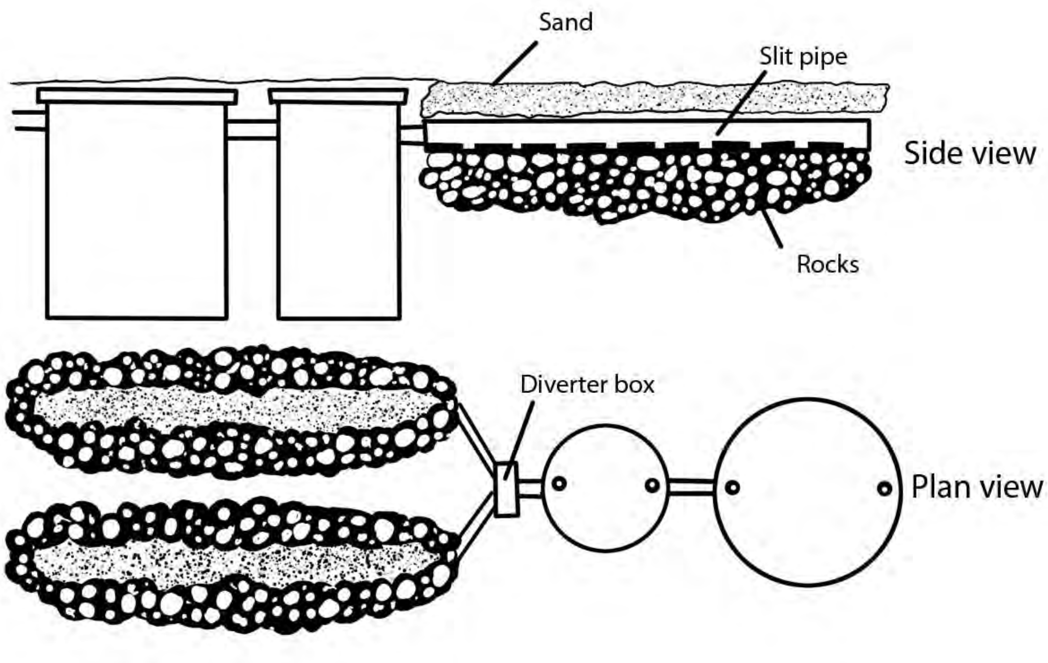


Fig. 2.40: French drain (rubble drain).

10.3 LEACH/FRENCH DRAIN MAINTENANCE

It is very important to remember that leach and French drains have a limited life (they do not last forever) because the surrounding soil can become clogged with oil and grease.

By using the dual drain systems, only one half of the system is being used at any one time. By alternating the use of these dual systems, the half that is not being used can dry out, the air breaks down the oil and grease so that the drain can be used again once the soil has become unclogged.

It is important to make sure that these alternating drains have their diversion valve switched over regularly so that the drains give a long life use.

By making sure septic tanks are regularly pumped out there is less solids entering the drains and they will have a much longer life.

All leach and French drain sizes are determined by the EHO who follows a set of regulations. These take into account surrounding soil types and the amount of effluent which needs to be disposed of each day. These rules also detail siting and construction requirements.

If there are any enquiries regarding these drains, contact the local EHO or Environmental Health Practitioner.

11 Sewage lagoons

A **sewage lagoon** is a large pond into which the sewage or effluent from the sewage system flows. Sewage lagoons are also called **effluent ponds.**

The sewage and effluent are broken down by germs in the lagoon. The sun and wind play an important role in the working of the lagoon. They provide light, warmth and oxygen to the water. This is necessary for the growth of the bacteria in the water.

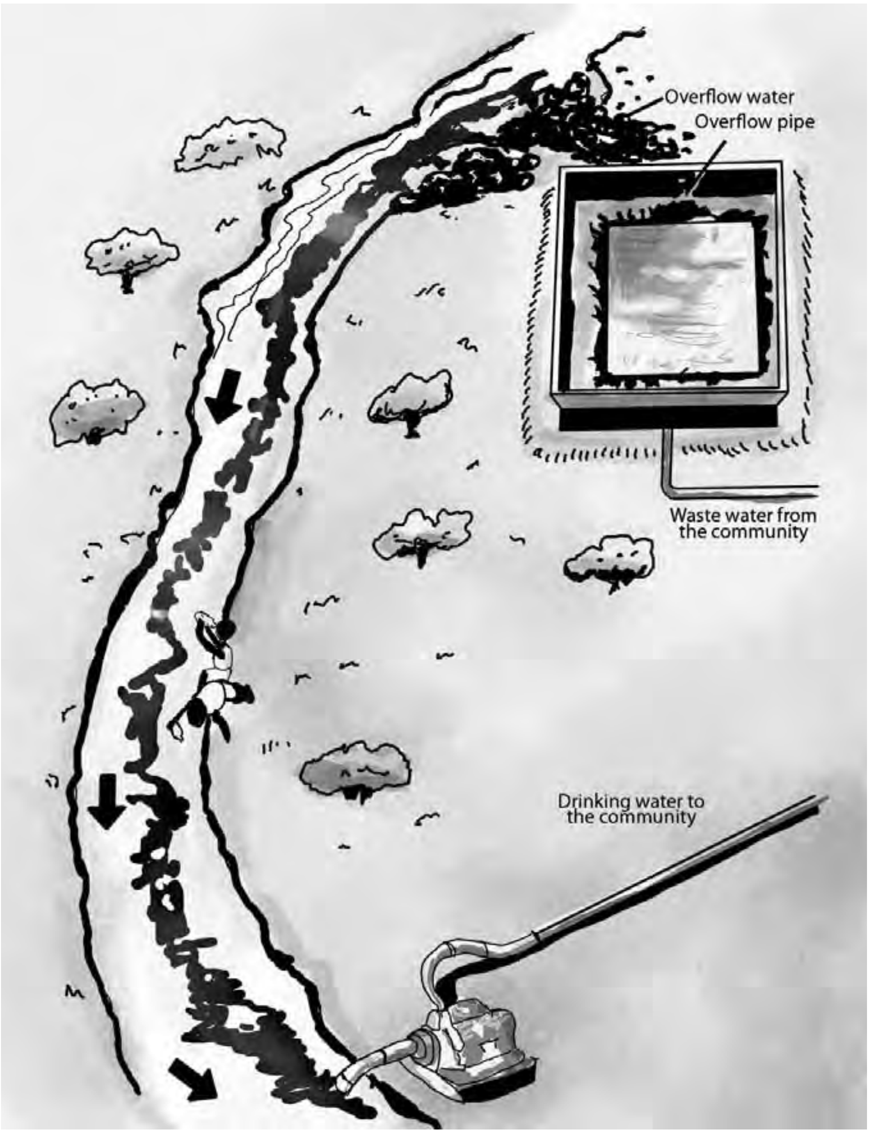
The light, warmth and oxygen also aid the growth of algae in the water. The algae give the lagoon its greenish flecked colour. The algae helps the bacteria to break down the sewage and effluent.

The wind helps with the evaporation of the water and serves to get oxygen into the water. It also creates waves which help stop insects from breeding and living in the water. Disease-causing mosquitoes, for example, need still water to breed.

For a lagoon to be able to break down the sewage or effluent properly and to be a healthy place it must meet the following requirements:

- It must not be more than 1 m deep.
- The banks need to be sloped at approximately 15 to 20 degrees and made of concrete, gravel or rock. This stops the wave action from eroding (breaking down) the banks.
- There must be no grass, trees or other vegetation on the banks or surrounding area which would stop the sun and wind action needed by the lagoon.
- The water must be free of vegetation or objects which stop the lagoon's surface wave action or create still patches.
- It must be surrounded by a high fence with a lockable gate to keep children and animals out.

11.1 LAGOON OVERFLOWS



Where there is only one lagoon in the sewage disposal system, it will have an **overflow** situated directly opposite where the pipe carrying the sewage or effluent enters the lagoon. If there is more than one lagoon in the system, the overflow will be in the last lagoon.

Fig. 2.41: This is how the overflow from sewage lagoon contaminates the community drinking water supply. This is the wrong way.

SEWAGE SYSTEM MANAGEMENT

The overflow releases water from the lagoon system which has not been removed by evaporation. New lagoon systems are required to be designed so disposal occurs by evaporation only. They should not rely on overflow, except during very heavy rainfall periods. However, where an existing lagoon system uses an overflow method, the overflow should not create a flooded or swampy area suitable for mosquito breeding, or where it may contaminate drinking water or the environment.

11.2 LAGOON MAINTENANCE

Lagoons which are not working properly or are poorly maintained or damaged may be dangerous to health.

Signs of a lagoon which is not working properly are heavy overflow, mosquito breeding or a bad smell.

Signs of a lagoon which is poorly maintained or damaged include broken fences and gates, trees, shrubs or grass on the banks, grass growing and other objects in the water causing still patches.

Fig. 2.42: Unsafe sewage lagoon.

To be properly maintained the lagoon should be checked frequently and any problems reported to the authority responsible for providing the maintenance.

It is important to report any of the following:

- eroded or broken lagoon banks
- lagoon banks which are not angled at 15-20 degrees
- trees and/or other vegetation growing in the lagoon, on its banks or in the area around the lagoon
- bad smells given off by the lagoon
- water which is not a light, flecked green colour
- still areas on the surface of the lagoon
- signs of mosquitoes breeding in the water
- damaged fences or gates that cannot be locked properly to keep out animals and children
- rubbish in the water
- a swampy situation near the lagoon (possibly caused by the overflow) which could provide mosquito breeding areas
- grass on the banks of lagoons, particularly growing at the edge of water, which can provide ideal mosquito breeding areas.

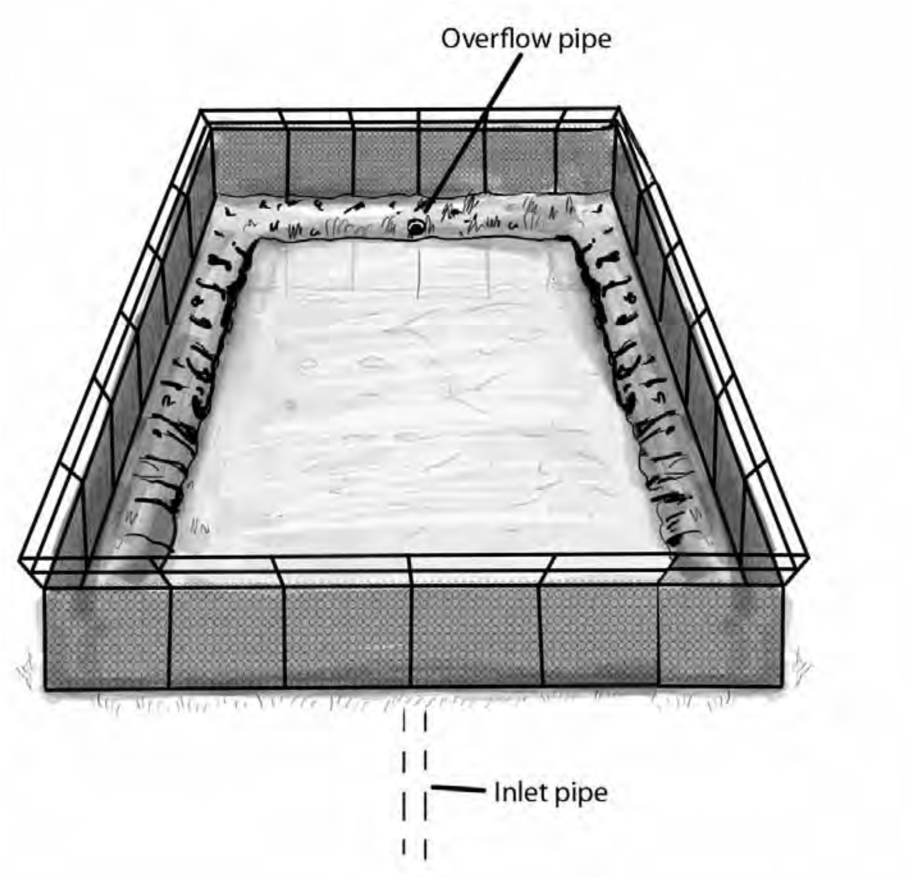


Fig. 2.43: Properly maintained lagoon.

SEWAGE SYSTEM MANAGEMENT

12 Communities without a sewage disposal system

Some communities may not have sewage systems with pipes, septic tanks/leach drains or lagoons. This may be because they are new communities or the people are staying in a place which is not used all the time.

The sewage and effluent has to be disposed of properly in some other way. If this does not happen the sewage and effluent may cause disease.

Wastewater from people washing themselves and their clothes and bedding, and from cooking must not be tipped onto the ground. This wastewater can contain disease-causing germs. The wastewater can lie in pools allowing germs to breed and causing bad smells. It attracts flies and mosquitoes, and can also be harmful to children and family pets who like to play in water.

The methods of sewage disposal outlined below can be used as temporary (short-term) solutions, but they will never be as good as a proper sewage system.

Combination of a grease trap and soakage pit

This pit can be used for disposing of cooking and washing wastewater in temporary camps and in new communities for a short period of time until proper disposal systems are installed. It cannot be used for toilet waste.

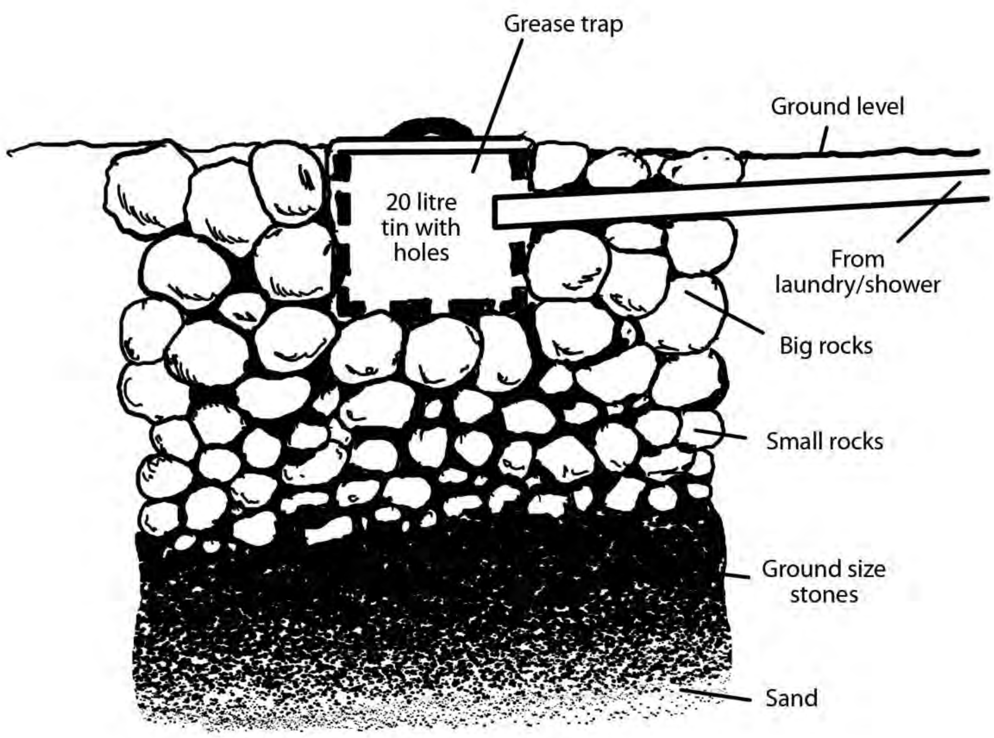


Fig. 2.44: Grease trap and soakage pit.

The **grease trap** collects any food scraps and solids and prevents any grease or fat from entering the **soakage pit**.

The grease trap is a 20 L (4 gallon) drum with a tight fitting removable lid. It has holes in the bottom and in the sides.

The grease trap is set into a large hole called the soakage pit. This is filled with stones and sand. The hole should be carefully packed with sand at the bottom and layered with stones of different sizes—small stones (gravel) at the bottom to large stones at the top.

Soakage pits should be about 1200 mm square and the same distance (1200 mm) deep. If one pit is not big enough more of the same size can be dug. These can be individual pits or connected by pipes.

It may be necessary to clean out the grease trap every day depending on how much use the pit is getting. The waste from the grease trap should be buried at the place where other rubbish (solid waste) is being buried.

Grease traps and soakage pits should be covered to keep out flies. Flywire can be used to cover the soakage pit around the grease trap.

Pit toilets

Where there are temporary camps or where the community is newly established and there is not yet a water supply which will allow the use of flush toilets, the following types of pit toilets can be used:

- bore-hole latrines
- VIP latrines
- shallow trench latrines.

Shallow trench latrines can be built where there are large numbers of people who are going to live in a place for a short time only. There is a latrine for each sex and each time a person goes to the toilet he/she should cover any faeces with soil.

When a trench is nearly full, it should be filled with soil.

Chemical toilets may be considered, but are rarely practical in these situations because of the need for supplies of chemical and pump-out equipment. Also, it is sometimes difficult transporting these toilets to remote places.

3 HEALTHY PEOPLE, HOMES AND DOGS

1 Domestic and personal hygiene

Today, most Indigenous people live in the one house for a long time. It is important that the house be kept clean so that it is a healthy place. If the house and everything in it are not cleaned often, moisture and dirt gather and it becomes an ideal place for germs, parasites and vectors (disease-carrying animals) to breed and multiply. These germs can cause the people living in the house to get sick.

Domestic hygiene activities include all the jobs which are done to keep the house and people's clothes and bedding clean. These jobs include sweeping and washing floors, cleaning the toilet, washing clothes and bedding, and washing dishes and cooking utensils after meals. There are many more.

Fig. 3.1: Sweeping the floor.

As well as making sure that the house is a clean and healthy place, it is important for good health to keep our bodies clean. If our bodies become dirty and sweaty and stay that way for a while, the skin and hair become ideal places for disease-causing germs to grow and multiply. The teeth and gums also need to be kept clean to stop them from becoming diseased.

Personal hygiene activities are all the things done to keep the body clean. Some of these activities are showering, washing hair, cleaning teeth and changing into clean clothes when necessary.

Fig. 3.2: Cleaning teeth.

2 Poor hygiene and disease

There are many sicknesses which can be caused by inadequate (poor) domestic or personal hygiene.

Signs of poor domestic hygiene include:

- not cleaning the toilet
- not getting rid of rubbish
- not washing clothes and bedding frequently
- not storing food properly.

Signs of poor personal hygiene include:

- not washing hands
- not showering
- not washing hair.

Diseases in Indigenous communities caused by germs and parasites resulting from inadequate domestic and personal hygiene

Bacterial

- food poisoning
- gastroenteritis
- diarrhoea caused by *Campylobacter*
- pneumonia
- trachoma
- skin infections.

Viral

- hepatitis A
- gastroenteritis
- colds and flu.

Parasitic

- giardiasis
- scabies infection
- pediculosis (head lice infection)
- hookworm infection
- threadworm infection
- roundworm infection (strongyloides).

Poor domestic and personal hygiene practices can help the transmission of disease-causing germs:

- **directly** by the faecal-oral route, or by person to person or pet to person contact
- **indirectly** by vectors coming into contact with people or their food, people breathing in airborne droplets of moisture which contain germs or eating contaminated food.

3 House design and health

it is important that houses are pleasant and healthy places in which to live. There are many factors to be considered in a house design to make it a healthy place.

Protection from the weather

A house should keep out the rain and strong winds. It should keep out as much heat as possible in hot weather and keep in the warmth during cold weather. If the house meets all these requirements it lowers the chances of people getting sick from too much heat, cold or dampness.

Size of rooms

Each room in the house should be large enough to allow the people living there to have enough space to live comfortably.

Rooms that are too small can lead to overcrowding and this can make it easier for diseases to be spread from person to person. Overcrowding can make people annoyed and depressed (downhearted). Rooms that are too small can result in the people using them not getting enough air.

Even a large house can become overcrowded if too many people live in it.

Ventilation

All rooms should be well **ventilated**. This means that air should be able to flow into and out of each of the rooms. This is important so that fresh air can get inside all the rooms and stale air can get out. Ventilation also allows heat, steam and odours (smells) to escape, particularly from the kitchen, bathroom, laundry and toilet. This is important for the good health of the people living there.

Open windows and doors allow the house to be well ventilated. Sometimes air vents are placed in the walls or the corners of the ceiling to provide ventilation when doors and windows are closed.

Toilets usually have a window with one part always fixed open, or have an air vent in the ceiling which opens to the outside air.

Cooking areas also should be well ventilated so that any cooking smells are blown or sucked out of the house.

Sometimes houses do have plenty of windows but the people living in the house rarely or never open them. These people should be encouraged to open their windows, especially on days when a breeze is blowing. Fly screens allow for windows to be open while protecting people inside from flying insects (flies and mosquitoes).

Lighting

As well as providing ventilation, windows also let natural light into the house. There should be enough windows to let in plenty of light. It is difficult for germs and insects to live and breed in light, airy rooms. When plenty of light can get into the house, it helps to make the home a cheery place to live in.

When electric power is supplied to the house, each room usually has electric light. Electric light is one kind of artificial light (not supplied naturally by the sun or moon). Gas, kerosene and candle lights are also artificial.

Where possible, electric lights also should be positioned outside to light up areas such as verandahs and outside toilet blocks at night.

Power

If it is available in the house, electric power can be used for many purposes. For example, it can be used for lighting, heating water, cooking and for running many appliances such as refrigerators, TV sets, radios, kettles, toasters, and vacuum cleaners.

Water supply

Every house should have clean drinking water supplied to it. Plumbing carries the water to taps in different parts of the house.

The kitchen, laundry and bathroom should each have water supplied. Water must also be supplied to the toilet if it has a flushing mechanism. Outside the house, water can be used on gardens and trees. Care should be taken to avoid wasting water.

Kitchen

If possible, the kitchen should have:

- a window or vent to let in fresh air and to allow cooking odours to escape. Sometimes a mechanical fan will ventilate the room
- screens covering the windows to stop flies from coming in
- a sink with water supplied to wash food and dishes
- if possible, hot as well as cold water should be available to the sink
- a workbench area which can be used to prepare food
- a ventilated storage cupboard in which to keep dry and canned foods
- storage areas for crockery (cups, saucers, plates, glasses), cutlery (knives and forks), kitchen utensils (saucepans, frying pans, billies) and cleaning equipment

- a stove for cooking
- a refrigerator for keeping foods cold to stop them from going bad too quickly.

Fig. 3.3: A well designed and equipped kitchen.

Bathroom

Every house should have an area where people can clean their bodies. The bathroom should have a basin and a shower or bath with water supplied directly to each of them. If possible, hot as well as cold water should be available at these places.

Many families have small children or babies who need to be bathed regularly. If there is no bath in the bathroom, the shower recess may be deep enough to plug and use as a bath. If the shower recess is to be used in this way, the water must be drained out immediately after use and the floor of the shower kept very clean.

The bathroom should also have towel rails, hooks to hang clothes on, a mirror and a cabinet for storing toiletry items such as soaps, deodorants, toothpaste, and toothbrushes.

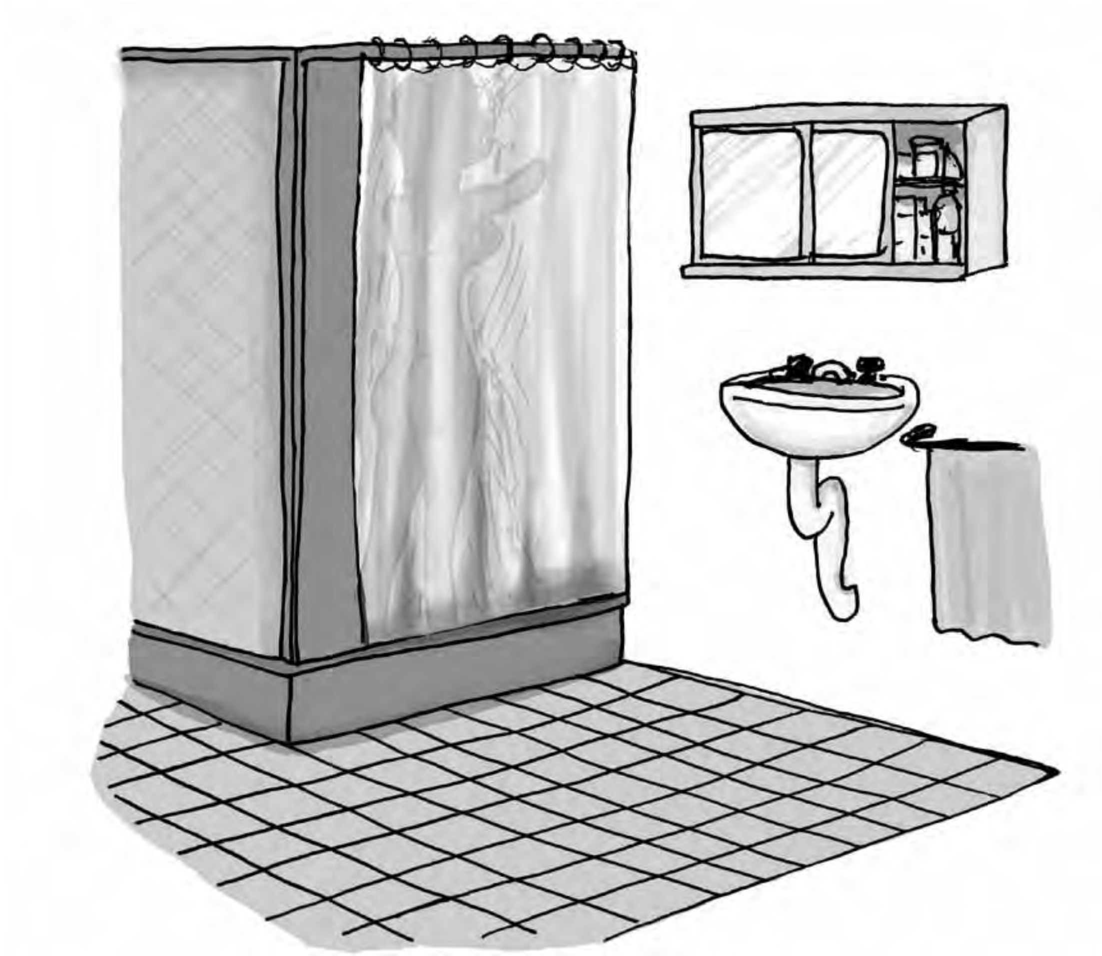


Fig. 3.4: A bathroom with shower, basin, cupboard and towel rail.

Laundry

This is the room or area in which clothes, bedding, towels and other linen are washed.

The laundry should have a deep tub. Cold and hot water should be supplied to it. There may be a washing machine. The tub can be used for soaking and washing clothes and linen when there is no washing machine. A large tub can also be used as a baby bath if there is no proper bath in the house. However, the water must be drained out immediately after use and the tub kept very clean.

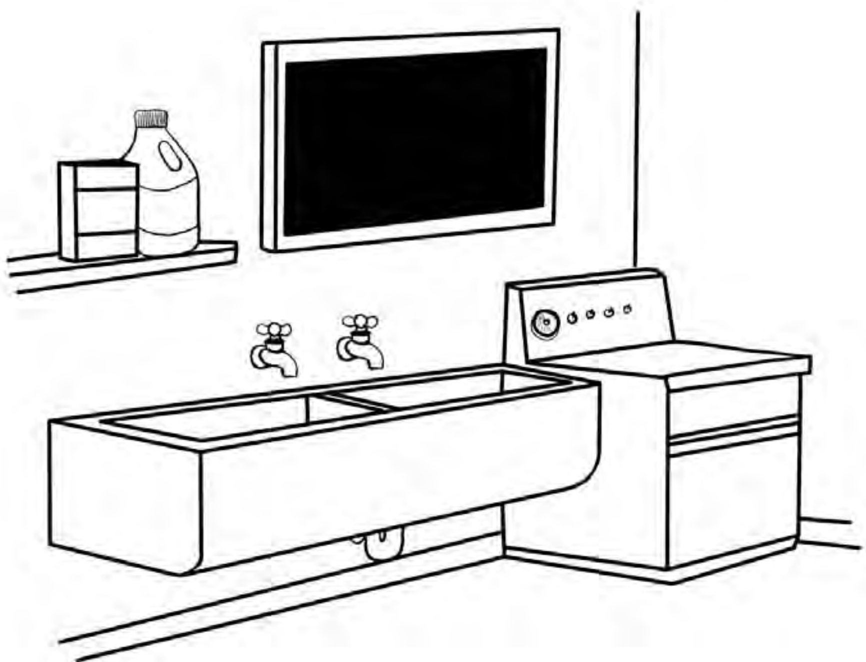


Fig. 3.5: Laundry with tub and washing machine.

Toilet

Every house or other type of dwelling (place in which people live) must have some type of toilet provided or at least there should be one close to the house. Modern houses have toilets under the main roof, while older houses may have them in a small separate building located nearby. In some Indigenous communities, several families share toilets in an toilet block.

The toilet may be a full flush water type, a dry septic tank type or a borehole toilet. The toilet is important as it removes faeces and urine, and their disease-causing germs and parasites, from the environment in which people live.

It is important that water and soap are nearby so that people can wash their hands after going to the toilet. This water may be provided by a tap connected to a house water supply or a sealed container with a tap.

Fig. 3.6: A flush toilet with ventilation.

Sewage disposal

There must be a way of removing the sewage produced in a house. The sewage comes from the toilet, bathroom, kitchen and laundry.

There are two main disposal systems. These are:

- on-site septic tanks and leach or French drains
- community effluent or full sewage systems.

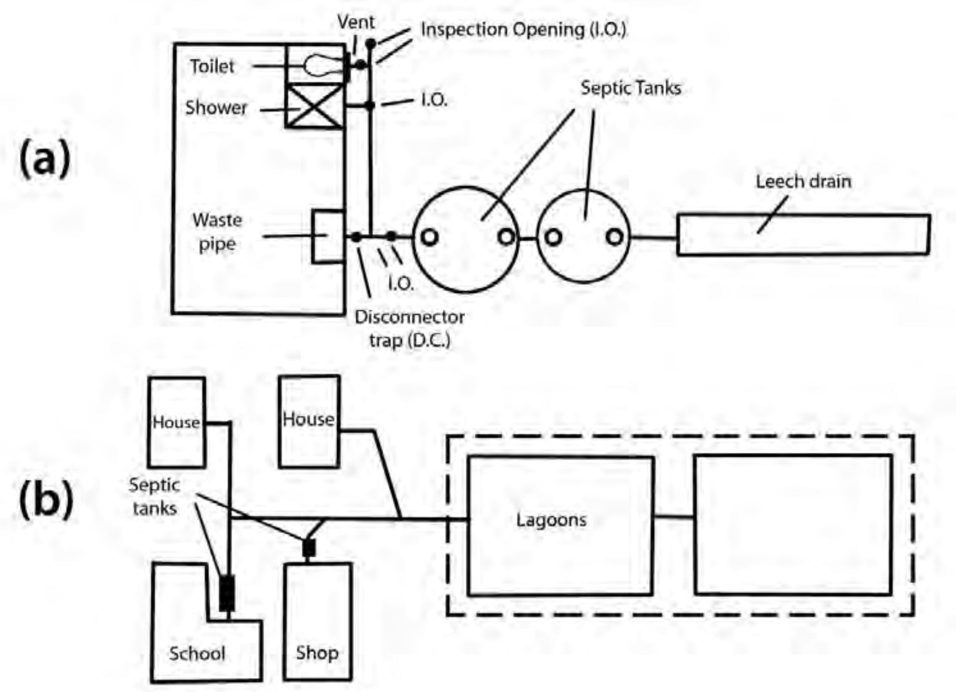


Fig. 3.7: Plan views of sewage disposal systems
(a) Septic tanks
(b) Community effluent system.

Rubbish disposal

Each house should have a way of properly disposing of the **solid waste** produced by the people living in the house. This solid waste is called **rubbish** and includes things such as food scraps, tin cans, plastic containers, glass bottles and jars, papers, cardboard and disposable nappies. If this rubbish is not properly disposed of it will quickly attract pests and germs.

Solid waste disposal for a house should include:

- a small bin inside the house for daily use
- a large bin in the yard into which all the household rubbish is placed. This rubbish should be collected and taken away at least once a week by a rubbish truck.

Protection from pests

There are many pests which carry disease-causing germs and parasites and are therefore a danger to health. Such pests include flies, mosquitoes, cockroaches and rodents.

Houses can be made safe from these pests by:

- putting flyscreens on all windows and vents, and fitting doorways with flywire doors or hanging strip barriers
- sealing (closing) all gaps where pipes pass through walls
- sealing all gaps, such as cracks and crevices, around food storage cupboards which allow entry to the cupboard.

Fig. 3.8: Kitchen with a window flyscreen to keep out pests.

4 House hygiene—cleaning

if a house is to be a healthy place it must have all the design features already listed. However, it is also important that everything in the house is kept clean. If the house is not regularly cleaned then rubbish and dirt will build up. Germs and parasites will multiply and grow in the dirt and people living in the house may get sick.

4.1 CLEANING EQUIPMENT AND MATERIALS

Equipment and materials which help to make housecleaning tasks easier and more effective include:

- cleaning products for floors
- cleaning products for wet areas (baths, handbasins, laundry tubs, kitchen sinks)
- cleaning products for food preparation and meal areas (tables and benchtops)
- dish washing detergent for cleaning kitchen utensils (pots, pans, plates and cutlery)
- laundry detergent for washing household linen (towels, sheets, blankets) and clothes
- oven cleaner
- disinfectant (kills germs)
- cleaning cloths and sponges. These should be replaced regularly and there should be different ones for different cleaning areas (for example, never use the same cloth or sponge to clean the bathroom and the kitchen, as this can spread germs from one place to another)
- scrubbing brush
- stainless steel pot scourer
- broom, dust pan and brush
- bucket
- mop or squeegee.

It is important to remember that some household cleaning liquids and powders contain dangerous ingredients and can be poisonous. Always follow the instructions on the label and keep these products out of reach of children.

4.2 HOUSE CLEANING TASKS

Each room in the house has its own particular cleaning requirements, which are outlined below.

The Kitchen

The cleaning tasks (jobs) which should be done in the kitchen include:

- washing the dishes
- cleaning down the kitchen bench and table top
- emptying and washing the kitchen rubbish bin
- sweeping and/or washing (mopping) the floor
- wiping the shelves and cleaning the cupboards, inside and out
- cleaning the stove and oven
- cleaning out the refrigerator
- cleaning the walls, windows and brushing flyscreens
- removing cobwebs.

Fig. 3.9: Cleaning kitchen cupboards and benches gets rid of unwanted germs and parasites.

The Bathroom

The cleaning jobs which should be done in the bathroom include:

- cleaning the hand basin, shower recess and/or bath
- sweeping and washing (mopping) the floor
- cleaning the mirror, cupboards and/or shelves
- changing or washing the towels and the bath mat
- cleaning the walls and windows and brushing flyscreens
- removing cobwebs.

Fig. 3.10: Cleaning the bathroom.

The Laundry and Toilet

The cleaning jobs which should be done in the laundry and toilet include:

- washing clothes, linen (for example, towels, sheets) and blankets
- sweeping and washing (mopping) the floor
- cleaning the tub and washing machine
- cleaning the cupboards, walls and windows and brushing flyscreens
- cleaning the toilet
- removing cobwebs.

Fig. 3.11: Cleaning the laundry and toilet.

Bedrooms

The cleaning jobs which should be done in bedrooms include:

- sweeping and/or washing the floors
- dusting the shelves and cleaning out cupboards
- cleaning walls and windows and brushing flyscreens
- removing cobwebs
- changing the sheets on the bed and airing (putting in the sun for a few hours) the blankets and mattresses.

Fig. 3.12: Airing bedding in the sun.

Living Rooms and Verandah

The cleaning jobs which should be done in living rooms and verandahs include:

- sweeping and/or washing (mopping) the floors, including the verandah
- dusting the shelves and cleaning out cupboards
- cleaning the walls and windows and brushing flyscreens
- removing cobwebs.

Fig. 3.13: Keeping the bedroom and living room clean.

It is important when washing or mopping floors anywhere in the house to make sure that:

- no water gets into any power outlets or electrical appliance, such as a radio or video recorder
- pools of water are removed immediately.

4.3 HOUSE CLEANING TIMETABLE

How often the various parts of a house need to be cleaned depends upon:

- how many people live in the house
- how many other people use the house
- how tidy people are, such as whether or not people clean up after meals
- how many pets belong to the household
- whether or not there is sickness in the house, such as when someone has scabies or diarrhoea
- whether there has been a plumbing problem, such as water from an overflowing handbasin
- any other environmental factors, such as wind blowing dust into the house or wet soil being walked into the house when it is raining.

Household cleaning tasks are usually done according to the following timetable:

Several times each day

- Wipe down kitchen benches after food preparation.
- Wash dishes and cooking utensils after each meal.

Once each day

- Sweep the floors.
- Empty the kitchen rubbish bin.

Once or twice each week

- Wash the floors.
- Clean the toilet.
- Clean the laundry tubs.
- Clean the shower recess/bath and handbasin.
- Dust surfaces.
- Wash clothes and bed linen.

Once each month

- Clean the stove/oven and refrigerator.
- Clean cupboards, windows and walls.
- Brush the flyscreens.
- Get rid of cobwebs.

It is important to remember that it may be necessary to do some cleaning tasks more often than is suggested in the timetable. This is because there are times when parts of the house get much dirtier than usual. For example, the toilet may get very dirty when a lot of children or visitors are using it or when someone in the house has diarrhoea.

Some people may not know about the importance of keeping a house clean or what needs to be done. The EHP can help community members by:

- explaining why it is important to clean the house.
- showing them what needs to be cleaned and what equipment and materials are needed.
- telling them how often the cleaning needs to be done.
- demonstrating the cleaning method.

Fig. 3.14: EHP demonstrating how to clean a stove.

5 House cleaning—tidying and maintaining the yard

The outside of the house is also an area where disease-causing germs can grow and multiply or where vectors can live and breed. For example, germs can live in rubbish and faeces, and mosquitoes can breed in water in old washing machines and tyres.

Grass is effective at reducing dust levels in the yard. Long grass is attractive to snakes so, where grass grows, it should be kept short.

5.1 EQUIPMENT

The equipment needed to tidy and maintain the yard includes:

- a rake
- a shovel
- a hose
- an axe.

There are some other items which may be needed to help tidy or maintain the yard and garden. These include wheelbarrows, lawn mowers, pruning saws, or brush cutters. Because these items can be very expensive, it may be a good idea for the Community Council to purchase them for people to borrow. A loan system can be organised.

This could be a job for the EHP who would need to:

- work out the arrangements with the community and the Council
- organise the ordering, storing, and lending of the equipment
- be responsible for ensuring the return of the equipment after use.

The rules of the loan system would make the person who borrows the equipment responsible for paying for any lost or damaged items. However, the equipment will eventually break down or wear out with normal use. The cost of maintaining and repairing worn out equipment will always be the responsibility of the Council.

5.2 YARD TIDYING AND MAINTENANCE TASKS

The jobs which should be done to keep the yard tidy and well maintained include:

- raking up and disposing of rubbish (for example, cans, papers, plastic containers, bottles, broken glass), faeces and leaves
- mowing lawns, trimming edges and removing weeds

- pruning shrubs and trees
- cleaning out gutters if necessary
- removing bulky rubbish (for example, old tyres, refrigerators, car bodies)
- watering lawn, shrubs or trees. This particular job maintains the garden. Lawns and shrubs help keep dust under control. Lawns need only be watered twice a week.

Fig. 3.15: Cleaning the yard.

5.3 YARD TIDYING TIMETABLE

Most yard tidying tasks are usually done once a week or less often. What needs to be done and how often depends upon one or more of the following:

- How many people use the yard and what they do there. For example, one or two people having a barbecue will probably not make as much mess as thirty people.

- The number and kind of pets that use the yard. For example, dogs are dirtier and more destructive than cats.
- Weather factors. For example, rain collecting in containers can allow mosquitoes to breed and very strong winds blow objects, such as pieces of tin, around the community.
- Other environmental factors such as the vegetation in the yard. For example, shrub types may differ as to how often they need to be cut back.
- How tidy people are who used the yard. For example, some people will usually put their rubbish in a bin, while others do not.

6 Communal facilities

in some communities the houses have no bathrooms, toilets or laundries. Instead there are **communal toilet blocks** for everyone to use. A toilet block usually contains separate toilets and showers for males and females, handbasins, and sometimes a communal laundry facility.

Toilet blocks need to be cleaned regularly just as if they were part of a house. Since they are used by all of the people in the community the toilet blocks should be cleaned daily. If they are allowed to get dirty and surfaces become contaminated with germs, many people in the community could get sick.

Plumbing problems, such as blockages and leaking taps, pipes or cisterns need to be repaired as soon as possible. Regular (daily) cleaning allows for problems to be identified and reported to the community office or organisation responsible for repairs and maintenance.

For communal toilet blocks to be healthy places the cleaner must:

- make sure there is always toilet paper in the toilets
- clean the toilets, showers, basins and tubs once a day, and more often if they get very dirty
- hose or sweep the floors regularly
- report any faults or damage immediately to the community office.

It should be the EHP's job to check that communal toilet blocks are being properly cleaned and maintained

Fig. 3.16: Communal toilet blocks need to be cleaned often.

7 Personal hygiene

the human body can provide places for disease-causing germs and parasites to grow and multiply. These places include the skin and in and around the openings to the body. It is less likely that germs and parasites will get inside the body if people have good **personal hygiene habits**.

7.1 GOOD PERSONAL HYGIENE

Good personal hygiene habits include:

- washing the body often. If possible, everybody should have a shower or a bath every day. However, there may be times when this is not possible, for example, when people are out camping or there is a shortage of water. If this happens, a swim or a wash all over the body with a wet sponge or cloth will do
- cleaning the teeth at least once a day. Brushing the teeth after each meal is the best way of making sure that gum disease and tooth decay are avoided. It is very important to clean teeth after breakfast and immediately before going to bed
- washing the hair with soap or shampoo at least once a week
- washing hands with soap after going to the toilet
- washing hands with soap before preparing and/or eating food. During normal daily activities, such as working and playing, disease causing germs may get onto the hands and under the nails. If the germs are not washed off before preparing food or eating, they may get onto the food

- changing into clean clothes. Dirty clothes should be washed with laundry soap before wearing them again
- hanging clothes in the sun to dry. The sun's rays will kill some disease-causing germs and parasites
- turning away from other people and covering the nose and mouth with a tissue or the hand when coughing or sneezing. If this is not done, droplets of liquid containing germs from the nose and mouth will be spread in the air and other people can breathe them in, or the droplets can get onto food.

Fig. 3.17: Washing the body helps keep it free of disease-causing germs

Fig. 3.18: Cleaning teeth helps keep gums and teeth healthy.

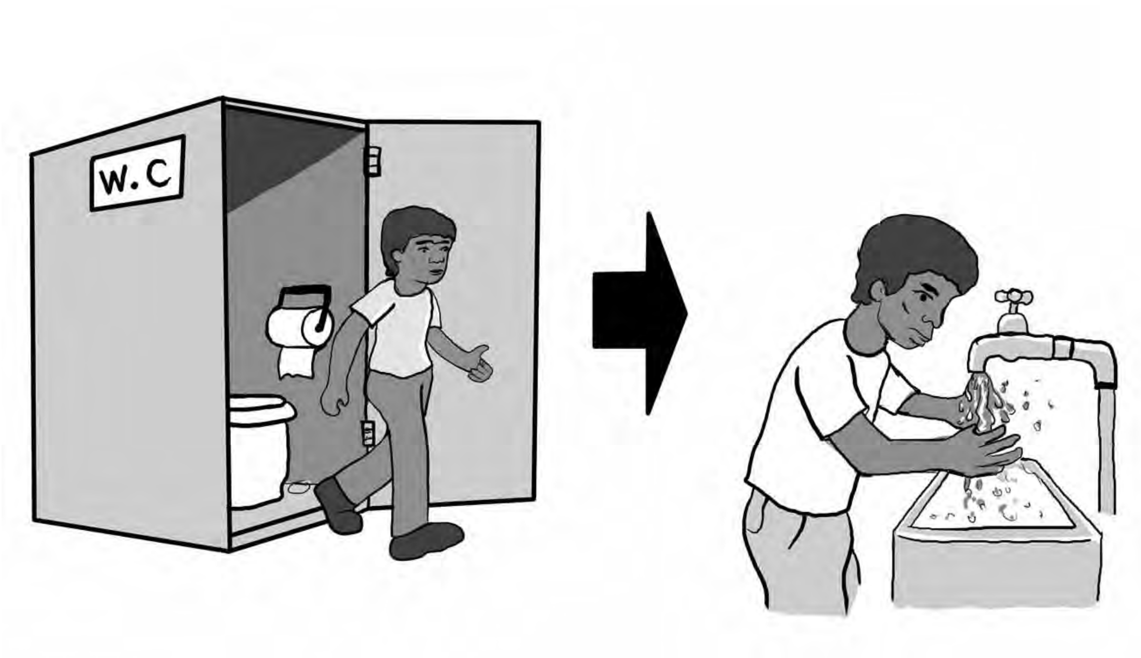


Fig. 3.19: Washing hands after going to the toilet helps stop the spread of germs.

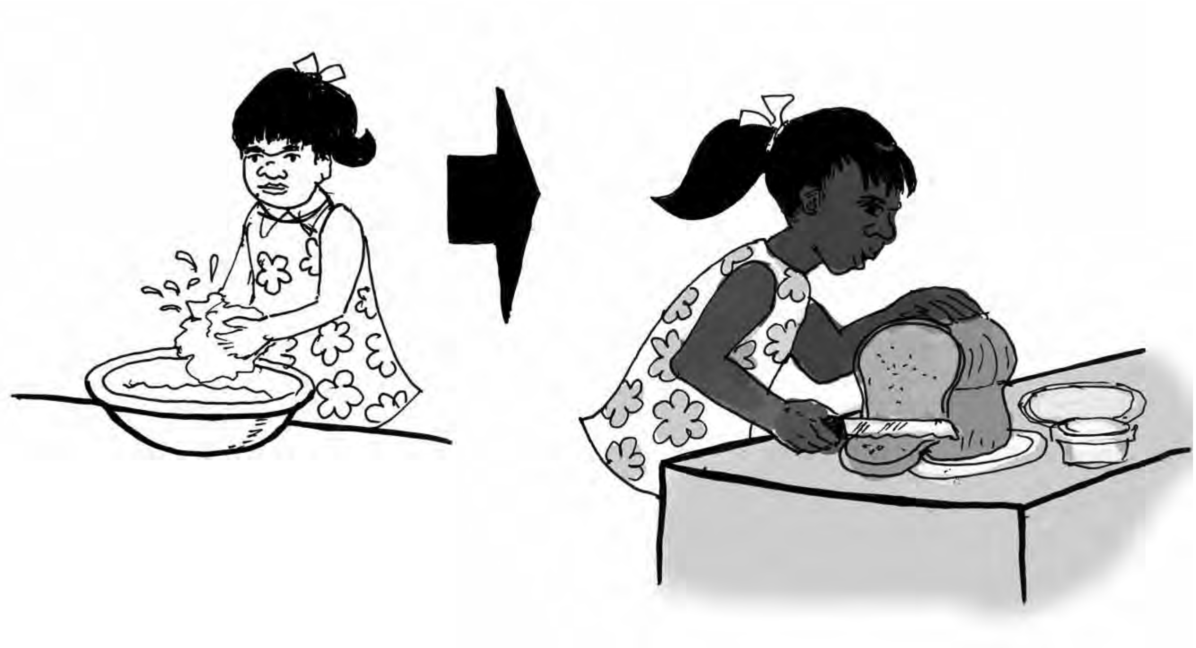


Fig. 3.20: Washing hands before preparing food helps keep germs out of our bodies.

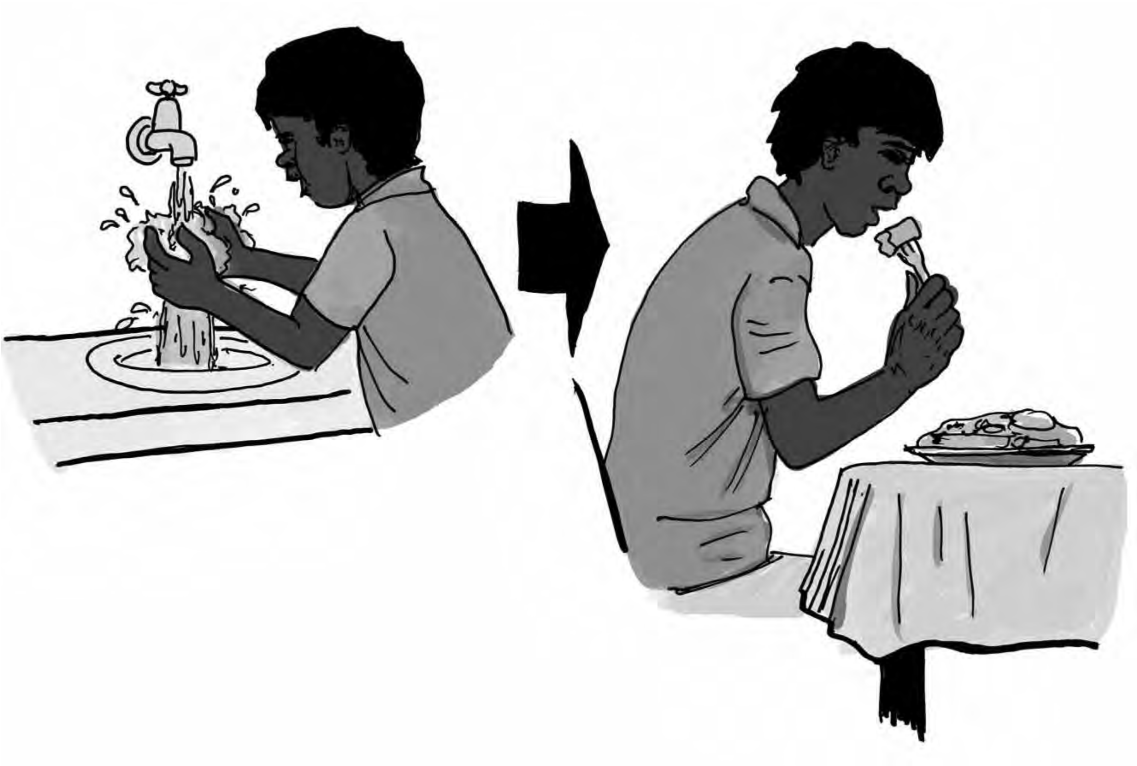


Fig. 3.21: Washing hands before eating food helps stop germs getting into our bodies

Fig. 3.22: Washing clothes helps keep them free of disease-causing germ

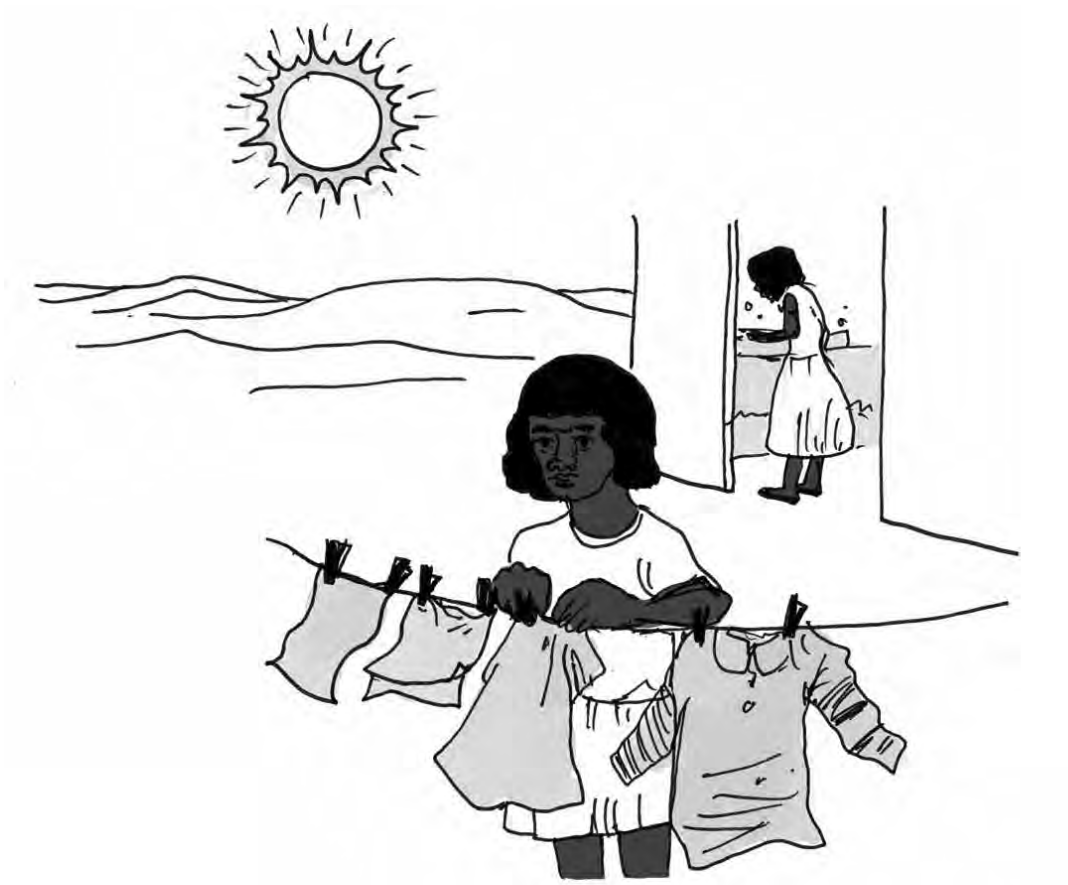


Fig. 3.23: Hanging clothes in the sun helps to kill some disease-causing germs and parasites.

Fig. 3.24: Covering the nose and mouth when sneezing helps stop the spread of germs.

7.2 OVERCROWDING

When there are too many people in any house, the likelihood of them getting disease is greater than if the house is not overcrowded. This is because people in an overcrowded house will be much closer to each other and it is therefore easier for any germs to spread from one to another. For example:

- sneezing and coughing in crowded rooms makes it easier to spread cold and flu germs
- sharing towels can spread trachoma germs and other germs which cause eye infections (runny or sore eyes)
- several children sleeping in the same bed makes it easier to spread a scabies infection.

Fig. 3.25: Overcrowding helps spread germs and parasites such as scabies.

Each house is designed to allow a particular number of people to live there comfortably. This number will depend upon the number and size of the rooms, especially bedrooms, and the size of other facilities such as the sewage system and washing and cooking areas.

If the number of people living in the house is greater than the number it was designed for, these facilities will not be able to cope properly. For example, large numbers of people using the toilet may mean that the septic tank will not be big enough to take and treat the additional load of sewage.

For good health and comfort, the number of people who should live in a house depends upon the factors outlined below.

The number and size of bedrooms

While most people who live permanently in a house will have a bedroom to themselves or share one with one or two other people, other rooms are often used as bedrooms. The number of people who should sleep in a room will depend upon the amount of air which is available to each person. The law requires that each adult person has at least 13 cubic metres of air and each child has at least 10 cubic metres of air in a sleeping area.

The type and size of the sewage system

Usually, a household septic tank system with 2 round tanks caters for a maximum of ten people.

The size and availability of other facilities

The facilities within the house may not be able to handle all of the demands placed on them by the occupants. For example, the hot water system may not be able to produce enough hot water, or the amount of food to be chilled is too great for the refrigerator to hold.

In Indigenous communities, overcrowding in houses occurs for a number of reasons, such as:

- there not being enough houses for the number of people who live in the community
- families not being able to afford to pay rent on a house of their own and needing to live with relatives to share the cost
- people visiting relatives and staying for a long time
- visitors coming to stay so that they can attend special events such as funerals.

It is important that EHPs remember that overcrowding is a significant environmental health problem in many communities.

8 Food poisoning and contamination

8.1 FOOD POISONING

Everybody at one time or another has had the experience of eating food and some time later becoming sick. This is called **food poisoning**. The symptoms may include:

- nausea
- vomiting
- stomach pains
- diarrhoea
- feeling weak
- fever or chills/sweating
- headache.

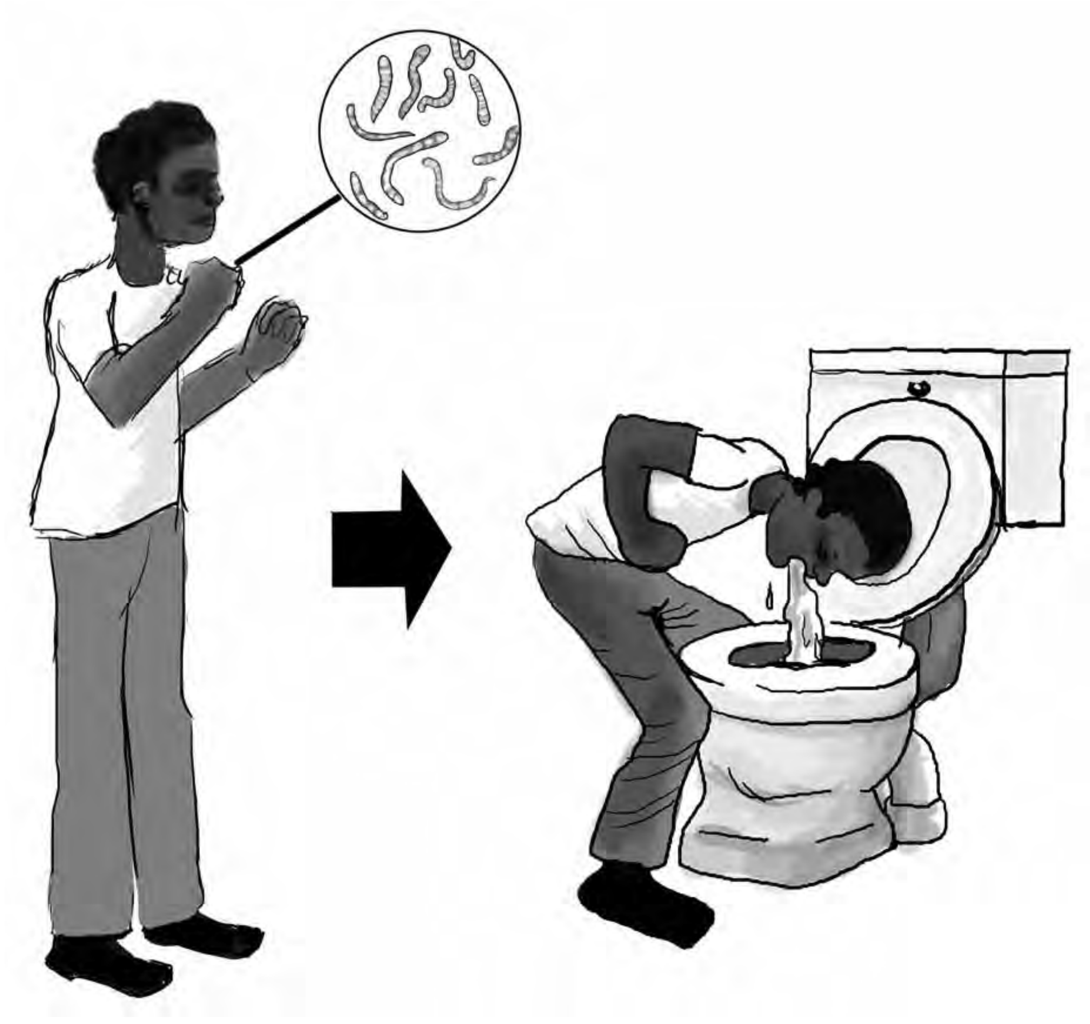


Fig. 3.26: Food poisoning comes from harmful bacteria on food.

Food poisoning can be caused by eating food contaminated with bacteria, viruses, chemicals or poisonous metals such as lead or cadmium. Most food poisoning, however, is caused by bacteria and because of this, only bacteria will be discussed in this section.

Food which has become contaminated with harmful bacteria does not always taste bad. Most of the time it looks, smells and tastes like it normally does.

Some food poisoning diseases are more common than others. For example, disease caused by Staphylococcus aureus occurs a lot more often than disease caused by Clostridium botulinum.

Some foods cause food poisoning more than others and need to be cooked properly and/or kept in the refrigerator. These include chicken, meat, seafood, eggs, cooked rice, ham, salami, milk and all dairy foods. It is important chicken is cooked properly to the bone and then kept in the fridge for no more than 2 days. If reheating chicken, or left-overs, make sure it is steaming hot and only reheat it once.

It is important to remember that the same food handling practices are used to prevent all food poisoning diseases. Washing your hands with soap and drying them on a paper towel or with a clean cloth is the best way to stop the spread of bad bacteria.

The four most common types of food poisoning bacteria are discussed below.

Staphylococcus

These bacteria are found on the skin, in sores, infected eyes and in the nose, throat, saliva and bowel of humans. There may be many of these bacteria in the yellow mucus (slimy substance) which comes from the nose or is coughed up when a person has a cold or a lung infection.

Staphylococci do not cause illness until they get onto food and grow and multiply. While they are doing this they produce a toxin (poison). It is the toxin which causes the illness. The toxin is not destroyed by cooking the food.

Symptoms of staphylococcus food poisoning usually appear between 1 and 8 hours after eating the infected food.

Salmonella

There are hundreds of different types of salmonella bacteria but not all are harmful to humans. They are found mainly in the intestines, bowels and faeces of humans and other animals. It is the salmonella bacteria themselves which can cause salmonella food poisoning.

Fig. 3.27: Bacteria on food.

People can get salmonella food poisoning from:

- poor food handling practices in the home or in food outlets
- seafood caught in polluted water or eggs with dirty shells
- meat or poultry which has been contaminated by poor food handling before it gets to the food outlet, such as at the abattoir.

Salmonella food poisoning takes up to 48 hours to develop after the food is eaten. Symptoms include nausea, stomach cramps, diarrhoea, fever and headache, and may last between 3 and 21 days. It can cause death in very young, weak or very old people. People who have cancer or are taking medication for serious health conditions such as heart, kidney or liver problems need to also be particularly careful that they eat safe food.

Clostridium

These bacteria are found in the soil and in the intestines of animals, including cattle, poultry, fish and humans. Food poisoning caused by clostridium bacteria is important to know about because these bacteria are common in the environment.

People can get clostridium food poisoning from poor food handling practices in the home, in the factory or in a food outlet, especially relating to cooking and storage/ refrigeration temperatures.

Clostridium food poisoning symptoms occur about 12 hours after eating the contaminated food and are similar but usually less severe than the other types.

Symptoms include stomach pains, diarrhoea and sometimes nausea and vomiting. Symptoms last about 24 hours.

One type of clostridium bacteria produces a very serious food poisoning disease called **botulism**. This disease is caused by eating food which is contaminated with an extremely poisonous toxin produced by the bacteria Clostridium botulinum. Unless properly treated about one-third of people who get this disease die within 3-7 days.

Campylobacter

These bacteria are found in many animals including dogs, cats, cattle and poultry. The sources of infection from these bacteria are usually contaminated food and water.

People can get campylobacter from:

- ingestion of contaminated food or water (especially undercooked chicken & creek or river water)
- contact with infected animals (especially puppies or kittens with diarrhoea)
- poor food handling (especially by using the same chopping boards, knives and plates for raw and cooked chicken).

Campylobacter food poisoning symptoms usually last from 2 to 5 days. These include diarrhoea, severe abdominal pain, vomiting and fever. It is a serious disease in Indigenous communities because of the possibility of dehydration from diarrhoea.

8.2 HOW BACTERIA GROW AND MULTIPLY

Bacteria reproduce (breed) by splitting in half. When they do this they are said to **multiply**. In the right conditions, bacteria multiply at a very fast rate.

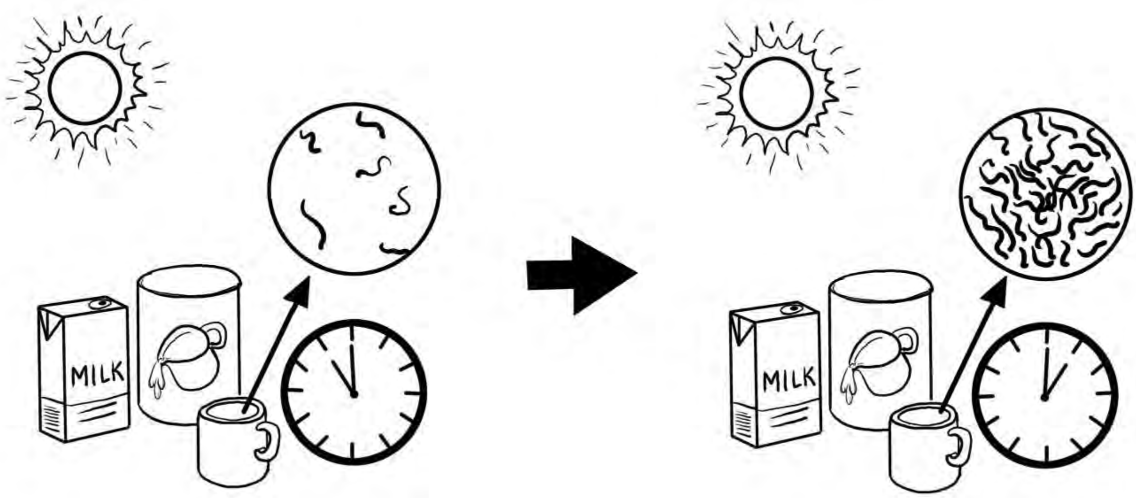


Fig. 3.28: Bacteria can multiply very quickly.

Disease causing bacteria grow best when there is:

- warmth (37°C–38°C) (**Note:** human body temperature is 37°C)
- moisture
- food supply.

In ideal conditions, bacteria double their numbers every 20 minutes. For example, if a piece of kangaroo meat infected with 100 food poisoning bacteria is left lying on a kitchen bench on a warm day, the bacteria will double their number every 20 minutes, and in 3 hours, the 100 bacteria will multiply to over 50,000 bacteria.

The following table shows how the bacteria will multiply on the meat over 3 hours:

Time	**Number of bacteria**
Start	100
20 minutes	200
40 minutes	400
1 hour	800
1 hour 20 minutes	1600
1 hour 40 minutes	3200
2 hours	6400
2 hours 20 minutes	12800
2 hours 40 minutes	25600
3 hours	51200

It is important to note that once inside a person's intestine the bacteria can continue to multiply. This means that a person may eat contaminated food having only a few bacteria on it, but eventually suffer from food poisoning.

8.3 WAYS FOOD CAN BECOME CONTAMINATED THROUGH INCORRECT FOOD HANDLING

Food can become contaminated with disease-causing bacteria anywhere the food is handled or stored. These places include:

- in a factory where it is processed ready for sale
- in a truck in which it is taken from the factory to the shop
- in a shop
- in a food outlet such as a school canteen or take-away shop
- between the shop and home
- in a home.

Most food has to be prepared in some way before it is eaten. During this preparation the food is handled by people. There are many ways in which unhygienic practices can cause food poisoning bacteria to be deposited on the food while it is being handled. Some examples are:

Leaving food uncovered. Pets, flies, cockroaches and other insects carry germs, including food poisoning bacteria, which contaminate the food

Touching parts of the body while handling food. While preparing food a food handler might scratch a pimple, touch a sore, push back hair, scratch an ear or rub or pick the nose. Every one of these activities contaminates the fingers with bacteria. If the person's hands are not washed before handling food again, these bacteria will be passed to the food.

Fig. 3.29: Rubbing the nose while preparing food helps spread germs.

- Sneezing or coughing near food. If a food handler, or anyone else, sneezes or coughs near uncovered food, then the food almost will certainly be sprayed with bacteria laden droplets.

Fig. 3.30: Sneezing over food spreads germs.

- Licking fingers while handling food. Human saliva carries staphylococcus bacteria and licking the fingers could result in these bacteria being passed to the food.

Fig. 3.31: Licking fingers while handling food spreads germs.

- Not washing hands after going to the toilet during food handling. If a person goes to the toilet during food handling activities and does not wash his/her hands afterwards food poisoning bacteria may be passed onto the food.

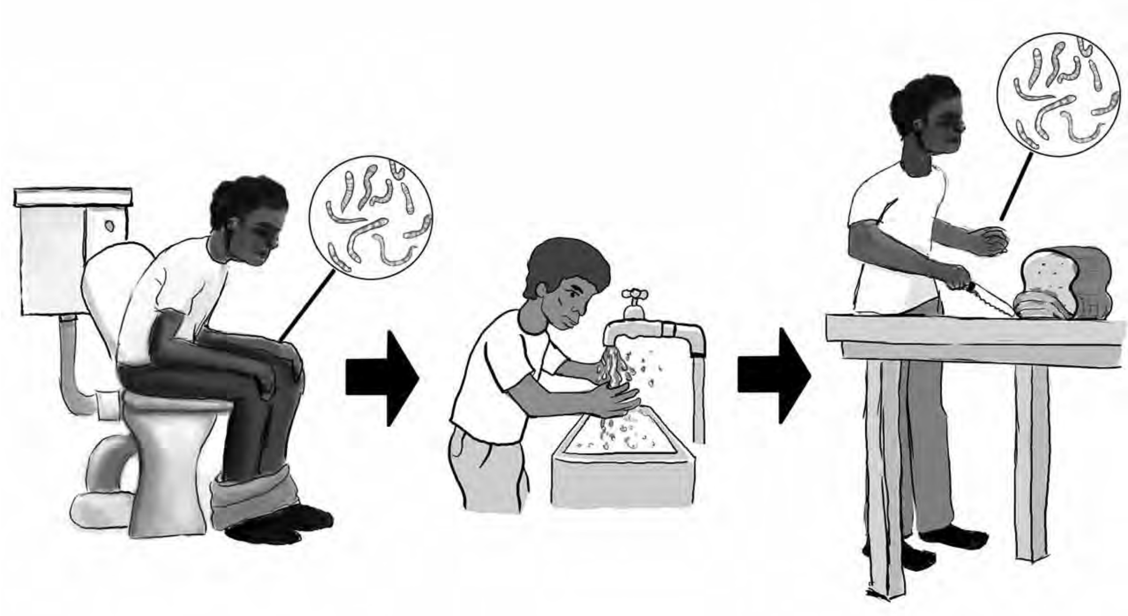


Fig. 3.32: Washing hands after going to the toilet helps stop the spread of germs.

- Poor handling of **high risk foods**. High risk foods are those which generally need refrigeration and have a high moisture content. Poor handling of high risk foods is a common cause of food poisoning. High risk foods include:
  - » chicken, duck and other poultry
  - » fish and shellfish
  - » raw meat products
  - » dairy products (milk, cheese, cream)
  - » unpasteurized cow or goats milk
  - » eggs and egg products
  - » gravies.

Cross contamination. Certain foods will always contain some bacteria. Poor handling of these foods may result in **cross contamination**. Cross contamination is the passing of bacteria from contaminated food to uncontaminated food. Cross contamination can occur when storing or handling food.

An example of cross contamination during storage is:

A high risk food, such as a raw chicken thawing in a refrigerator, is placed in contact with cooked meat. The bacteria from the raw chicken contaminates the cooked meat. Since the cooked meat is not heated again before eating, the bacteria from the chicken pass to the person who eats the meat.

An example of cross contamination during handling is:

Before cooking a fish which is contaminated with salmonella bacteria, a person uses a knife and cutting board to cut it up. Bacteria from the fish will be left on the knife and cutting board. The person slices cooked ham using the same knife and board without washing them first. The bacteria are transferred to the ham.

9 Protecting food from contamination

Correct food handling practice and food storage helps prevent bacteria from contaminating and multiplying on foods. The following action needs to be taken to prevent bacterial contamination:

- Protect food from contamination—handle food properly
- Prevent bacteria from multiplying
- Destroy germs on/in food

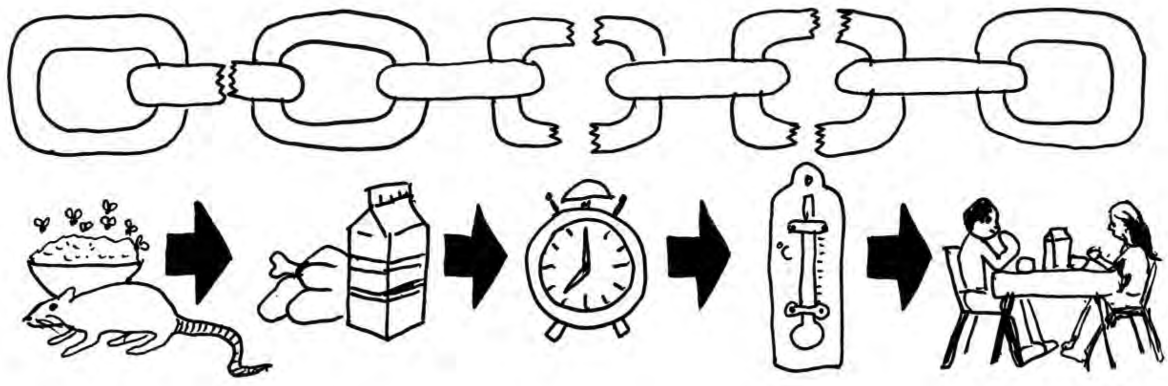


Fig. 3.33: The food contamination chain can be broken in several places.

Food can be protected from contamination by handling it with care. Food handlers should think about:

- where food poisoning bacteria come from. They can come from people's bodies, sneezes, coughs, high risk foods, insects, rodents, pets, toilets and dust particles in the air

- the different ways bacteria can get on to the food they are handling, for example, from cross contamination and contaminated hands and clothing
- the correct cooking and storage temperatures which prevent bacteria multiplying.

The number of people affected in an outbreak of food poisoning will depend on where the food contamination occurs. For example, contaminated food prepared and eaten in the home is only likely to affect a few people but contaminated food prepared in a fast food outlet or in a factory is likely to affect many people.

9.1 CORRECT FOOD HANDLING RULES

Always wash hands with soap and warm water before handling food. Wet the hands before applying the soap. Make sure you rub in between fingers and on the front and backs of hands. Remember to clean under fingernails. Rubbing with soap loosens bacteria. They must be rinsed off with water. (When possible, use hot water for washing the hands.)

Fig. 3.34: Wash hands before handling food and be sure to clean under the finger nails.

Always wash hands with soap and warm water after going to the toilet or touching any parts of the body, such as the skin or nose.

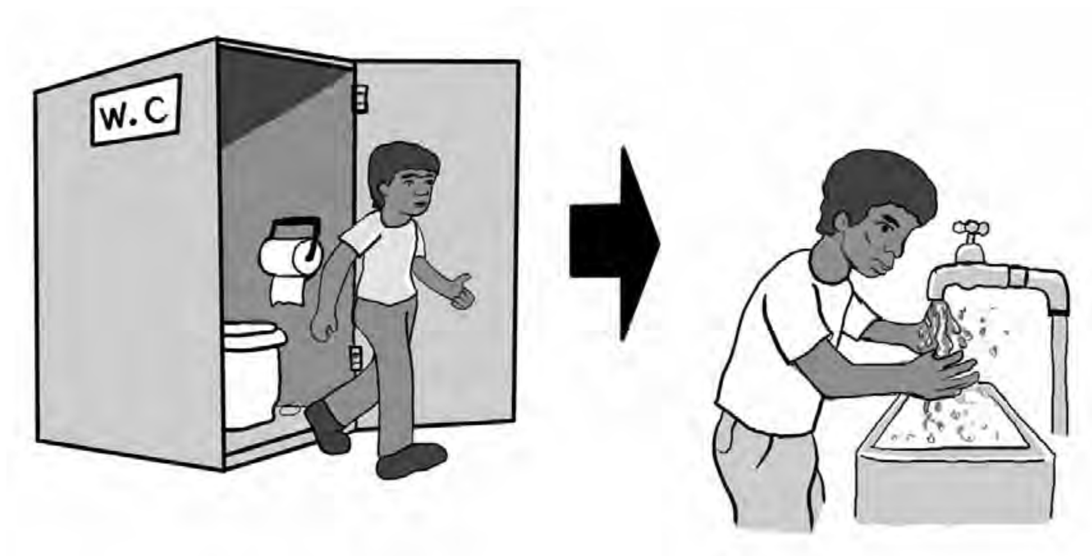


Fig. 3.35: Wash hands after going to the toilet.

- Do not smoke while preparing food.
- Handle food with tongs, a spoon or some other utensil which is clean.
- When sneezing or coughing always cover the face with a tissue or the hands and turn away from the food. Wash hands immediately after as they may have been contaminated.
- Avoid preparing food for others if you have diarrhoea.

Fig. 3.36: If sneezing, turn away from the food and use a tissue.

- If food does have to be left standing in the open for a few minutes during preparation always cover it with a lid, clean cloth or cling wrap.
- Do not let raw high risk foods touch other foods.
- Always clean and sanitise utensils and benches/work surfaces used to prepare high risk foods immediately after the food has been prepared.
- Work benches and cooking utensils should always be kept clean.
- Make sure insects, rats, mice and other pests cannot get into the food preparation area.
- Pets should also be discouraged from domestic kitchens and must never be allowed into a shop or community kitchen.

Fig. 3.37: Keep all work benches clean.

- Dispose of rubbish regularly and correctly.
- Make sure the floors, walls, window sills and all fixtures in the food preparation area are regularly and properly cleaned.

9.2 CORRECT FOOD STORAGE

Food poisoning bacteria can only multiply in the temperature danger zone of between **5°C and 60°C**.

However, food poisoning bacteria do not multiply at the same rate throughout this temperature range. They multiply most quickly between 36°C and 38°C, which is around human body temperature.

Above 60°C nearly all food poisoning germs are killed. Below 5°C the germs stay alive but they do not multiply. Keeping food out of the temperature danger zone helps stop the multiplication and growth of bacteria.

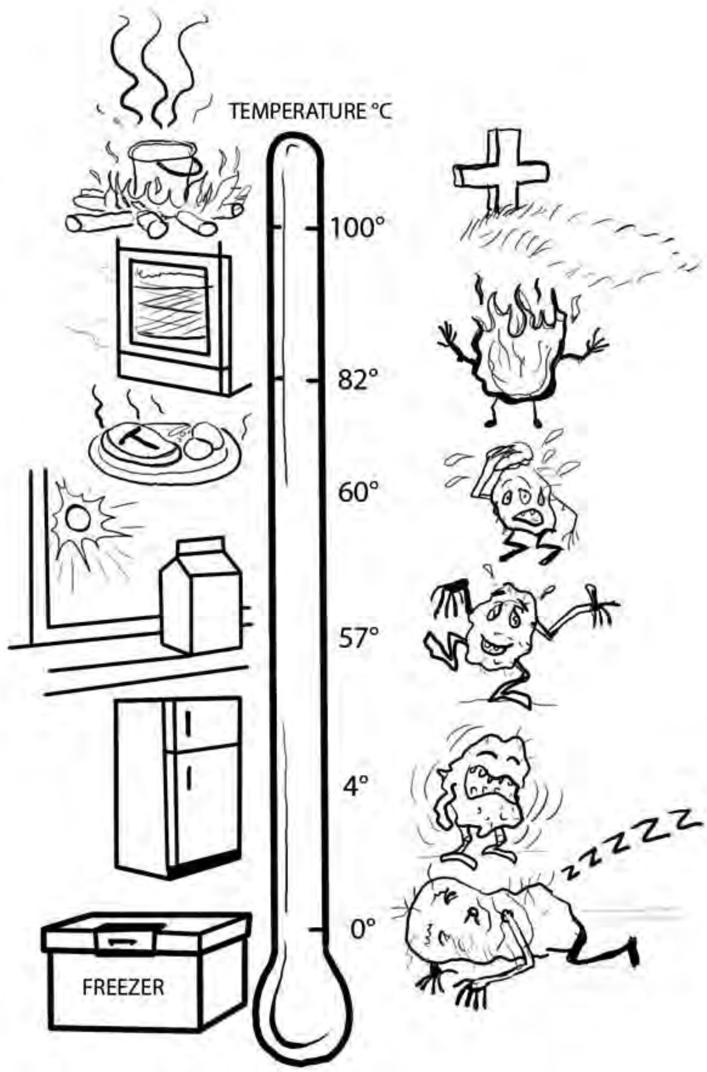


Fig. 3.38: The food temperature danger zone.

Food should be stored according to its food type. For example:

- high risk foods such as milk and milk products and fish should be stored in a refrigerator or freezer. They should never be left in the food temperature danger zone
- foods such as fresh fruit and vegetables last longer when they are kept cold, and should be stored in a refrigerator
- dry foods such as flour, breakfast cereals and rice are likely to be attacked by pests and need to be stored in sealed containers.

Storing foods in refrigerators and freezers

Freezers, including the freezer section in household refrigerators, will keep foods frozen. Frozen foods can last many months depending on the food type. However, some foods are unsuitable for freezing. For example, cheese and processed foods will lose food quality when frozen.

Frozen foods taken from the freezer and allowed to thaw must be cooked or eaten straight away. Thawing means returning the frozen food to its normal soft state by increasing its temperature. It is safest to do this by putting the frozen food into the normal refrigerator compartment, or by defrosting in a microwave oven on the defrost setting.

Once food has been thawed it should never be frozen again. This is because bacteria will grow and multiply in the food during the freezing and defrosting process.

Refrigerators chill foods. Foods which are to be eaten cold should be kept in the refrigerator until they are ready to be served. These foods include milk, cheese, custards, salads and cold meats. Many of these foods will deteriorate (break down) after several days in refrigerator storage and will not be fit to eat.

Storing foods which do not need to be frozen or chilled

These foods include cereals, flour, sugar, unopened canned goods, dried products, sauces and spices. They do not support the growth of bacteria like the high risk/ high moisture foods. They can lose quality from being kept too long in storage and their major source of contaminants is pests.

Some bacterial contamination can occur when canned high risk/high moisture foods are kept too long in storage or when containers become broken or damaged during production, transport or storage. Other foods may suffer bacterial contamination from exposure to pests, especially insects and rodents.

Care should always be taken when purchasing tinned foods. Do not buy dented or blown cans. A blown can occurs when gas forms from the action of bacteria in the product. It is easy to tell a blown can because the lid and base will pop when pressed.

When dealing with foods that are normally stored at room temperature, remember:

- canned or packaged foods should be used in rotation, with the oldest used first
- cereals, flour, sugar and other dried foods should be stored in sealed containers to stop the access of pests
- when containers with re-sealable lids are opened, such as sauce bottles, pickle and jam jars, the lid should be put back tightly if all of the food is not used. Check the label for storage instructions as some foods must be stored in the fridge after opening
- when cans without re-sealable lids are opened, such as some sauces, gravies, fruit, meat and vegetables, all of the unused contents should be transferred to a clean container with a tight lid. If the contents are high risk/high moisture foods such as fruit, vegetables or meat this container should be kept in the refrigerator.

Clean up any spilled food as soon as possible, for example spills in cupboards, open shelves, the fridge or freezer.

9.3 CORRECT COOKING TEMPERATURES

Food poisoning bacteria do not grow at temperatures above 60°C. If the temperature falls into the danger zone between 5°C and 60°C, the bacteria will be able to grow and multiply rapidly.

Before some frozen foods are eaten they will need to be thawed. Foods which are to be eaten hot should be cooked and served immediately while they are still hot. If they are not to be eaten straight away they should be placed in the refrigerator or freezer immediately after cooking.

Cooked foods which have been stored in the refrigerator or freezer must be thawed if necessary and reheated quickly and thoroughly to a temperature of at least 75°C.

No high risk food should be left standing in the danger zone for more than a few minutes.

9.4 FOOD SHOPS AND STORES

There are laws which strictly control food handling practices in places where food is prepared ready for sale to the public. This is because there is usually a lot more food involved and more people could be affected by food contamination. Many Indigenous communities now have food outlets that sell ready to eat food or provide meals to schools or elderly people. Therefore, Community Councils must take particular care to follow the correct food handling practices. The requirements are detailed in the Australian Food Standards Code.

Environmental Health Practitioners employed by the Department of Health and local government have responsibility for routinely inspecting shops and making sure that these regulations are followed. These inspections are very specialised, but sometimes the EHP can make occasional visits.

One task that the community can ask the EHP to do is a frequent routine inspection of any food shops and stores in the community. Before doing them alone, it would be necessary for the EHP to learn to do them properly. The best way to do this would be for the EHP to accompany the EHO on a number of shop inspections.

Any EHP wishing to learn how to do shop inspections must contact his/her local EHO.

These inspections will include checking:

- date codes on foods ('best before' or 'use by' date). Some foods display a date by which they should be used. It is for the information of buyers and is called the date code. When this date has been passed the food is said to be out of code

  It is not illegal to sell foods after the 'best before' date, but buyers should be careful because such foods could be stale or have lost some of their quality, such as loss of nutrients or taste. It is illegal to sell foods after the 'use by' date

- for food contamination. Signs of food contamination include:
  - broken packets
  - blown cans (the lid or base will 'pop' when pressed)
  - weevils in packaged dried goods, such as plastic bags of rice. Weevils are a type of insect, and leave webs which can be seen through clear plastic packaging
  - meat in shrink-sealed plastic bags will develop gas when contaminated with bacteria. The bag will bubble or bulge under the pressure of the gas
  - discolouration and mould on chilled goods

- food storage in freezers, chillers and refrigerators. Raw and cooked foods must be stored separately in freezers, chillers and refrigerators and the cabinets of these storage facilities must be kept very clean

  Also, a build-up of frost and ice inside the cabinets probably means that the correct temperature is not being maintained

- storage of dry foods. It is important that dry foods, such as flour, breakfast cereals and sugar, are stored safely. Storage areas for dry goods, including dry foods, are favourite places for rats and mice and checks should be made for signs of these pests

  Dry foods should always be separated from household cleaning and other products which may be poisonous or which could spoil the food in other ways. For example, odours given off from these products may poison or flavour the dry foods

- that correct cooking temperatures are used. Where food is prepared on the premises, such as in fast food outlets or school canteens, it is important that all food is cooked at 75°C or hotter to kill harmful bacteria. After cooking, high risk foods should be stored above 60°C. This includes hot foods displayed for sale in shops

- that proper food and personal hygiene practices are followed

- that proper food handling facilities are provided. It is important that all shops where food is prepared provide food handlers with a hand basin, soap and clean, single-use towels, e.g. paper towels
- for evidence of disease-carrying pests. It is important that all premises where food is sold are free of pests, such as rats, mice, cockroaches and flies. Checks should be made for evidence of these pests, such as rat or mice droppings.

The EHP can also provide advice on cleaning programs and education on correct food handling and storage practices.

10 Dog health

Note : This section provides a brief overview of Dog Health.

> A comprehensive manual on "*Conducting Dog Health Programs in Remote Indigenous Communities—An Environmental Health Practitioners Guide*" has been developed by Dr Sam Phelan of Animal Management in Rural and Remote Indigenous Communities (AMRRIC). Copies of this publication can be sourced through the state or territory environmental health authority or from Animal Management in Rural and Remote Indigenous Communities (AMRRIC).

Domesticated dogs have always been closely associated with humans. For thousands of years they have protected us, worked for us and been our pets.

Dogs are particularly important to Indigenous people. It is common for one person or one family to own several dogs. This means that there are often large numbers of dogs in Indigenous communities. If these dogs are not properly cared for this can cause of a lot of sickness both in the dog population and in the broader community. In particular, young children can catch serious diseases from unhealthy dogs.

10.1 RESPONSIBILITIES OF DOG OWNERSHIP

There are a number reasons why people find happiness and satisfaction in owning dogs, for example:

- they are faithful and friendly
- they guard people and their property
- they help find and catch food
- they are useful working animals. For example, they are often used to help herd sheep and cattle and in search and rescue operations.

Fig. 3.39: A happy, healthy dog.

In return for the benefits of having a dog, dog owners must be prepared to accept certain responsibilities. When people forget these responsibilities dogs can become a serious health problem or a menace to the community.

These responsibilities include:

- feeding their dog/s every day and caring for them properly. Meeting this responsibility takes time and costs money
- controlling their dog/s. Dogs running unchecked around the community can be dangerous, particularly if they annoy or attack people or other animals
- controlling the number of puppies their dog has. Too many dogs can be difficult to care for properly, including providing enough food, and hungry dogs can be dangerous
- registering their dogs.

Fig. 3.40: Dogs must be fed every day.

Local authorities require that dog owners in towns and in cities register their dogs.

In Indigenous communities the most common problems with dogs are:

- dogs being allowed to breed unchecked, so there are too many dogs in the community
- dogs becoming sick or injured because people do not know how to care for them. Because some diseases of dogs can be passed to humans, sick dogs can create a serious health problem in a community
- cheeky or nasty dogs which can be difficult to control and may bite people
- starving dogs. Usually, dogs are not fed because people cannot afford to buy the food needed to feed them. When this happens, the dogs tend to attack rubbish bins and tips in their search for food. Sometimes elderly people will give their food to their dogs and go without themselves. This can result in personal health problems.

Fig. 3.41: Dogs will often knock over a rubbish bin looking for food.

10.2 DISEASES OF DOGS

There are many diseases which can make a dog unhealthy. Of those commonly found in Indigenous communities, many are caused by internal and external parasites some of which can also affect people. Some of these are listed below.

Internal parasites

These animals live inside the dog's body and include:

- hookworms
- roundworms
- tapeworms
- heartworm.

External parasites

These animals live on the dog's skin and include:

- fleas
- ticks
- scabies
- mites.

Fungal infection

Fungi live on the skin, the most common being ringworm.

Parasitic diseases of dogs and other animals which can be passed to humans are called **zoonotic diseases**. Diseases of dogs and other animals which cannot be passed on to humans are called non-zoonotic diseases. Examples of common **non-zoonotic dog diseases** are distemper and heartworm.

10.3 SOME IMPORTANT ZOONOTIC DISEASES

Hookworm infection

There is a special dog and cat hookworm. The life cycle of this hookworm has similar stages to the one which completes its life cycle in humans.

The adult hookworms live and lay their eggs in the intestines of dogs and cats. The eggs are passed out of the body in the faeces. This releases the eggs to the ground. The eggs then hatch in damp soil and develop into larvae.

Larvae in the soil may burrow through people's skin. For example, they may burrow through the feet of children and adults walking around without shoes. This can cause skin irritations in the skin where the larvae have burrowed. The larvae do not develop into adult worms in human hosts.

Dogs' and cats' licking, chewing and grooming habits bring them into direct contact with eggs in the soil, on their coats and in faeces. Without treatment, infected dogs can contaminate the soil for many months.

Roundworm (Ascariasis) infection

Roundworms are about 20 cm long, have round bodies and are pointed at both ends. Like hookworms, they live in the dog's intestine. The eggs from the female worms will be passed out onto the ground in the faeces.

Roundworm eggs can only get into the body through the mouth. This can happen if young children eat dirt contaminated with the eggs.

After the eggs are ingested, the larvae hatch in the intestine and travel in the blood to the lungs where they grow and develop. After about 10 days they travel back to the intestine. They do this by working their way from the lungs, up through the trachea (the tube which carries the air from the mouth into the lungs), into the oesophagus (the tube which carries the food from the mouth and then down into the stomach. Once in the intestine they grow to maturity and lay their eggs.

When roundworms infect humans they can cause wheezing, coughing and lung damage. Heavy infestations of the adult worms can block the intestine and other parts of the digestive system and may even result in death.

Hydatid tapeworm infection

Although the worm is a parasite of dogs it can be very dangerous to humans. The life cycle of the hydatid tapeworm is outlined below.

(a) The adult hydatid tapeworm (about 5 mm long) lives and lays eggs in the dog's intestine. The eggs are passed out onto the ground in faeces.

(b) Sheep (or cattle, pigs, kangaroos, wallabies, goats) take the eggs into their bodies as they graze. These animals are called intermediate hosts in this life cycle.

(c) Inside the intermediate host the eggs hatch and eventually form cysts in various parts of the body. These cysts contain the new hydatid tapeworms.

(d) The life cycle is completed when dogs eat parts of the intermediate host, such as kangaroo or goat meat infected with cysts. When this happens the new hydatid tapeworm is released to grow to an adult.

Humans can also act as intermediate hosts for hydatid tapeworms. The eggs can be picked up easily from an infected dog. They can be breathed in or taken in through the mouth by people, especially children, who get very close to dogs.

Humans who become infected with hydatid tapeworm, especially with the cysts, suffer damage to their internal organs and experience a lot of pain.

Ringworm infection

This disease is caused by a fungus which forms on the dog's skin. There are no worms involved.

Ringworms appear as small circular patches which grow outwards from the centre. The patch usually has a dry, crusty appearance with short, broken shafts of hair in it. Ringworm causes patchy baldness.

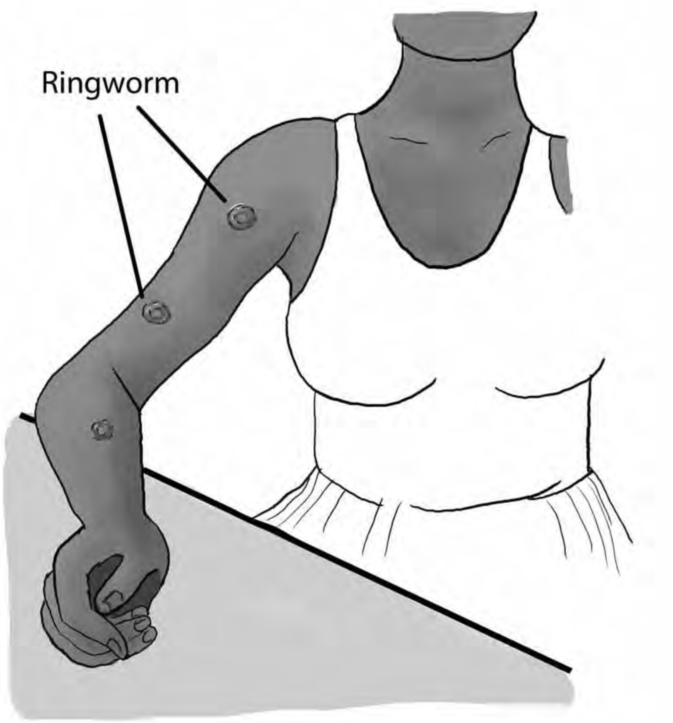


Fig. 3.42: Ringworm infections on a person's arm.

If a person pats or touches an infected dog (or cat), he/she can become infected with ringworm. It is also possible for a dog or cat which has ringworm to pass the fungus on to bedding, furniture or anything else which it touches. Humans who then touch these objects can pick up the disease.

Ringworm may be itchy and uncomfortable. Treatment is usually with an antifungal cream but some ringworm can be difficult to treat.

Mange (dog scabies)

This is caused by a very small mite which burrows into the skin and results in severe irritation. Dogs with these mites spend a lot of time scratching. This may cause the skin to break and become infected. Dogs with this disease are likely to lose their hair. This causes the mangy or 'leatherback' look.

Fig. 3.43: Skin parasites cause irritation.

As with the other dog diseases, humans pick up mange mites by close contact with infected dogs. In humans the mite also burrows causing itching and irritation of the skin. Although the dog mite cannot breed or survive on people (it dies within a couple of days), continued exposure to untreated dogs can cause continuous irritation of the skin.

Flea infection

These insects cause much the same skin irritations as mange mites except instead of burrowing they bite. When they get onto humans, they also bite. The place on the skin which has been bitten is usually reddish, slightly raised and very itchy. As with dogs, any excessive scratching can break the skin and this may lead to an infection.

Fleas can also transfer various disease-causing parasites, such as flea tapeworm, from one dog to another.

10.4 REDUCING ZOONOTIC DISEASES

People can get zoonotic diseases from infected dogs when they come into contact with:

- eggs of parasitic worms which have come from a dog's faeces and are in the soil
- eggs or cysts of parasitic worms which are in a dog's mouth or on its lips
- larvae of parasitic worms which are in water or damp soil
- mites that cause skin diseases which are on the dog's skin or anything the dog touches, such as beds, chairs, clothing, rugs and floors.

Fig. 3.44: Dogs should be kept off people's beds.

The precautions listed below should be taken to reduce the chances of getting diseases from dogs or cats.

- Do not cuddle or touch dogs or cats any more than is necessary.
- Do not let a dog or cat lick a person's face.
- Avoid contact between the ground and bare skin. Always wear shoes, boots, thongs or sandals when outdoors. Do not allow babies to sit on the ground if they are not wearing pants.
- Make sure young children do not eat soil.
- Try to avoid having any permanent moist areas of soil around the yard.
- If a dog or cat shows signs of illness have it treated immediately.
- Treat the dog or cat regularly for internal parasitic worms and for the various skin parasites.
- Wash the dog's or cat's bedding regularly.

11 Caring for dogs

11.1 KEEPING DOGS HEALTHY

For a dog to be healthy it will need:

- a daily feed with enough nutritious food. A dog should eat meat, vegetables and cereals.
- a supply of clean water.
- a clean, dry place to shelter when necessary.
- regular exercise.
- vaccination protection against disease, such as distemper.
- regular checks for signs of external parasites such as fleas, ticks and mange mites.
- regular preventive treatments for internal parasites such as worms, and external parasites such as fleas, ticks and mites.

11.2 GETTING RID OF EXTERNAL PARASITES

External dog parasites such as fleas, ticks and mange mites are usually treated by washing the dog with a special shampoo or treating the dog with a special chemical.

You should always follow the instructions on the label of the container of whichever treatment is chosen.

11.3 PLANNING AND CONDUCTING A COMMUNITY DOG TREATMENT PROGRAM

Providing regular preventive treatments for internal and external parasites can be difficult for dog owners. For communities, particularly where there are large numbers of dogs, it may be a good idea for these treatments to be done on a regular basis with all the community dogs being treated together. This makes the treatment cheaper and it lessens the chance of a clean dog being reinfected by a disease-carrying dog.

Planning and conducting regular dog treatment programs is one of the roles of the EHP and may involve working with veterinary surgeons (vets).

To conduct a successful community dog treatment program it will be necessary to follow the steps outlined below. The AMRRIC manual is also very helpful.

(a) Plan when the dogs will be treated.

Plan (decide beforehand) when the dog treatments should be done over the year and mark the dates on the calendar/year planner. If a veterinary service is to be used, the EHP will need to organise dates that suit both the community and the vet.

Arrangements will need to be made well before each dog treatment session to make sure that the proper chemicals and equipment are available for each dog treatment. It is also important that the session does not clash with special community events.

(b) Get the community involved.

The success of a dog treatment program in a community will depend upon the cooperation of everyone. This will happen only if people understand why the treatments are necessary and how they will be carried out.

To get this cooperation it is important to educate people about the importance of dog treatment and tell them about the planned program. People need to be told:

» the types of external parasites which can infect a dog's skin and hair and how its health is affected

» how these parasites can cause disease in humans (zoonosis)

» the type of treatment which will be used and how the dogs should improve after treatment

» that the chemical when used correctly will not harm the dog, humans or the environment

» why it is important that all the dogs should be treated at the same time

- » when the community dog treatment is to be done
- » that a dog treatment involves everyone in the community.
  It is especially important for all dog owners to be present with their dogs.

The EHP will need to plan how and when he/she will conduct the education activities.

It is a good idea to use education materials such as posters, flipcharts and videos, to help explain why it is important to treat dogs and what will need to be done. Arrangements to get these materials will need to be made. The Environmental Health supervisor and the Environmental Health Program education staff will be able to help.

Dog treatment programs are best done every three months. The EHP should organise education activities about 3 to 5 days before each planned treatment as this is likely to attract more people with their dogs.

(c) Put up reminder notices which tell people:

- » that there is going to be a dog treatment day(s)
- » when it will be held. Check the date closer to the day to make sure the day and time are still suitable. The plan may have been affected by a special community event which now will take place on the day for which the dog treatment was planned. If this happens the dog treatment may have to be held the next day or put off for a week or so
- » that dog owners must be there to help with their dog(s).

About 2 to 3 days before the dog treatment, these notices should be put up around the community so that everyone will see them.

(d) Make sure that all of the materials and equipment are available.

Remind other people who are going to help of the time and date of the dog treatment. This might be the EHP, EHP supervisor, an EHO, or other community members.

(e) Make sure that the dogs are handled properly.

Each owner should be encouraged to bring their dogs to the treatment team. Catching dogs is not the responsibility of the EHP.

- » The dogs should be handled gently and without fuss so that they do not become frightened.

11.4 MANAGING THE DOG POPULATION

It is important for the health of the people in a community and for their dogs' health that the dog population is managed so that:

- there are not too many dogs in the community
- sick and injured dogs are properly cared for

Controlling dog numbers

Dog numbers in a community can be controlled by stopping the dogs from breeding, or by culling dogs (reducing their numbers). These two methods are discussed below.

- Preventing dogs from breeding

  Dog breeding can be effectively controlled by **desexing**. Desexing means operating on the dogs so that they cannot have puppies. In females this is done by removing the womb (baby bag) and the ovaries (the place where the eggs are produced). In males, the testicles (balls) are removed.

  Desexing is preferable to culling as the animals are not harmed and recover quickly. Desexing may also help to change aggressive behaviour in dogs.

  Dogs can be desexed just after they become sexually mature. Desexing operations should always be done by a veterinarian (animal doctor).

  A dog's ability to breed can be also stopped for a short time by giving it an injection of a special drug.

  The EHP should discuss breeding control methods with the local EHO, the Environmental Health supervisor and/or the local veterinarian. These methods will need to be discussed with the Community Council and the other people in the community.

- Culling dog populations

  Another way of controlling the number of dogs in a community is by culling them. To do this, certain dogs are put down (killed). However, the community and the dog owners must agree that it can be done and how it will be done.

  If it is decided that some of the dogs are to be put down then this job needs to be organised properly:

  » The owners of the dogs need to be spoken to and they must agree to the dogs being put down

  » The method of putting the dogs down must be agreed to

- The date and time of the culling program must be set and the community told
- Where the culling is to occur. Culling is a sensitive issue and should be done away from the community
- If anybody from outside the community needs to be involved, they must be contacted and arrangements made for them to be present at the time the culling is to take place
- After the dogs have been put down, arrangements have to be made for the disposal of their bodies. These should be buried in a deep hole at the rubbish tip or in another appropriate place. It may be wise to organise for the bodies of culled dogs to be disposed away from the community.

AMRRIC's publication "Conducting Dog Health Programs in Remote Indigenous Communities—An Environmental Health Practitioners Guide" provides a thorough explanation of how to manage dog populations in remote settings and all aspects of dog health. EHPs are strongly encouraged to use this manual when planning any dog health program.

Sick dogs

Sometimes in a community one or more of the dogs may be very sick. This could happen because:

- they have not been fed properly and have become very weak and undernourished
- they are suffering from a serious disease
- they have been badly injured in an accident or a fight with other dogs.

A very sick dog is an unhappy and miserable animal. Every effort should be made to see to it that dogs are cared for properly. If they get sick they should be treated if possible.

It is sometimes kinder to the animal to have it put down than to let it suffer day after day. Even though it is a very hard decision to make, people who own a really sick dog should be willing to consider having the dog put down.

The EHP may need to discuss this action with the owners of any very sick dogs.

Putting dogs down

There are three usual ways of putting dogs down:

- They can be given a lethal injection
- They can be gassed
- They can be shot.

Shooting a dog can be a messy way of ending its life and many Indigenous people would not allow this to happen. Giving a lethal injection to a dog or gassing it may be more acceptable to dog owners but requires more equipment and animal handling and sometimes specially qualified people.

If chemical injections are to be used, only certain people, such as veterinarians or EHPs (only in WA) with permits can administer the chemical.

Some communities will prefer the putting down to be done away from the community. The dogs are taken away in a caged trailer or utility, and put down somewhere else. This way, the people cannot see it happening.

For further information refer to your EHO.

4 RUBBISH STORAGE, COLLECTION AND DISPOSAL AND ENVIRONMENTAL MANAGEMENT

1 Rubbish

Rubbish is everything that people do not want any more. A lot of rubbish comes from people's homes. Examples are food scraps, paper, plastic, bottles, tins, old rags, clothing and bedding. Other things such as broken furniture, car bodies and parts are also rubbish when people do not want them any more.

Rubbish is also known as **solid waste.** This term helps distinguish it from the liquid waste (sewage) from toilets, showers, tubs and sinks.

If rubbish is not disposed of properly it will become a major environmental health problem because it can have a most unpleasant smell, can cause injury and it assists in the spread of disease.

People can cut themselves on broken bottles, tins, wood and metal left lying around. Also, rubbish has disease-causing germs which can be spread to people. For example, germs on rubbish can be spread by flies to people or food.

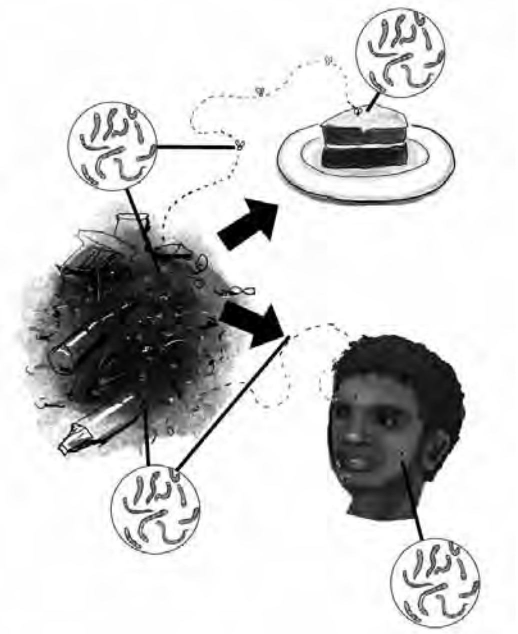


Fig. 4.1: Flies spread germs from rubbish to people and their food.

Rubbish should not be dropped or left all over the ground. It is most important that rubbish is disposed of properly.

Proper disposal of rubbish means its safe storage for a short period of time, proper collection and final disposal at the rubbish tip.

2 Rubbish and disease

Food scraps and other rubbish will have lots of germs and sometimes parasites on them.

If food scraps are left lying around in the house or on the ground, particularly in warm, damp weather, it will rot and lots of germs will grow on it. If people, flies, cockroaches, rats or mice touch the rubbish they can get disease-causing germs on them. Anything they touch is then likely to get some of the germs. For example, germs will get onto people's food if it comes into contact with flies, cockroaches, or mice that have germs on them.

Below is a list of the diseases which people can get as a result of inadequate rubbish and pest control.

Diseases caused by germs

Bacterial diseases include:

- salmonellosis
- shigellosis
- staphyloccal food poisoning
- skin infections
- tetanus.

Viral diseases include:

- trachoma
- hepatitis A
- gastroenteritis
- Murray Valley encephalitis
- Ross River virus disease.

Parasitic diseases include:

- hookworm
- threadworm
- roundworm.

Germs and parasites can be transmitted from rubbish to people:

- **Directly** by people:
  - » coming into contact with rubbish which contains germs and parasites. For example, children may come into contact with rubbish when they play at the rubbish tip
  - » injuring themselves on rubbish. For example, someone might cut themself on a rusty tin, allowing tetanus bacteria to enter the body
- **Indirectly** by providing places for vectors to live and breed. Vectors are disease-spreading animals, and include mosquitoes, flies, rats and mice which provide a 'vehicle' for germs and parasites to spread

Rubbish should **never** be left lying around for the following reasons:

- Flies which breed in rubbish can carry disease-causing germs, like those that cause food poisoning or eye infections such as trachoma, directly to our bodies and to our food.

Fig. 4.2: Flies carry germs to our food.

Flies can carry germs which cause trachoma and other eye infections.

Fig. 4.3: Flies spread the germs which cause trachoma.

Sores, cuts and burns can also become infected when germs are transmitted to them by flies.

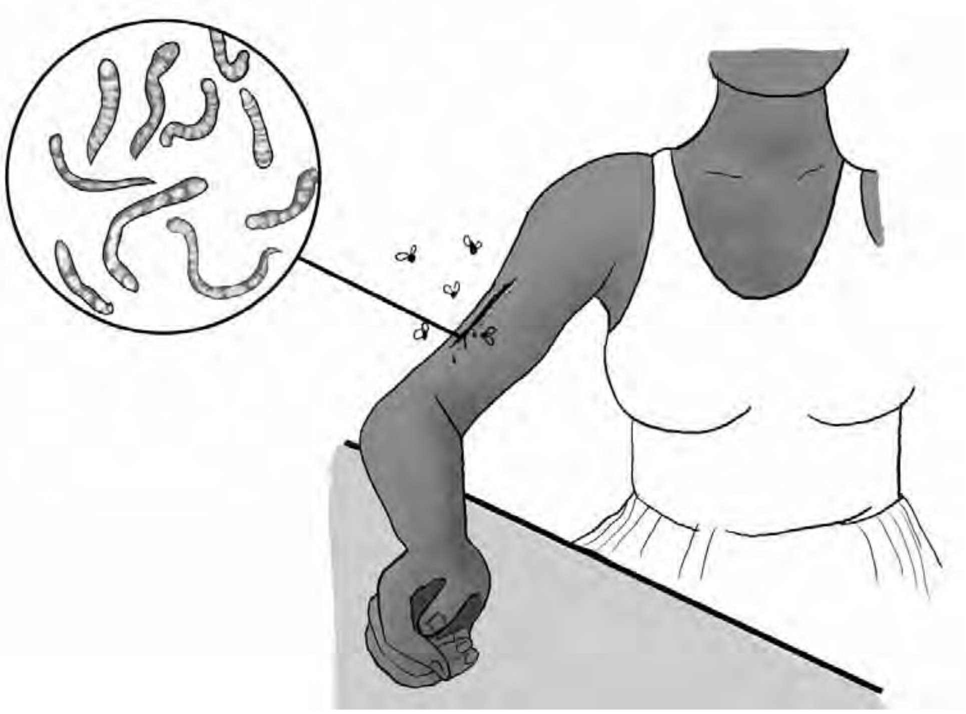
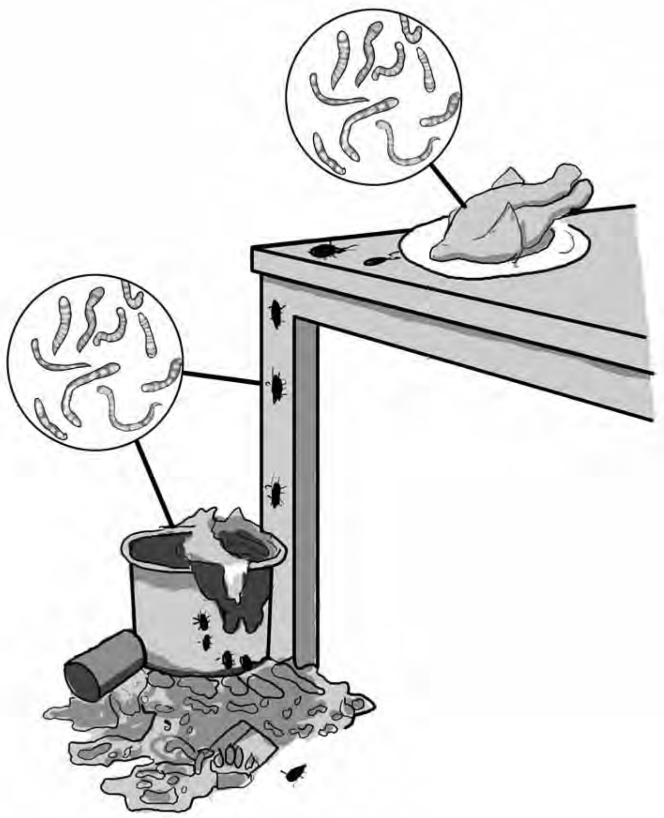


Fig. 4.4: Flies carry germs which can cause cuts and burns to become infected.



- Cockroaches breed in rubbish and can carry disease-causing germs, like those that cause food poisoning, to food and cooking utensils.

Fig. 4.5: Cockroaches carry disease-causing germs to people's food.

- Mosquitoes can breed in water trapped in old containers left lying around. This could include water trapped in old refrigerators, washing machines, tins, bottles or other containers.

Most of the mosquitoes in non tropical areas of Australia which like to breed in containers are just annoying. However, in tropical places such as areas of Queensland and the Top End, these containers can provide breeding places for mosquitoes which carry dengue fever.

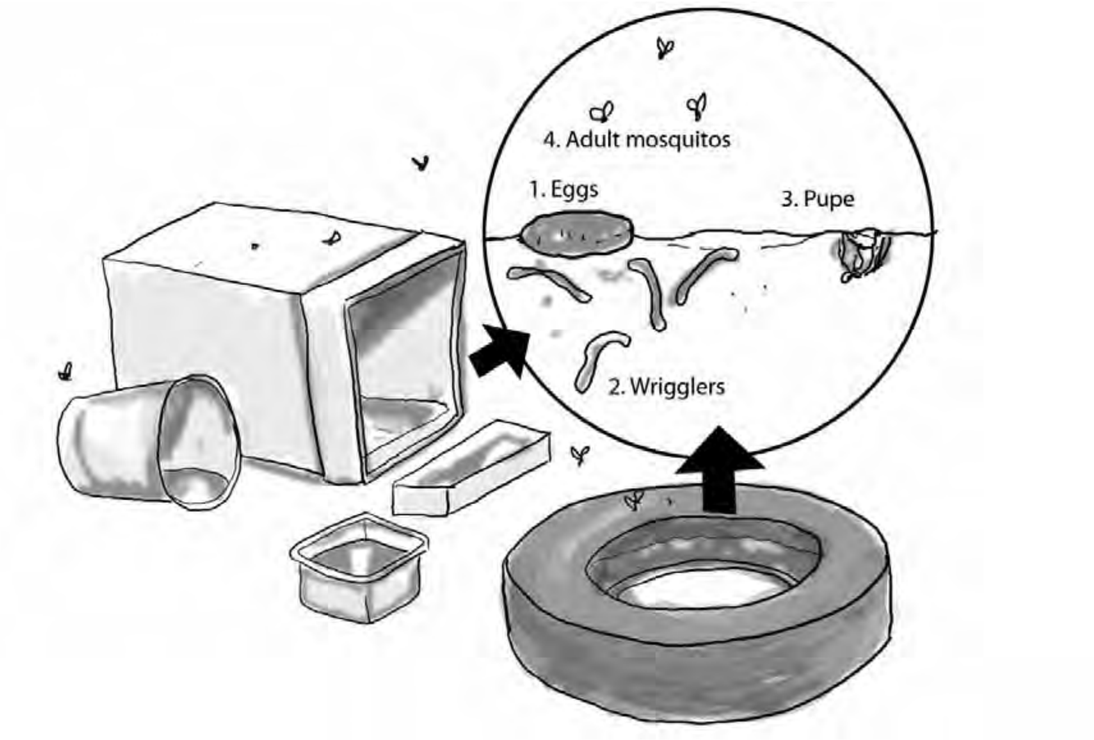


Fig. 4.6: Many mosquitoes breed in water which collects in containers.

People can get infected sores from cutting themselves on broken bottles, old tins or sharp-edged metal objects which have germs on them

When people cut themselves on these things, the germs get into the cuts and the cuts can become infected.

Fig.4.7: Infected sores often come when people cut themselves on glass which has germs on it.

Rubbish must be stored properly, disposed of often and in the proper way.

3 Domestic rubbish

Besides food scraps, there are many things people use in their daily lives that end up as rubbish. Some examples are given below.

Food containers

Fig. 4.8: Empty food containers like this are usually thrown away.

Other containers

Fig. 4.9: Empty plastic bags, detergent bottles, cartons and many other different containers are thrown away.

Unwanted household equipment, clothes, paper products and plant material from the garden

People often get rid of old clothes, cars, refrigerators, lawn clippings, paper and other things they do not want.

Fig. 4.10: Household rubbish like this should not be left lying around.

4 Disposal of rubbish

4.1 HANDLING RUBBISH

Unless it is too large, all rubbish should be put into the house bin as soon as possible. The items which are too big for the bin should be taken to the community rubbish tip as soon as possible.

Some items of household rubbish need special treatment before they are put in the house bin. Some examples of these are given below.

Food scraps

If possible, these should be wrapped tightly in paper before being put in the bin. This will stop the smells which attract insects and animals to the bin.

Fig. 4.11: Food and moist rubbish should always be wrapped before it is put in a rubbish bin.

Disposable nappies

The faeces should be scraped off and put down the toilet. The nappies should then be wrapped tightly in paper and put in the bin.

Bottles, cartons, paper, tin cans and similar items

Usually these can go straight into the bin. However, if they contain food they should be wrapped first. If they contain poisons (pesticides, household cleaners, medicines), the poison should be disposed of safely and the container washed out before it is put in the bin. In the case of pesticides and their containers there are special rules for their safe disposal (see Chapter 5).

Large household items

Some items of rubbish that occur around the home are too large for the regular household bin. These include:

- large cartons
- car parts and bodies
- sheets of iron
- worn out washing machines and refrigerators
- branches of trees.

These things should not be allowed to lie around the house/yard where they can become health hazards. For example, they may collect water which provides a place for disease-carrying mosquitoes to breed. These unwanted things should be taken to the community rubbish tip as soon as possible.

4.2 RECYCLING RUBBISH

Today, many people are worried that the earth's supplies of raw materials, such as iron ore and bauxite from which metals such as steel and aluminium are made, will soon be all used up. The same applies to trees from which paper products are made. As a result, governments are encouraging people to collect metal and paper products which people no longer need and use them to make new products. This is called **recycling**.

Much of the material which people throw away as rubbish can actually be recycled. For example, many aluminium products coming out of today's factories are made from recycled aluminium drink cans, window frames and other discarded aluminium products.

Recycling is becoming a big business in our modern world.

In some places, particularly near towns, some types of rubbish are collected for recycling. Manufacturers will pay money for aluminium cans and other kinds of scrap metal so these can be well worth saving.

The main items which can be recycled are:

- aluminium products such as drink cans, old window frames, flyscreens, and aluminium foil
- paper products such as newspaper, cardboard and old cartons
- plain and coloured glass products, such as bottles and broken drinking glasses
- iron, copper, brass, and some other metal products, such as car bodies, electrical appliances, bicycles, copper wire, brass taps and machinery
- motor oil.

Recycling is difficult in remote places because of the problem of transporting the items to the buyer. Recycling is easier for those communities which are close to towns where a recycling project is operating.

Plant material and some food items can be **composted** to make a natural fertiliser for gardens or any community vegetable or fruit growing activities. **Composting** is a process in which bacteria are used to break down plant materials to a type of substance which can be used as a fertiliser. Items which could be used are vegetable food scraps, grass clippings and leaves.

Making compost for community gardens and food growing activities is probably the easiest recycling activity in which communities can become involved. However, composting must be controlled because if it is not done properly it can smell and allow disease-carrying insects to breed.

If the community wants to consider recycling items of rubbish it is best to contact its local authority to see if this is possible.

Before becoming involved in a recycling project the community will need to:

- agree about the idea
- make arrangements to sell the recycled items direct to an outside agency which will buy the material. Sometimes the items can be sold to a central agency in a nearby town. This is often a charitable organisation like Apex. These groups then make all the arrangements to sell to the central buyer
- set up a way of collecting the items for recycling from the people in the community. This might be to locate bins for collecting the items to be recycled at convenient places in the community

- make arrangements to transport the items to be recycled to the outside agency.

Type of rubbish treatment		Recyclable
Food scraps	Wrapped then to bin	Yes*
Bottles	Bin	Yes
Cans	Bin	Yes
Plastic articles	Bin	Yes**
Paper products	Bin	Yes
Rags	Bin	Yes
Nappies (disposable)	Wrapped then to bin	No
Bones	Bin	Yes*

* Can be composted.
** Some plastic items cannot be recycled.

Table 4.1 Proper disposal of rubbish

5 Rubbish bins

5.1 RUBBISH BINS INSIDE THE HOUSE

There are several containers which can be used to store rubbish inside a house before it is emptied into the main bin outside the house. These are:

- pedal bins bought from the shop
- plastic buckets or something similar
- plastic shopping bags.

Rubbish bins inside the house should be kept clean and washed out regularly.

If a pedal bin or plastic bucket is used it is a good idea to use a bin liner. This is a plastic bag which is put inside the bin to hold the rubbish. Rubbish liners stop the bin from getting too dirty and make it easier to take out the rubbish. Plastic shopping bags make good liners.

When the bin liner is full of rubbish, it should be tied up tightly before it is put in the outside bin.

Fig. 4.12: Plastic shopping bags can be used to line kitchen rubbish bins.

5.2 RUBBISH BINS OUTSIDE BUILDINGS

Each home should have an outside rubbish bin with a strong, tight-fitting lid to keep out insects and rain. Sometimes a large plastic bag can be put into the bin first, to act as a liner. These bags not only help stop the bin from getting very dirty, they also make it easy to get rid of the rubbish. It is important to remember to tie bags when they are full.

It is important to stop dogs and other animals knocking rubbish bins over to get to the food scraps. The best way to do this is to raise the rubbish bins off the ground and attach them firmly to a frame or post.

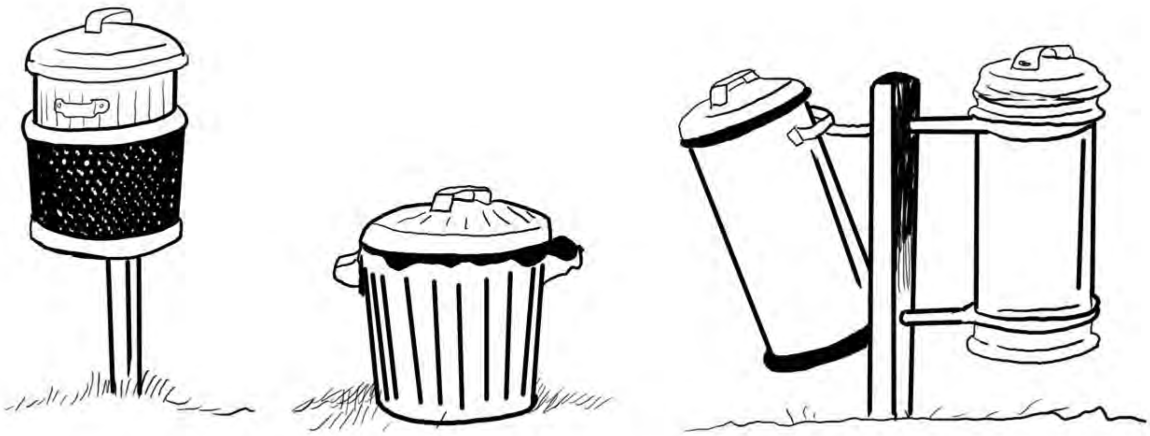


Fig. 4.13: Different types of household rubbish bins.

Bins for use outside the house can be made of metal or plastic. These bins can be bought from a shop or made from old metal drums or other large metal containers. These bins:

- must be strong
- must have a tight-fitting lid which should always be kept on the bin
- should be washed regularly with soapy water and then hosed out.

Rubbish bins should not be too big or heavy. If they are too big, they will be hard to lift when full. If old drums, such as 44 gallon drums, are used to make rubbish bins they may need to be cut down so that they are not too big or heavy. Well-fitting lids will need to be made for these drums to keep out the flies.

Rubbish bins should be emptied before they are too full, that is, before there is so much rubbish in the bin that the lid cannot close properly. Emptying household bins twice a week is usually often enough. However, bins around the community and near shops may need to be emptied every day.

Outside the store and other community buildings

Metal rubbish bins should be provided at the store, office, school and around the community.

The store may need to have a bulk bin which can contain large amounts of rubbish. Some examples of rubbish from the store are transport cartons and drums, protective plastic sheeting, old or damaged stock such as canned foods, dairy products, vegetables and cooked meats.

Community rubbish bins should have drain holes in the base (bottom) to allow water to get out. This is because they are not usually fitted with lids.

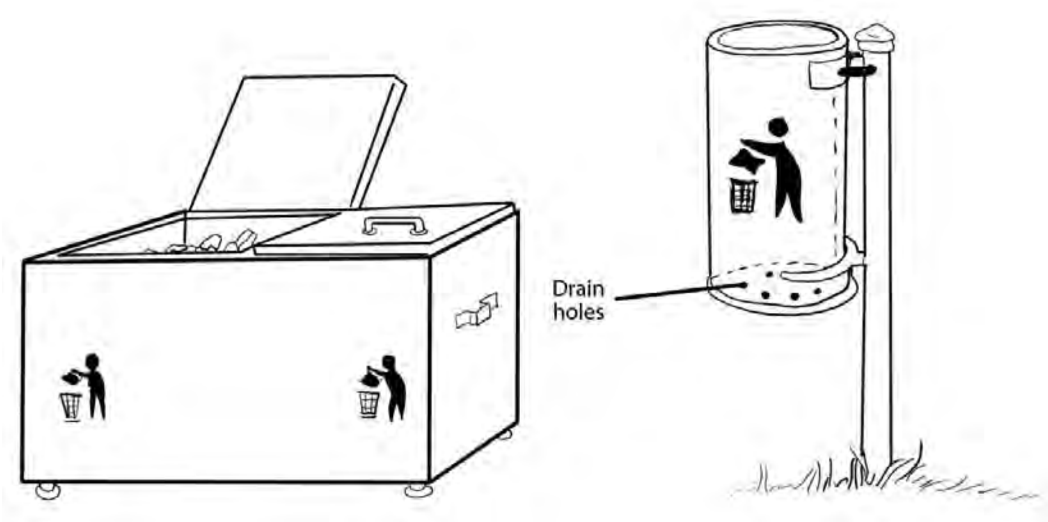


Fig. 4.14: Community rubbish bins.

5.3 RUBBISH DISPOSAL GUIDELINES

The main things to remember for the proper disposal of rubbish are listed below.

- Every house should have its own rubbish bin.
- Rubbish bins must have tight-fitting lids.
- If possible, the bin should be raised off the ground and be firmly supported by a frame or attached firmly to a post.
- Bins must be kept clean to stop germs breeding and to discourage flies. They should be washed after they are emptied and before the next lot of rubbish is put in them.
- All food scraps and disposable nappies should be wrapped before they are placed in the bin.
- There should be rubbish bins around the community, in the school grounds, and outside the store and office.
- Bins should be emptied before there is so much rubbish it overflows onto the ground or the lid cannot be put on properly.

Fig. 4.15: Overflowing rubbish bins attract flies and cockroaches.

6 Household incinerators

Burning of household waste and industrial waste is prohibited.

7 Rubbish collection

Rubbish should not be left in a bin until it rots or the bin gets so full that the rubbish spills onto the ground.

Rubbish collection is a very important service for the community. The risks to health increase greatly if this service breaks down. It is the responsibility of the Community Council through its administrative staff and EHP to make sure this service is carried out properly.

Every rubbish bin in the community should be emptied frequently and regularly, at least twice a week. The rubbish should then be taken away and buried so that:

- the risk of direct contact with disease-causing germs is reduced
- flies, cockroaches and rats cannot live and breed in the rubbish.

Usually it is someone's paid job to go around to the bins and collect the rubbish. Rubbish collection from houses is usually done twice a week and from shops, rubbish is often collected every day.

Sometimes it is necessary to have special rubbish collections for old furniture, mattresses, stoves, fridges and other large items.

The EHP should encourage the householders to wash out their rubbish bins regularly. Rubbish collection day is a good time to do it.

7.1 RUBBISH COLLECTION VEHICLES

Tractors and trailers, utilities (utes), or small trucks are commonly used for collecting rubbish in small to medium sized communities. These vehicles are probably the most readily available in a community.

The two methods outlined below can be used to transport the rubbish to the tip site.

Rubbish transported to the tip in a vehicle which does not have a cage

If the truck, utility or trailer does not have a cage, it is best to take the full bins to the tip. While the bins are being taken to the tip, their lids must be on tightly.

All the bins can be placed on the vehicle and then taken to the rubbish tip and emptied. Each bin must be labelled with the owner's name or house number so that it can be returned to the correct house.

Rubbish transported to the tip in a vehicle which has a cage

If the rubbish vehicle, such as a ute or trailer, is fitted with a cage, the bins can be emptied directly into the cage at the house. The rubbish is then taken to the tip. A rubbish vehicle cage must be enclosed on all sides, including the roof. There will need to be a loading door to allow access to the inside of the cage.

This method may be a little more efficient than taking the bins because more rubbish can be transported per trip. However, it is messy because all the rubbish must be cleaned out of the cage at tip following each trip. It is also important to wash the vehicle down at the end of the collection day and to make sure no rubbish fails off the vehicle or blows away during loading and transport.

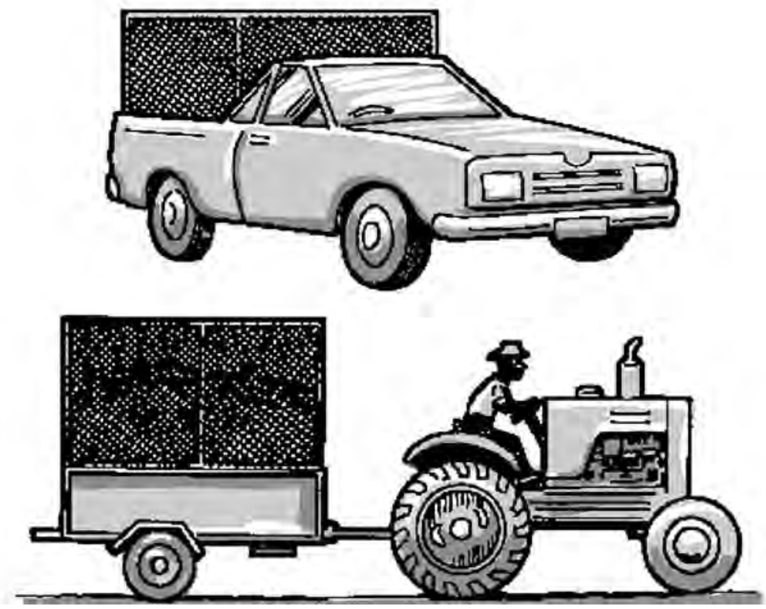


Fig. 4.16: Community rubbish collection vehicles.

Another type of rubbish vehicle is a tip truck with a cage. These are mainly used in very large communities or towns.

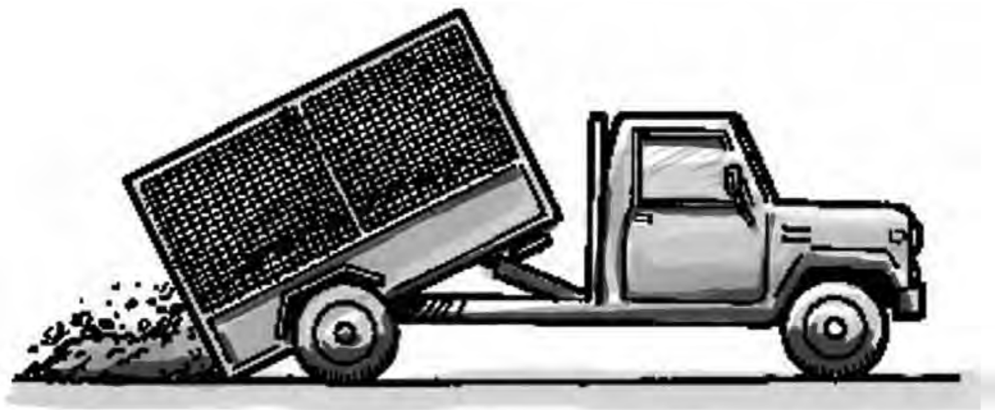


Fig. 4.17: A tip truck with cage.

Different types of rubbish compactor trucks are available and are used within communities provided with sulo bins.

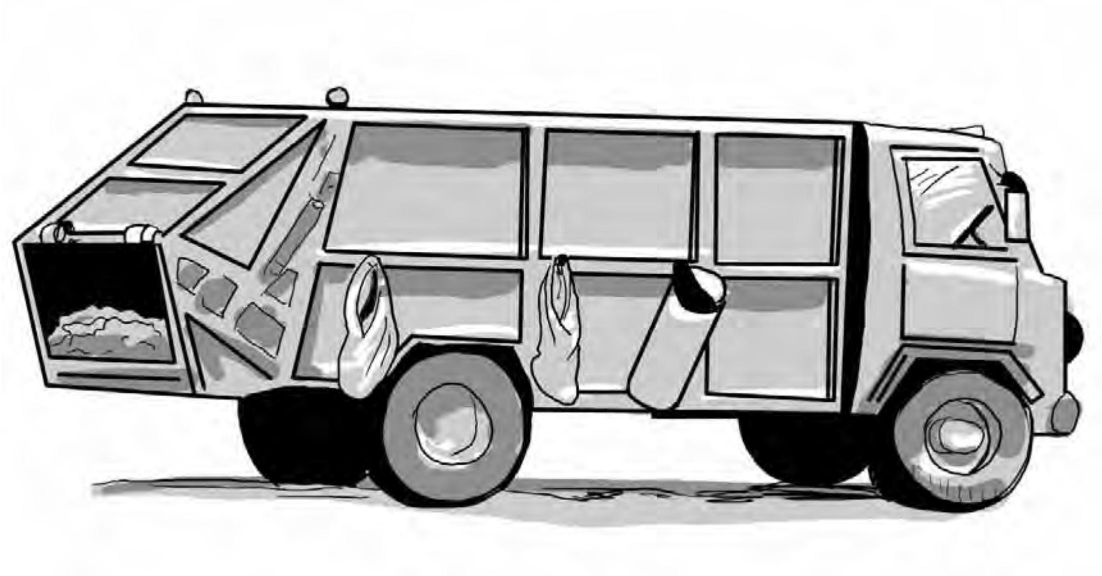


Fig. 4.18: A rubbish compactor.

Rubbish compactors are large trucks which are fitted with special compacting equipment. This equipment compacts (presses together) the rubbish into a smaller space. This means that the truck can hold a lot more rubbish and as a result fewer trips have to be made to the tip to empty the rubbish. This saves time and money.

Where rubbish compactors are used, it is most usual for each household, shop, factory or office to have special plastic or metal bins on wheels. These can be lifted by special equipment on the truck and emptied mechanically into the compactor.

The truck which is used to carry the rubbish to the tip must be looked after and be available when it is required for rubbish collection. If it breaks down or is not regularly available, the community will not be able to get rid of the rubbish and a health risk may occur.

8 Setting up a community rubbish collection system

A community rubbish collection and disposal system is very important to maintaining a good standard of environmental health. Getting the system started and working properly, will be one of the most important tasks for the community council and EHP.

It is an important part of an EHP's job to help organise the community's rubbish collection system.

The EHP does this by:

- educating community members about the great importance of proper community rubbish disposal. All community members, including children, should be taught about:
  - » the risks to health of an inadequate rubbish disposal system
  - » everything that goes to make up a proper rubbish disposal system
- encouraging community members to ask their Council to establish and maintain a proper rubbish disposal system.

  If the community does not have a proper rubbish disposal system, the EHP will need to talk to people about putting pressure on the Council to establish and run one properly
- discussing with the Community Council about how to set up and maintain a system.

  The EHP may get help from the local EHO to explain the importance of rubbish collection/disposal to the Council and what needs to be done. This includes getting advice as to the best system and disposal site for the community
- talking to the local authorities or other government agencies about provision of equipment, materials and vehicles to operate a rubbish collection/disposal system.

  Some local authorities might be able to help the Council with the actual collection and disposal of rubbish. For example, if the community is close to a town the local authority may be able to provide a regular collection service if the Community Council will support it. If not, it may be able to help in other ways, for example, by making earthmoving equipment available at times to dig rubbish disposal trenches.

  The local EHO would be able to advise on these matters.

  Other government agencies can assist the community in technical and onsite support
- encouraging the community to use the rubbish disposal system properly.

  When the rubbish disposal system is operating it will be necessary to tell people how to use it properly and to keep reminding them what to do.

  People can be reminded by posters and stickers with rubbish disposal messages on them. These can be displayed around the community, particularly near community bins
- checking that the rubbish collection system is operating and that people are using it properly.

It is important that EHPs do frequent and regular checks to see that:

- people are putting their rubbish in their house bins and making sure that their bins are put out to be emptied at rubbish collection time
- the rubbish is being collected from houses and other places in the community at least once each week and taken to the tip
- the rubbish is being properly disposed of at the tip
- the rubbish vehicle is being properly cleaned and maintained and is always available for the regular collection runs.

If the Environmental Health Practitioner has any difficulties with the setting up and operating a rubbish collection/disposal system, he/she should contact the Environmental Health supervisor or the local EHO. The EHP can also assist in community education.

9 Community and yard clean-ups

Homes and yards must be kept free of rubbish and of any unwanted materials such as old drums, refrigerators, washing machines or car bodies which can collect water. To do this, a special clean-up should be organised once a year or more often if necessary. This is very important in cyclone areas because this kind of rubbish can get blown around and cause damage to buildings and injuries to people.

By removing unwanted items, yards will look better and pests such as rats, mice, cockroaches, flies and mosquitoes will not be able to live and breed.

The community clean-up will need to be discussed at a full community meeting. The Council and other community members will need to know why the clean-up is needed, and about its benefits. Everyone should be encouraged to get involved and help to clean up all the places that need it.

Plans must be made which set out the day the clean-up will happen, which community members are going to help, and how it will be done.

Posters and reminders during community meetings and can be used to advertise the clean-up. This publicity should be started 3 weeks before collection day. If people cannot read, the posters will need to explain the message with pictures.

When doing clean-ups of this kind, it is necessary for householders to place all their unwanted items at the front of their houses near the road edge. The collection vehicles then pick it up and take it away to the rubbish tip. It is not the pick-up team's job to go into houses and carry out the item/s.

Large items like car bodies will probably need a special trip to get them out to the tip. These items are often difficult to handle and the community may need to use a front-end loader or similar equipment to pick them up. If this is not possible, it may be necessary to try and break the items up before taking them to the tip.

The community may wish to consider hiring the necessary equipment to do this or any other jobs around the community that need large or special equipment, such as tip maintenance. Equipment required for this kind of work might include bulldozers or front-end loaders.

If a local authority supplies a rubbish service to the community, it may agree to help in a community and yard clean-up. However, the EHP will need to discuss these arrangements with the EHO so that plans can be made.

10 Rubbish tips

The **rubbish tip** is the place where all of the community rubbish is taken and buried after it is collected from houses and yards.

The rubbish tip is usually well away from the community. Rubbish tips are unhealthy places and children should not be allowed to play around them.

10.1 FINDING THE BEST SITE FOR THE RUBBISH TIP

Many things have to be remembered when a community is planning the best place to put its rubbish tip.

The tip should:

- be down wind from the community, to help stops smells from the tip being blown back towards the community

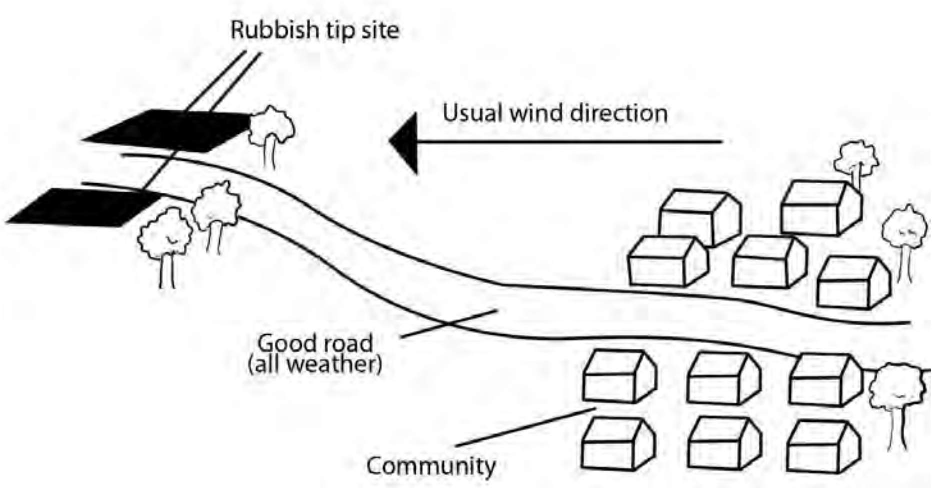


Fig. 4.19: Rubbish tips should be down wind of community buildings.

- not be too close to any rivers or creeks. This is to stop the creek from being polluted by solid rubbish blowing into the creek or by liquid waste soaking through the ground into the water
- not be placed where the water table is close to the surface. This stops the water being contaminated when rain washes toxic materials and pollutants from the rubbish into the underground water
- not be placed in or near an area which is important to the community, such as a sacred site, men's area, children's playground
- be placed in an area where earthmoving machines will be able to get to it
- if possible, be placed in a depression or hollow. This makes it easier to cover the tip with soil. It also hides the tip from view more than if it was on fiat ground. However, first check that the depression or hollow is not a natural water body, such as a soak
- if possible, be placed in an area where the soil is easy to dig.

10.2 BURYING COMMUNITY RUBBISH

The ideal rubbish tip is a hole dug ready for the rubbish. This is usually a large **trench** (a rectangular hole). The soil is taken out of the trench and is piled to one side of it.

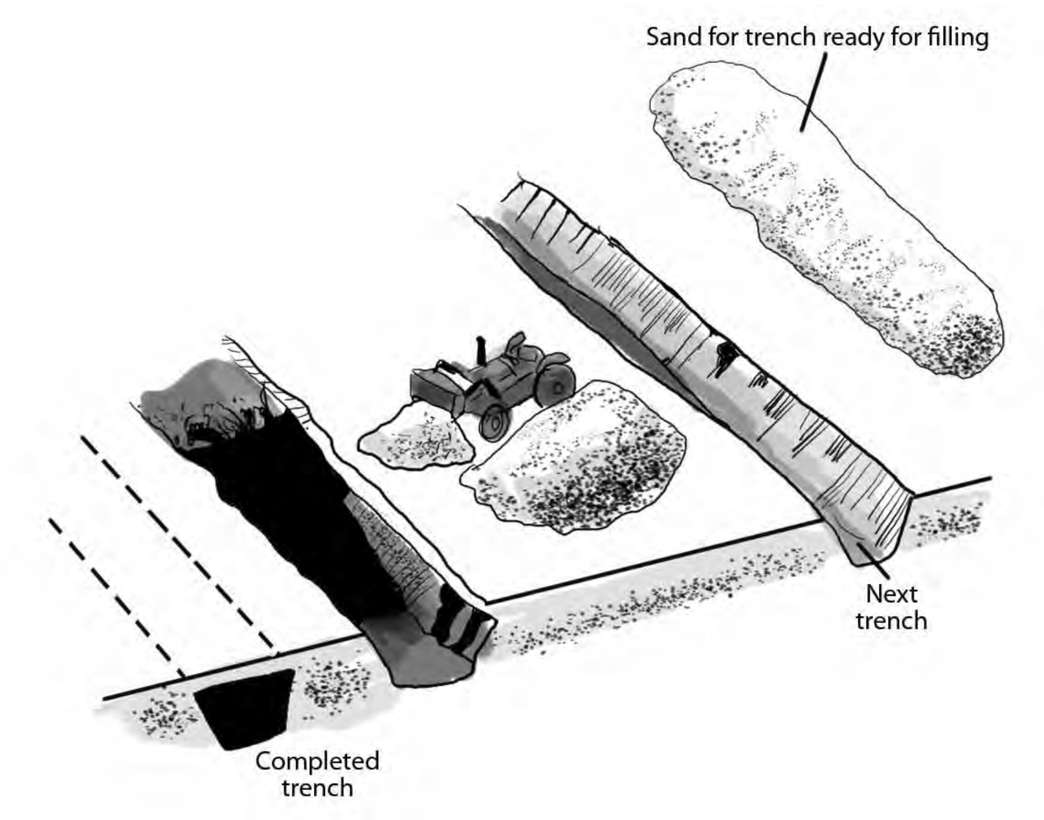


Fig. 4.20: Diagram of rubbish trench in which community rubbish can be buried.

Sewage and effluent should also be dumped at the rubbish tip. There should be a separate place at the tip where trenches are dug in which to empty sewage and effluent.

A track for vehicles will need to be made from the road to the working area of the trench. The track must be kept clear of rubbish so that trucks can get in and out easily to dump their loads in the right place.

Posts, guide fences, or old drums can be used to mark the place where the rubbish is to be put as the trench is used. Otherwise, people will not know where to dump their rubbish and it will end up all over the place.

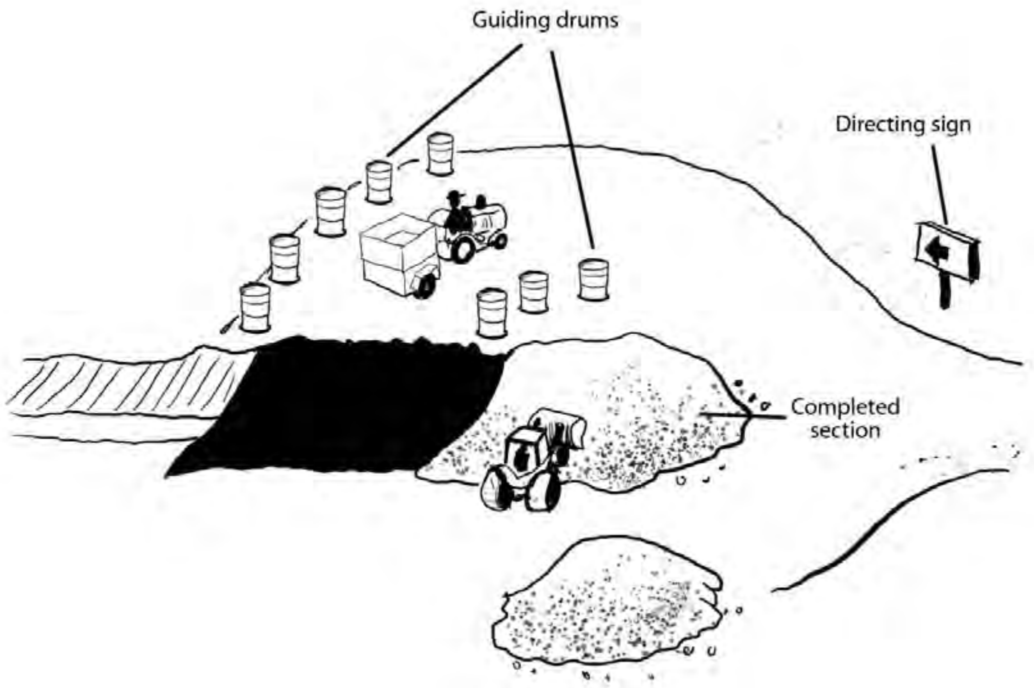


Fig. 4.21: The place where rubbish is to be dumped should be marked.

Unless they are dumping rubbish, people should be kept away from the tip because of the risk of injury and of coming into contact with disease-causing germs. If possible, the rubbish tip site should have a fence around it with a lockable gate. There should also be a notice near the gate warning people of the dangers.

10.3 TRENCHING METHOD OF RUBBISH DISPOSAL

Before any rubbish is collected it is important to make sure that trenches are dug ready to receive the rubbish. Whether the tip is to be used by a large or a small community, each trench should be large enough to take at least 3-4 weeks' rubbish.

Where the community is a large permanent one, it is usual to dig several large trenches at one time. This is a more efficient use of tractor and operator time, particularly if the tractor is being borrowed or hired.

In the case of camps and small permanent communities, it is more efficient to dig enough trenches to take all the rubbish for the length of time of the camp or to meet the needs of a small permanent community for one year.

It is important to remember to dig a special trench to take sewage. A notice warning people that it contains dangerous sewage should be put next to this trench.

Constructing rubbish disposal trenches

Where large trenches are needed they may have to be dug with a **front-end loader.** This is a large tractor with a scoop on the front. Each trench should be about 2 or 3 metres deep, 5 or 6 metres wide and about 20 metres long.

If the community is a large one, it is important that a suitable machine is used to dig the trenches. If the community does not have one and wants to buy or hire one, it is important to get advice from the local EHO or Environmental Health supervisor as to the best type for the job which needs to be done.

An arrangement may be made with the local authority to have trenches dug by its machines when they are in the area.

For camps and small communities the trenches can be smaller and may be constructed and filled by hand using a pick and shovel. They may take advantage of a natural hollow providing it is not a natural water body.

The EHP should consult with the local EHO as to the required size of rubbish trenches for their community.

Fig. 4.22: A rubbish tip for a small community or a temporary camp.

Filling the trench with rubbish

When the trench is being used, the rubbish is first put in at one end. When this section is filled with rubbish to within 150 mm (6 inches) of the top (ground level), it is covered with soil and the filling of the next section is started. Move along the length of the trench repeating this process until the trench is filled. Each section should be between 2 and 4 metres long and the operators use only one section at a time.

It is important to always place the rubbish as close as possible to the working area, rather than in the middle of the section.

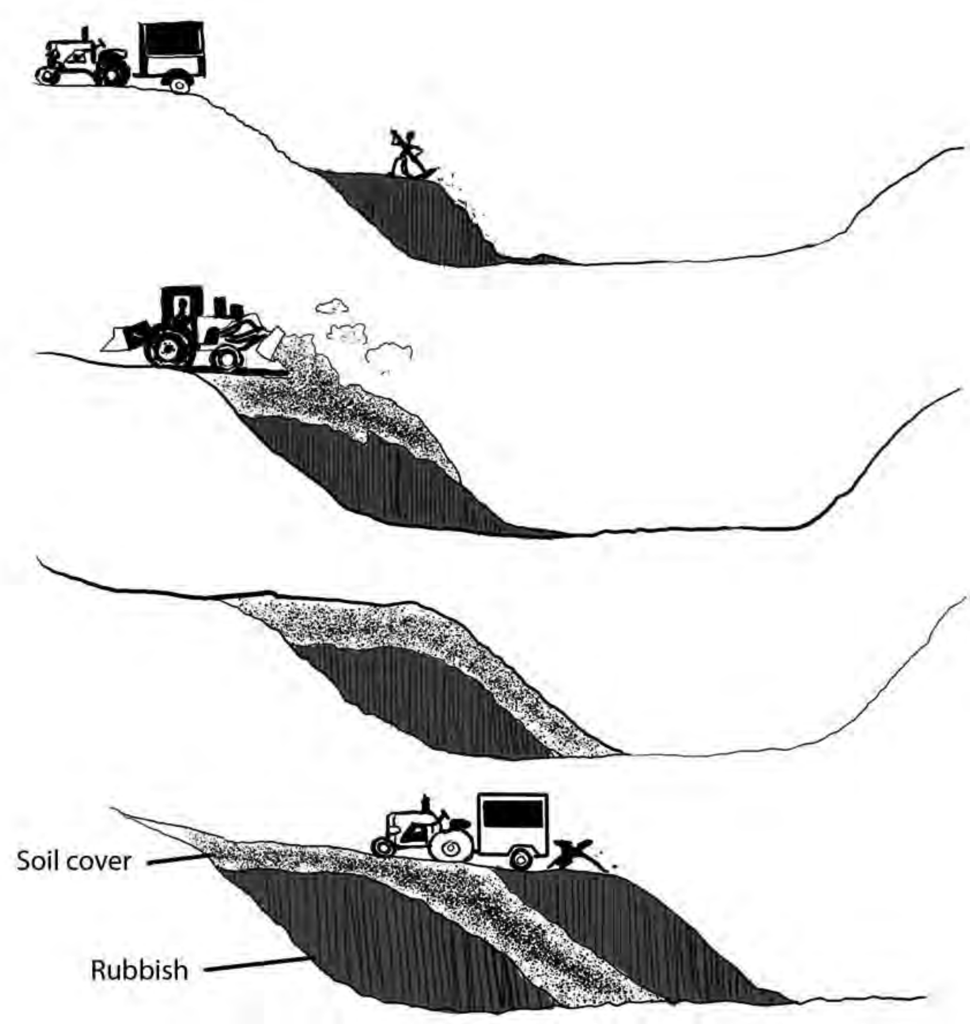


Fig. 4.23: Diagrams showing rubbish trenches which are completed, being filled and yet to be used.

Because the rubbish is loose when it is put in the trench, it should be compacted if possible. If the rubbish is just covered and compacted, the ground will sink later on. This is dangerous because people who walk on top of full trenches can fall through holes where the rubbish is loose. If the area cannot be compacted it should be topped up with covering soil as it settles. Keep people away from these areas.

When sewage is dumped in a trench, the sewage should be covered with a layer of soil as soon as the water has soaked away.

Rubbish and sewage trenches are always separate.

10.4 SANITARY LANDFILL RUBBISH DISPOSAL METHOD

A **sanitary landfill site** is an area of land where rubbish is dumped in layers or cells. Each layer or cell is covered with sand. Disused quarries, depressions or hollows make good sanitary landfill sites. This rubbish disposal method has been used extensively around cities to fill and level areas for later development.

Care must be taken when choosing a place for this kind of rubbish tip. This is because there may be small rivers or streams underground or a high water table and contaminants in the rubbish tip could soak through the soil into the water beneath. As a result, people and wildlife drinking the water could be poisoned.

It is necessary to contact an EHO to help choose a sanitary landfill site.

This method also requires a reliable vehicle or machine to maintain the tip and a supply of sand, because each time the rubbish is taken to the tip it must be covered.

11 Litter

litter is any kind of rubbish dropped on the ground by people when they are moving from place to place. Litter includes drink cans, bottles, cigarette packets, fast-food containers, paper wrapping and many other things.

Fig. 4.24: Many people throw rubbish out of moving cars.

11.1 WHY PEOPLE LITTER

Traditionally, Indigenous people did not stay in one place for long and they usually moved around the land in small family groups, so very little rubbish collected in one place. What rubbish they did leave behind was just faeces, urine and the remains of plant and animal foods. This was not a problem because waste material soon dried up and became free of bacteria, or other animals used it for their food.

When Indigenous people began to live in houses they did not understand how to get rid of new types of rubbish like glass, plastic, paper and cans. Today, there are many Indigenous people who have still not yet learned about this. However, there are also many people who do know that they should not litter but still throw their rubbish about.

Some of the reasons they do this are:

- a lack of rubbish bins
- no system being in place to deal with rubbish and litter
- not understanding the links between rubbish and disease or injury
- lack of community spirit—some people are not interested in keeping the community clean, tidy and healthy
- adults failing to set a good example for children—if the adults are always dropping litter then children will think it is the right thing to do and they will do the same thing. Children must be shown how to use rubbish bins.

Fig. 4.25: Some people are too lazy to make sure rubbish is put in bins.

Fig. 4.26: The people who live in this dirty, unhealthy community do not get rid of their rubbish properly.

11.2 IDEAS TO STOP PEOPLE LITTERING

When people in a community drop rubbish on the ground, they should be encouraged to stop doing it. To do this the EHP could try the following ideas:

- Set up a system for dealing with rubbish in the community.
- Have enough rubbish bins around the community.
- Place rubbish bins where people usually meet to talk and play, for example, outside the store, near playgrounds, meeting places and schools.
- Empty the rubbish bins regularly.
- Educate people so they understand:
  - » the health problems caused by litter
  - » the danger of injury from litter
  - » the pleasure of a clean and tidy environment.
- Encourage community spirit. This can be done by:
  - » organising community clean-ups
  - » planting trees and gardens

   » making playgrounds
   » painting fences, walls and buildings.

- Encourage the Community Council to set fines for people who litter. This means the Council will make people pay some money when they are caught dropping litter.

  It will be necessary for the Council to get advice from the local authority on how to go about making littering an offence which can be punished by a fine.

- Encourage people to recycle rubbish. Not all rubbish can be recycled but some can, such as:
   » metals
   » glass
   » paper
   » aluminium cans.

The EHP may be able to make arrangements for people in the community to sell some items of rubbish, such as aluminium cans, for recycling. Getting money for their rubbish is a very good way of encouraging people not to litter.

Fig. 4.27: The people in this clean, healthy community dispose of their rubbish properly all the time.

12 Environmental management—area beautification

it is important for people's good health that the community they live in is not only clean and free from rubbish, but that it is a comfortable and pleasant place in other ways. There is a greater chance of achieving these things if people plan the community layout before building starts. People should give a lot of thought to:

- where buildings and other facilities should be located
- what the buildings and their surroundings will look like.

12.1 ENVIRONMENTAL PLANNING

Working out ahead of time where schools, playing fields, houses, shops and other buildings and facilities will be built in a community is called **environmental planning**.

This can be done by people in a community discussing their ideas and deciding together what they need and where the buildings and facilities should be located. However, in Australia, environmental planning is usually done by specially trained planners who are employed by local authorities or government town planning authorities.

Environmental planning can be done before anything is built in a new community or before changes are made to an existing community.

A good community plan provides for:

- areas such as roadside reserves, playgrounds, gardens and parks which can be made more attractive by planting trees, shrubs and grass
- plenty of good places to play and exercise
- shady places in which to sit and talk
- shops, public toilets, health centres and other important facilities which are easy to reach
- roads, footpaths and street lighting which allow people to get around the community easily and safely
- water and power supplies to every house and public facility
- sewage and rubbish disposal systems which will meet the community's requirements
- placing houses so that people have privacy but can mix easily with neighbours if they wish.

Some of these facilities, such as rubbish tips, bores and sewage ponds require special consideration when finding a place to put them.

12.2 BENEFITS OF ENVIRONMENTAL PLANNING

For people who live in a well planned community, the benefits can be very great, particularly if the community:

- looks after the buildings and facilities
- makes sure that water and power supplies and hygiene systems operate properly.

These benefits can include:

- a clean and healthy environment
- a nice, pleasant place in which to live
- plenty of places to play and exercise
- healthier people
- people living longer
- people feeling happy.

12.3 HOW TO PLAN FOR A HEALTHY COMMUNITY

Australian cities, towns and some Indigenous communities have a **town plan**. A town plan is like a map. It is a document which sets out where all the buildings, roads and facilities are to be located. It may also set out where and what kind of sewage and rubbish disposal systems are to be built, the width of the roads, the size of the playing fields, parks and gardens and so on.

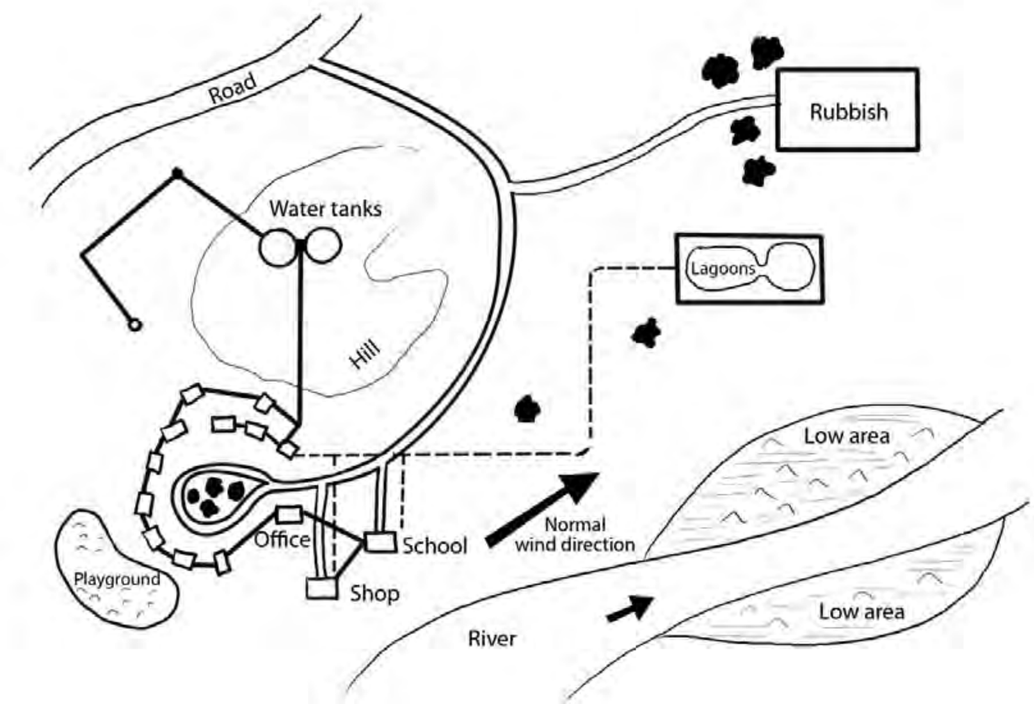


Fig. 4.28: An example of a community town plan.

These plans are usually prepared by a government department or local authority which has the power to make sure that people who live in the city, town or community follow the plan. This means that people cannot just put any kind of building anywhere they like. For example, they can only build a house in a place which has been specially set aside for housing.

Town plans are usually prepared before a town or community is built. When the town planning authority decides that a city, town or community needs to be changed, a new plan for the area will be drawn up. The local planning authority may also be able to assist.

Changes to cities, towns and communities usually come about because people see that there are better ways of doing things. For example:

- people may find that the road layout is dangerous and is causing a lot of accidents and needs to be changed
- a lot of people in the community may want a swimming pool or playing field
- health authorities may want to have the rubbish tip shifted because it is too close to some buildings.

When town planning authorities produce a new town plan, they usually ask people living in the town, city or community to look at it and give their opinions as to whether or not they are happy with it. When people do not agree with it, it is often changed to meet their needs.

If people in Indigenous communities think that their community needs changing, they should decide among themselves what changes they need. When they do this they might decide that:

- the community needs one or more new buildings, such as a preschool centre, a community centre, public toilets or a new community health centre
- some buildings would be better in other places. For example, moving a building away from the river to prevent damage during floods, or relocating communal toilets so that they are easier to reach
- the community needs to be a more beautiful place, by doing things like planting more trees, making a park or putting in place better systems for managing rubbish
- the community needs a new sewage system.

They should then discuss the changes they think need to be made with the appropriate town planning authority. It would probably be best to discuss any changes to rubbish and sewage disposal systems and water supplies with the local EHO or the state or territory government department who can advise on what action needs to be taken.

12.4 IDEAS TO IMPROVE THE COMMUNITY ENVIRONMENT

There are many changes which can be made to a community to make it a much more pleasant place to live in. The community should make its own list of priorities.

Here are some suggestions:

- build children's playgrounds
- make sportsfields
- provide BBQ areas
- plant trees and grass or ground cover for shade and dust control in the community
- paint houses and fences
- organise community clean-ups
- provide park benches.

It is important to take steps to beautify a community and make it a more pleasant place. For example, planting more trees and taking care of existing ones makes a community a more pleasant place to be in. Everyone likes to be able to sit in the shade of a big tree. Trees around a house can help to keep it cool and they look good. Trees are also important because they give out oxygen which people and other animals need to survive.

Gardens are not just for flowers. They can also be for growing vegetables and fruit. The roots of plants help hold the soil in place during floods and strong winds.

If there is grass or ground cover it can provide a good place to sit or rest. Children can play on the grass or meetings can be held there. Grassed areas are good for playing on too. Sports such as basketball, football, softball and netball can be played there. Ground covers also help to control dust in the community.

5 PEST CONTROL

1 What is a pest?

A **pest** is any animal or plant which has a harmful effect on humans, their food or their living conditions. Pests include animals which:

- carry disease-causing micro-organisms and parasites, for example, mosquitoes which carry Ross River virus and Murray Valley encephalitis.
- attack and eat vegetable and cereal crops, for example, caterpillars and grasshoppers.
- damage stored food. For example, rats and mice may eat grain in silos, rice or biscuits in shops and homes and contaminate this food with their faeces (droppings) and urine.
- attack and eat farm and station animals. For example, feral dogs (dingoes) kill or maim many sheep and goats each year; foxes will kill poultry, lambs and many species of native wildlife; and feral cats also prey on native wildlife.
- damage clothing. Silverfish, for example, eat holes in clothes.
- damage buildings. For example, termites can cause considerable damage to timber in buildings.
- bite people. For example, bed bugs (so called because they often bite people in their beds) are very difficult and expensive to control. Their bites can cause great irritation to those bitten and, like mosquito bites, can become infected if scratched.

There are thousands of different kinds of pests which are harmful to humans. The great majority of these are types of insect.

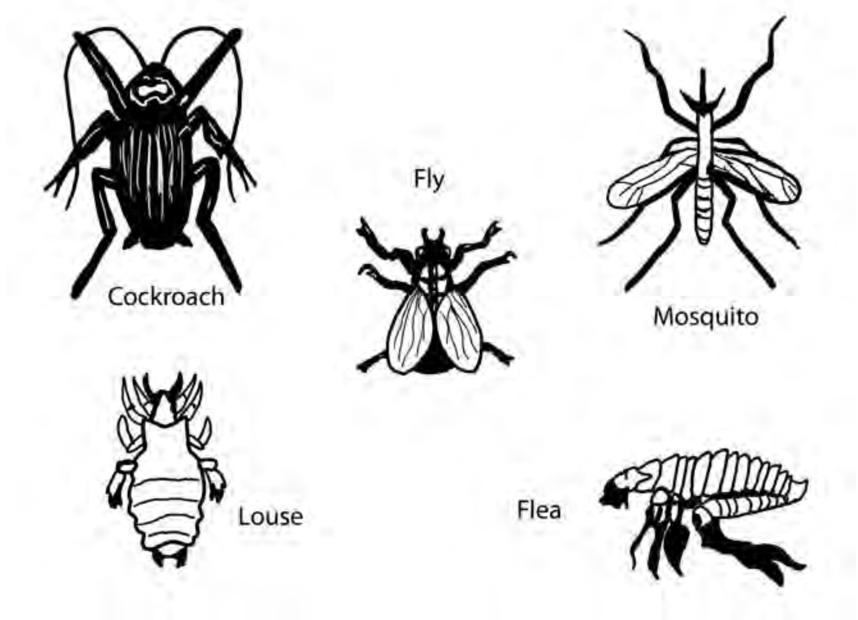


Fig. 5.1: Some insect pests.

2 Pest control

The numbers of pests in communities, on farms and pastoral stations must be controlled. Control is necessary, so that people, their stock and food supplies are not destroyed or contaminated, and the health of humans is not put at unnecessary risk. **Pest control** is all the action taken to help keep the number of pests down to a level where the risk to people, their food and the environment is minimised.

3 Common pests

There are many different kinds of pests and only some of these create health problems in Indigenous communities. The control of these will be described in this chapter.

3.1 LIVING AND BREEDING PLACES OF COMMON PESTS

Listed below are the pests which are commonly found in Indigenous communities, along with information about their living and breeding places and food sources.

Flies

Rubbish, food scraps, open septic tanks, open leach drains, under eaves, dirty benches and tables, lawn clippings and animal faeces.

Cockroaches

Rubbish, food scraps, dirty benches and tables, drains, behind stoves and fridges, bathroom and kitchen cupboards, under floors of older houses, septic tanks and leach drains.

Mosquitoes

Cool, dark and damp places such as rain water in discarded refrigerators, car tyres and tins, and in septic tanks/leach drains, water storage tanks, protected corners of effluent ponds and natural bodies of water.

Fleas

Like sandy areas. They need blood to breed. They will also bite humans when there are no animals around. Many fleas are brought into houses on peoples clothes, having jumped onto them from outside their house. Fleas are also transported on bedding.

Fleas are usually found on animals like cats and dogs, so it is important that these animals are kept outside the house to reduce the likelihood of fleas infesting houses.

Mites

Live and breed on animals and people.

Rats and Mice

Rubbish, exposed food, storage places, kitchen cupboards and holes in walls. They are also found in pipes, insulation, under buildings, in ceilings and in trees and gardens.

Bed bugs

Are transported from place to place in or on a persons luggage or their bedding. They hide in cracks and crevices during the day where people sleep and will seek a blood meal by biting a person in their bed during the night.

Bed bugs also need a blood meal to mature into adults. Bites can be very itchy and if scratched can become infected.

3.2 FLIES

There are many different kinds of flies. Three common types are shown below:

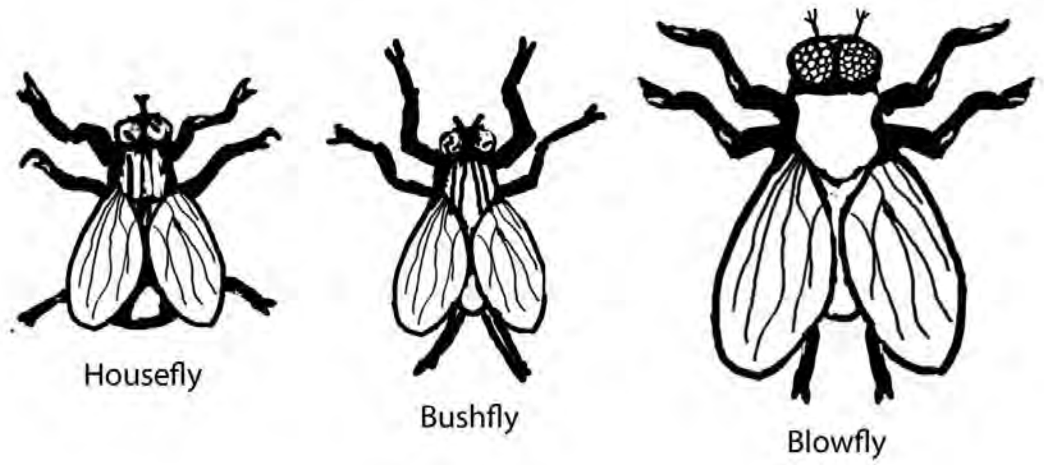


Fig. 5.2: Common types of flies.

Fly life cycle

Adult flies lay their eggs in moist organic material, for example, food scraps, animal faeces (droppings), grass clippings or dead animals. After a few hours the eggs turn into larvae, called **maggots**.

The maggots feed on the organic material and grow quickly. After four or five days the maggots move to dry soil and burrow down into it and turn into **pupae**. A special hard protective covering called a **pupal case** encloses each of the pupae while they continue to develop. Pupae are brown to black in colour and can sometimes be mistaken for mice droppings.

After four or five days, pupae turn into **adult flies**. They break out of the pupal case, burrow up through the soil to the surface and fly away.

Flies are able to travel many kilometres from their breeding place. However, if there are lots of flies around, it usually means there is a good breeding place nearby.

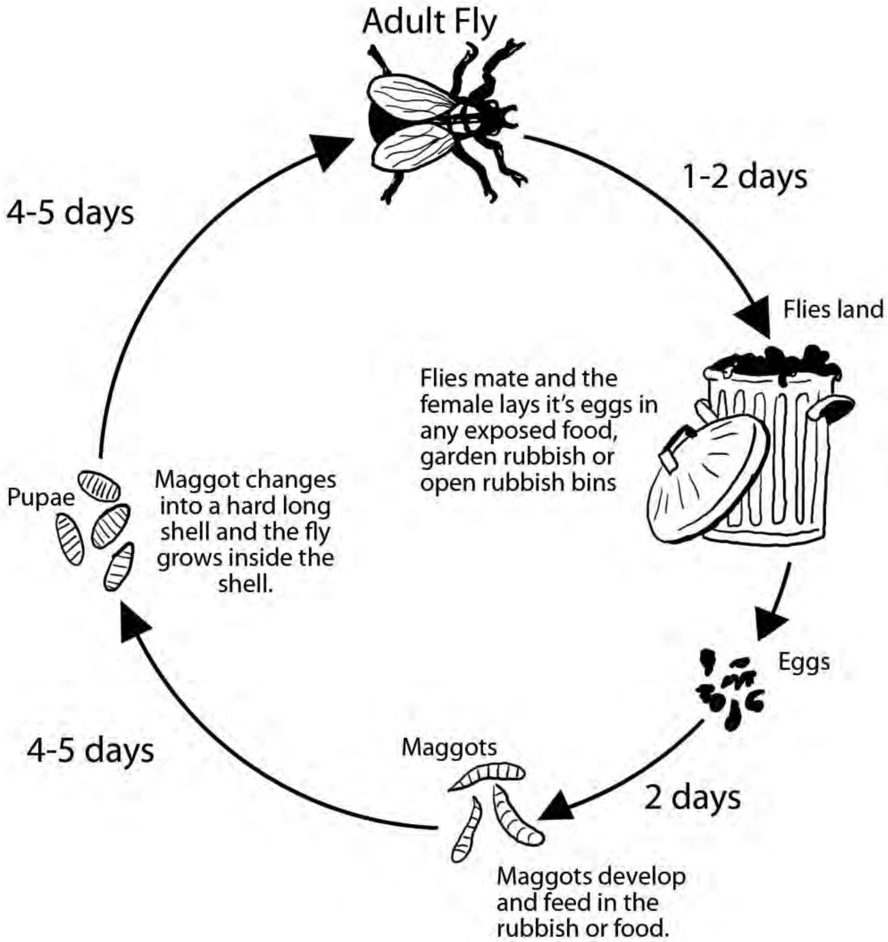


Fig. 5.3: Life cycle of the fly.

Flies and disease

When flies land on things like food scraps, manure, faeces or dead animals they pick up disease-carrying germs and germs. The germs are carried on their hairy bodies and legs and in their stomachs.

When the flies land on things like food, cups, knives and plates, the germs can be passed on to these articles. If people then eat the food or use these articles when eating food, they will get the germs into their bodies and may become sick.

Flies feed by putting a special substance from its stomach onto the food through its long, hollow, tube-shaped mouth. This special type of mouth is called a **proboscis**. The special substance which comes from the fly's stomach makes the food liquid and the fly then sucks this up through its proboscis.

Germs from the fly's legs and body, and from the liquid that comes from its stomach, get onto the food while it is eating. Some of these germs will be left behind on the food after the fly has gone.

This is a list of the diseases caused by germs and parasites which come from flies.

Diseases in Indigenous communities caused by germs carried by flies

Bacterial diseases:

- salmonellosis
- shigellosis
- trachoma.

Viral dieases:

- hepatitis A

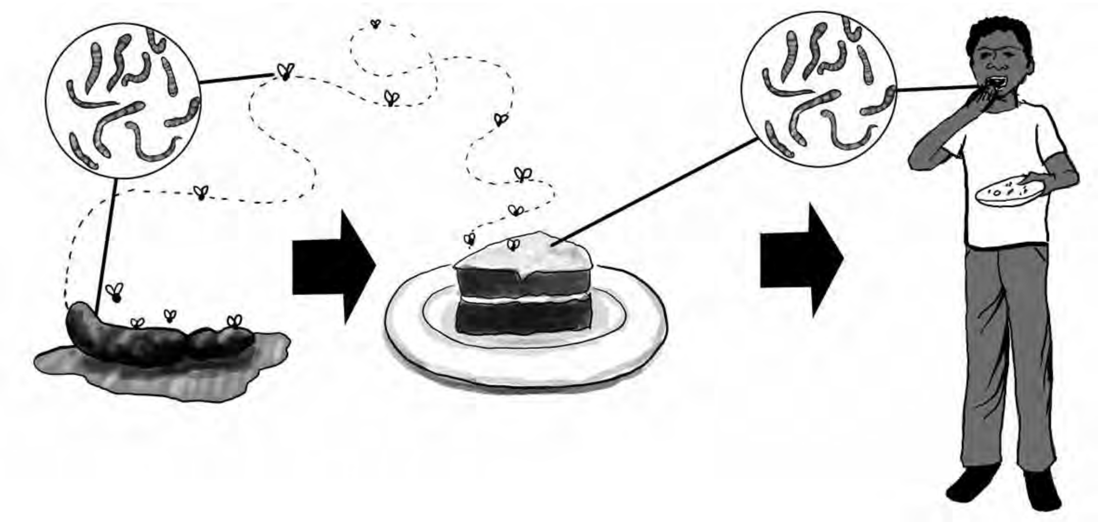


Fig. 5.4: How flies spread germs which cause such diseases as food poisoning and hepatitis A.

When people have cuts and sores on their bodies, disease-carrying flies can land on them and cause them to become infected.

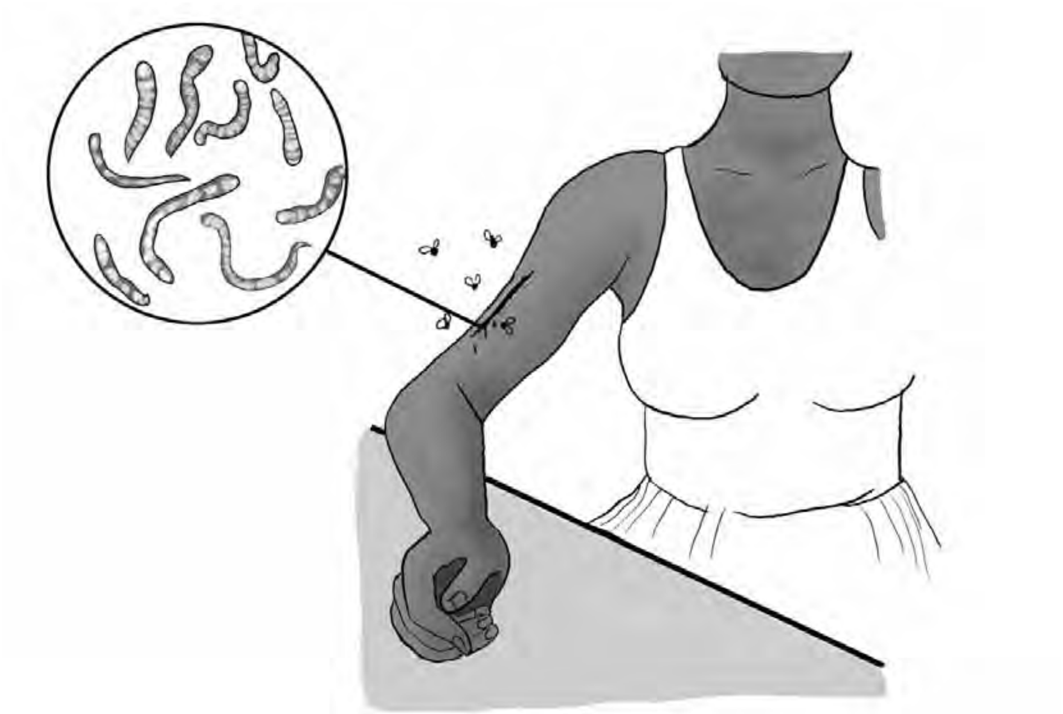


Fig. 5.5: Flies spread germs which cause cuts and sores to become infected.

Bush flies can carry a germ which causes a serious eye disease called **trachoma**. These flies are attracted to the salt in the tears (moisture) from people's eyes. As bush flies go from one person's eyes to another, they can pass on this disease from one person to the next. The common house fly is also attracted to the moisture around people's eyes. These flies can pass on germs which cause other kinds of eye infections, such as pus eyes.

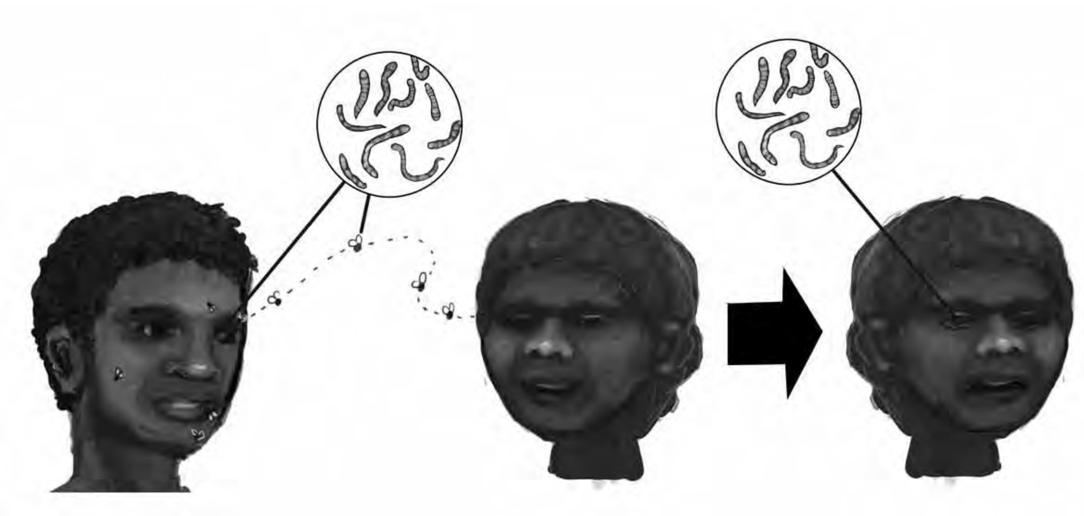


Fig. 5.6: How flies spread germs which cause trachoma.

Controlling flies

Probably the best method of fly control is to make sure the flies have no place where they can breed. Some of the ways of getting rid of breeding sites around the home are listed below.

- Wrap all food scraps tightly.
- Make sure the rubbish bin has an undamaged, tight-fitting lid that stops flies from getting in.
- Empty the rubbish bin regularly (at least weekly and more frequently if there are many people visiting or there is a house with a large family).
- Make sure rubbish is disposed of properly at the rubbish tip and covered regularly.
- Make sure the toilet is clean and working properly.
- Make sure the toilet vent pipes are fly-proofed.
- Make sure that septic tanks and leach drains are not damaged and have proper sealed lids.
- Remove dog and other animal faeces daily if possible.
- Dispose of faeces and dead animals to the rubbish tip as quickly as possible.

The EHP should make regular checks around the community to identify possible fly-breeding places. If maggots are found they should be killed immediately and the breeding site cleared of all organic material. After this, these places should be checked regularly.

3.3 COCKROACHES

There are many different types of cockroaches and most of them can spread disease. The three main types of cockroach in Australia are the **German Cockroach, Australian Cockroach** and the **American Cockroach**.

The **German Cockroach** is one of the smallest of the cockroaches and is probably the most commonly found species inside buildings. Adults are 12 to 15 mm long, have a light amber/brown colour with two dark stripes on the head.

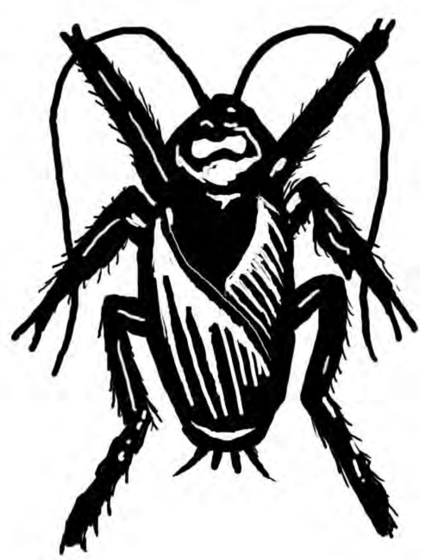


Fig. 5.7: The German Cockroach

German Cockroaches are mostly found in and around kitchens, pantries, storerooms and other food handling areas. They prefer to be near food, moisture and warmth. They do not fly.

The **Australian Cockroach** is larger (30 to 35 mm) and is able to fly. It is dark brown with clearly defined yellow markings on the head and the front wings. This cockroach prefers plant food and is usually found outdoors. For example, under the bark of trees and among woodpiles.

The **American Cockroach** is one of the largest of the cockroaches (30 to 45 mm). It is red brown in colour with a pale yellow border around the head and it can fly. The American Cockroach prefers warm and moist conditions. It is a very widespread pest which lives in wall and roof cavities, sewers, drains, cellars, grease traps and rubbish dumps. It can be found around any food preparation area.

Cockroach life cycle

After mating, the female cockroach produces an egg case. This egg case can be either carried by the cockroach or left in a secure place until the young are due to hatch. When she is ready, the female cockroach leaves the egg case in a quiet, dark, warm location.

The eggs then hatch, these are called **nymphs**, they look much like a small version of an the adult. Cockroaches do not undergo a series of marked changes like flies and some other insects. Cockroach nymphs grow to adult size by a series of moulting processes.

In each of these, the nymph sheds its hard outer covering for a new, larger one. Depending on the type of cockroach it may take from one to twelve months for a nymph to grow to adult size.

Note: When cockroaches moult, they will be white in colour, after a day or so they will return to their original colour of brown to dark brown, depending on the species).

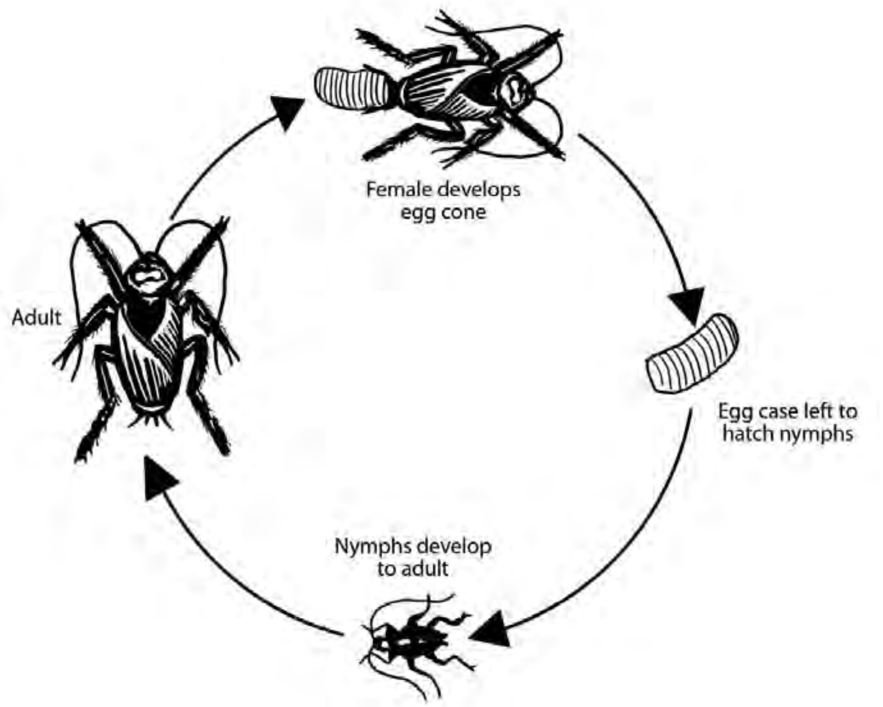


Fig. 5.8: Life cycle of the cockroach.

Cockroaches and disease

Like flies, cockroaches can carry many disease-causing germs on and in their bodies. Because their natural homes include rubbish, dirt and filth they readily pick up germs from these areas. They then walk over food, cutlery, crockery and cooking equipment, benches, tables and other places in the home and pass the germs on to people.

Diseases in Indigenous communities caused by germs carried by cockroaches.

Bacterial diseases:

- salmonellosis
- shigellosis.

Viral:

- gastroenteritis
- hepatitis A.

Controlling Cockroaches

All of the suggestions listed to control flies will also help control cockroaches. However, there are other kinds of actions which can be taken to keep cockroaches away from living areas. For example:

- keep food in containers which have tightly fitting lids
- store food handling equipment and containers up off the floor
- where possible, fill in small cracks and crevices (holes), in which cockroaches could hide. It is especially important to fill in cracks and crevices around pipes in walls
- clean shelves and inside and underneath cupboards regularly. This will reduce the build-up of food particles
- when required, apply a low toxicity liquid or gel insecticide to those areas where cockroaches may hide, especially cracks and crevices inside and around the outside of buildings, behind stoves and fridges and underneath the shelves of cupboards. There are many suitable insecticides that can be used to effectively control cockroaches. Before insecticides are used, people should be encouraged to regularly clean in and around their houses to reduce the cockroaches' food source.

3.4 MOSQUITOES

The adult mosquito has a **proboscis** similar to a fly except that it has a needle-sharp end which is used for piercing the skin of a person or other animal to suck blood.

When mosquitoes pierce the skin to suck blood, this can result in the transmission of many serious diseases among humans and other animals. However, most mosquitoes do not carry disease-causing germs, but only annoy people with the itchy 'bites' they cause. If people scratch their mosquito bites this can break the skin and lead to secondary infections.

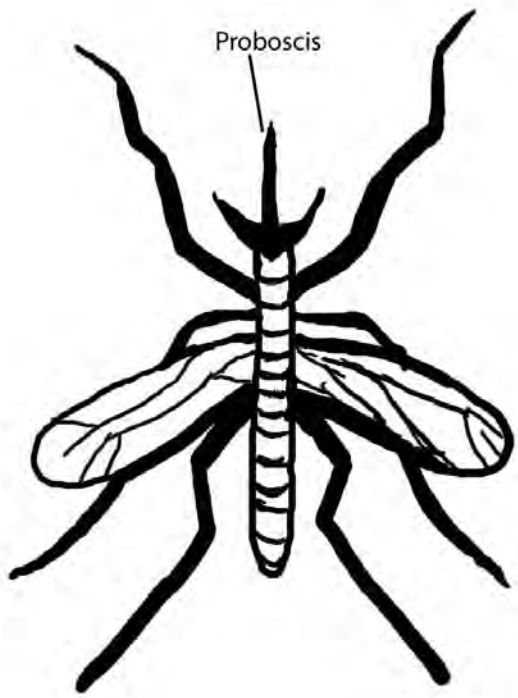


Fig. 5.9: The mosquito.

PEST CONTROL

Mosquito life cycle

Mosquitoes, like flies, undergo a complete change in appearance as they develop from the egg to the adult. Mosquitoes need water to complete their life cycle, and this water must remain until the adult mosquito is able to fly. If the water should drain away or dry up, the larvae or pupae will die.

Female mosquitoes often lay their **eggs** on a water surface. After a few days the larvae (which are called **wrigglers**) hatch from the egg and begin to feed on organic matter in the water. The wrigglers stay in calm, protected water as they cannot breathe properly in rough water. The wrigglers breathe through a siphon (tube), the opening of which is pushed above the water surface. Rough water will stop them from being able to breathe.

Some mosquitoes, however, will lay their eggs in moist areas just above the water level, for example, on leaves, blades of grass or on mud next to a waterhole. These eggs will lay dormant (asleep) for a period of time when the conditions are not right for them to hatch, for example, if it is too dry. When the conditions are right, such as when the rains come, the area floods, or there are high tides, the water will cover the eggs and they will hatch within 1 to 2 days.

After several days the wrigglers change body form and become pupae which are also called **tumblers**. The tumblers do not feed but they do move around.

After 1 to 4 days the **adult mosquito** comes out of the pupal case. It stays on the surface of the water until it dries out and then flies off. This drying off time is dangerous for the mosquito because it is easy for it to be attacked and eaten by other insects, frogs or birds.

The length of the life cycle will vary from one type of mosquito to another, but usually takes between 5 and 10 days at temperatures above 30°C and up to 3 weeks at temperatures lower than 20°C. A rise in the temperature of the water may speed up life cycle.

Adult female mosquitoes may live for several weeks.

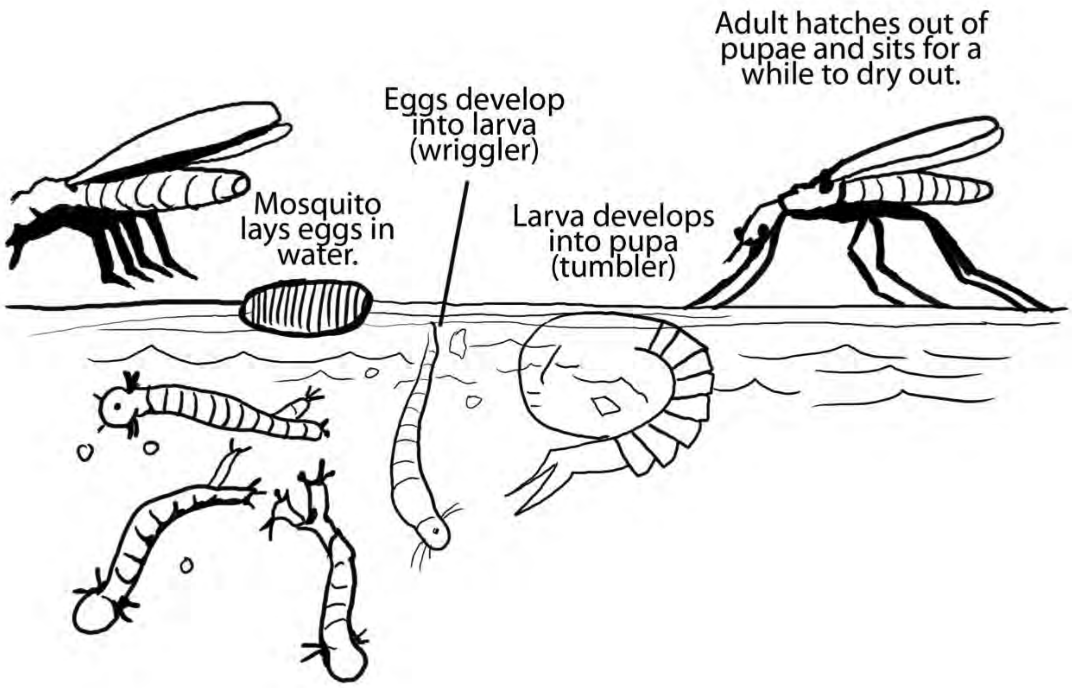


Fig. 5.10: Life cycle of the mosquito.

Mosquitoes and disease

Before the female can lay her eggs, she must have a blood meal. She gets this blood by sticking her proboscis into the person or animal's skin and sucking out the blood, often called a mosquito 'bite'. The time when biting is most likely is at dawn and dusk.

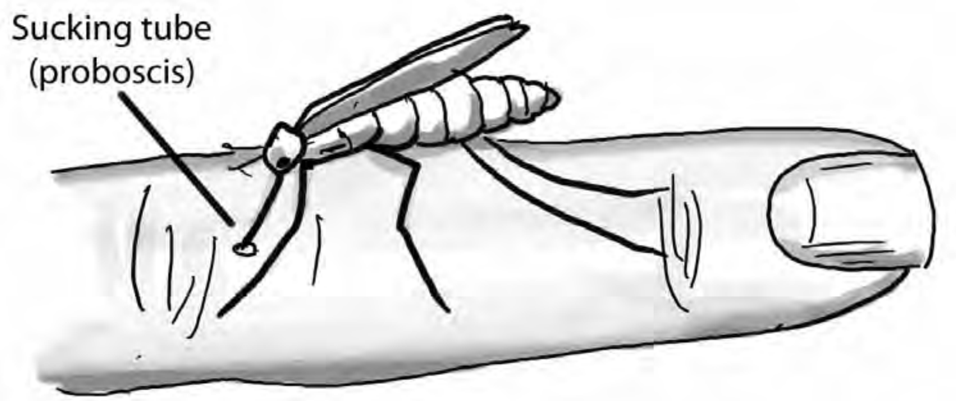


Fig. 5.11: Mosquito piercing skin with its proboscis to suck blood.

If a mosquito takes a blood meal from a person or animal that is infected with these virus germs then the virus will grow inside the mosquito. If it later bites another person or animal, it may pass on some of the virus germs, and that person or animal may catch the disease. This cycle can go on and on, infecting lots of people and animals and causing a disease outbreak with lots of sick people.

Many people all over the world have died as a result of diseases transmitted by mosquitoes.

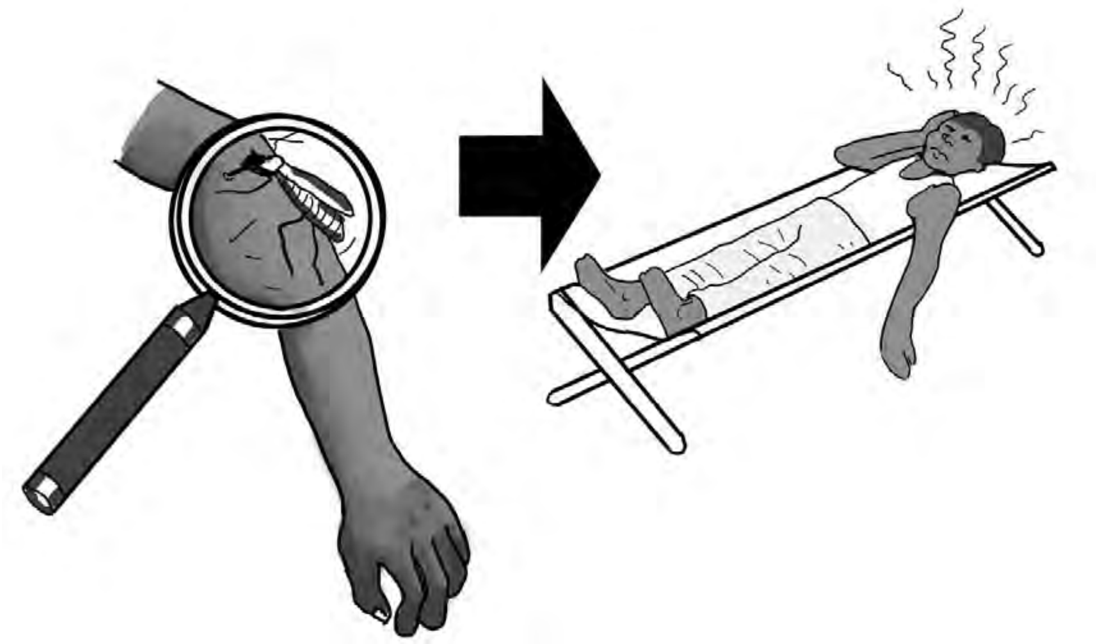


Fig. 5.12: Mosquitoes carry disease.

Diseases in Indigenous communities caused by germs and carried by mosquitoes

Ross River virus disease

The mosquitoes likely to carry Ross River virus breed in salt marshes, tidal flats, shallow freshwater swamps, poorly maintained sewage lagoons and containers such as old tyres and drums.

Murray Valley encephalitis (also called MVE)

The mosquitoes likely to carry Murray Valley encephalitis virus breed in open, shallow freshwater swamps and poorly maintained sewage lagoons.

Barmah Forest virus disease

The mosquitoes likely to carry Barmah Forest virus breed in salt marshes, tidal flats, shallow freshwater swamps, poorly maintained sewage lagoons and containers such as old tyres and drums.

Kunjin virus disease

The mosquitoes likely to carry Kunjin virus breed in open, shallow freshwater swamps and poorly maintained sewage lagoons.

To keep an eye on whether Murray Valley and Kunjin viruses are around, sometimes there are 'sentinel chicken flocks' in communities. Chickens will get these diseases before people do so blood samples are taken from the chickens to see if there is any of the virus around that might affect people living in the community. The EHP may be able to help by caring for (feeding and watering) the chooks and taking blood samples that are sent to a laboratory for testing. Sentinel chickens are no good for knowing if Ross River or Barmah Forest virus are around.

Dengue fever

At the moment, dengue fever is only a problem in north Queensland because it's currently the only part of Australia where the dengue fever mosquito breeds. The dengue mosquito breeds in water-holding containers, including rubbish left lying around people's yards. This mosquito will bite indoors and during the day. The risk of dengue in north Queensland can be reduced by regularly emptying water if it has collected in containers in the yard or by removing these containers altogether.

Controlling mosquitoes

As with most insect pests, the best way to control mosquitoes is to get rid of their breeding sites. This means making sure that water is not allowed to collect in unwanted equipment and containers which are left lying around.

These containers might include:

- car bodies and panels, engine blocks and tyres
- tin cans, plastic containers, drums, lids and jars

Mosquitoes can also breed in:

- water which has collected in blocked gutters and drains
- water tanks, septic tanks and leach drains which do not have lids
- still areas of water in sewage lagoons
- pools of water lying under leaking taps.

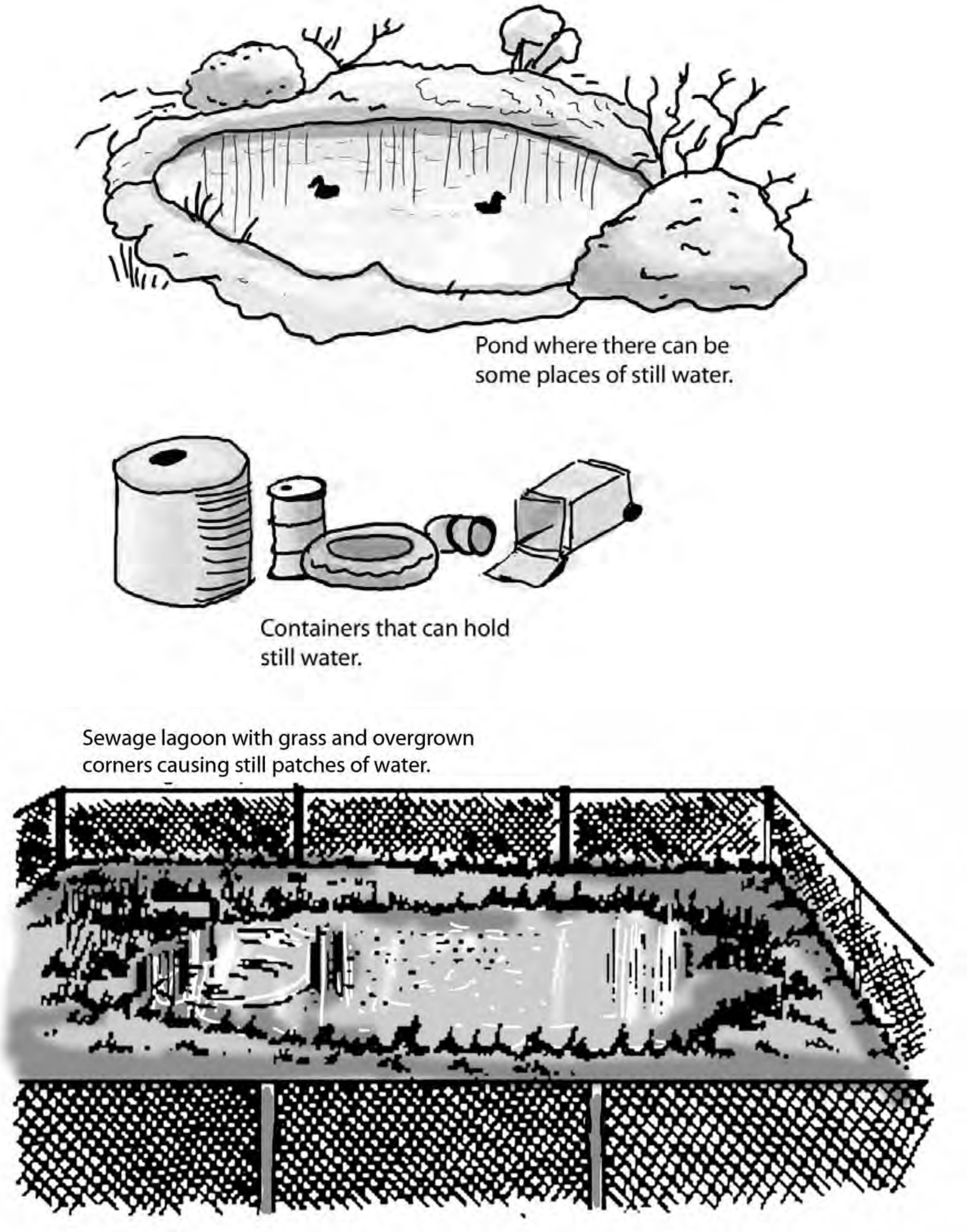


Fig. 5.13: Common mosquito breeding places.

It is important to make sure that there are always lids on water tanks, septic tanks and leach drains and that sewage ponds are kept free of grass and other vegetation around the edges.

For those mosquitoes which do manage to breed somewhere and become a pest in the community, it is important to keep them out of houses.

Putting up flywire on all door openings and windows is a good way of keeping mosquitoes out. Wearing cover-up clothes and using insect repellent on exposed skin reduces the risk of being bitten when outside during the biting times. Loose clothes are best because mosquitoes can bite through clothing which is tight against the skin, even jeans. Sleeping children and babies should be protected with mosquito nets. Insect repellent should never be used on babies – cover them with a net instead.

Sometimes when the mosquitoes are really bad or if there is lots of mosquito disease around, the mosquitoes might need to be controlled using pesticides. There are two types of pesticides – one that kills the wrigglers in the water and one that kills the adult mosquitoes that are flying around. A properly trained person who has a special pesticide license will need to do this work.

3.5 RODENTS (RATS AND MICE)

Rodents comprise a group of furred, warm blooded animals which include rats and mice. In Australia, there are a number of introduced (feral) rodents which are pests around homes, shops and warehouses. These are:

- the ground rat (also called the Norway rat)
- the roof rat (also called the climbing or black Rat)
- the house mouse (also called the field mouse).

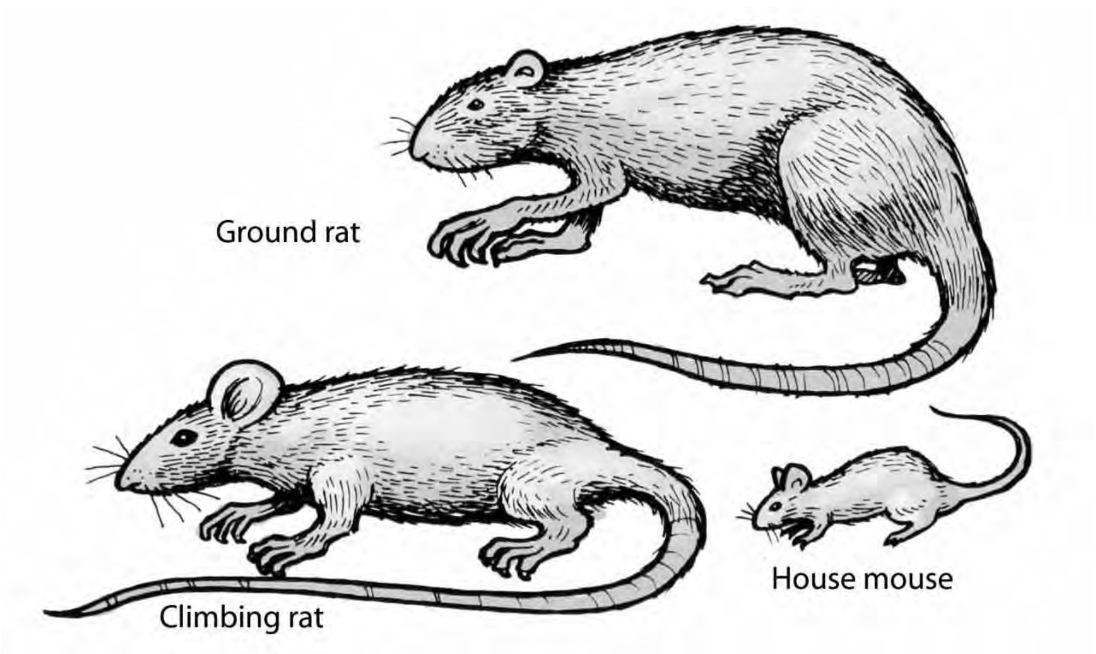


Fig. 5.14: Rodents show picture of a typical house mouse

Rats and mice differ in size, mice being much smaller than rats. Ground and Roof Rats are similar in size. However, they differ in some ways.

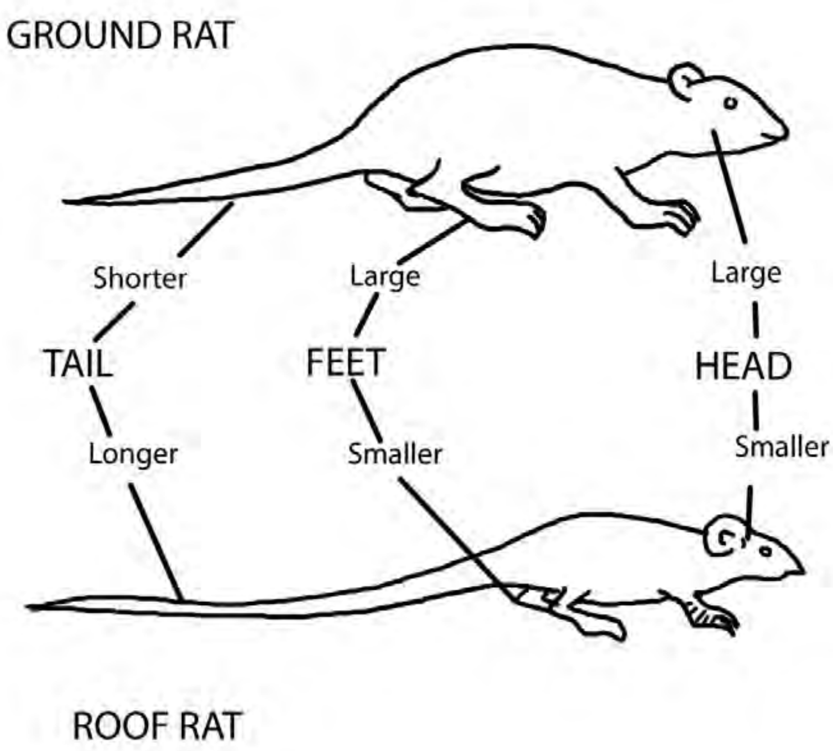


Fig. 5.15: Differences between Ground and Roof Rats.

Rodents and disease

Rats and mice, like other animals which live in rubbish tips, drains, sewers and other unhygienic places, pick up disease-causing germs from their environment. They then become carriers of these germs and can spread dangerous diseases by entering our houses. Six hundred years ago, roof rats and their fleas were responsible for spreading the bacteria which caused bubonic plague (the Black Death) throughout Europe. Twenty-five million people died in this plague.

Rats and mice may pass disease-causing germs to humans in several ways, such as:

- carrying disease-causing germs from sewers, drains and rubbish tips to food, kitchen benches, storage areas and utensils
- depositing infected urine or faeces on food utensils
- depositing infected urine or faeces in places where people can come in contact with it
- biting people
- passing the germs to household pets, which then pass them on to humans.

Fig. 5.16: Rats spread germs which cause disease.

Diseases in Indigenous communities caused by germs carried by rodents

Bacterial diseases:

- leptospirosis
- rat-bite fever
- salmonellosis.

In addition to being major pests because they spread disease, rats and mice also cause significant problems in other ways, for example:

- they can destroy large amounts of stored grain in bulk stores and silos by contaminating it with their urine and faeces
- their habit of constantly gnawing (chewing) causes much damage to doors, skirtings, upholstery, books, food and other packaging, wires, cables and pipes.

Controlling rodents

All of the good hygiene practices listed for other pests will also help to keep rodent numbers low. It is also possible to design a building that makes it difficult for rats or mice to enter, although as long as people have access to buildings, these rodents will often also find a way to gain entry.

Flywire doors and window screens also help to keep rodents out of houses.

Other methods of controlling rats and mice are to use traps and poison baits. Ensure that baits are placed well out of the reach of children and pets, such as cats and dogs.

3.6 BED BUGS

Bed bugs are small insects about 4-6mm in length. They are flat in shape and when they hatch are cream in colour, turning reddish brown as they mature. When they have a blood meal they turn dark brown. There is no evidence to date that these insects transmit disease. They are often brought into a house by people who may have recently travelled interstate, overseas or visited relatives in a nearby town or community. Bed bugs attached themselves to luggage, bedding, furniture and so on. Then when any of these items are brought into a house, the insects run off and hide and wait for a person to bite. They often bite while a person is sleeping.

Bed bugs can quickly infest most areas of a house, particularly bedrooms and are difficult and very expensive to treat/eradicate. Often people have to throw away their mattresses and start again. Simply buying a new mattress will not get rid of bed bugs, as rooms have to be treated with insecticides and where possible steam or a combination of both.

The life cycle is as follows:

- Eggs—clusters of three or more stuck together, they are white in colour.
- Eggs hatch in 6–17 days and form nymphs, (nymphs shed their outer skin, 5 times).
- Nymphs turn into adults after 5–12 weeks.
- Adults are very mobile as they are good walkers and can run.

Controlling Bed Bugs

- Thoroughly inspect used bedding (including mattresses and bed frames) before it is brought into a house.
- Inspect luggage before it is brought into a house and never put your luggage or that of others onto your bed, as bed bugs attached to the outside of the luggage will jump off and infest your bed.

- If bed bugs are found, a combination of treatments is likely to be necessary for all rooms of the house, particularly bedrooms. It is likely that both insecticides and steam will have to be used. Insecticides alone will not kill the eggs, whereas steam will kill all growth stages. It is recommended that only a properly trained person is brought into treat for bed bugs. Two or more treatments might be required to eradicate these insects costing many hundreds of dollars, so preventing them infesting a house in the first place is important. Educating a community on the ways bed bugs can travel and where they could be found in a house is important. There are brochures available from the Dept of Health, the local government or council or from the Dept of Health web site. There is also a national Code of Practice developed for the control of these insects.

4 Environmental conditions which encourage pests

Where an EHP surveys a community and finds some of the conditions listed below, it is likely that some pests will be found in the community.

- Faeces or dead animals lying around.
- Septic tanks and leach drains with lids broken or missing.
- Pools of water caused by leaking taps.
- Overflowing effluent drains.
- Objects such as old tyres and other water-holding containers left lying around which could collect water.
- Rubbish, including food scraps, left lying around.
- Blocked and/or unclean toilets.
- Grass growing in sewage lagoons.

Homes with:

- food left uncovered in kitchens
- unclean tables and bench tops
- unclean cupboards and shelves
- unclean kitchen floors.

Fig. 5.17: Some places where pests live.

4.1 SIGNS THAT THERE ARE PESTS IN A HOUSE

It is easy to know when flies and mosquitoes are in a house because they usually annoy people and are easy to see.

Where houses are not properly cleaned, there can be significant number of cockroaches, which can be often seen during the day. Large cockroach infestations can produce a sickly smell and leave much faecal material around.

Rats and mice usually hide during the day and are rarely seen, unless in large numbers.

Listed below are some of the signs which show that pests are around.

Signs of cockroaches include:

- lots of little black droppings
- a sweet, sickly smell
- dead cockroaches
- empty egg cases
- chewed labels and paper.

Signs of rats and mice include:

- teeth marks and damage from chewing
- rat and mice droppings
- greasy smears from the rats' fur mark their runways
- rat and mice holes
- running, chewing or scratching noises.

Signs of bed bugs include:

- dark blood spots on bedding
- adult bed bugs hiding in the seams of mattresses, bed frames, etc.
- small white clusters of eggs sticking to the mattress seams
- people complaining of being bitten.

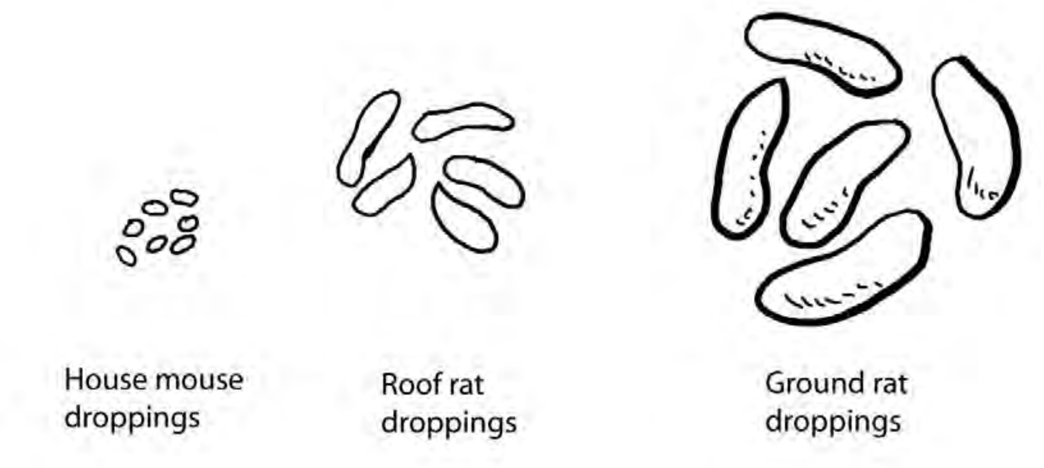


Fig. 5.18: House mouse and rat droppings (faeces).

5 Pesticides

5.1 WHAT ARE PESTICIDES?

A **pesticide** is a substance used to kill feral animals, insects, fungi or plants. There are thousands of different pesticides in use today. Pesticides are used in houses, shops, offices, storerooms, sheds, gardens, farms, pastoral stations and many other places.

Most of the pesticides used today are chemicals which have been developed in a laboratory by scientists and produced in factories. Some pesticides are quite hazardous, as they can be harmful to humans and other living things.

They can contaminate land, the air, food crops, water ways and seriously harm or kill native animals, pets and domestic animals.

In addition to being hazardous to the user, pesticides can also cause great harm and sometimes death to a person or other living things nearby, if the instructions on the pesticide container are not followed carefully.

Pesticides come in three different forms:

- **solids**, which come in powder form (like flour), or in crystal or granular form (like sugar)
- **liquids**, which look like milky water
- **aerosols**, which are sprayed out in a fine mist.

5.2 PEOPLE AND PESTICIDE POISONING

While pesticides are useful for the control of various pests, many of them are hazardous chemicals. They are hazardous because they can poison the land, the water and the air.

It is very important to only use pesticides in accordance with the label directions which are found on the pesticide container. When people using pesticides become careless they run the risk of poisoning themselves, other people and animals and plants.

Animals which are intended to be killed with pesticides are called **target animals**. Animals (including people) which are not intended to be killed when a pesticide is used are called **non-target animals**.

Pesticides can enter the human body in three ways, which are outlined below.

Oral entry

This type of entry is through the mouth in the food we eat or the liquids we drink. Also, if there is any pesticide on our hands it can get into the body when the hands are licked, when the face is wiped near the mouth, or when a cigarette becomes contaminated and is put into the mouth.

Respiratory entry

Pesticide sprays, vapours or powders can be breathed in through the mouth and nose.

Dermal entry

Pesticide spray which lands on the body can be absorbed through the skin and eyes. Pesticides are commonly absorbed very quickly through the eyes, forehead and forearms.

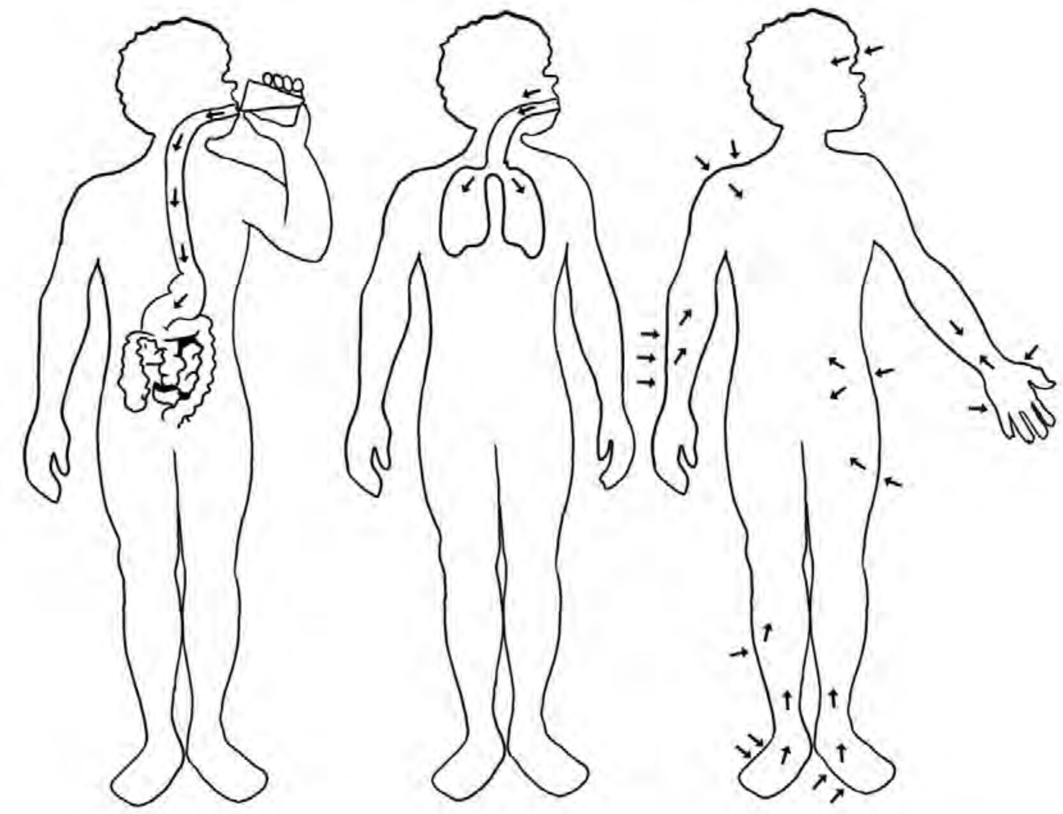


Fig. 5.19: Ways pesticides enter the body.

Some of the ways by which careless use of pesticides can cause people or other animals to be poisoned accidentally include:

- not reading the label
- putting pesticide in a food or drink container, such as a drink bottle. Children may eat or drink the pesticide by mistake
- leaving pesticide baits in places where children and pets can get them
- not using protective clothing or equipment when mixing or spraying a pesticide
- contaminating uncovered food and drink or cooking/eating utensils while carrying out a spraying operation
- spraying in windy conditions so that the spray drifts away to other areas
- spraying areas which do not need to be treated
- not moving other people and animals away from the spraying area.

All of these careless practices greatly increase the chance of someone being harmed by accidently absorbing (taking into the body) some of the pesticide either orally, dermally or through respiration.

5.3 PESTICIDE LABELS AND POISON SCHEDULES

Pesticide labels

It is often stressed that the most important few minutes in pest control is the time spent in reading the label.

The label of a pesticide container has all the information needed for safe and effective use.

READ THE LABEL

The label on a pesticide container has three main functions:

- To tell the user what pest the product can be used on.
- To tell the user how to handle, use and store the pesticide safely.
- To tell the user how and when to apply the pesticide for the best effect.

By law, pesticide labels must contain:

- the name of the product
- its poison schedule in words which will alert the user of its level of toxicity
- the name of the active constituent (actual pesticide chemical in the container) and its strength.

Note: Pesticide containers will usually have only a small percentage of actual pesticide chemical in them. The other substances making up the product may include:

- solvents such as water, which help dissolve the chemical
- carrying agents which help distribute the chemical, for example, talc in the case of pesticide powders and gases in the case of aerosol sprays.

- the pests which the product will control
- the rate of application of the product (how much of it to use)
- the time and method of application
- directions for handling the product safely
- first aid procedures in case of an accident
- any special instructions or warnings about its use or disposal
- the net contents (weight when packed) of the container.

Here is an example of a label on pesticides which are often used in communities:

POISON

KEEP OUT OF REACH OF CHILDREN

READ SAFETY DIRECTIONS BEFORE OPENING OR USING

MAXFORCE

PROFESSIONAL INSECT CONTROL ROACH GEL

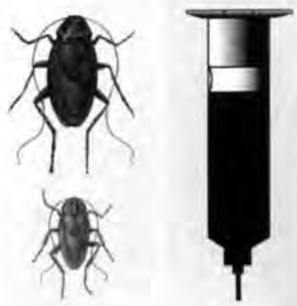
ACTIVE CONSTITUENT 16.5g/kg HYDRAMETHYLNON

A spot or crack crevice treatment for the control indoor or outdoor of cockroaches in residential and commercial areas by professional pest control operators as per directions for use.

Before using this product read all directions.

This pack contains 4 pre-filled reservoirs for use with MAXFORCE bait injector.

Sale of these dispensers except in an unopened pack is illegal.



4x30g (120g) NET

DIRECTIONS FOR USE:

DO NOT place in areas that are routinely washed.

PEST: For the control of German and other common cockroaches

RATE: Apply as 1-2 spots or in a bead 75 to 150mm long per square metre.

Recommended spot size 1/4-1/2 g

NOT TO BE USED FOR ANY PURPOSE, OR IN ANY MANNER, CONTRARY TO THIS LABEL UNLESS AUTHORISED UNDER THE APPROPRIATE LEGISLATION.

GENERAL INSTRUCTIONS: Maxforce Professional Insect Control Roach is an insect stomach poison.

Directions for loading reservoirs and operation: On the handle of the drive rod, point the arrow facing up. Pull the drive rod as far as it will go. Attach a pre-filled reservoir of MAXFORCE Gel to the Bait Injector with a twist-locking movement. Break off and dispose of the plastic tip and attach dispensing cap. Push the drive rod until the plunger seats against the piston in the reservoir of gel. Turn the drive rod knob until teeth are facing down and engaging trigger mechanism (arrow down). Gently squeeze the trigger until the gel flows out.

The bait will adhere to non greasy and non dusty surfaces and will remain pliable and palatable to cockroaches as long as it is visibly present. Reapply when bait is no longer visibly present, according to the remaining level of infestation. A visible inspection of bait placements is recommended at one month after the initial treatment. Re- application should occur if the bait is visibly depleted. Pest population reduction will be apparent within a week or less. Avoid contact with porous surfaces as bait may stain.

9 324054 501032

Directions for changing reservoirs: With the arrow on the drive rod pointing up, pull the drive rod out as far as it will go. Remove the empty reservoir, wrap, and place in rubbish bin. Reservoirs that still contain gel can be sealed with the supplied cap for further use. To attach a new reservoir, follow the directions above.

PRECAUTIONS: Avoid contact with food, food utensils or places where food is prepared or stored. Do not apply in food preparation or serving areas.

Should not be used in areas accessible to children.

STORAGE: Store in the closed original container in a cool well ventilated area. Do not store for prolonged periods in direct sunlight.

DISPOSAL: Place used tube in household rubbish.

PROTECTION OF LIVESTOCK, WILDLIFE AND OTHERS:

DO NOT contaminate streams, rivers, waterways with the chemical or used containers.

DO NOT use the product on or around electrical equipment due to the possibility of electric shock.

DO NOT apply product in any areas easily accessible to children or animals.

SAFETY DIRECTIONS: Harmful if swallowed. When using this product wear rubber gloves. Wash hands after use. After each days use, wash gloves.

Refer to MSDS before use.

FIRST AID: If poisoning occurs, contact a doctor or the Poisons Information Centre on the phone number 13 11 26.

NRA Approval Number: 45678/0400

Batch No:

Date of Manufacture:

NationalPak Pty. Limited
36 Gow Street, Padstow N.S.W. 2211

It is important to always read the label on the pesticide container before using it.

Before buying or ordering a pesticide always answer the following questions:

- Is it the right chemical for the pests to be treated?
- Is it the chemical which is least harmful to people?
- What are the application precautions?
- What safety equipment is required?
- What equipment is needed to apply the chemical?
- What needs to be done to store the concentrate and dispose of leftover solution safely?
- What needs to be done to decontaminate (clean) equipment and clothing afterwards?

Poison schedules

Many of the substances used in people's daily lives can be poisonous when used incorrectly, such as medicines, tablets, solvents, cleaning aids, glues and of course pesticides.

To help people know how poisonous a substance is, there are **poison schedules**.

These are lists of substances which are classified according to how **toxic** (poisonous) they are. Scheduled substances must all carry labels warning people that the substances:

- are poisonous or can cause injury
- must be used carefully by people
- must be kept away from children.

A substance which is considered poisonous or can cause injury is put into one of the poison schedules. There are eight different schedules.

Pesticides may be unscheduled, or may be listed in Schedules 5, 6 or 7.

Unscheduled:	These are very low in toxicity and are unlikely to cause harm to humans, provided they are used in accordance with label directions, most aerosol cans fall within this area.
S5 Pesticides:	These have **low toxicity** and available to the public but require caution in handling, use and storage.
S6 Pesticides:	These have **moderate toxicity** and available to the public and also require caution in use, handling and storage.

S7 Pesticides: These have **high to very high toxicity**. These pesticides are extremely hazardous and dangerous to health and have a high potential for causing harm at low exposures. They require special labelling, handling and use and are not available to the general public.

Pesticides undergo laboratory tests to establish their level of toxicity. The chemical is tested on 'test animals', such as rats, mice and rabbits, to see how much chemical is needed to kill an animal. These tests establish the pesticide's LD50 (lethal or killing dose).

The lower the LD5O the more toxic (more poisonous) the chemical.

The schedules will take into account the substance's toxicity, any special precautions or warnings and any other relevant factors which relate to how poisonous it may be.

5.4 PROTECTION OF THE ENVIRONMENT AND NON-TARGET SPECIES

Pesticides are designed to kill. When people use them they are aiming to kill a particular kind of pest. Because pesticides are poisonous chemicals, great care must be taken when using them, so that non-target animals and plants are not killed.

For example, if a house is being sprayed for cockroaches it is important not to harm any of the adults, children and pets such as dogs and cats who may live there. All of these animals make up the non-target animals in the house.

Fig. 5.20: Spraying for pests can affect non-target animals.

As well as protecting non-target animals and plants when pesticides are used, it is also important that every effort is made to protect the rest of the environment. Some pesticides are very poisonous and will last in the environment for a long time where they can poison the land, the water and the air.

This can happen when pesticides are used incorrectly, or when treated materials which should never be touched by people come into contact with them. For example, moving termite treated soil from beneath a building to use in a children's playground.

Non-biodegradable and biodegradable pesticides

Some pesticides do not break down for a long time. These types of pesticides are often used when something must be protected from pest attack for a long period of time, for example, protecting houses from termite attack.

Pesticides which remain in the soil or on the treated surface are also often called **residual** chemicals.

When residual pesticides get into the environment they can remain poisonous and active for many years. If applied incorrectly or used in the wrong place, these chemicals may spread to other land areas and possibly to the water supply.

Sometimes people do not know that the chemical is in the ground and may dig up the soil. They may then use it for a garden or some other purpose which brings other people, their pets and other animals into contact with it. As a result, many non-target animals can be affected by pesticides In this way.

Prior to 1996, some pesticides were non-biodegradable. Some of them, such as D.D.T and Dieldrin can still be found in the environment today, although they are no longer available and have not been used for many years.

Scientists nowadays are developing pesticides which are **biodegradable**. These chemicals stay active long enough to do the job required and then they break down into simple and harmless chemicals like water and carbon dioxide. Scientists are also developing less toxic residual chemicals. For example, pesticides used to protect houses from termites.

Pesticides and the food chain

In nature, plants are eaten by animals. These animals are in turn eaten by other animals, which are eaten by other animals, and so on. This is called the **food chain**.

Along the food chain there are many different ways pesticides can accidentally contaminate animals and plants which could then be eaten by humans. Pesticides can enter the food chain at different points.

Below is an example of how pesticides can enter the food chain.

> After an insect pest has been killed by a pesticide the chemical may stay in its body and still be active. If another animal eats the insect's body the pesticide will be transferred to its body and it may also be harmed by the pesticide. The second animal may of course be eaten by a third animal and it too could be harmed by the pesticide and so on.
>
> In the example of the food chain given in this picture, pesticide has entered and killed the target pest, the grasshopper. However, the pesticide in the grasshopper has found its way into three useful non-target animals via a food chain.

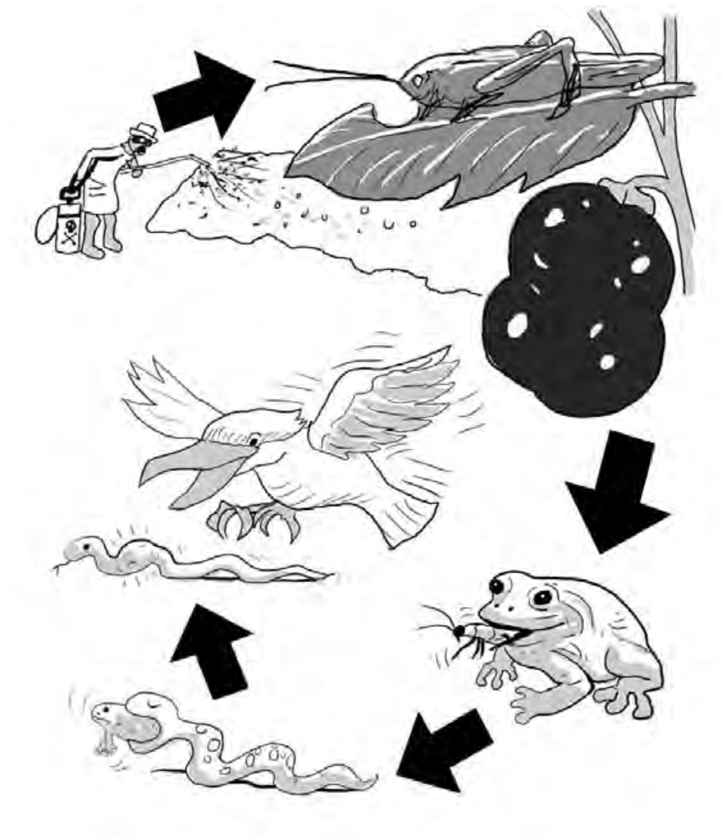


Fig. 5.21: An example of a food chain.

Using pesticides correctly to protect the environment, including people

When a pesticide spray is used, it is important to protect the environment by following the rules listed below.

- Ensure that the correct pesticide for the job is chosen and applied in accordance with the label directions.
- Only spray those areas that need to be treated.

- Only mix or use sufficient pesticide solution that is necessary to do the job, that is, **do not overspray** or use too much concentrate.
- Only spray in low wind conditions. Try to have as little spray drift as possible and preferably none at all. Do not spray where the wind exceeds 15kmph.
- Ensure that there is no pesticide left at the end of the treatment. Leftover pesticide must be either be used on the next job or buried. If the pesticide is buried there is always the risk that it may contaminate rivers, swamps and underground water supplies. Every effort should be made to reduce the chances of this happening.
- Ensure that all other people and animals are moved well away from the spraying area and that they stay away until it is safe to return.
- Ensure that people who have had the inside of their homes treated are advised to open windows and doors to get rid of any chemical smell which might be present when they return.
- If treating the inside of a home, ensure that the chemical has dried before people re-enter the house.

Fig. 5.22: It is important when spraying pesticide in a building to make sure everyone is outside.

5.5 ADVANTAGES AND DISADVANTAGES OF USING PESTICIDES

The use of pesticides to control pests can cause concern to some people. People can become worried about the effects of the continued use of pesticide on the environment and its impact on human health.

There are good reasons (advantages) for using pesticides and there are reasons for not using them (disadvantages).

Advantages of using pesticides

- Applying pesticides is not difficult, provided users are properly trained.
- Modern pesticides are very effective. This means that nearly all the target pests which come in contact with these pesticides are killed.
- Results are quick. This means the pests are killed within a very short time.
- Using pesticides can be an economical (cheap) way of controlling pests. Pesticides can be applied quickly and there is not the high labour cost which might apply to other methods of control, such as removing weeds by hand.

Disadvantages of using pesticides

- If pesticides are not used correctly, they can affect human health or cause serious injury or death to the pesticide operator, other people or household pets.
- Pesticides can also directly affect other non-target animals. For example, a gardener spraying his garden to kill caterpillars will probably also kill harmless ladybird beetles and praying mantises.
- If pesticides are used incorrectly or applied wrongly, they may find their way into places where they are not wanted, for example, they might be washed into rivers or into the soil.
- Pesticides can enter the food chain.

6 Other methods of pest control

The use of pesticides to control pests should always be the last resort. Other action can be taken around homes and communities to control pests. Most of these actions simply relate to clean and healthy living.

6.1 HYGIENE AS A METHOD OF PEST CONTROL

When houses and yards are kept clean, there is no food for pests and nowhere for them to live and breed, and this in turn means that there are few pests.

Pests can be controlled by practising good hygiene in the following ways:

- Clean up after meals. Put food scraps in the bin, and wash and dry plates, cups, glasses, cutlery and cooking pots after use.
- Put all rubbish into the bin.
- Wrap all food scraps tightly in paper before putting them in the bin.
- Keep all the benches, cupboards and floors clean and free of food scraps.
- Regularly clean behind stoves, refrigerators and other household appliances.
- Keep food in containers with tight-fitting lids.
- Use the toilet properly. Make sure that all urine and faeces goes into the pedestal pan and that the toilet is flushed after use. Toilet paper is the only kind of paper that should be flushed down the toilet.
- Make sure the toilet is clean and the cistern works correctly.
- Make sure that all septic tanks and leach drains are well sealed.
- Make sure that the community rubbish tip is operated correctly with the rubbish being buried regularly.
- Use flyscreens to stop pests entering the house and seal holes around pipes.

There is little point to having a pesticide program to control domestic pests if the relevant hygiene factors are not addressed as well. The pests will soon return if good hygiene is not maintained.

6.2 BIOLOGICAL CONTROL METHODS

Biological control methods can also be used to control pests. These methods include using natural enemies of the pest and biologically interfering with their ability to breed. Pesticides are not used.

Two examples of biological control methods are:

- the use of Australian native fish to feed on mosquito larvae in water bodies
- the use of the dung beetle to break down and bury cow faeces so that it is no longer available as a breeding place for flies.

However, biological control methods can go wrong. One such example was the introduction of the giant cane toad to Queensland some years ago to control cane beetles. It was though the toad would to feed on the cane beetles and so reduce their numbers. But the toad was not successful in controlling cane beetles. Instead the poisonous toads multiplied rapidly, and have now become a major environmental pest in Queensland, the Northern Territory, and are likely to enter the Kimberley region of Western Australia.

There are other areas where biological products have been successfully introduced to control pests. One such example is the use of BTI to control mosquito larvae. BTI is a **larvicide** composed of a toxin producing bacteria. The mosquito larvae are killed when they eat the bacteria. BTI will not kill mosquito pupae.

BTI comes in liquid and granule form and is added to water bodies. BTI will not be effective if the dose rate for the amount of water is not correct. The correct method of application is very important to get the best results.

7 Types of pesticides and how they enter animals and plants

Pesticides can be grouped according to the types of pests which they kill:

- Insecticides—insects.
- Herbicides—plants.
- Rodenticides—rodents (rats and mice).
- Bactericides—bacteria.
- Fungicides—fungi.
- Larvicides—larvae.

Fig. 5.23: Some well known insecticide containers

There are also other ways to group pesticides. For example, they can be grouped according to the chemicals in them or to the method of application.

7.1 HOW PESTICIDES ENTER ANIMALS AND PLANTS

Insecticides

It is important to know the target insect's habits when choosing the insecticide and which form (solid, liquid, granule or aerosol) to use. For example, flying pests such as adult mosquitoes are best attacked by aerosol sprays or fogs (droplets in the air), while crawling insects are best treated with surface powders, sprays or granules for dermal and/or oral entry.

Insecticides kill insects by getting inside their bodies where they then act as poison.

There are three different ways insecticides can get into an insect body.

These are:

- Dermal Entry

  The insecticide enters the body through the skin. In insects, the skin is called the **cuticle**. Insecticides of this kind are called **contact poisons**.

  Dermal entry can happen when:

  » aerosol spray droplets hit the insect

  » insects walk over and thereby come into contact with powder or granule forms of insecticide.

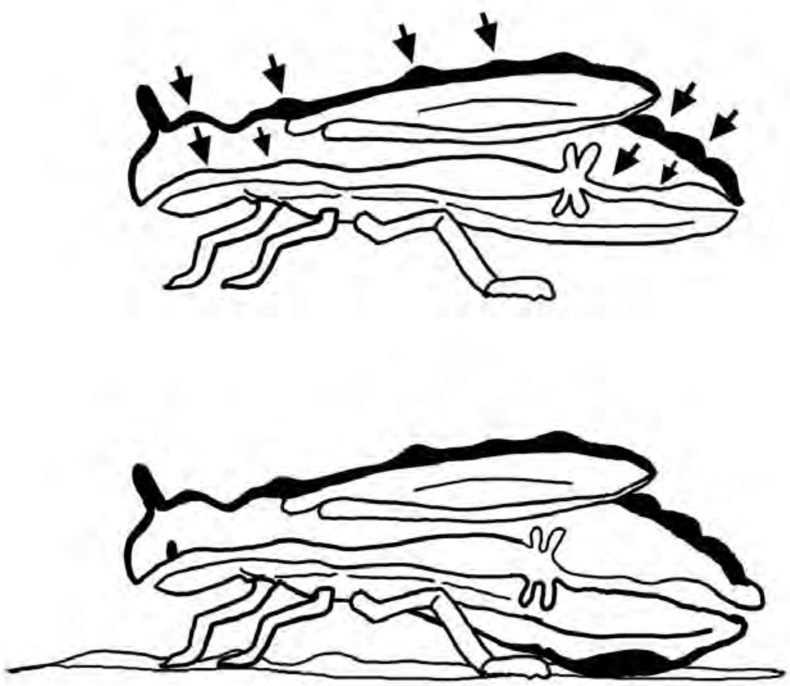


Fig. 5.24: Dermal entry.

- Oral Entry

  The insecticide enters the body through the mouth when the insect eats it. Insecticides of this type are called **ingested poisons**. The insecticide may be ingested by the insect:

  » as a poisonous bait (a food to which insecticide has been added)

  » when it 'grooms' (cleans) itself after the poison comes into contact with its body.

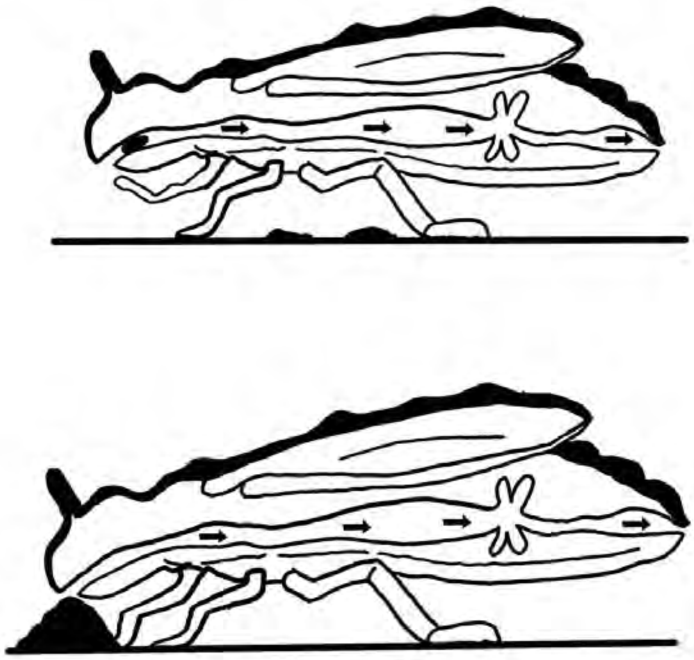


Fig. 5.25: Oral entry.

- Respiratory Entry

  The insecticide is breathed in by the insect. These insecticides are called **inhaled poisons**.

  Insects do not breathe through the mouth as most animals do. They breathe through **spiracles** (small holes along the side of the abdomen).

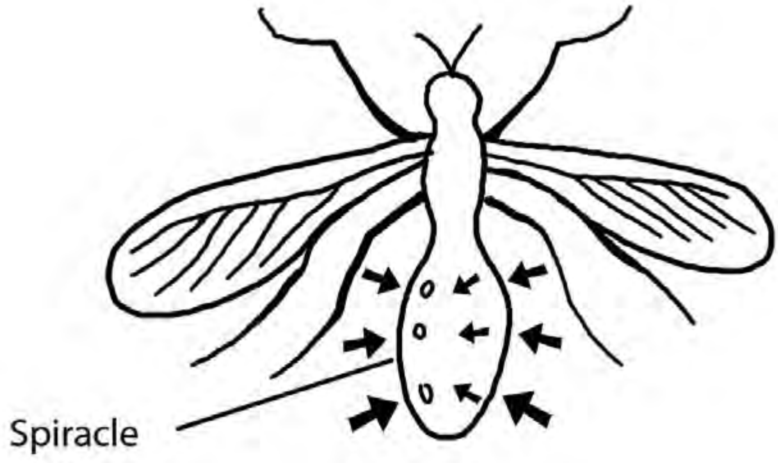


Fig. 5.26: Respiratory entry.

Herbicides

Herbicides are used to kill plants. This may be by:

- killing that part of the plant which they touch
- killing the plant when they are absorbed into it through the leaves, stems or roots.

Rodenticides

Rodenticides are used to kill rodents. These poisons are usually put into food to make poisonous baits which rodents eat.

8 Pesticide treatment program

A **pesticide treatment program** is designed to get rid of pests by using one or more pesticides. Pesticides should not be used unless there is a definite need to do so and where a pest problem has been identified, such as extensive cockroach infestations in people's houses.

Before a pesticide application program is undertaken, alternative methods of pest control must be considered, such as domestic hygiene measures.

In applying a pesticide it is extremely important to choose the correct one for the job and to apply it safely and in accordance with the label directions.

8.1 CHOOSING THE CORRECT PESTICIDE

In choosing the correct pesticide for a treatment program there are a number of factors that should be considered:

- Which of the available pesticides will control the target pest or pests?
- Of these, which would be the better pesticide to use? The choice should take into account the required application method and the pesticide's level of toxicity.
- How is it applied?
- For how long will it control the pest?
- How toxic is it to humans and other non-target species?
- Can it cause damage to the environment and how might this occur?
- Is it biodegradable?
- How much pesticide is required for the job?

The pesticide selected in the end should be the least toxic to humans and other non-target species and be easy to apply, yet effective in the control of the target pest.

All of these questions need to be considered carefully before the final choice of pesticide is made. If for some reason there is not enough information supplied with the product to answer all the questions, it is important to get this information before buying or using the pesticide from the people who sell it.

If there is any doubt about any aspect of pesticide use, check with an EHO at your local government. It may also be possible to contact the manufacturer directly.

Once the pesticide has been chosen, there are a number of questions which need to be answered in relation to the pesticide itself, the equipment and the application method. These are outlined below.

The pesticide

- How much of the job will one container of pesticide do? Will more be needed and if so, how much? Does it need to be mixed with anything? If so, what and how much?
- Where and how should it be stored?
- How should containers and leftover pesticide be disposed of?

The equipment

- What application equipment is needed?
- What protective clothing and equipment is required?
- How should the protective clothing and equipment, and the application equipment be cleaned?

The application method

- What warnings are given?
- What safety measures are necessary while the pesticide is being used?
- How must the pesticide be applied?

8.2 INSECTICIDE TYPES

Most of the pesticides used around houses are insecticides. They are used to kill the many insect pests that annoy people and/or affect their health. The majority of insecticides belong to several basic groups which are broadly defined by the chemicals used to make them. These are inorganic insecticides, organic pyrethrins, synthetic pyrethroids, organophosphorous insecticides and insect growth regulators.

Inorganic insecticides

These insecticides are of mineral origin and include substances such as arsenic trioxide powder (used in termite treatments) and boric acid (used in cockroach treatments). Some of them are not commonly used these days. This is because they are often highly toxic to mammals (furred, warm-blloded animals), are non-biodegradable, or simply because easier methods have been found.

Most inorganic pesticides have a stomach poisoning action. For this reason they are usually in solid form and are applied as baits.

Organic pyrethrins

These are made from certain plants. The most widely used natural insecticide is **pyrethrin** which is obtained from a type of chrysanthemum flower.

Pyrethrin has a number of advantages as an insecticide:

- It is a **broad spectrum insecticide**. This means it will kill a wide range of insect pests.
- It has low toxicity to mammals.
- It acts quickly, that is, it has a **fast knockdown**.
- It is biodegradable (breaks down fairly quickly).

The main disadvantage of pyrethrin is that it has little or no residual action.

Synthetic pyrethroids

This is a group of synthetic insecticides. This means they are insecticides which have been chemically manufactured (man-made) to work like naturally occurring pyrethrins. This group of chemicals are generally low in toxicity to humans, but are very effective against a wide variety of insect pests.

Examples of synthetic pyrethroids are:

- bifenthrin
- permethrin
- bioresmethrin
- tetramethrin
- deltamethrin
- Coopex, Cislin, Crackdown and Biflex are four commercial products in this group.

Fig 5.27: Synthetic Pyrethroid

Organochlorine insecticides

These are synthetic organic compounds which contain chlorine. They include substances such as DDT, dieldrin, chlordane, heptachlor and endosulphan.

Organochlorines are mainly used as contact and oral poisons which act on the nervous system. Because of their persistence in and impact on the environment, organochlorines are no longer used to treat pests in or around buildings.

Only one organochlorine is currently registered and it is used only in agriculture under permit. All other organchlorines were deregistered for use in Australia in 1996.

Organophosphorus insecticides

These are synthetic organic pesticides which are manufactured from carbon chemicals and also contain phosphorus. They include chlorpyrifos, dichlorvos, malathion, diazinon and temephos.

Some pesticides in this group are very toxic to mammals, such as people, kangaroos and dogs, and other animals such as bees and fish. Their use is restricted to prevent exposure to non-target species.

Organophosphates tend to break down in the environment more rapidly than organochlorines but some of them do remain active for months or years. A number of organophosphate insecticides have been developed for the control of common household pests, for example: termites, flies, cockroaches, mosquitoes, and spiders. Some organophosphates contain solvents and can have a strong chemical odour. Some people object to this odour and as a consequence prefer only odourless pesticides be used around or in their homes.

Carbamate insecticides

These are manufactured compounds that are relatively **unstable**. That is, they usually break down in the environment within weeks or months. One of the most common carbamates is propoxur which is the active chemical in the product Baygon.

Carbamate insecticides act mainly as contact and oral poisons and are used as surface sprays or baits to control household pests.

8.3 INSECTICIDE APPLICATIONS

Insecticides are applied (used) in one of the following ways:

- **Surface spraying** for the control of crawling insects.
- **Space spraying** for the control of flying insects.
- **As baits, powders, dusts and granules** for the control of crawling insects.

- **As fumigation treatments** for the control of insects inside materials, such as timber, stored grain.

Surface spraying

Surface spraying with insecticides can include spraying floors, skirting boards, under benches, inside cupboards, outside walls, around the yard and at the rubbish tip. The insecticide is often applied as a liquid spray or paint so that the surface is effectively covered with the substance.

Liquid insecticides are usually dispensed (released) from some form of hand operated pressurised **sprayer**. There are a number of different sprayers, which are discussed below.

Aerosol can

The insecticide and a propellant are contained in one can. Examples are products like Baygon and Mortein. This is an easy and convenient method of killing small numbers of flying or crawling insects, but is usually expensive. Aerosol cans should be used only for small areas and are effective knock-down pesticides.

Fig. 5.28: Using an aerosol surface spray. Picture of a pressurised can

Pressurised (compressed air) sprayer

This sprayer, also called a hand pump sprayer, contains:

- a tank to hold the insecticide
- a plunger assembly to pump air into the tank and thus create pressure inside the tank
- a hose to deliver the insecticide from the tank
- a nozzle (or gun) from which the insecticide is sprayed. The nozzle also has some kind of tap to control the flow of insecticide. There are several types of nozzle which produce different spray shapes such as wide sprays for foundations or pin point sprays for cracks and crevices in cupboards.

Compressed air sprayers usually have a relief valve set in the tank. This valve will release the pressure inside the tank if it becomes too high. The valve can also be used (in most cases) to relieve the pressure after spraying.

Compressed air sprayers can be made of stainless steel or of strong plastic.

Fig 5.29: Compressed air sprayers

Steps to take before mixing and applying pesticides

Prior to mixing any pesticide, ensure all equipment is checked and repaired where found to be faulty.

Note: Before checking and or filling spray equipment put on personnel protective equipment (PPE) and where necessary wash the spray equipment.

To fill the sprayer with insecticide, first read the label and put on any additional personal protective equipment required.

Before the plunger assembly is unscrewed from the sprayer, release the pressure relief valve, this is usually located towards the top of the sprayer, then carefully unscrew the plunger.

Note: Sometimes there will still be some air left in the sprayer even though the pressure relief valve has been activated, so take care when removing the plunger as pesticide residue may escape and could contaminate hands and eyes.

Place a small quantity of clean water in the sprayer, this will assist in the mixing process. It will also reduce the likelihood of the operator being splashed with undiluted pesticide when pouring the pesticide into the sprayer.

Carefully read the label for the amount of pesticide required to treat the pest and place the appropriate amount of pesticide into a measuring jug, then carefully pour it into the sprayer.

Next, slowly add the required amount of water to the sprayer in accordance with the label, being mindful of the capacity of the sprayer and careful not to overfill the sprayer.

After the sprayer has been filled, screw the plunger on tightly. If there is an adjustable nozzle on the end of the lance, check to make sure it is off and the handle or plunger (depending on the type of sprayer) is used to pump up the pressure. When enough pressure is produced (usually about 10–20 pumps) the sprayer is ready for use.

A number of precautions should be remembered while using the sprayer and applying the insecticide:

- The trigger on the lance or the nozzle tap should not be turned on or activated unless the lance is pointed at the area to be sprayed.
- Care should be taken to make sure that spray does not drift onto the operator or anywhere it is not intended. If weather conditions deteriorate and it becomes windy, spraying should cease or be delayed. Even in low wind, wind direction must be noted and action taken to reduce the effect of any spray drift.

If appropriate, a nozzle hood can be fitted to the sprayer to reduce spray drift. These are often used with herbicides.

- The spraying area should be cleared of other people, pets and food bowls while the insecticide is applied.

Note: Fish and birds are very susceptible to pesticide poisoning, so great care must be taken not to allow spray drift to contaminate them or their food.

- The operator must be wearing the correct protective clothing and equipment during the whole spraying operation.
- Spraying should be carried out in the cool times of the day.
- The operator must be upwind of spray drift, if any, and must not smoke or eat while applying the insecticide.

  At mealtimes and tea-breaks, the operator must wash their hands and face with soap and cool to warm water (i.e. not hot water) and remove aprons and gloves before eating or smoking.
- At the end of the operation the spray equipment must be thoroughly cleaned. Dispose of any pesticide left over and rinse the spray equipment with water. The nozzle and hose are best cleaned by partly filling the tank with clean water, pumping up the pressure and spraying water through the nozzle, ensuring the waste liquid does not create a health hazard or harm to the environment.

  Periodically the sprayer should be cleaned with a brush and warm soapy water and any faults repaired.

Motorised back pack sprayer

This sprayer is mounted on the operator's back. Instead of using a hand pump to create pressure inside the tank, a small petrol engine drives a pump which pumps the insecticide to the nozzle which is fitted with a control tap.

It is essential these sprayers are well maintained, as contamination of the user can occur without them knowing. It is not unusual for leaking equipment to be mistaken for sweat, as using this type of equipment is hard work. Therefore, it is essential this equipment is checked regularly.

This type of sprayer is useful for large scale operations. The same precautions for the hand pump sprayer also apply to motorised sprayers.

Fig 5.30: Motorised back pack sprayer

Large and small capacity power sprayers

This type of sprayer is used by professional pest control operators for medium- to large-volume spraying or continuous spraying. A petrol motor connected to a pump and pesticide emulsion tank is mounted on a trailer, or the back of a ute or truck. Chemical flows are controlled by various taps. Hose reel/s are connected to the pump which to allow large area to be treated without the need to shift the vehicle.

Fig 5.31: Vehicle mounted spray rig

Smaller battery-powered sprayers which can be mounted on trolleys are available and may be useful in applying pesticides in community situations. Batteries must be kept charged to prolong battery life.

Note: If using lithium batteries on the sprayer, ensure the correct charger is used for charging this type of battery.

Applying pesticides by paint brush

A very simple way to apply liquid insecticide is to use a paint brush to spread it over the required surfaces. It is a particularly good method for crack and crevice treatments in food areas, such as kitchen and house cupboards, along skirting boards, and in some types of shops. This method can be used also for small areas which need treatment or when it is important to have no spray drift.

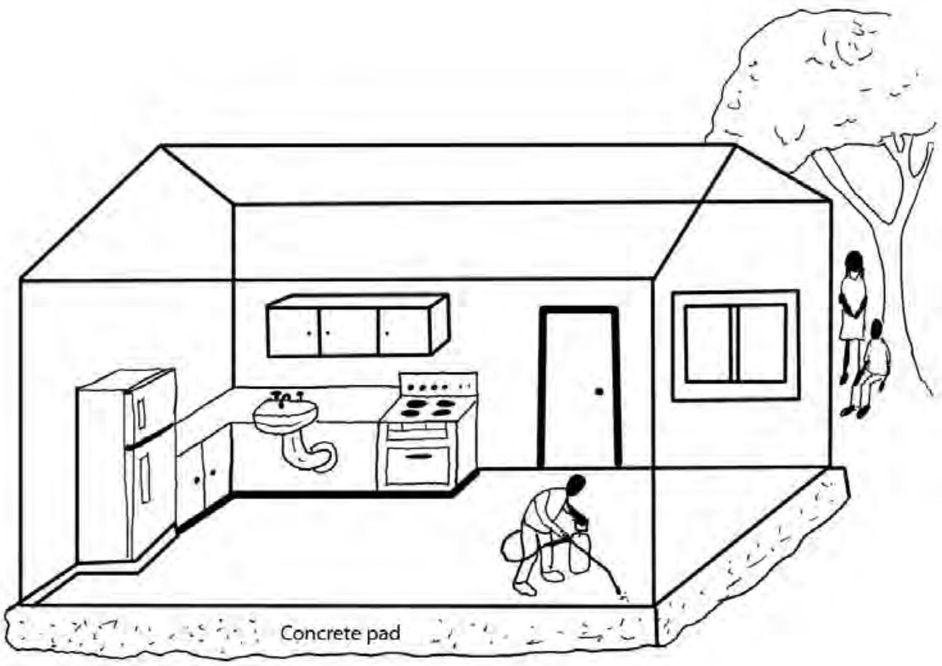


Fig. 5.32: Crack and crevice painting treatment.

8.4 OTHER PESTICIDE APPLICATIONS

Rodenticides

Rodenticides used in communities may either be in pellet or solid block form. Great care must be taken in placing these baits, as cats and dogs are known to eat them. These baits must be kept out of the reach of children and should be placed in lockable bait boxes. Where bait boxes are placed outside a building in full view of the public they should be secured at all time.

Fig 5.33: Rodenticide for Rats and Mice

If an EHP needs to use rodenticide baits, check with the EHP supervisor or the Shire EHO before using them.

The label will provide the general precautions (safety rules) and baiting method. The positioning and number of rodenticide baits is particularly important.

It is difficult to guess the number of rodents to be treated, so it may be necessary to use a trial-and-error method. For example, a number of baits are positioned and checked each day to see if they are being eaten away. If all the baits are being taken, the number of baits should be increased to make sure all the rodents are killed.

Baits must be put in places where:

- the mice and rats are known to rest or search for food, such as in cupboards
- they cannot be reached by children or pets.

Baits should be in containers clearly marked with the name of the rodenticide. If the containers are used outside, they may need to be firmly anchored and weatherproofed. Baits become ineffective when they are wet or covered in dust or soil. Change uneaten baits regularly.

It is also important to remember where the baits have been put, so that any unused baits can be picked up once the program is finished.

Fig 5.34: Bait box for Rats and Mice

Other pesticides

The EHP may be required to apply other pesticides, such as adulticides, larvicides (for mosquito control) or herbicides in their environmental health activities. Be sure all the correct Personal Protective Equipment (PPE) and spray equipment is available and that use and storage information is known. If in any doubt seek advice from the EHP supervisor or the local EHO. It is always good practice to contact these people before a different pesticide or application method is used.

9 Protective clothing and equipment (personal protective equipment)

As pesticides are poisonous, it is extremely important that anyone using them be protected from the chemical, including the spray and fumes. Appropriate protective clothing and equipment must be used to provide a barrier between the pesticide and the body to stop the pesticide getting into the body.

Protective clothing and equipment must prevent dermal (skin and eyes), respiratory (lungs) and oral (mouth) entry of the pesticide into the body. Therefore, the protective clothing and equipment must cover all of the operator's body. The different kinds of protective clothing and equipment are described below.

9.1 PROTECTIVE CLOTHING

Overalls

Full-length overalls which button at the neck and wrists should be worn. Trouser cuffs should be worn outside boots.

Waterproof apron

Where splashing may occur, such as in dog dipping, a full-length waterproof PVC apron and rubber boots should be worn.

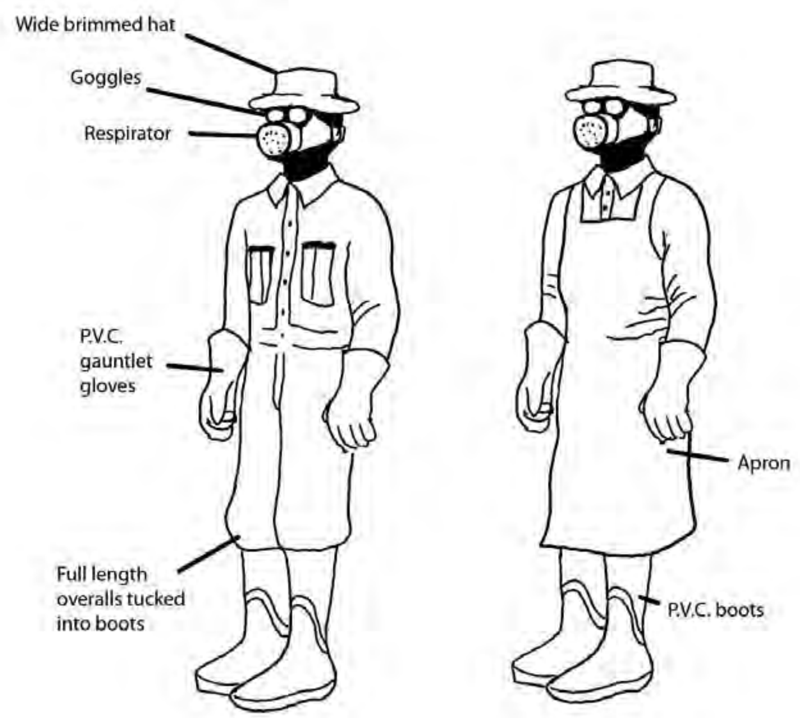


Fig 5.35: Protective clothing.

Washable hat

A wide-brimmed hat will stop pesticide getting on to the operator's hair and then into his/her body. The hat should be made of washable material so it can be cleaned easily after use.

PVC gloves

Gauntlet-type PVC gloves are required. These are gloves which cover the arm to just below the elbow as well as covering the hand.

Some types of gloves deteriorate quickly in contact with pesticides and must be checked regularly for cracks, especially between the fingers. Cracked gloves should not be used for spraying.

Note: Gloves that are cotton lined should not be used as they are difficult to decontaminate.

Boots

Only PVC boots in good condition should be worn. If the boots are damaged or cracked, chemical can soak into the material and be absorbed into the body through the feet. If chemical has soaked into the boots or they are cracked or damaged they must be replaced.

Thorough cleaning of boots is very important and should be done properly. Boots should also be inspected regularly for any signs of damage or cracks.

Care and maintenance of protective clothing

All protective clothing should be inspected frequently and regularly to make sure it is clean and in good working order.

The operator must put on all of the required protective clothing before the spraying operation starts. At the end of every spraying operation all protective clothing should be thoroughly washed, rinsed and allowed to dry in an airy environment. Protective clothing should be washed on its own and not with other clothing.

If spraying is to be done on two or more days in a row, protective clothing should be washed at the end of each day's spraying operation.

9.2 PROTECTIVE EQUIPMENT

Pesticide application must not be undertaken without a respirator.

A **respirator** is a mask which fits tightly over the nose and mouth and holds a cartridge containing a special material. This material removes chemical fumes from the air so it is clean to breathe.

Fig 5.36: Respirator

The respirator should be carefully checked for damage before it is used. Valves, the rubber, cartridges, seals or straps may need replacing. The operator should also make sure that the respirator is fitted with the correct cartridge for pest control work.

The operator must make sure that the respirator forms a good seal with the face. **Beards or moustaches usually stop a good seal from being formed,** so those who use respirators must be clean shaven.

A good way to check the face seal or to see if the cartridges are still working, is to put an open bottle of nail polish remover or aftershave or perfume up to the cartridge or around the seal edges. If the person can smell it inside the respirator then the cartridge needs replacing or there is no face seal. If the substance can still be smelt after a new cartridge is used then the seal is at fault.

Respirators have to be stored in a plastic airtight container away from the pesticides and from other solvents. This is because the cartridges are very sensitive to the presence of chemical vapours such as petrol, turps and other solvents.

Cartridges have an approximate life of 4 to 12 hours of continuous use. If they are stored with the pesticides, they may quickly lose their effectiveness due to the presence of chemical vapours.

Face shield and goggles

A face shield is a mask that is used to protect the face and eyes when mixing chemicals. It gives protection from splashing. Shields can be used with a respirator although fitting the respirator under the shield can be difficult if using a single cartridge respirator. Often a twin cartridge respirator is easier to use under a face shield as they do not protrude as much. Goggles to protect the eyes may be a better option.

Shields and goggles should be used:

- when mixing chemicals
- when spraying for protection against spray drift
- when working in small confined spaces
- in dog dipping programs (because of splashing)

Shields and goggles must fit properly (goggles must form a good seal with the face) and not slip. They must be kept in good condition and cleaned after each job is finished or at the end of each day's use.

10 Calculating and mixing the correct amount of chemical

10.1 CALCULATING THE CORRECT AMOUNT OF CHEMICAL

Pesticides purchased for spraying programs will come in the form of **pesticide concentrate**. This concentrate is very strong and must be **diluted** before use by mixing a small volume (amount) of the pesticide with a larger volume of water.

It is necessary to work out how much of the concentrate will be needed for the spraying job and how much water it must be mixed with. Only enough pesticide solution to fill the sprayer should be mixed at any one time.

The steps for calculating the correct amount of chemical are outlined below.

(a) Check the pesticide label to find the application rate at which the concentrate should be used. The application rate of a particular pesticide is the amount of mixed pesticide solution (chemical plus water) which is needed to treat an area of a particular size.

Some examples are:

» Use 10 ml concentrate per 5 L water to cover 40 square metres (40 m^2)

» Mix 5 g powder with 5 L water to cover 20 square metres (20 m^2)

» Use 1 packet of powder per 10 L water.

(b) Work out the area to be sprayed. This may be the area of a floor or the combined areas of skirting boards or the combined area of external (outside) building foundations.

(c) Using the application rate stated in the instructions, calculate the amount of pesticide concentrate needed for the size of the area to be sprayed.

(d) Calculate how much water is needed to dilute the pesticide to the correct strength.

It is very important that these calculations are done correctly. If they are not done correctly the pesticide will not be the right strength for the job.
Help can be obtained from people such as the community nurse, school teacher, EHP supervisor or an EHO.

10.2 MIXING THE CHEMICAL

Once the amount of the concentrate and the amount of water needed to dilute it have been worked out, the water and the chemical can be mixed.

This dilution exercise should be carried out carefully because the pesticide chemical is dangerous.

These are the rules which should always be followed when diluting pesticide concentrates:

(a) Always work in the open and avoid breathing the fumes.

(b) Read the label and put on the appropriate protective equipment as indicated.

Depending upon the type of pesticide it may be appropriate to wear a respirator.

(c) Mix water and concentrate in a large clean container, such as a 10 L bucket. This container and any measuring cups must be used only for this purpose. They should be clearly labelled 'DANGER—POISON: DO NOT TOUCH'. When they are not being used they should be stored safely in the equipment shed.

(d) Put a small amount of water into the bucket first. Place the required amount of pesticide into the water.

Rinse the measuring cup with clean water and add this solution to the bucket. Stir it so that it is thoroughly mixed into the water. Pour this solution into the sprayer tank and then add the rest of the water to the tank. Make sure this water is well mixed into the pesticide solution.

(e) Stir the solution carefully with a flat paddle (stirrer) and avoid splashing.

The safest paddles are made of plastic, aluminium or steel because these materials are **impervious**. This means the pesticide cannot soak into them. They can be washed and used again. Wooden paddles soak up the pesticide and must be disposed of immediately after use. This must be done with extreme care. It is best to bury them along with the empty pesticide containers.

Never leave the paddles lying around after use as they will be a danger to small children and animals.

Fig. 5.37: Concentrated pesticide should be diluted in water according to the instructions on the bottle or packet.

11 Disposal of unused pesticide and empty pesticide containers

In a well planned spraying operation the amount of pesticide solution required for the job should have been worked out carefully so that there is little or no pesticide left over.

Pesticides are poisonous and it is bad for the environment and a danger to people and other animals to leave them lying around. Most of the pesticides used in environmental health work will not last very long after they have been mixed with water. This means that preparing too much spray is a waste of money and effort because the pesticide will not be effective if it is used later.

Unused pesticide

If there is any pesticide left over at the end of a spraying operation then it is important that it be **disposed of correctly**. This means getting rid of the chemical so that it has no harmful effect on the environment, including people and their pets.

Note: Rather than have pesticide left over, go back over the job and use up the small amount that may be leftover, particularly if the pesticide is being used on weeds or the outside of a building for insects.

If it is not possible to use up all the mixed pesticide, then the following steps should be taken to get rid of leftover pesticide safely:

(a) If further spraying is going to take place the next day then use any left over pesticide on that job. However if no more spraying is planned then follow the procedure as below.

(b) Choose a place well away from community buildings and meeting/play areas, any streams, water supply areas, or low-lying areas where water may collect or there may be a high water table. Near the storage shed or at the rubbish tip may be appropriate.

(c) Dig a hole 50 cm deep.

(d) Cover the bottom of the pit with a 25 to 40 mm layer of hydrated lime. Pour the unwanted pesticide into the hole.

(e) Cover with soil.

Fig. 5.38: Unused pesticides must always be disposed of safely.

Empty pesticide containers

Empty pesticide containers must also be disposed of so that they cannot cause any possible danger to the environment, including people.

The best place to dispose of empty pesticide containers is at the community's rubbish tip.

These are the correct ways to dispose of empty pesticide containers:

(a) All glass, metal or plastic containers should be rinsed out with water at least 3 times.

The wash-water should, of course, be disposed of correctly so that it does not become a danger. However, if the container is emptied as the spray solution is mixed, the wash-water can be added to the spray solution. The wash-water should have little effect on the strength of the solution. Paper packets cannot be rinsed out.

(b) The lids of all containers should be removed before disposal.

(c) Glass or plastic containers must be buried deep in an isolated area away from water supplies.

If it is safe to do so, it is a good idea to break glass containers before disposal. Plastic containers must be punched with holes so that they cannot be used to carry water.

(d) Glass or plastic pesticide containers which cannot be broken or punched with holes must never be left around in case people use them for some other purpose.

(e) Each metal container should be made unusable by punching holes in the top and bottom and then crushing it. Flattened containers are easier to bury or dispose of at the tip.

Never burn pesticide containers because they may give off poisonous gases. Never use these containers or any pesticide treated materials, such as wood, on fires.

Fig. 5.39: Empty pesticide containers must be disposed of safely.

If the EHP has any worries about the disposal of leftover pesticides or empty pesticide containers then he/she should contact the EHP supervisor or an EHO.

12 Decontamination and maintenance of pesticide application equipment

When a pesticide operation has been completed all of the equipment used must be cleaned properly, by following the steps below.

(a) Choose an area where the waste wash-water run-off will not affect water supplies, rivers, billabongs, the soil and plants or lie on the ground and create a danger to people, especially children, and animals. Near the storage shed may be appropriate.

(b) Wear protective clothing and equipment while cleaning the spray gear.

(c) Thoroughly rinse the equipment with water several times. It may be easier to partly dismantle the sprayer. Equipment should be washed occasionally with warm, soapy water.

(d) After rinsing, equipment should be reassembled, partly filled with water and tested to make sure there are no blocked nozzles or hoses and no pesticide left in them.

(e) The equipment should be stored so that any water still in it will drain out.

(f) Other containers, such as measuring jugs, used in the spray operation should be rinsed thoroughly and stored dry.

(g) Finally, the operator's protective clothing should be removed, thoroughly washed and rinsed and then hung out to dry. It must be dry before being stored away.

Do not wash protective clothing with other clothes.

Fig. 5.40: It is important to wash and dry all protective clothing every time it is used.

13 Safe storage of pesticides and spray equipment

It is important that pesticide chemicals and spray equipment be safely and securely stored. They should be stored in a separate shed or at least in a separated and locked part of an existing equipment shed. The shed or storage area must be well away from dwellings and must only be used for equipment and maintenance materials. It must never be used for food storage.

The storage shed should:

- be constructed of fire resistant materials
- be well ventilated
- be secure and lockable
- have water available
- have a floor that can be washed if spills occur. The floor area must have raised edges so that any water and spilled chemical can be contained
- have a drain system and disposal area with a pit nearby so that any excess or spilled materials can be washed down and drained away. This area can also be used for decontaminating equipment
- be labelled clearly on the outside that there are dangerous materials stored inside
- have high metal shelves for the storage of pesticides.

Also there should be a supply of sand or some other some absorbent material, such as sawdust or kitty litter close to the shed to use in the event of a pesticide spill. A high fence around the shed and disposal area would help keep people away. However, this may not be possible if the shed is used for other equipment storage.

Fig. 5.41: A pesticide storage shed.

There are rules which should be followed for the safe storage of pesticides in the shed:

- Pesticides should always be kept in their original containers. The outside of the containers should be kept clean and the labels kept in good condition so they can always be read.
- Containers should be checked regularly for leaks or corrosion.
- Protective clothing and equipment should not be stored close to pesticides.
- Spray equipment should be stored in the pesticide storage shed and should be hung up so that any water left in after washing will drain out.

14 Cleaning up a pesticide spill

Accidents sometimes happen. If all or part of the operator's clothing becomes saturated (soaked or wet) with pesticide at any time:

(a) The spraying must be stopped **immediately** and any wet clothing taken off.

(b) Any part of the operator's body which might have come into contact with pesticide must be washed immediately with plenty of soapy warm water. Do not use hot water as this opens the pores of the skin allowing pesticide to contaminate more of the skin, and to enter the body more easily.

Another possible danger occurs if pesticides spill onto the ground. These steps must be followed to clean up a pesticide spill:

(a) The clean-up team must wear protective clothing and equipment.

(b) Keep other people away from the spill area and carry out the clean-up immediately.

(c) The spill area must be covered with a layer of sand or other absorbent material thick enough to soak up the pesticide. It is equally important to make sure that the spilled pesticide does not spread. Building a bund (a small wall of soil or absorbent material) around the spillage area is the best way of containing the chemical.

Obviously, it is easier to clean up spillages outside buildings, especially on impervious surfaces, such as bitumen roads and concrete paths because they do not allow the liquid to soak away.

Spills on absorbent surfaces are more difficult to clean up. If this happens outside a building on absorbent soil, as much as possible of the layer of soil which has absorbed the pesticide will have to be removed. This area can then be covered with clean fill.

Inside a building a spill must not be allowed to spread. It must be covered with absorbent material. After the pesticide has been soaked up and the absorbent material is removed, the contaminated area will need to be cleaned.

(d) When the pesticide has been soaked up by the sand or absorbent material, scrape up the material and place it in a deep hole at least 50cm deep. This hole should be in a place well away from people, buildings, playgrounds, streams and water supplies. The rubbish tip is the best place to dispose of this material.

(e) Once the absorbent material has been removed from an impervious surface outside a building, the spillage area should then be washed thoroughly with water and soap/detergent. The water used for washing should not be allowed to run over the ground, or into water courses or storm drains. The wash-down water should be directed as much as possible into a 50 cm deep hole which can be covered with soil when the clean-up is finished.

The nature of the surfaces inside a building may make it difficult to carry out a wash-down and clean-up. For example: in the case of carpets, rugs and mats. This may require special cleaning methods or the removal of the floor covering.

Advice on cleaning up major pesticide spills should be obtained from the EHO or the EHP supervisor.

Fig. 5.42: Pesticide spills must be cleaned up safely.

15 Pesticides and fire

If a fire occurs in a pesticide storage shed or an area where pesticides are kept, special precautions must be taken as many pesticide vapours which are given off during a fire are very hazardous. Only properly trained people with self-contained breathing apparatus should attempt to put out chemical fires.

If in doubt about how to put out a pesticide fire, call the fire brigade or the police before taking any action to control the fire.

In the event of a pesticide fire, follow these steps:

(a) Make sure all the people downwind of the fire are moved out of the path of smoke and kept well away.

(b) Keep a safe distance away in case of an explosion.

(c) Approach the fire only if it is safe to do so. This must be done from the upwind side or at right angles. Do not work downwind.

(d) If the fire is small enough for you to handle, stay upwind and use soft streams of water so that you do not tear open paper containers or break jars.

(e) Spray drums containing liquids with water to keep them cool.

(f) Remember that self-contained breathing equipment is essential for anyone likely to be exposed to pesticide fumes or smoke in a pesticide fire.

(g) Take care not to allow excess water used to fight a fire to run into creeks or a drinking water supply.

(h) Call the fire brigade for all chemical fires, to report the fire and to get advice.

16 First aid procedures for pesticide poisoning

There are two types of pesticide poisoning:

Acute poisoning

This happens when someone has been exposed to a high dose of pesticide. This could occur when the pesticide is being mixed, for example, or if a hose breaks drenching the person or bystanders with liquid pesticide solution. Another example might be accidental ingestion of a pesticide, such as a child swallowing the chemical.

Chronic poisoning

This results from a person being exposed to a small amount of pesticide on many occasions over a long period of time. Chronic poisoning may happen when the operator repeatedly uses pesticide improperly, especially if they does not wear protective clothing and equipment or wears protective clothing which is not clean or is worn out, like wearing cracked or torn gloves.

16.1 SYMPTOMS OF PESTICIDE POISONING

There are a number of **symptoms** (signs) which may indicate that pesticides may be affecting a person's health. However, these symptoms may be caused by other illnesses. The possibility of poisoning should always be considered when a person may have been exposed to pesticides.

Symptoms of mild poisoning

- headache
- sweating
- diarrhoea
- irritation of nose and throat
- eye irritation
- nausea
- fatigue
- changes of mood
- skin irritation
- insomnia
- loss of appetite
- thirst
- weakness
- restlessness
- dizziness
- sore joints
- nervousness.

Symptoms of severe poisoning

- vomiting
- convulsions
- loss of reflexes

- unconsciousness
- inability to breathe
- fever
- muscle twitching
- thirst
- constriction of eye pupils (eye pupils become small)
- increased rate of breathing.

16.2 FIRST AID

If someone shows any of these symptoms after being exposed to pesticides medical advice should always be sought.

Fig. 5.43: Always seek medical advice if you think someone might have pesticide poisoning.

Fig 5.44: First Aid Kit

First aid—acute pesticide poisoning

If a person suffers acute pesticide poisoning do the following **immediately**:

(a) Find out if possible the way the poison entered the body. This may either be through the mouth, nose, skin or eyes.

- » If the pesticide has been inhaled, move the person to fresh air.
- » If the pesticide is in the person's eyes, quickly wash the eyes for 15 minutes with clean, gently running water. If there is no running water, bathe eyes from a container, frequently changing the water.
- » If the pesticide is on the skin, remove all contaminated clothing and wash the affected area thoroughly with soap and water.

(b) If the patient is not breathing, apply artificial respiration if possible.

(c) Read the label on the pesticide container for any first aid instructions and keep the label for the doctor. It is very important to be able to tell the doctor the name of the pesticide.

(d) If the pesticide is swallowed, and only if the person is conscious, rinse the mouth with plenty of water and read the label on the pesticide container for further instructions.

(e) Quickly arrange for the doctor, or Community Nurse or Health Worker to be called or take the person to the doctor, clinic or hospital immediately.

(f) Keep the patient warm and comfortable.

First aid kit

It is essential to keep a first aid kit on hand for emergencies. Syrup of Ipecac was often used to make people vomit after they swallowed pesticide or other poison. However, **always follow the first aid instructions on the pesticide container label**. If in doubt, seek medical advice.

Note: Syrup of Ipecac is now generally not available, so if the first aid instructions on the label say to induce vomiting, you may need to stick your fingers down the throat as this may do the same job (make sure you have washed your hands first).

It is suggested that the EHP ask the Community Health Nurse what items should be included in a first aid kit, including those which might be needed for the emergency treatment of pesticide poisoning.

These items should be purchased and stored in a clean sealed container and kept close by when pesticide is being applied. When something from the kit is used, it should be replaced as soon as possible.

First aid charts and emergency contacts charts are available which give more details on first aid instructions for chemical poisoning emergencies. Charts and pamphlets on poisoning, first aid instructions, and artificial respiration are available from first aid training organisations in your state or territory.

The EHP should have access to these numbers in the office and when on spraying operations.

Other important telephone numbers which must be displayed in the office and kept on hand during spraying operations are:

- the Poisons Information Centre—13 11 26
- the local or nearest doctor
- the local or nearest hospital
- the local or nearest Police
- the local or nearest Fire Brigade
- the local or nearest Shire Council and the name of the EHO.

6 WATER SUPPLY

1 Water—its importance and sources

1.1 THE IMPORTANCE OF WATER

Water is one of the most important substances on earth. All plants and animals must have water to survive. If there was no water there would be no life on earth.

Fig. 6.1: Plants and animals need water.

Apart from drinking it to survive, people have many other uses for water. These include:

- cooking
- washing their bodies
- washing clothes
- washing cooking and eating utensils; such as billies, saucepans, crockery and cutlery
- keeping houses and communities clean
- recreation; such as swimming pools
- keeping plants alive in gardens and parks.

Water is also essential for the healthy growth of farm crops and farm stock and is used in the manufacture of many products.

Fig. 6.2: Some domestic uses of water.

It is most important that the water which people drink and use for other purposes is **clean water.** This means that the water must be free of germs and chemicals and be clear (not cloudy).

Water that is safe for drinking is called **potable water**.

Disease-causing germs and chemicals can find their way into water supplies. When this happens the water becomes polluted or contaminated and when people drink it or come in contact with it in other ways they can become very sick.

Water that is not safe to drink is said to be non-potable. Throughout history there have been many occasions when hundreds of thousands of people have died because disease-causing germs have been spread through a community by a polluted water supply.

One of the reasons this happens less frequently now is that people in many countries make sure drinking water supplies are potable. Water supplies are routinely checked for germs and chemicals which can pollute water. If the water is not safe to drink it is treated. All the action taken to make sure that drinking water is potable is called **water treatment.**

1.2 SOURCES OF WATER

There are many ways in which we can collect water. The main sources are discussed below.

Surface water

This is water which falls to the ground as rain or hail.

This water is collected from a special area called a **catchment**. The catchment feeds water into a holding area via rivers, streams and creeks. The water is then stored in a natural or artificial (manmade) barrier called a **dam or reservoir**. Dams are usually placed at the lower end of a valley.

Catchment areas are usually far away from towns or cities to lessen the chance of the water being polluted. There are laws which control human activities, such as farming and recreation in catchment areas and on dams to make sure that water supplies are kept potable.

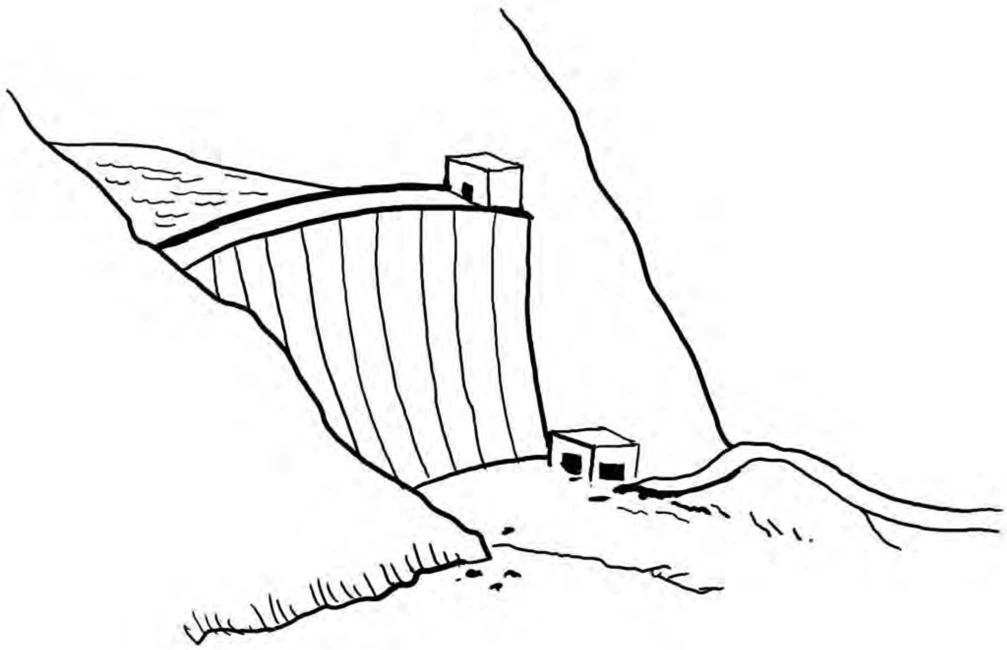


Fig. 6.3: A surface water dam.

Rivers or lakes

Town or community water supplies are sometimes drawn directly from nearby rivers or lakes.

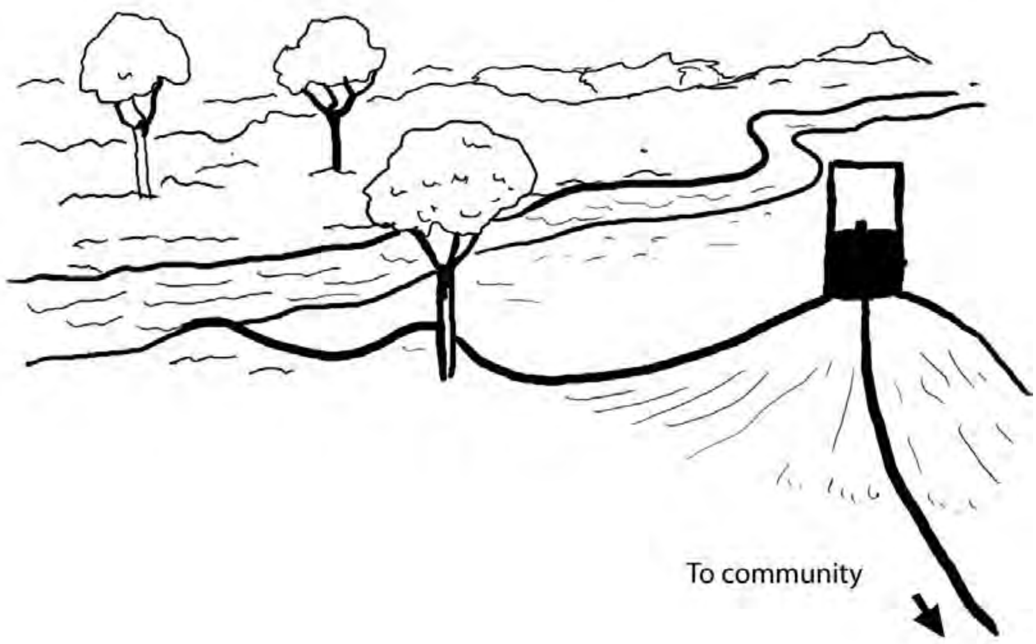


Fig. 6.4: Rivers and lakes can supply water.

Springs

These are found where underground water flows out of the ground naturally without the use of bores, wells or pumps.

Springs often occur towards the bottom of a hill or on sloping ground.

Fig. 6.5: A spring.

Rock catchment areas and rockholes

Sometimes large rocky outcrops contain low areas in which water is trapped. These low areas make good natural dams. Often a wall can be built to increase the amount of trapped water.

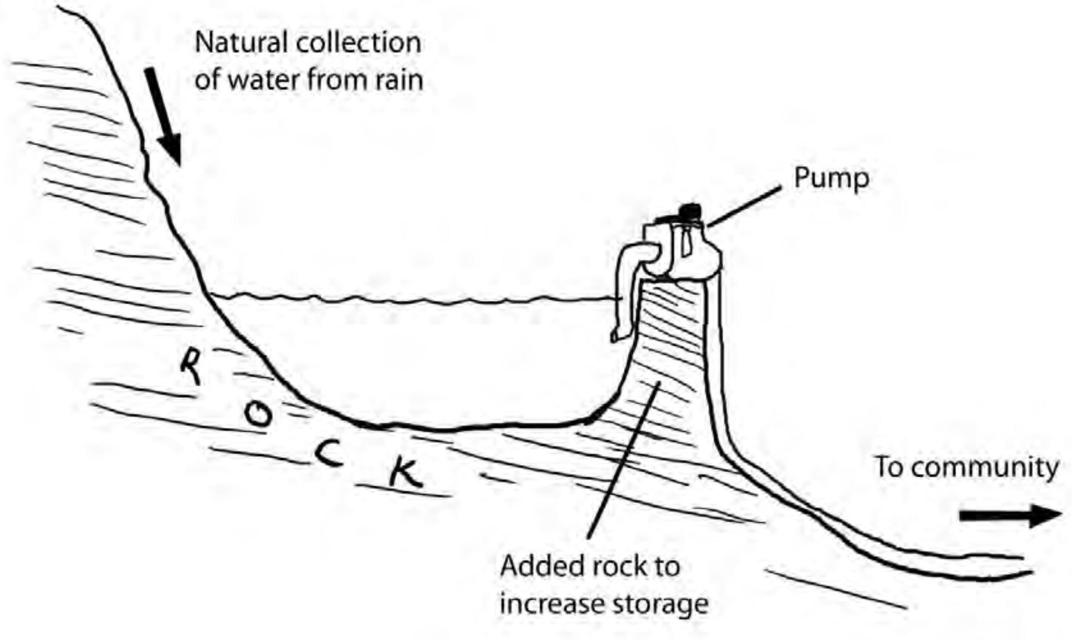


Fig. 6.6: A rockhole.

Excavated dams

Excavated dams are made by scooping out soil to make a large shallow hole. These dams are sometimes placed at the bottom of a slope to aid water collection. However, this can only be done in areas where the soil will not allow the water to drain away very easily through the ground. For example, in clay soils.

Soils which do not allow water to drain away are called **impervious**.

If a community wants a dam in an area where the soil is not impervious this can still be done by digging the hole and lining it with clay or an impervious liner, such as concrete or heavy plastic. Excavated dams are often used by farmers to supply water to stock.

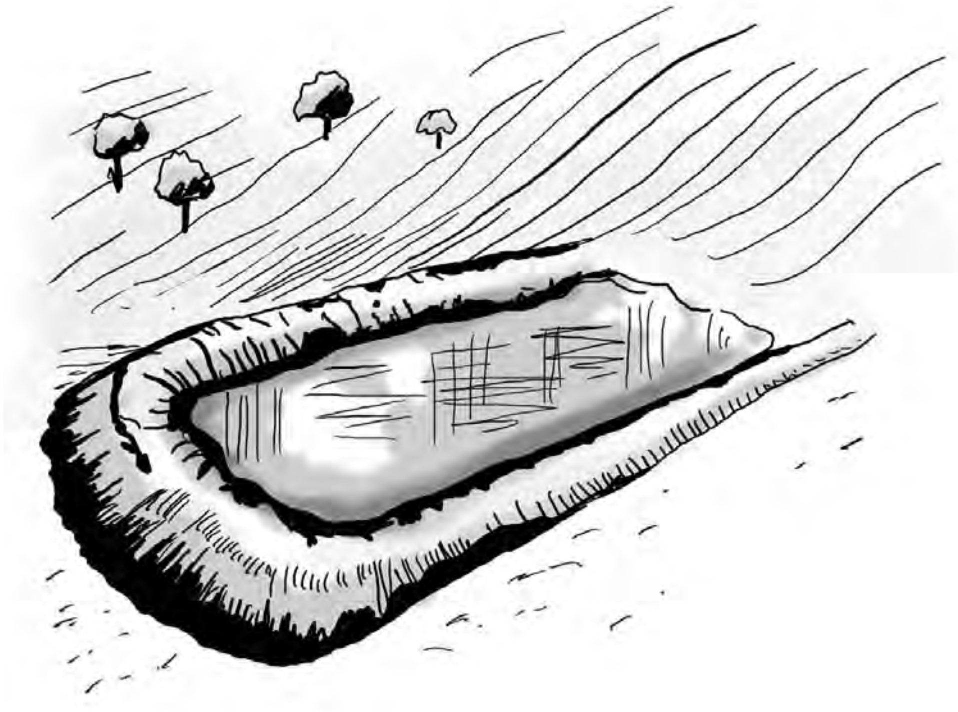


Fig. 6.7: An excavated dam.

There is often a layer of water lying beneath the ground surface, trapped by an impervious layer of rock which will not allow it to drain away. The water may be close to ground level or it may be deep in the ground. This layer of water is called the **water table**.

When this water table is close to ground level the water may actually come to the surface and create a permanent wet area called a **soak**. This usually occurs in low lying areas or hollows.

Soaks are affected by changes in the depth of the water table. That is, if the water table drops then soaks may dry up. Some causes of this can be drought or overuse of ground water by people.

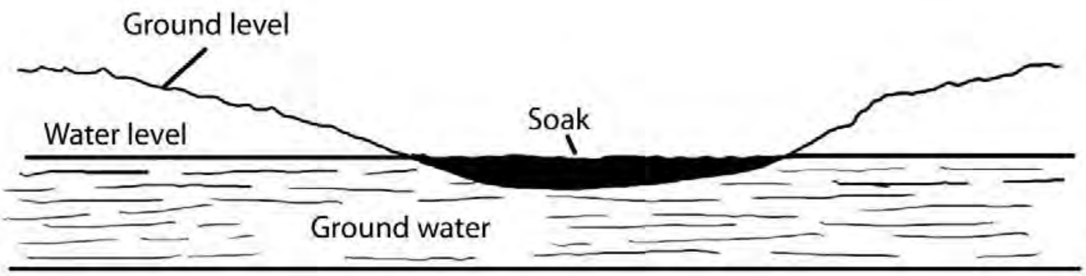


Fig. 6.8: A soak.

Rainwater tanks

The rainwater which falls on the roofs of houses is often collected using roof guttering leading through a pipe to a storage tank.

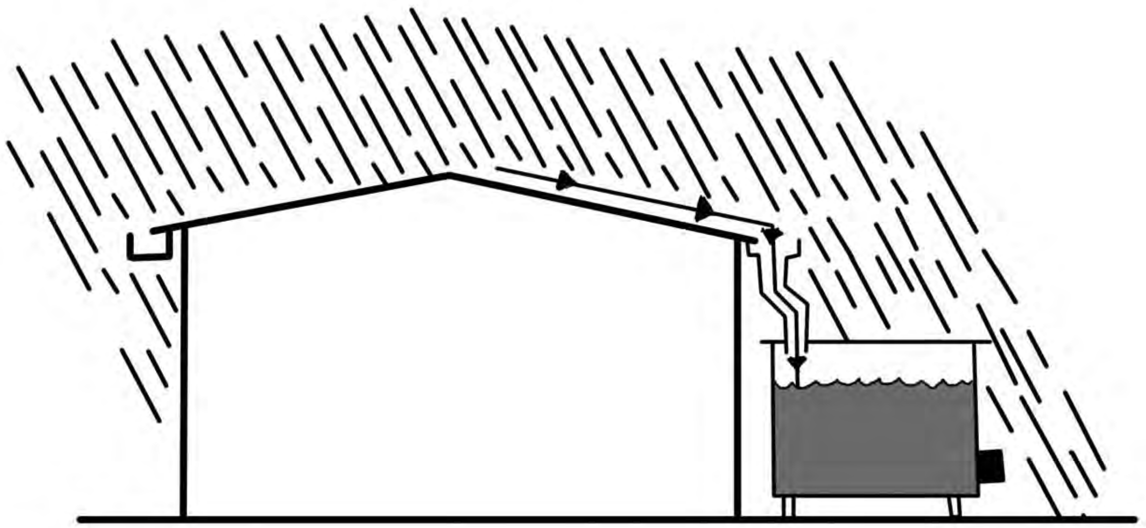


Fig. 6.9: A rainwater tank.

Note: enHealth's monograph *'Guidance on use of Rainwater Tanks'* provides the most up-to-date information and advice on the range of potential hazards that can threaten rain water tank water quality. Environmental Health Practitioners are encouraged to use the guide when planning how to prevent these hazards from contaminating rainwater, straightforward monitoring and maintenance activities and, where necessary, corrective actions. The monograph can be found on the enHealth website or by using a search engine with the title of the monograph.

Bores and wells

These are holes drilled into the ground deep enough to find a permanent (long-lasting) body of water. A pipe runs down the hole into the water and a pump is used to get the water up to ground level. The water is then pumped to the community.

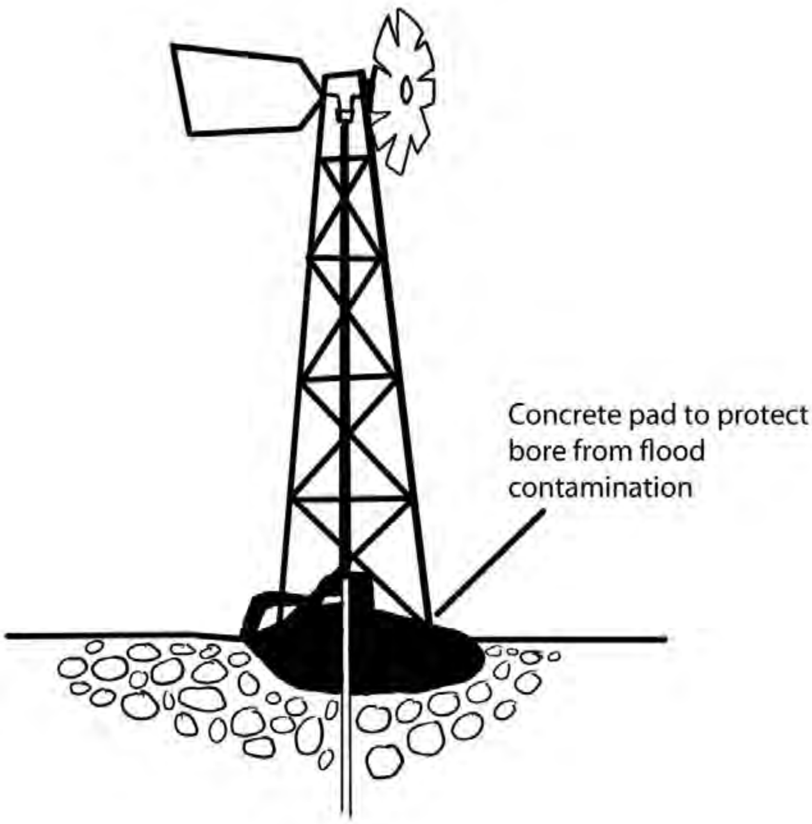


Fig. 6.10: A bore.

Artesian bores

Sometimes when a bore is sunk into a low lying area the water gushes out of the hole under its own pressure. This water is under pressure because it is part of an underground body of water much of which is at a higher level than the bore opening. This kind of bore is called an artesian bore.

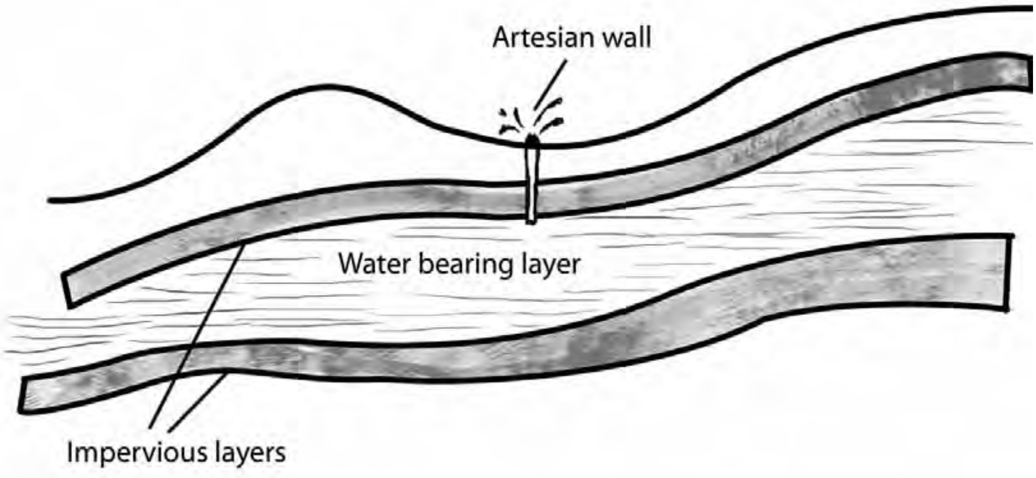


Fig. 6.11: An artesian bore.

WATER SUPPLY

A water supply taken directly from a bore or well is often called **groundwater**.

The water which comes from any of these sources may be salty, cloudy, smell unpleasant or have germs in it. Water of this kind would require special treatment to make it potable.

2 Water contamination and disease

It is very important that the community water supply be kept clean and free of germs and chemicals.

2.1 DISEASES WHICH CAN COME FROM POLLUTED DRINKING WATER

Diseases in Indigenous communities caused by germs from polluted water

Bacterial diseases:

- salmonellosis
- shigellosis
- acute diarrhoea (caused by E. coli).

Viral diseases:

- gastroenteritis
- hepatitis A.

Parasitic:

- giardiasis
- hookworm infection (there is some evidence that hookworm larvae can live in drinking water).

Fig. 6.12: Stomach upsets can be caused by contaminated drinking water.

In most parts of Australia and many other countries, proper water treatment methods have almost eliminated the germs that cause many of these diseases from water supplies. However, water treatment and hygiene standards in Indigenous communities, especially small communities or camps, are often inadequate and this is why many of these diseases still occur in Indigenous communities.

The germs may get into the water:

Directly by:

- a lagoon overflow effluent pipe discharging into a river or stream supplying drinking water
- the presence of dead animals in the water
- people or other animals swimming, washing or going to the toilet in a drinking water supply.

Indirectly by:

- contamination from an effluent system, such as a leach drain too close to a bore or the overflow from a lagoon flowing into a water supply
- people washing themselves or going to the toilet in or near a water source.

2.2 WATER CONTAMINATION AND HOW IT CAN BE PREVENTED

Anything which contaminates water is called a contaminant or pollutant. Water can be contaminated or polluted by:

- **Organic materials** such as:
  - animal carcasses
  - animal and human faeces and sewage
  - food waste
  - plant matter (grass, leaves, wood)
  - oil, petrol and grease.
- **Inorganic materials** such as:
  - scrap metal and junk
  - sand
  - chemicals.

Many of these materials can carry disease-causing germs into water supplies. Chemicals in the water supply can poison people and other animals.

Water can be contaminated at:

- the source, such as the river or bore
- in storage, such as in elevated tanks
- in the pipe system which delivers water to the user.

Fig. 6.13: Drinking or swimming in contaminated water can be dangerous to health.

Different types of water supplies can become contaminated in a number of ways. Some of these, and their methods of prevention are described below.

Domestic rainwater tanks

Contamination

The rain which fails onto the roof of a house is usually clean, and should not normally contain germs. However, there may be a lot of dirt and rubbish on the roof, especially if it has not rained for a long time.

This dirt might include the faeces from birds and small animals. Also, the wind can carry germs in dust blown onto the roof. When it rains the dirt and rubbish will be washed into the storage tank, along with the germs. Some of these germs may cause disease.

Dirt, animals and bird faeces can get into a storage tank if it does not have a lid. All these things can carry disease-causing germs. Often animals are trapped in water tanks and drown. As dead bodies rot, germs will grow and contaminate the water.

The inside of the tank walls and floor may also become dirty after a period of time. This dirt can contaminate the water.

<u>Prevention</u>

If a house has a rainwater tank as its water supply, these are the things which should be done to keep the water clean:

(a) Install a first flush diverter. This prevents the first flush of water, which may have contaminants from the roof, from entering the tank.

(b) Keep the roof and gutters clean.

(c) Keep a lid on the water tank.

(d) Check for and repair any leaks.

(e) Regularly look into the tank. If the water or walls or floor are dirty the tank will need to be cleaned.

Rivers and billabongs

<u>Contamination</u>

There are several ways in which rivers and billabongs can become contaminated with germs or chemicals:

- Rubbish may fall into or be washed into the river or billabong, for example, from a nearby dump.
- Sewage may seep into the river or billabong from nearby septic tanks and leach drains.
- Faeces may be deposited directly into the river by people or other animals.
- Faeces deposited near the river may be washed into it by rain.
- Chemicals or poisons sprayed onto land near the river or billabong may be washed into the water.
- People or animals may wash themselves in the river or billabong.

There is a risk that the water supply will be contaminated if the community pumps its water from a place:

- near where a contaminant enters the water such as an effluent discharge point
- where contamination is occurring, such as a swimming area.

Fig. 6.14: Faeces contaminate drinking water.

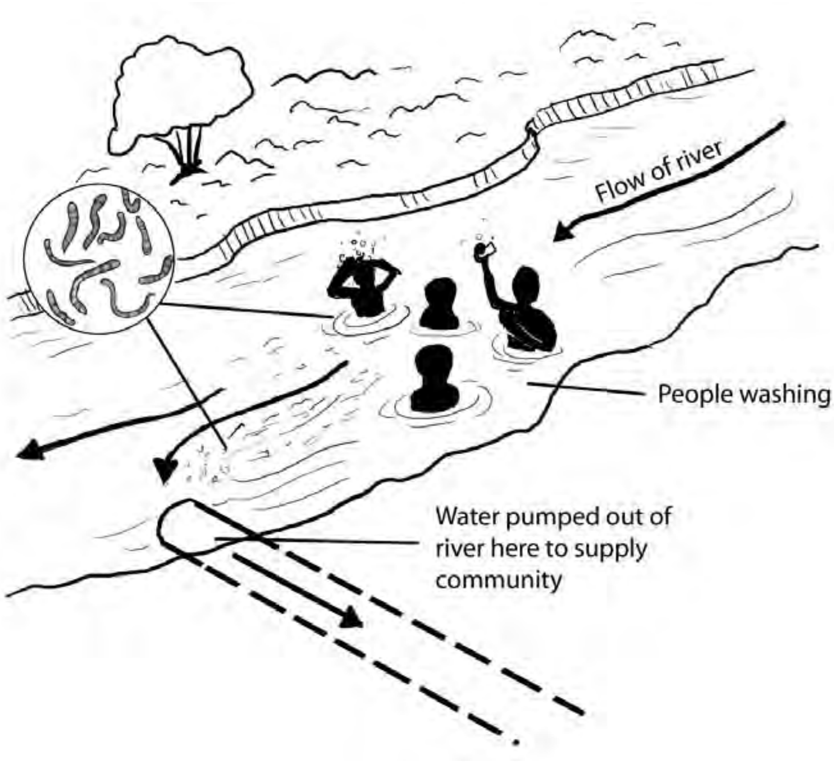


Fig. 6.15: People washing or swimming in a water source can pollute it.

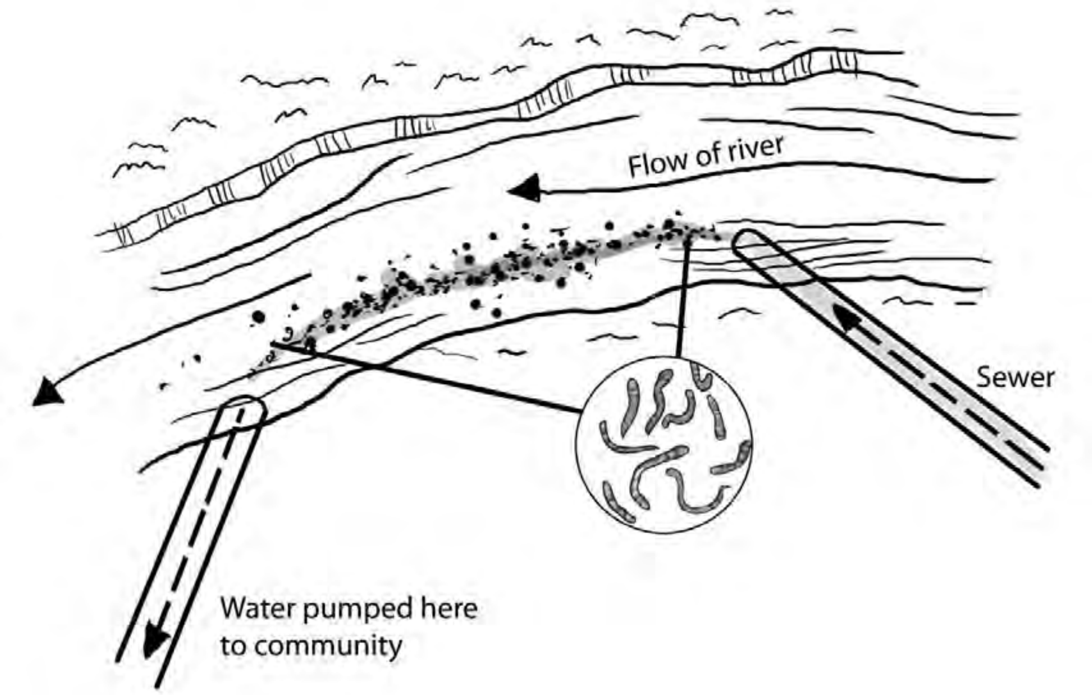


Fig. 6.16: Water supply contaminated by effluent discharge.

Prevention

It is important to try and stop the river or billabong from being contaminated, particularly in the area from which the community takes its water supply. Discharging effluent into rivers and streams should always be avoided.

Sometimes it is not possible to stop the contamination of a river or billabong. This is because the contamination source is not known, or cannot be controlled, like if the contamination is occurring upstream or is because of not being able to keep cattle out of a billabong.

The following prevention methods can be adopted:

(a) If the community water supply comes from a river make sure:

- » it is obtained upstream from any possible contamination sources, for example, swimming holes or effluent runoff points
- » it is taken from the deepest possible point in the body of water.

(b) Make sure that there is little or no building development near the water supply source. There are laws which control where people can put septic tanks/leach drains, effluent ponds, and rubbish tips in relation to water supplies.

(c) Make sure people do not use the area around the water supply source for recreational purposes, such as playing sport and having picnics.

(d) In the case of a billabong, it may be possible to fence the water source to prevent contamination by people and other animals.

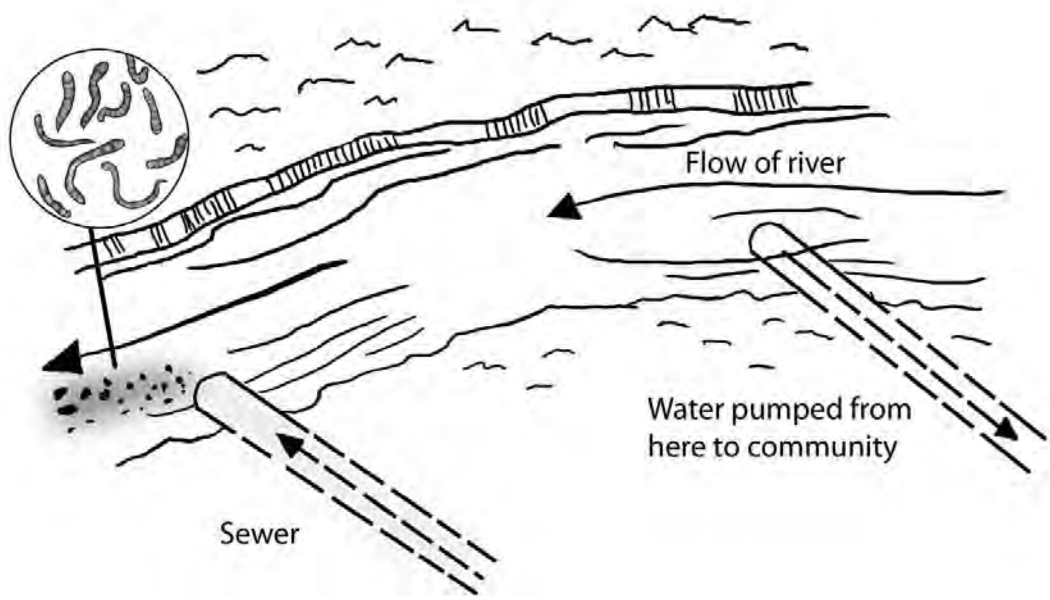


Fig. 6.17: Take drinking water upstream from effluent discharge.

Bores

Contamination

Bores can become contaminated:

- underground. (This can happen if a contaminant is able to get to the water body, for example, if a leach drain is built too close to the water source, or a faulty effluent disposal system allows disease-causing germs to soak down into the groundwater)
- while bringing it to the surface.

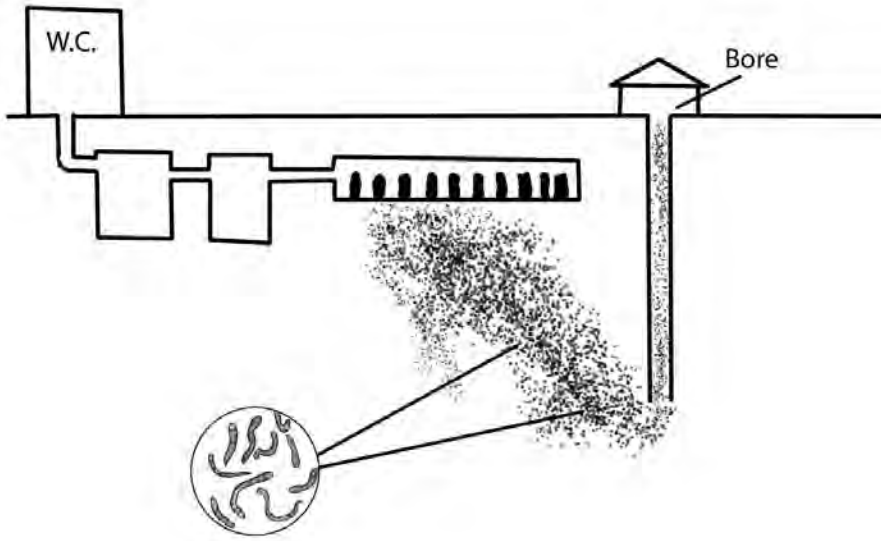


Fig. 6.18: Leach drain too close to water supply.

This could occur in the bore itself or at the place where the bore pipe comes out of the ground. This is called the **bore head**.

If the bore head is unprotected then animals can spread disease causing germs and parasites to the water via the equipment. For example, if the equipment leaks and allows water to pool, animals will be attracted (especially stock and birds) and their faeces may enter the water at the bore head.

Prevention

It is important that:

(a) covers be placed over bore heads

(b) there are fences around bore heads to keep animals away

(c) the bore head area is protected from flooding as this can carry disease-causing germs into the bore. The bore head is usually protected by raising it above ground level

(d) septic tanks/leach drains and effluent disposal sites are well away from the bore.

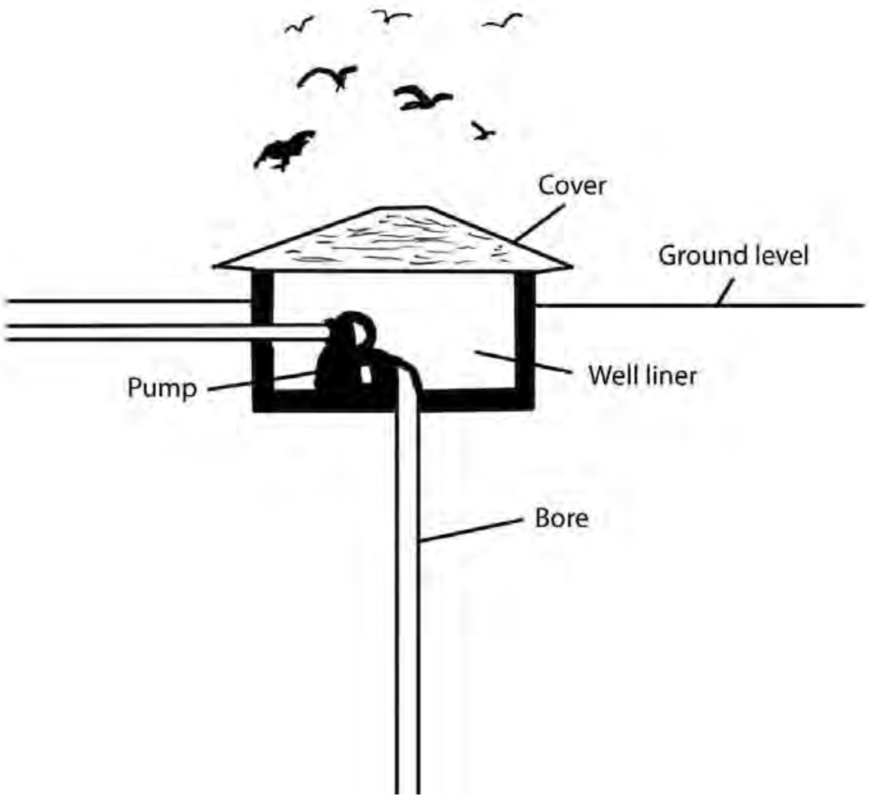


Fig. 6.19: Protective cover for bore.

Laws control the distances these facilities must be away from a bore or water source.

WATER SUPPLY

Community water tanks

Contamination

If a large community tank does not have a proper fitting lid, then people, especially children, birds or other animals may find their way into it and contaminate the water with disease-causing germs.

Occasionally, the inside of the community water tank will get dirty and can contaminate the water.

Prevention

To make sure that the water in the community tank is always clean:

- The tank should have a proper fitting lid.
- There should be a high fence, with a locked gate, around the tank.
- The tank should be regularly inspected to make sure that it is not leaking and that the water is clean and free of animals, such as frogs.
- If the inside of the tank is dirty it must be cleaned. The proper way to clean a tank is described in Section 6.2.

Community water pipes and household plumbing

Contamination

A water supply can become contaminated between the source and the community water tank or the user. The pipes that carry the water can be below or on the surface of the ground. They can be above the ground also, such as in the case of pipes carrying water from an elevated tank to the ground. An elevated tank is one that is raised above the user's water outlets either on a stand or on a hill.

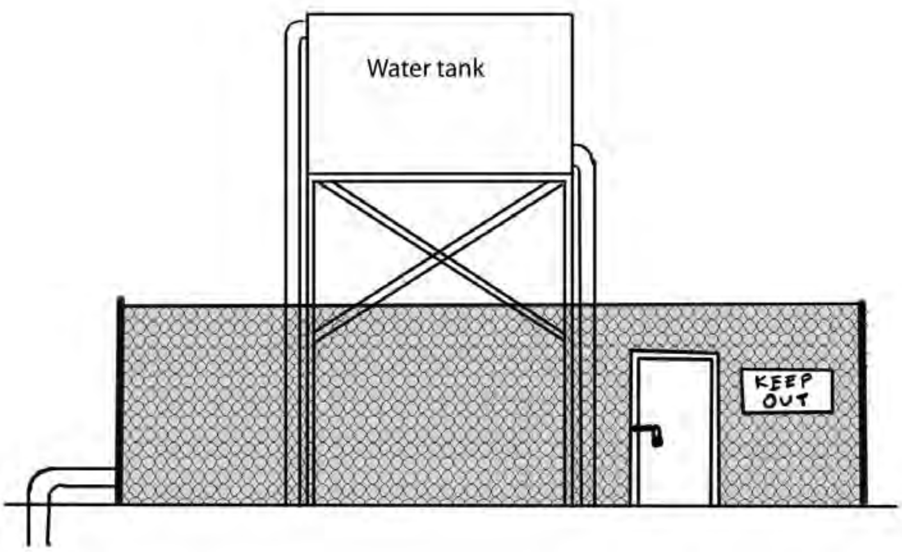


Fig. 6.20: Community elevated water tank.

If a pipe is leaking around a joint or has been broken, disease-causing germs and parasites can get into the water and contaminate it. These germs and parasites can come from:

- the surrounding soil
- the wind
- animals, including people, attracted to leak or the pools of water.

Prevention

Contamination of water in pipes can be avoided by ensuring that:

- all joints are maintained free of leaks
- pipes are placed below ground whenever possible to protect them from damage
- any above ground pipes are held secure and are protected from damage, especially from vehicles
- any leaks or broken pipes are repaired as soon as possible
- connections to tanks, pumps and bores are well maintained and kept free of leaks.

3 Community water supplies

3.1 TOWN COMMUNITIES

The supplier of water to most cities and towns is the state or territory water authority. Communities which are situated near towns usually get their water from the town water supply.

In these communities, the water is pumped from its source which is usually a dam or bore. The water is treated for possible contamination and is then stored in large tanks or reservoirs.

From these tanks or reservoirs a complex system of underground pipes takes the water to the community's houses, schools, hospitals and other users.

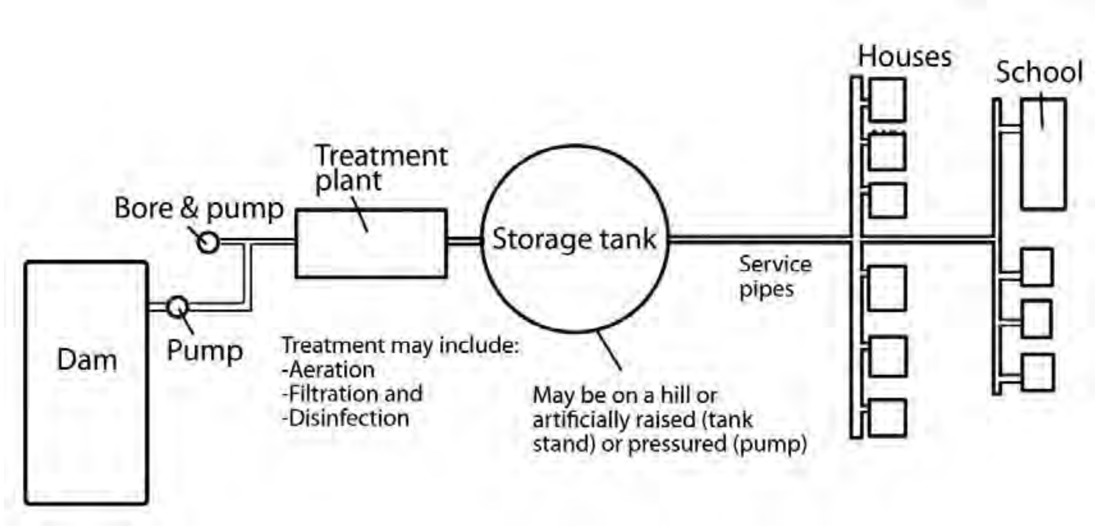


Fig. 6.21: Plan of large community water supply.

It is the supplier's responsibility to maintain the water supply equipment. Normally, this will be the water authority. The supplier usually looks after all pipelines to houses and other buildings. Maintenance and repair of water plumbing in the yard or house is the responsibility of the owner of the house.

3.2 BUSH COMMUNITIES

Most communities that are situated away from towns get their water supply from a bore. The bore is sunk in an area where the water is cleanest and most plentiful. Sometimes, water for a bush community is pumped from a river, pool or billabong.

The bush community's water supply is a smaller version of a town water supply. When the water is pumped from the bore it is first treated to make it clean and free of germs. It is then pumped into a storage tank.

From the storage tank a network of pipes carries the water to the houses, the school, the clinic, the shop and any other buildings.

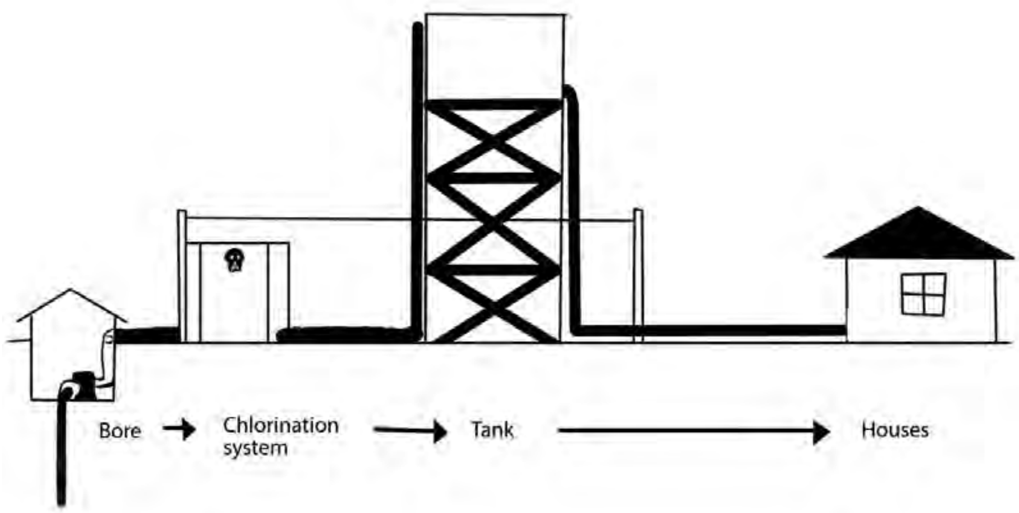


Fig. 6.22: Small community water supply.

3.3 THE ELEVATED TANK

Community water tanks can be set on high stands or placed on a nearby hill. The reason is that the elevation (height) of the tank creates the water pressure at the tap.

The higher the tank above the taps in the community, the greater is the water pressure at the taps. The maximum (greatest) height for a community water tank is usually 12 metres.

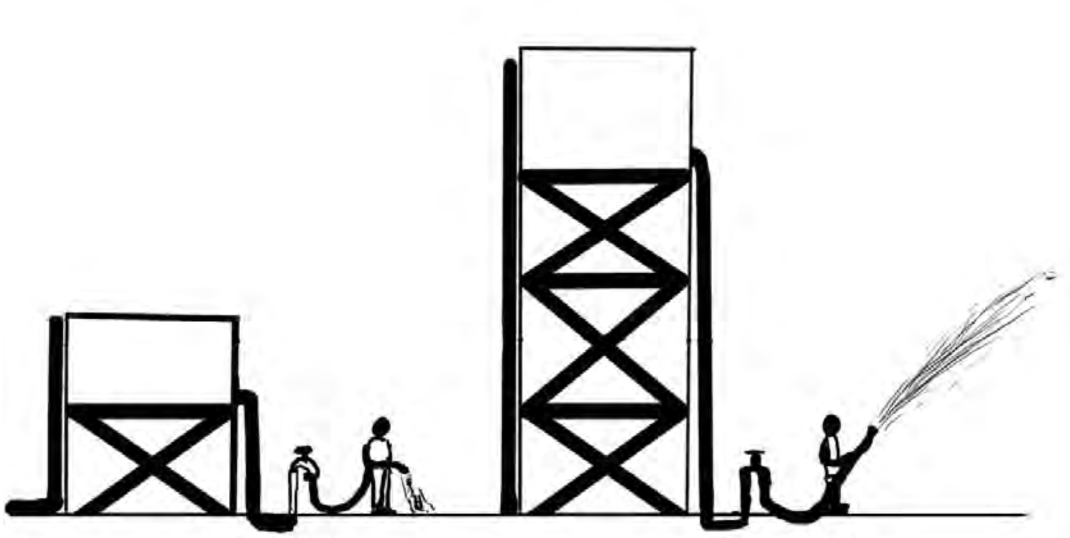


Fig. 6.23: The higher the tank the greater the pressure.

If water pressure at the taps was not created by elevating the tank, the water from the taps and hoses would dribble out very slowly or no water would come out at all, for example, it might take an hour to fill the toilet cistern or it might be impossible to have a proper shower.

3.4 PIPE LAYOUTS IN THE COMMUNITY

Water pipes come in different **widths**. The width of a pipe is the measurement of its **diameter**. The diameter is the distance across the centre of the pipe. Some measurements are taken across the inside of the pipe, and others from the outside.

House plumbing is usually copper or sometimes PVC. Copper is always used to carry hot water. Other water supply pipes around a community are usually PVC.

The water pipes around houses are usually 12 mm pipes, although 18 mm or 25 mm pipes are sometimes used. Pipes of these sizes would be too small to bring the water from the storage tank to all the houses and other water users, such as the clinic and the shop. These pipes are much larger and are strong enough for the high water pressure. They are called **main water pipes**.

For a small community the main water pipe from the supply tank to the houses is usually a 50 mm PVC pipe. For larger communities a 100 mm PVC pipe is used and very occasionally, a 150 mm PVC pipe. The larger pipe is used when there are lots of houses to be serviced or when the water has to be transported over a long distance. This larger pipe gives a better flow so that the pressure is not lost at the tap.

To get water from the main pipe to houses and other places, smaller branch pipes are taken from the main pipe. The main pipe will get smaller in size as the branch pipes are taken from it. This maintains the pressure to the water users regardless of their distance from the tank.

Depending on the community layout, individual water users will obtain their water service from the branch pipes or sometimes in small communities, directly from the main pipe. Pipes used to take the water from the main into the houses and other buildings are usually 18 mm PVC.

At several points along main pipes there are taps (or valves) which allow the water to be turned off. One of these taps is at the tank so that the whole community's water supply can be shut off if necessary.

Other taps are usually placed where branch pipes go off from the main. This is done so that only one branch needs to be shut off if a break occurs or if some maintenance work needs to be done.

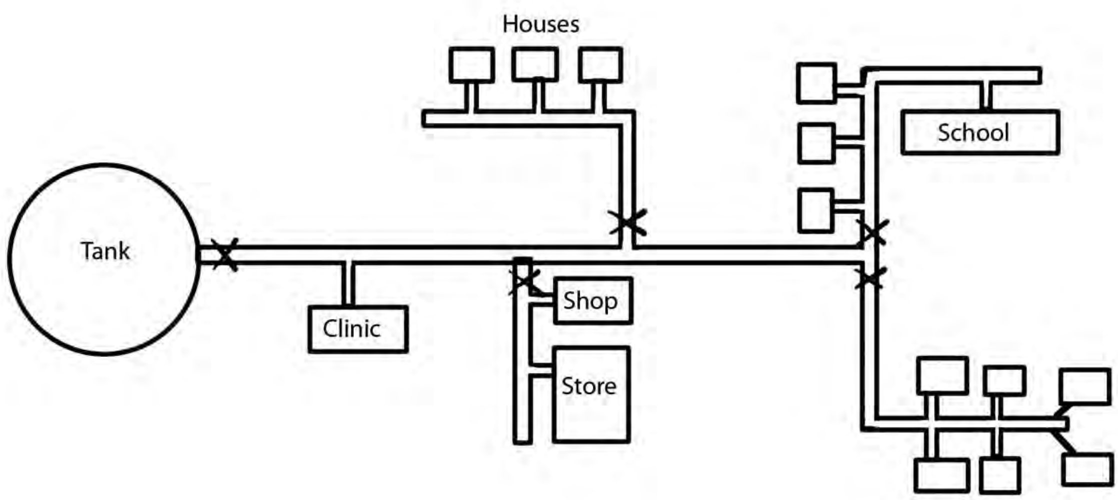


Fig 6.24: Plan of community water supply showing cut-off taps.

The government water authority has plans of the water supply system for most communities. These plans can be obtained through the community office.

It is wise for each community to try and get a copy of the plan of its own water supply system. This will help the EHP and/or other people to find all the underground pipes and the cut-off taps in the system.

Each house or building supplied with water has its own **main cut-off tap**. This tap is set in the pipe coming into the house from the main or branch water pipe. It is normally located in the ground not far in from the fence line of the house. If this tap is turned off, all the water to the house is stopped. Each householder should know where to find the main cut-off tap.

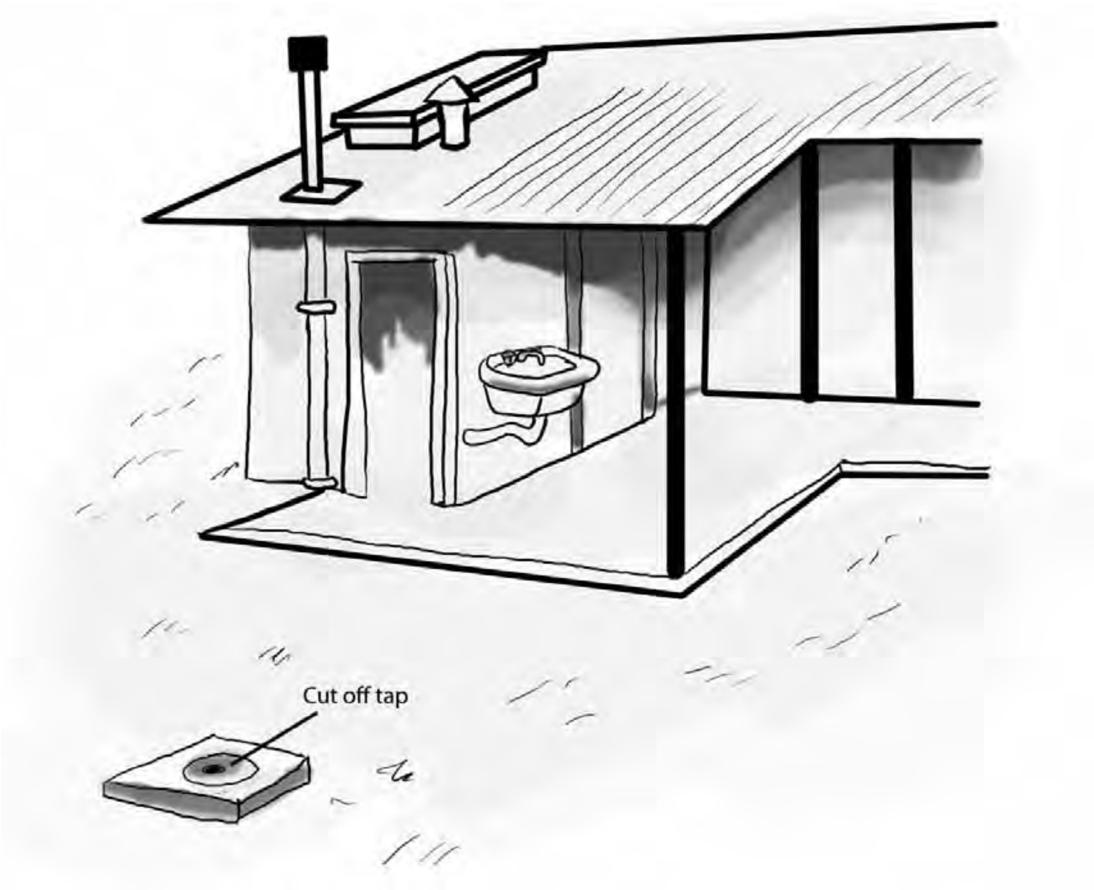


Fig. 6.25: House cut-off tap.

4 Water supply contaminants and disinfection

4.1 WATER SUPPLY CONTAMINANTS

There are four main types of contaminants that can be found in water that is taken from bores, rivers, billabongs and lakes. These are germs, suspended solids, dissolved salts and chemicals.

Germs

These deserve the greatest attention because of the health risk they present to everyone in the community.

Nearly all the water collected from bores, rivers, lakes and billabongs has to be checked regularly and if necessary treated to make sure it is free of germs. Rainwater collected with equipment known to be free of germs is probably the only type of water supply that does not normally have to be treated.

When searching for the source of germ contamination of a water supply, it may be necessary to check the whole supply system to try and find the point at which the germs are entering the water. This may be at the water supply source, the tank, anywhere in the pipelines or a breakdown in the water treatment system.

Suspended solids

Suspended solids include small particles of clay, iron oxide or plant matter which hang in the water and give it a murky (dirty and cloudy) appearance.

These solids can be removed by letting the water stand to allow solids to settle. Suspended solids can also be removed from water by filtration. This means running the water through very fine material which will catch the solids.

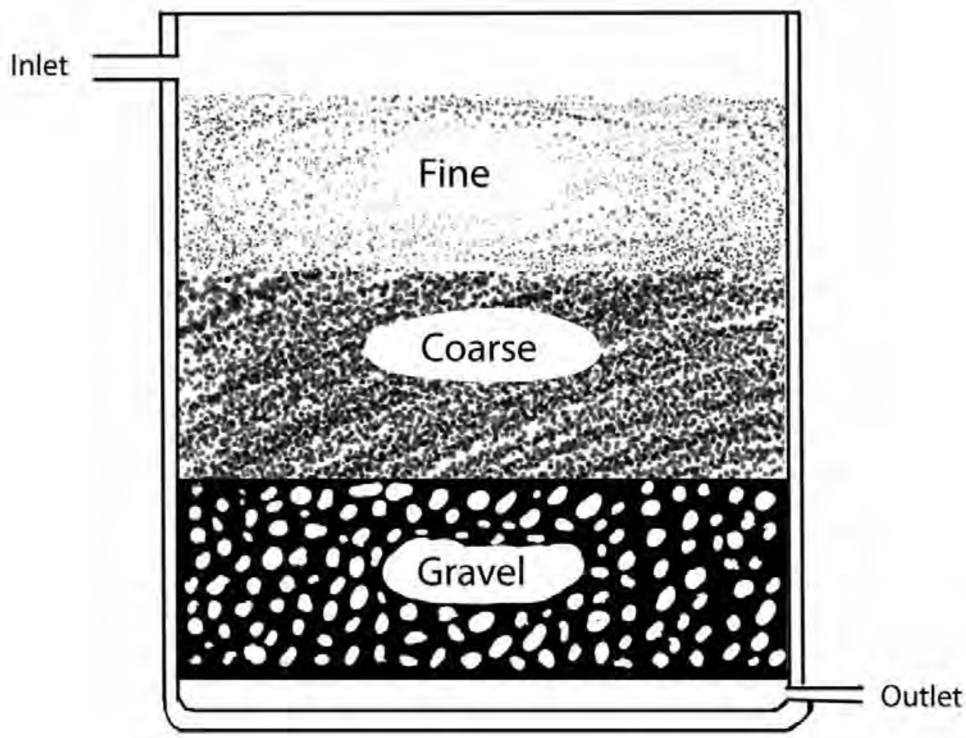


Fig. 6.26: Water filtration through coarse and fine sand and gravel.

Dissolved salts

As rainwater runs over the ground and down into the soil it sometimes comes into contact with limestone and similar rocks. Small amounts of minerals from these rocks dissolve in the water, in much the same way as sugar is dissolved in cups of tea. These minerals are the salts of sodium, calcium and magnesium. For example, sodium chloride (common salt), calcium carbonate (limestone) and magnesium sulphate.

The dissolved salts make the water **hard**. Hard water is what causes the white crust to form on the elements of electric kettles and on the inside parts of toilet cisterns. Soap will not lather easily in hard water. People may get an upset stomach from drinking hard water.

Hard water can be made **soft** by treatment with chemicals. However, this is not often done. Provided the mineral content is not too great and a danger to health, most people can put up with hard water.

4.2 DISINFECTION

Treating a water supply to kill germs is called disinfection. Communities get their water from sources such as bores, rivers, lakes and dams. The water from these sources is often contaminated; sometimes only slightly, sometimes badly. This is why the water supplier makes provision for water treatment (usually chlorination) between the water source and the storage tank or in the tank. This treatment should keep the water free of live germs and parasites.

These are some methods of disinfection:

Chlorination

Chlorination uses chlorine chemicals to kill the germs and should leave sufficient **free residual chlorine** in the water. This is a little extra chemical in the water which acts as a safety buffer against further contamination. That is, if all the germs in the water at the storage point are killed, there is still some chlorine left to attack any other germs which might get into the water system in the tank or the pipes which take the water to the community, for example, via a cracked or leaking pipe or tank.

The recommended level of free residual chlorine in drinking water is between 0.2 and 0.6 ppm (parts per million) or mg/L (milligrams per litre).

This means that there is between 0.2 and 0.6 parts of chlorine per million parts of water, or 0.2 and 0.6 milligrams of chlorine per litre of water. These units of measure are basically the same and either can be used in detailing the measured level of chlorine.

Swimming pool free residual chlorine levels are much higher than the level in drinking water.

The length of time which the chlorine needs to kill the germs depends upon the level of water contamination. It is important to note that at times the water supply, especially at the source, may be so badly contaminated that normal levels of chlorination will not be enough.

For example:

- a rotting carcass of an animal such as a cow or dog may have contaminated the water source
- a sewage leak or sewage dumped near the water source
- rubbish dumped near the water source
- water has high levels of iron

There are three main chemicals used to chlorinate water:

<u>Chlorine gas</u>

Many communities have a gas chlorination system for their water supply. Cylinders of chlorine gas are connected to the water supply line. The gas is automatically fed into the water at the correct dosage to make sure that all germs are killed.

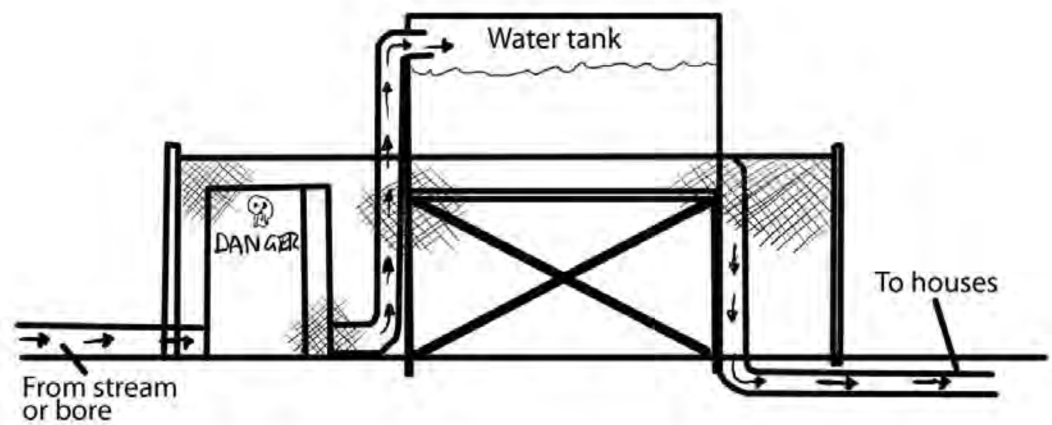


Fig 6.27: Gas chlorination of a small community water supply.

Chlorine gas is yellow-green in colour and has an irritating, sharp smell. It is an extremely poisonous gas and breathing even small quantities can be fatal.

If the gas chlorination system breaks down and causes chlorine gas to leak into the air, the EHP should make sure that no-one goes anywhere near the area and that the water supplier, is notified (told) immediately. People who enter areas into which chlorine gas has leaked must wear full breathing equipment (air tanks).

Sodium hypochlorite

The chlorine can also be combined with other substances. These can be in solid form or as a solution (liquid).

Sodium hypochlorite is one of these substances. This comes in a liquid form. Sodium hypochlorite is used where the chemical has to be added to the water on a regular basis. For example, in swimming pools or water tanks where the chlorine level needs to be checked every few days and sodium hypochlorite added as necessary.

Particular steps need to be taken in checking the chlorine level in drinking water and in adding more chlorine to the water. These are dealt with in Section 6.1.

Calcium hypochlorite

This is another chemical in which chlorine is combined with other substances.

Calcium hypochlorite comes as a white powder. It is often referred to as 'A chlorine'. It is used for the same purpose and in the same way as sodium hypochlorite. It is also discussed in Section 6.1.

Calcium hypochlorite is not as strong as sodium hypochlorite in its germ killing action. However, it is cheaper to buy and is used more often.

Ultraviolet (UV) light

Ultraviolet light cannot be seen by the human eye. However, when it is produced in a lamp (tube) other types of light are also produced which can be seen.

When the ultraviolet light is strong enough it is able to kill germs. The water flows through a container in which ultraviolet light producing tubes are set. The water pipes are placed between the ultraviolet light tubes. These pipes are made of Teflon which allows the UV light to pass through into the water and kill any germs present.

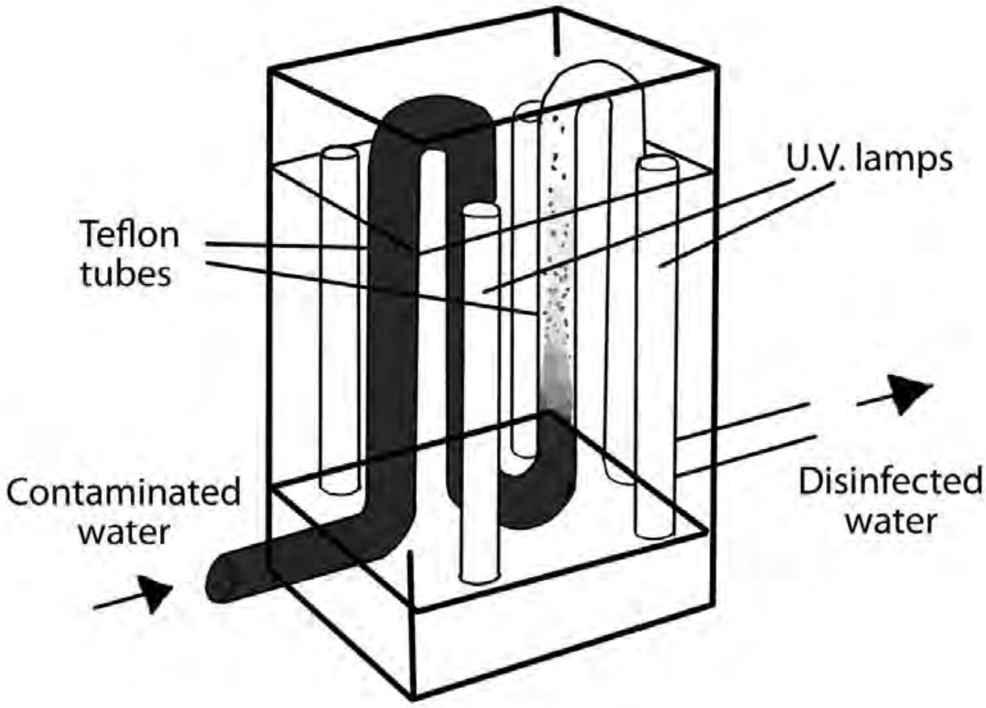


Fig 6.28: Ultraviolet light unit for water disinfection.

One disadvantage of ultraviolet light disinfection of water is that there is no residual effect. Germs are killed only at the point of contact with the ultraviolet light. Germs will not be killed if contamination occurs after the water has left the disinfection plant. Chlorine may still have to be added to provide the residual effect.

Filtration

When water is run through fine sand, the filtration process removes suspended solids.

Water supplies for large towns often have their disinfection systems assisted by filtering the water through large sand beds before chlorination. This will reduce the chemicals required for disinfection. However, this is rarely used in smaller water supplies.

Boiling

If none of the above methods is possible then boiling water for 5 minutes is an effective way of killing germs. Obviously this method would be only useful for small quantities of water. However, it is a good way of getting safe drinking water in an emergency or in a temporary bush camp.

5 Contaminated water supplies

5.1 SIGNS OF CONTAMINATED WATER

It is important for the EHP, or whoever is in charge of the water supply within the community, to constantly monitor the quality of the water.

One sign that the water supply might be contaminated is when several people from different families in the community become sick at the same time. A contaminated community water supply can make lots of people sick at the same time. Remember, however, such sickness may also be caused by contaminated food or vectors carrying disease-causing germs.

It is, therefore, a good idea to occasionally check the complete water supply system for any problems. If any are found they must be fixed. It might be necessary to call the water supplier for help in locating and fixing the problem. Where contamination by germs is suspected, sampling of the entire water supply system is recommended to find the contamination source. This is done by working through the water supply system and sampling at different places.

The results of these samples will show which parts of the system are contaminated and where the contamination may be happening.

It is important that every water tank is inspected regularly for signs of water contamination. These are signs that the water in the tank is contaminated:

- The water is a green or brown in colour.
- Green slime is growing on the sides or bottom of the tank.
- Faeces, rotting leaves or dead animals are in the water.
- Live animals, such as frogs, are in the water.
- There is no lid on the tank.
- The lid of the tank is not on tightly or is rusty and has holes in it.

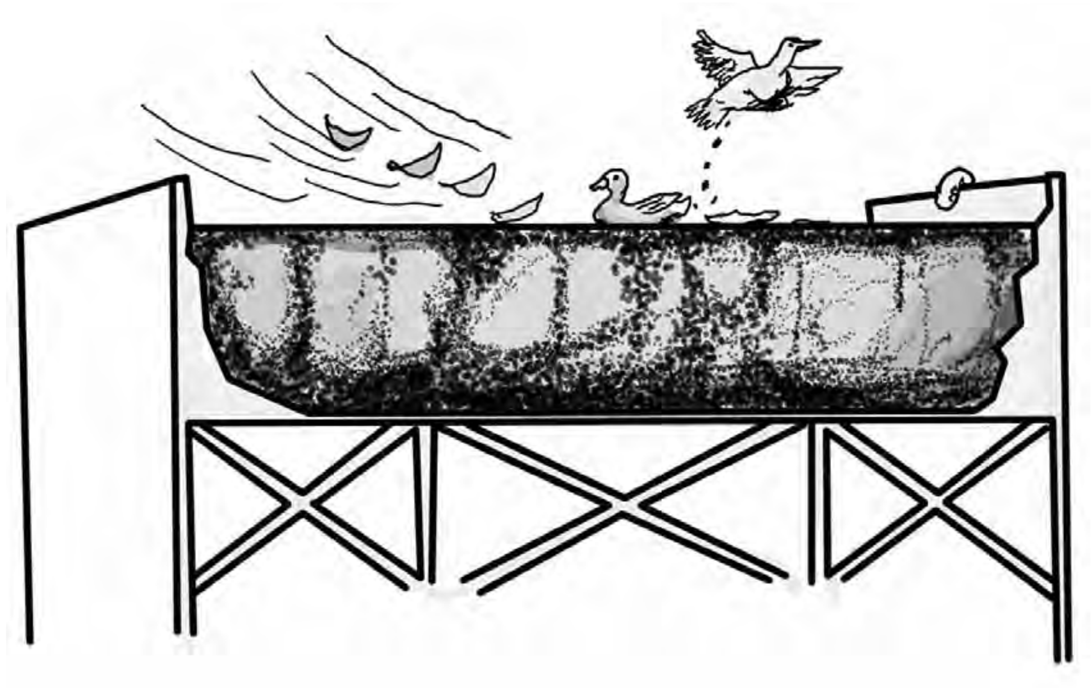


Fig. 6.29: Contaminated water tank.

If any of these problems are found, steps must be taken immediately to correct the fault so that water quality is maintained. This usually means making repairs to or cleaning out the tank. The procedure for cleaning a water tank is covered in Section 6.2.

5.2 TESTING FOR CONTAMINATED WATER

Water sampling and testing drinking water supplies in communities is undertaken by either the water supplier or the EHO from the local authority. Who does this job depends upon which of the two agencies has responsibility for providing the water supply. EHPs should make themselves known to these agencies so that they can assist in sampling programs. However, some communities may not have a regular sampling program.

If the results of the tests show there are germs in the water supply, steps will have to be taken to remove the germs and their source. For example, if the water bore is found to contain germs, the source of the germs will have to be found and fixed if possible. Where this cannot be done, the water in the tank will have to be more strongly chlorinated.

The EHO can make sure that EHPs follow the correct sampling procedure.

The EHP must talk with the EHO or the water supplier before doing any water sampling.

They will authorise any water sampling so that the community will not be charged for the cost of the test/s. If the EHP is to assist in water sampling programs, he/she should check with the EHO or water supplier before taking samples to make sure that all the necessary procedures are being followed, such as the correct way to send the sample/s to the laboratory for testing.

Routine water tests

There are two kinds of tests which may be routinely carried out on a community water supply:

The test for germs

Coliform bacteria is one of the most important germs that is looked for in water, in particular one type of coliform called E. coli (Escherichia coli).

Coliforms indicate faecal pollution. Faecal coliforms, including E. coli, indicate human faecal pollution.

This test is complicated and is done at professional laboratories.

The test for the chlorine level in the tank

This test is done to make sure there is enough chlorine in the water to produce sufficient free residual chlorine. If testing shows the correct free residual chlorine level, the water should be free of germs.

Other water tests

Another test can be done to find out what chemicals there are in the water. This can include testing for salt and hardness or other chemical contaminants.

Tests for some parasites in a water supply can also be done. Special samples of the water similar to those taken for germs must be submitted to a laboratory where the water will be examined. If such tests are required the EHP must contact the local EHO or the EHP supervisor before sampling.

Taking a water sample

To test the water supply for germs the water sample is taken in a special water **sample bottle**. Each bottle has its own label and comes in a sealed plastic bag. Make sure the cap is screwed on properly to protect the sample from contamination.

Any chlorine in the water is **neutralised** as soon as it enters the bottle. Neutralising means using a chemical action to combine the chlorine with another substance so that the chlorine is no longer free to act on germs while it is being transported to the laboratory. The substance in the bottle which neutralises the chlorine in the water is sodium thiosulphate.

Neutralising the chlorine in this way gives a true indication of the drinking quality of the water at the moment of sampling. If the chlorine is not neutralised it will continue to kill the germs in the sample before it gets to the laboratory. The test would then show a water supply that is potable even though the sample may have contained germs when it was taken.

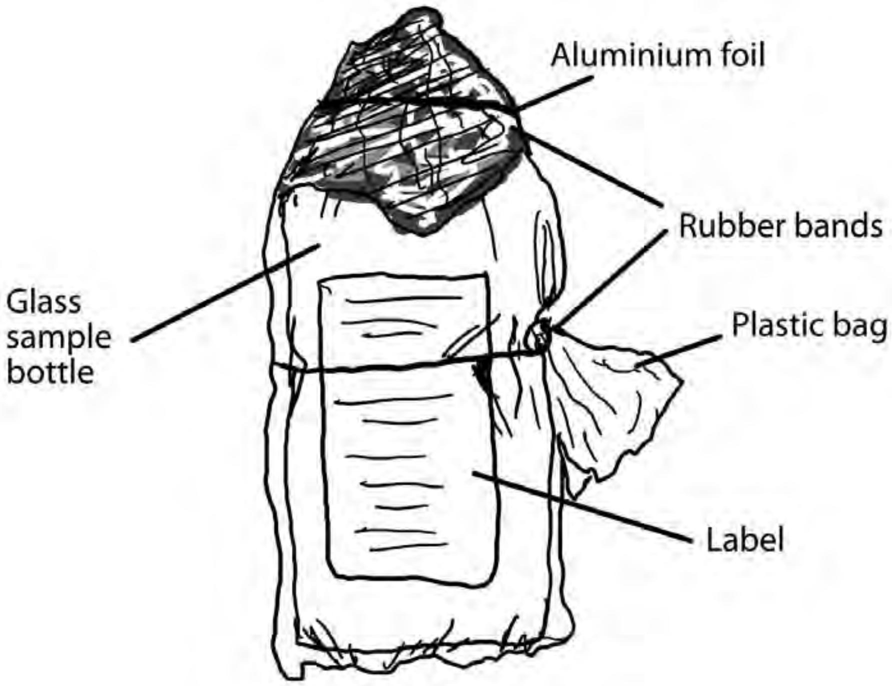


Fig. 6.30: A water sample bottle.

Several things must be remembered when taking water samples to test for germs:

- The water samples will have to be sent to an approved laboratory for testing.
- The water samples must be kept on ice while they are transported.
- The water samples should be at the testing laboratories within 6 hours of being collected. However, water samples can be accepted for up to 24 hours after the time of collection. EHPs or others collecting samples should contact their testing laboratories for guidelines on transit times for samples.

Before the EHP takes any water samples he/she must be properly prepared to do the job. This means:

(a) obtaining the necessary equipment. These include:

» bottles, forms, eskies and freezer bricks. These can be obtained from the professional laboratories

» a gas or methylated spirit burner if sampling from a tap. A methylated spirit burner can be a piece of cottonwool attached to the end of a length of wire and soaked in methylated spirits.

(b) contacting a professional laboratory for sampling kits

(c) organising the quickest possible transport of samples to the laboratory. There may be a charge for transporting samples

(d) remembering to **label the bottles** prior to taking the water sample. Once the bottle is wet it is difficult to write on the label. Also remember to fill **out the sample submission form** and have the correct address put on the esky.

When the water sample is taken from the water body, it is essential that **no germs from any other source get into the bottle**. The main outside source of germs will be the EHP's hands. When handling the bottle **do not touch the lip of the bottle or the inside of the cap**. Always try and hold the cap so that the inside faces the ground but never place it on the ground.

Water samples may need to be taken from any one of three different situations:

- Running water from a tap.
- Flowing water such as a river or stream.
- Still water such as a tank, dam or billabong.

Each of these situations requires a different sampling technique.

<u>Water sampling from a tap</u>

(a) Run water from the tap for one minute.

(b) Turn off the tap and sterilise it by flaming it for 30 seconds with a flame from a gas burner or methylated spirits burner.

(c) Run the water again for 20-30 seconds.

(d) Hold the bottle by the base, remove the cap and then take the water sample.

(e) Immediately recap the bottle and place the bottle in its plastic bag.

(f) Place the sample in the esky with a freezer brick. The completed sample submission form can be placed in an envelope in the esky.

Water sampling from flowing water

(a) Remove the bottle from its plastic bag, holding the bottle near the bottom.

(b) Remove the cap from the bottle.

(c) Hold the bottle upside down and lower it into the water to about elbow depth.

(d) Turn the bottle so that the top is slightly higher than the bottom and the lip of the bottle is facing into the flow of water. By facing into the flow of water, germs from the person's hand or arm are taken away from the sampling area. Fill the bottle with water.

(e) Remove the bottle from the water and complete the procedure as for water from a tap.

Fig. 6.31: Water sample from tap.

Fig. 6.32: Sampling flowing water.

<u>Sampling still water</u>

The procedure is basically the same as for running water. The only difference is when the bottle is turned ready to fill, the bottle should be gently pushed forwards to create an artificial flow while it is being filled. The flow of water takes any germs from the person's hand and arm away from the sampling area.

Fig. 6.33: Sampling still water.

There may be a time when an EHP finds it necessary to submit water samples from a swimming pool for testing. This type of water sampling requires a special number of samples to be taken and special transport arrangements. If this type of sampling needs to be done it is important to contact the local EHO to find out the correct procedure.

Sampling water for chemicals

Sometimes the community water supply is tested for chemicals or minerals, such as salts and metals which may have dissolved in it. In this case, it is not necessary to be so careful about not getting germs into the sample bottle. Get the sampling bottles from the laboratories and sample according to these procedures:

(a) Mark the bottle with source, identification, number and date.

(b) Run water for one minute.

(c) Take the sample.

(d) Seal the bottle and fill in the form giving sample details. Sometimes there is no form to fill in and when this happens a letter explaining the sample must be provided.

(e) Send off the sample and letter or completed form. This sample undergoes different tests to those for germs and, therefore, goes to a different laboratory. As there are several laboratories which do these tests, arrangements will need to be made with the laboratory before sampling.

Contact your local EHO or EHP supervisor for information regarding:

- the laboratory to which such samples should be sent
- the transport method
- any costs for testing and transport.

Testing for chlorine

The water in a community tank should be regularly tested for the amount of **free residual chlorine**. If it is not high enough germs in the water may not be killed and the water may not have its chlorine safety buffer against further contamination.

The chlorine level in water is usually tested with a **chlorine test kit**. The most common is a Lovibond Comparitor or a photometer although sometimes a less accurate swimming pool water test kit can be used. Both kits can also be used to test pH (the acidity or alkalinity level) of the water.

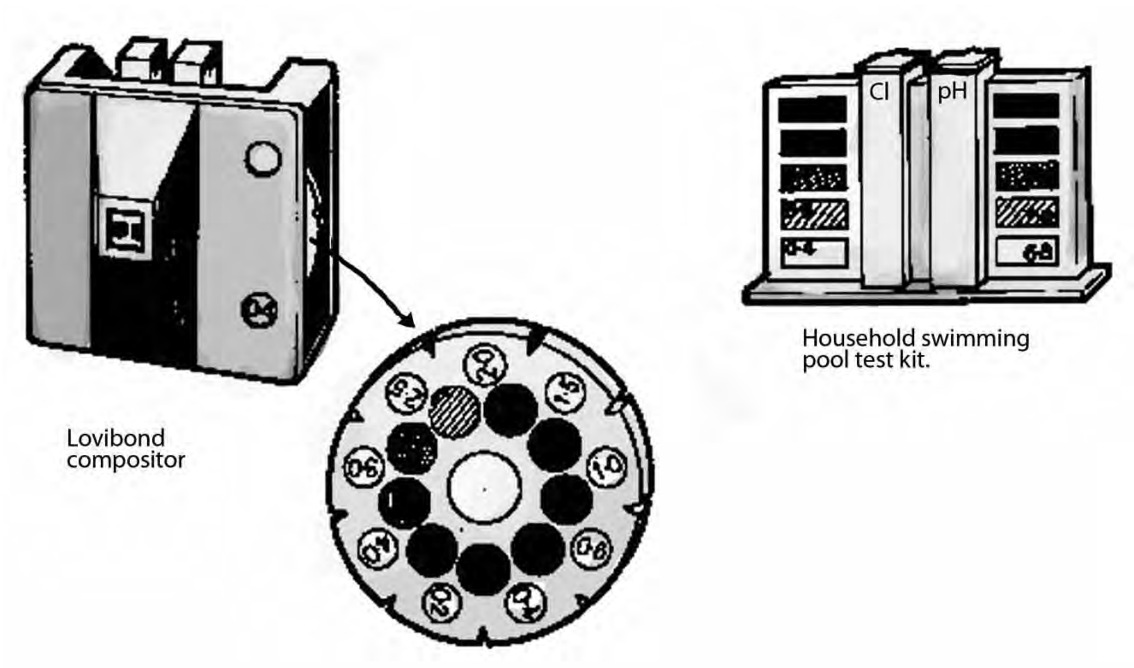


Fig. 6.34: Chlorine level testing kits.

The Lovibond Comparitor has two chambers in the centre for placing the samples of water. However, the swimming pool kit provides results for both chlorine and pH at the same time while the Lovibond requires two steps and a change in test disc. The Lovibond is the more accurate of the two kits.

With either kit, drops of solution or tablets are added to the water samples in the test chambers in accordance with the instructions provided.

Always remember to rinse the sampling chambers with some of the water to be tested before taking the water sample.

The chlorine level in the water can be found by matching the colour in the chlorine chamber to the standard colours alongside it for the swimming pool kit, or on the colour disc for the Lovibond Comparitor. The Comparitor has more chlorine levels but the discs must be changed to read the pH.

The photometer is different from the Lovibond Comparitor. Instead of comparing the colours manually, the photometer tells you how much residual chlorine is in the water. Drops of solution or tablets are added to the water samples in a small tube. The tube is then shaken and inserted into the photometer for a reading.

The recommended concentration of free residual chlorine in drinking water is 0.2 to 0.6 parts of chlorine per million parts of water (0.2 to 0.6 ppm or mg/L). On the Lovibond Comparitor the result will be shown as 0.2, 0.4, or 0.6. This test kit will also have readings of 1.0, 1.5, 2.0, 2.5, 3.0 and 4.0.

6 Treating contaminated water

Chlorine is normally added to the water tank:

- when the germ test shows that germs are present
- as a routine task to maintain the free residual chlorine level.

6.1 TREATING WATER WITH CHLORINE

Safety with chlorine

If a water supply requires chlorination and the system does not have an automatic chlorination plant, chlorine chemical will need to be added regularly to the water in the tank. The chemical, usually a form of hypochlorite, normally comes as a solid. When it is dissolved in water it produces chlorine which kills any germs in the water and provides the safety buffer.

Because chlorine comes in different forms there are different instructions for their use. Also, the dose will depend on the amount of water in the tank and the amount of chlorine already in the water. Chlorine powders usually come in plastic buckets or bottles. Instructions for use are always written on the container. **Always read and follow these instructions.**

Sometimes the instructions for using chlorine are difficult to follow. **Always check with the EHO, the EHP supervisor, Program education staff or the water supplier before using chlorine in a water tank for the first time.**

Chlorine powders are dangerous chemicals and must be used carefully.

There are two dangers associated with chlorine powder:

- The powder and its solution give off chlorine gas. Chlorine gas is very poisonous.
- If the powder gets onto the skin or into the eyes it can cause painful and damaging burns.

The wet powder will also bleach (take out the colour) in clothing.

The following safety precautions should always be taken with chlorine powder:

(a) When working with the chlorine concentrate avoid breathing in the fumes.

Always open the concentrate packet and mix the solution outside in the open air. Never lean close to the open part of the packet or the top of the bucket when mixing the concentrate. Always put the lid back on the concentrate container once the required amount has been removed.

(b) Keep chlorine powder away from children and food.

(c) Do not let the chlorine powder get wet before you mix it with water in a bucket.

(d) Do not add the chlorine powder straight into the water tank. The correct amount of powder should first be dissolved in water in a bucket.

(e) Always add the chlorine powder to the water, never the other way around.

(f) When adding chlorine powder to water in a bucket, add it slowly and stir the water all the time. Avoid splashing.

(g) Keep stirring the solution in the bucket until all the chlorine has dissolved.

(h) If any chlorine does get onto the skin or clothes, wash it off quickly with lots of water.

(i) The container used for measuring out the chlorine powder should be used only for that purpose.

Working out how much chlorine to use

Before starting to chlorinate the water in a tank, the **volume of water** in it must be measured. This is the amount of water in the tank measured in litres or cubic metres.

If the EHP finds these calculations difficult, he/she should check with the EHO, EHP supervisor, Community Nurse or the local school teacher.

It must be remembered that the amount of water in the tank will differ from time-to-time and because of this, the volume of water must be worked out each time the water is chlorinated.

It may also be necessary to allow for any chlorine left in the water from a previous treatment. Before adding any more chlorine, the chlorine level should be measured and taken into account when calculating how much more is needed. For example, if the chlorine level is 0.2 ppm, the amount to be added will be less than if there was no chlorine.

The volume in litres can be worked out in the following way:

(a) Using a stick marked in metres and centimetres measure the depth of the water. Write this measurement down.

(b) With a measuring tape also marked in metres and centimetres, measure and write down the diameter of the tank. The **diameter** of the tank is the distance from one side of the tank to the other side measured straight across the middle. Measure the depth of the water and the diameter of the tank in metres. As the diameter of the tank is not going to change, this measurement can be recorded in the office for future use.

(c) Using these measurements do this sum for a round tank:

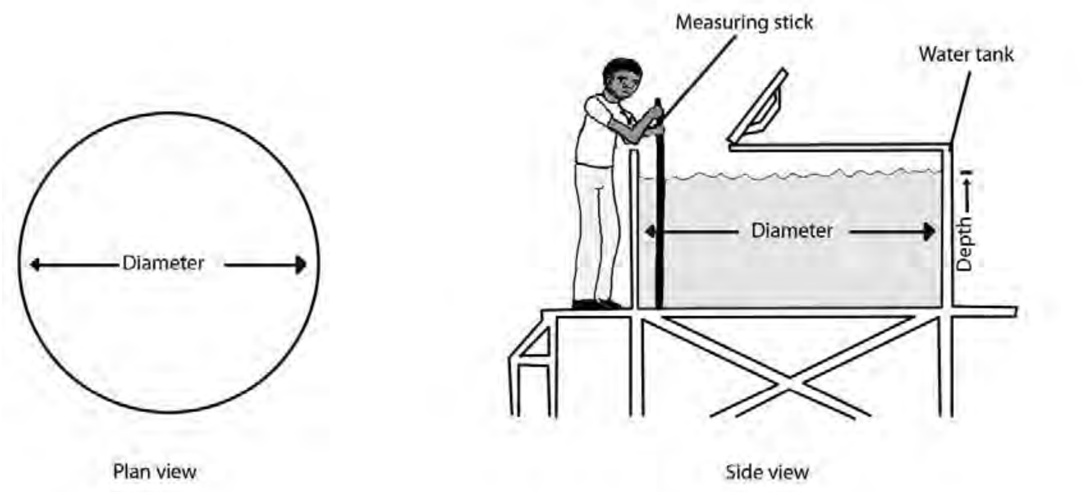


Fig. 6.35: Depth and diameter of tank.

Volume in litres = 785 x depth x diameter x diameter

Example: Depth of water in the tank = 3.5 metres

Diameter of the tank = 3.0 metres

Volume = 785 x 3.5 x 3.0 x 3.0

= 24 727 litres

Note: The factor of 785 used in this calculation is a simplified approximation of usual formula for calculating volume. The result is sufficiently accurate for a round tank chlorination.

The volume of a square or rectangular tank is easier to work out. Measure the depth of water in the tank as before, and then measure two of the sides. In the case of a square tank which sides are measured is not important. However, in a rectangular tank measure a long side and a short side.

Using these measurements do this sum for a square tank:

Volume = Depth x length of one side x length of the same side.

For a rectangular tank the sum will be:

Volume = Depth x length of a long side x length of a short side

Example for a rectangular tank:

Depth of water in the tank = 2.75 metres

Length of a long side = 3.0 metres

Length of a short side = 2.5 metres

Volume in cubic metres = 2.75 x 3.0 x 2.5 = 20.625

There are 1,000 litres in a cubic metre.

Therefore: Volume = 20.625 x 1 000 = 20,625 litres

After the volume of water in the tank has been worked out, the instructions on the chlorine container will tell how much chlorine powder will need to be added to the water in the tank.

Adding the chlorine

Always add the chlorine to the bucket holding the water ready for mixing. Never add the chlorine before the water.

(a) Check the level of water in the tank and work out the volume of water, to find how much chlorine powder will be needed.

(b) Measure out this amount of chlorine in the special container.

(c) Partly fill a plastic bucket with water and get a flat paddle to use as a stirrer.

(d) Slowly add the chlorine powder to the water and stir until it has all dissolved. **Do this out in the open air.**

(e) Take the bucket of chlorine solution to the water tank and slowly pour it into the tank. If possible add small amounts of the solution to different parts of the tank.

It may be necessary to climb a ladder to get to the opening of the tank. If this is the case, the EHP will need a ladder.

(f) If possible stir the water in the tank.

(g) Wait for 2 hours and then test the chlorine level in the tank water to make sure it is near the 0.2–0.6 level.

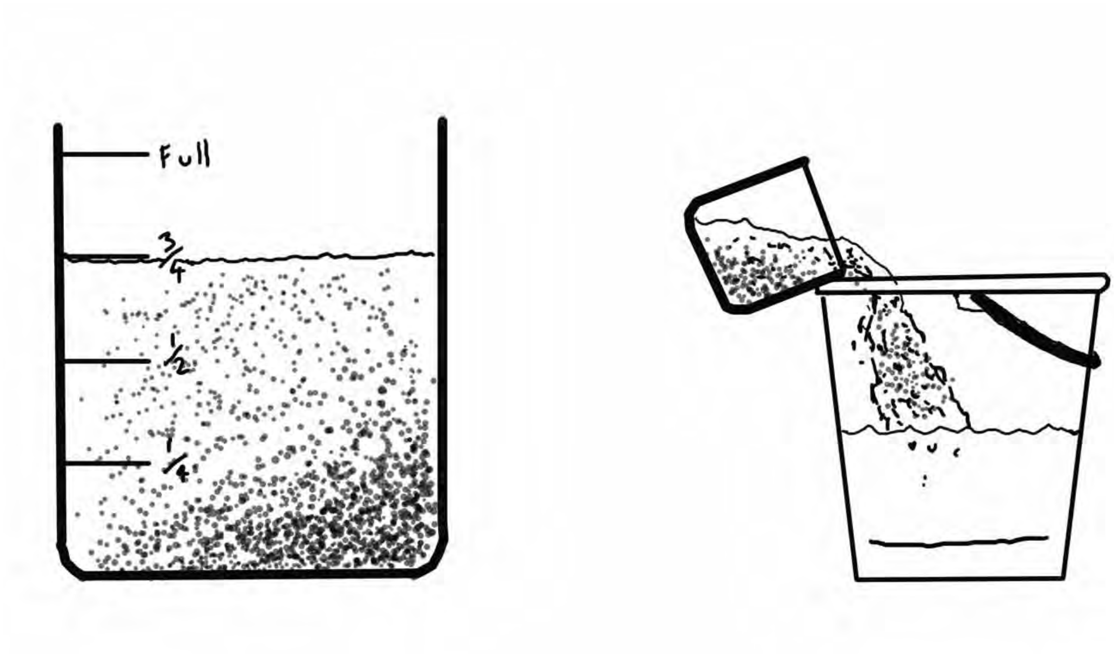


Fig. 6.36: Measuring chlorine powder.

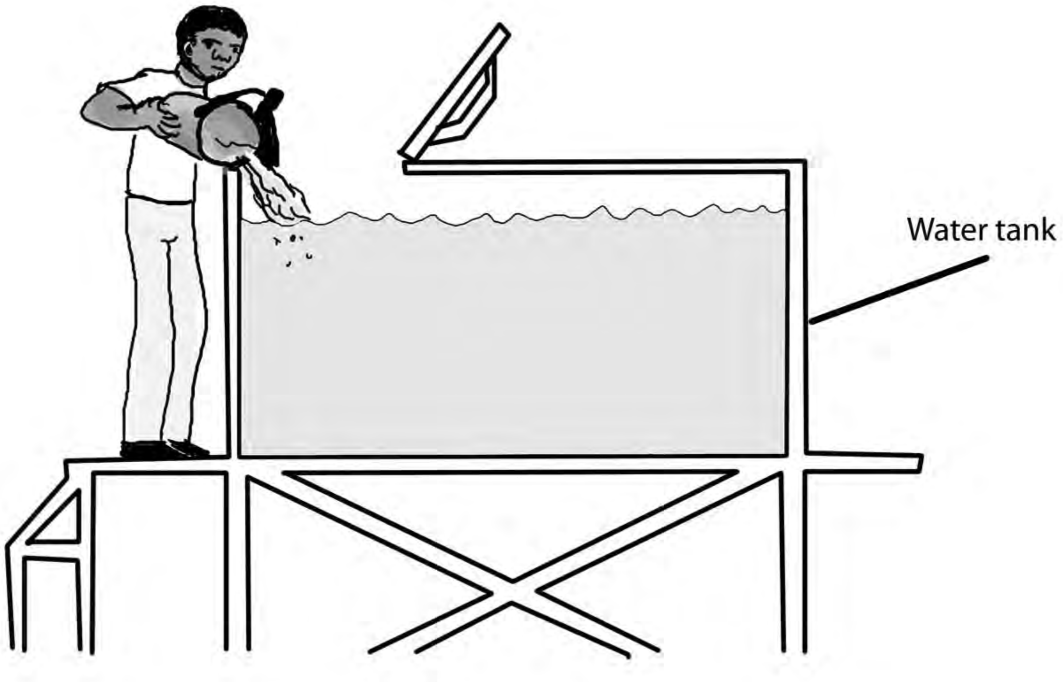


Fig. 6.37: Adding chlorine solution to tank.

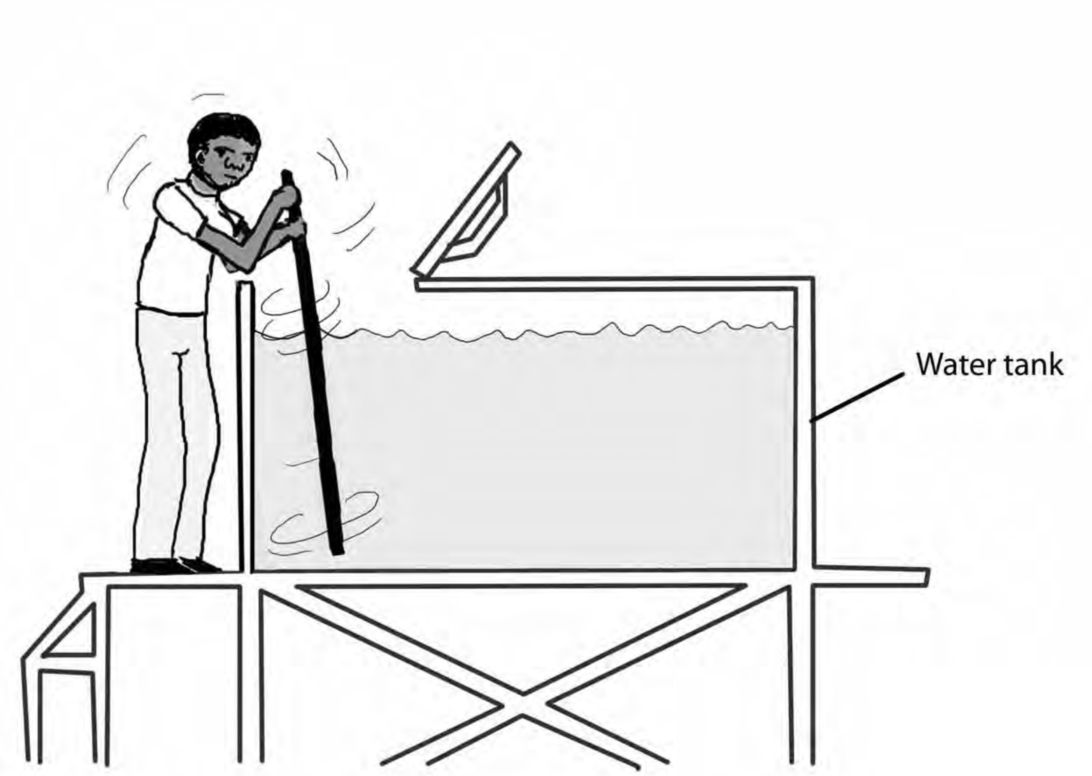


Fig. 6.38: Mixing in the tank.

If the chlorine level is less than the range of 0.2–0.6 ppm more chlorine will need to be added.

Should the chlorine level be above the 0.6 ppm level, it does not present a health problem. The high level of chlorine may make the water taste of chlorine and some people in the community may not like this. If the water is needed for drinking, let it stand in an open container or boil it. This will allow the chlorine to escape. However, if it is going to stand in the open the water must be protected from contamination.

The community may wish to take steps to correct a high chlorine level by topping-up the storage tank if there is room. Another solution to the problem is to allow some of the water to run to waste and then top-up the tank. Check the chlorine level after each of these actions.

Always remember that there should be a free residual chlorine level of 0.2–0.6 ppm after chlorination has been finished. Sometimes however, because of the level of contamination in the water, it may be necessary to add extra chlorine to kill all the germs and to get the required free residual chlorine level.

6.2 TANK CLEANING

Occasionally the inside of the community water tank will need to be cleaned out. This would be necessary if anything happened in the tank to contaminate the water supply. For example, a dead animal may be found in the tank, dust and dirt might be washed into it or slime may have built up on the sides.

These are the steps involved in cleaning out a water tank:

Before the cleaning day

(a) Let the community people know well beforehand that the tank is to be cleaned and that the water will have to be turned off for a few hours. This will allow them to collect enough water to keep them going whilst the water is turned off.

(b) Discuss the tank cleaning job with the water supply agency before commencing the job. The agency can provide any technical assistance especially if the system has an automatic chlorinator. There may be special precautions which need to be taken when the pump is switched off.

If you have any problems contacting the water supply agency, the EHO or the EHP supervisor can help.

(c) Try and plan the tank cleaning job when the tank is nearly empty so that a lot of water will not be wasted.

(d) Organise at least 2 people for the cleaning job. One person to get inside the tank and do the cleaning, the other to watch from the outside as a safety precaution and to assist with the cleaning job.

(e) Make sure all the necessary equipment will be on hand to do the job. For example, a broom with hard bristles, a scrubbing brush, bleach powder, and a shovel. A bucket on a rope may be needed to lift the dirt out of the tank.

(f) Make sure there will be enough water available to rinse and refill the tank after it has been cleaned.

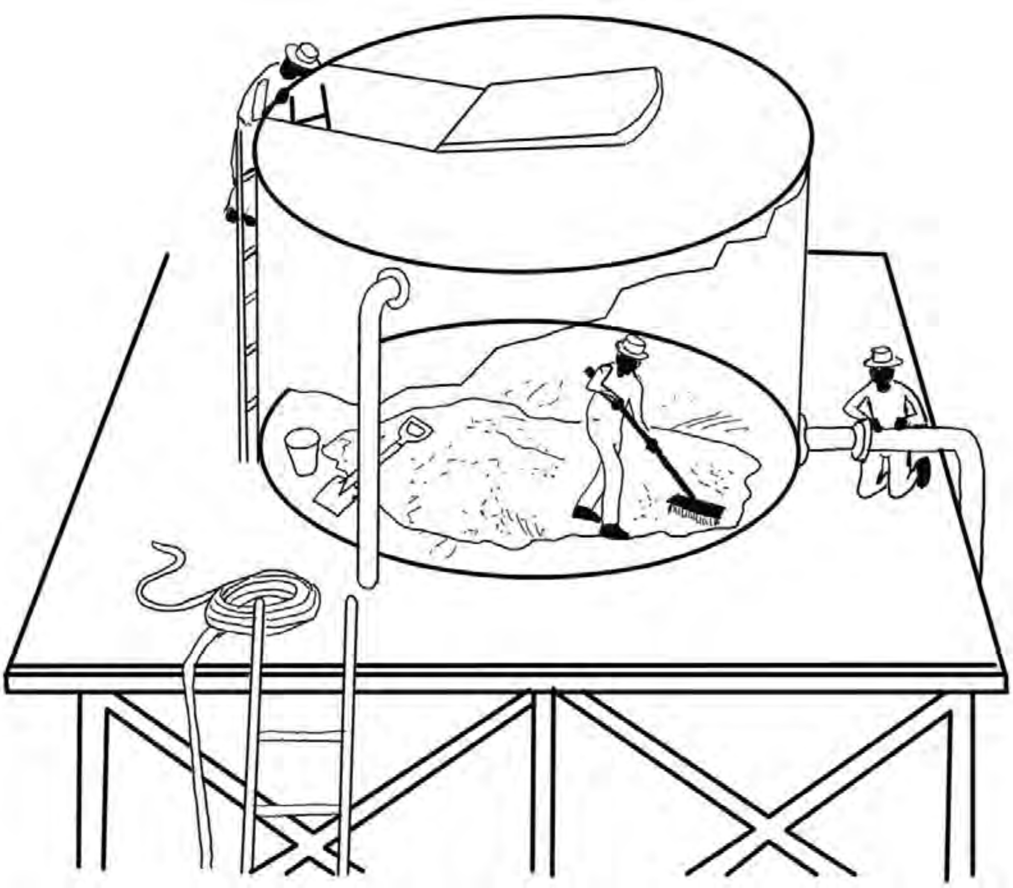


Fig. 6.39: Tank cleaning.

On the cleaning day

(a) Turn off the pump which fills the tank.

(b) There should be no need to turn off an automatic chlorinator. However, follow any instructions given by the water supplier.

(c) Turn off the main tap to cut off water supply to the houses.

(d) Disconnect the pipe which takes the water to the houses. This will allow the water in the tank to run out.

(e) It may not be necessary to disconnect any pipes if the tank has a draining pipe and a valve which can be used to let the water out of the tank.

(f) Empty the tank.

(g) Make sure that the second person is outside the tank all the time the cleaner is inside.

(h) Thoroughly clean all of the inside of the tank. It may be necessary to use a scrubbing brush. Bleach powder may help get rid of dirt and slime which has built up inside the tank.

(i) Thoroughly rinse out the tank with fresh water and allow this water to go to waste.

(j) Reconnect any disconnected pipes and turn on the pump to refill the tank. Turn on the main tap supplying water to the houses.

(k) Make sure the automatic chlorinator is working properly as the tank fills or add the correct amount of chlorine when the tank is full.

7 Water supply plumbing

Before undertaking domestic plumbing repairs, the mains tap must be turned off to cut the water to the house. Every building supplied with water in the community will have a mains tap.

This will need to be done when fixing taps, including replacing washers, repairing split pipes or broken pipe joints.

Taps

One of the most common water supply maintenance tasks is the repair of leaking or broken taps. A tap may require:

- a new jumper washer because the tap leaks from its outlet
- the washer seat to be smoothed because it has become pitted from use
- a new O-ring because the tap leaks around the spindle (handle). However, some new types of taps do not have this O-ring and the tap will have to be replaced.

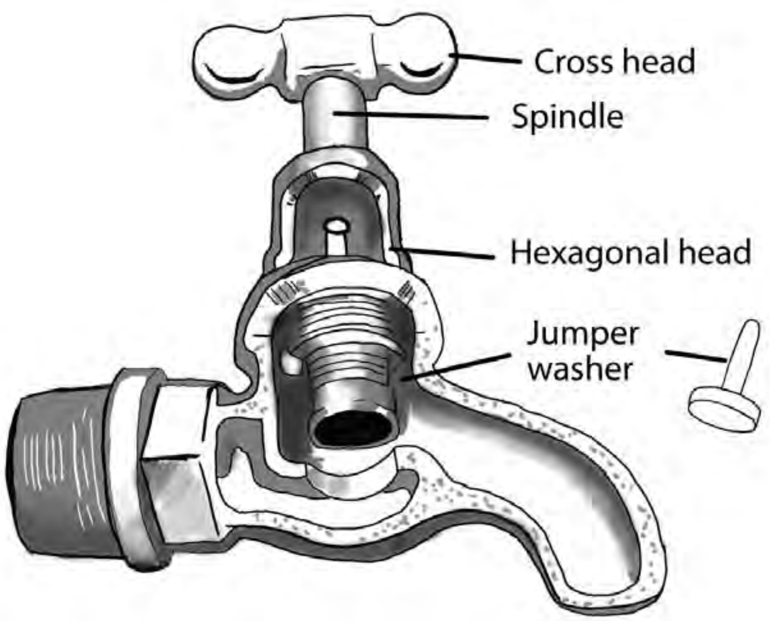


Fig. 6.40: Common domestic tap

The repair of split or broken pipes is another common area of water supply maintenance. This usually requires soldering or welding and/or the replacement of a piece of the pipe.

Leaks in toilet cisterns can be very wasteful of water. However, the repair of these items is covered in Chapter 2—Sewage systems (Section 5).

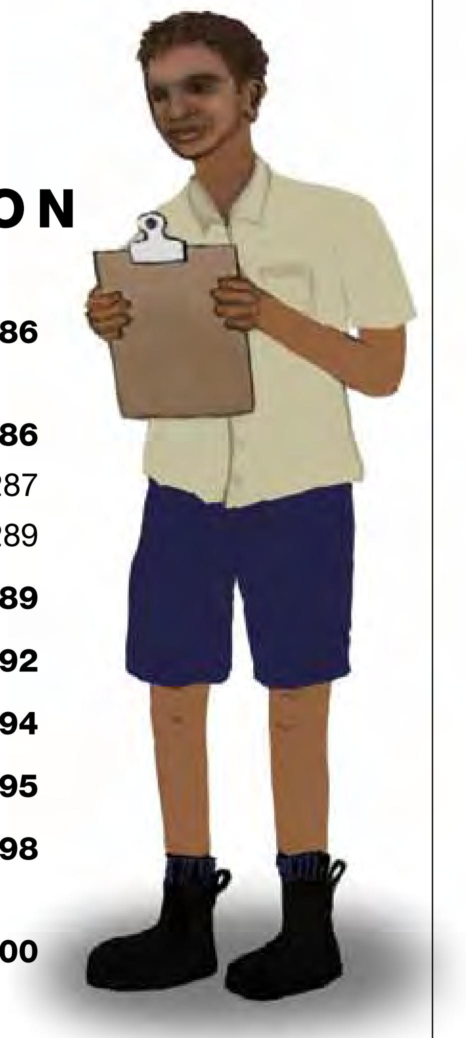
For further information refer to:

- enHealth (http://www.health.gov.au/internet/main/publishing.nsf/content/ohp-environ-enhealth-committee.htm)
- Community Water Planner (http://www.nhmrc.gov.au/publications/synopses/eh39.htm).

Environmental Health Practitioners are encouraged to refer to the *Community Water Planner Field Guide* developed by the Centre for Appropriate Technologies (CAT) under guidance from Water Quality Research Australia. This guide is available online at http://www.wqra.com.au/cwplanner/CWPlanner.htm

EHPs should also be aware of the National Health and Medical Research Council (NHMRC)'s Australian Drinking Water Guidelines which provide advice on what is good quality drinking water. The Australian Drinking Water Guidelines can be found at the NHMRC website (at http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm).

7 ENVIRONMENTAL HEALTH PROGRAM MANAGEMENT AND COMMUNITY EDUCATION



1 Environmental health work

Environmental Health Practitioners can help improve the health of the people in their communities by performing the tasks listed in their duty statement/job description.

The effectiveness of the work of EHPs depends a lot on the support they get from their communities and community councils.

A DVD has been developed by enHealth entitled *"Introduction to Engaging with Aboriginal and Torres Strait Islander Communities: An Environmental Health Resource".* EHPs are encouraged to view this DVD as it showcases many of the issues that need to be considered when planning environmental health activities and interacting with community members. You should be able to get a copy of this DVD from your state or territory environmental health head office.

2 Starting and managing environmental health work

There are two main parts to the management of a community's environmental health program. These are:

The community council's role

This role includes:

- the management of the EHPs
- acting upon the EHPs program plans and other recommendations
- working with the EHP to help make plans and programs effective.

The Environmental Health Practitioner's role

This role includes:

- planning the environmental health program in consultation with the community and its council
- making sure that the plan is carried out
- doing all the routine and special environmental health jobs which are expected of him or her.

2.1 THE COMMUNITY COUNCIL'S ROLE

The council should have a say in deciding which environmental health tasks the EHP is to do and which ones have the greatest importance.

Often the community council will have administrative staff or a coordinator to operate its regular business. The coordinator should supervise or support the EHP's day-to-day work activities.

Before an environmental health program can operate in a community, the people, through their council, must make a commitment to providing the support that is needed to get the job done well.

For any environmental health program to operate effectively, the council must provide the following supports:

Office

The council should provide the EHP with an office. This may be a building or a vacant room. If there is no such space then part of the community's office could be used.

Wherever the office is located, it will need to have:

- office furniture, such as desk, chairs, filing cabinet, waste paper basket, notice and planning boards
- access to a telephone. It is best that a telephone be in the EHP's office, but if this cannot be arranged the EHP will need to be able to use a telephone in the community office. Apart from an office phone, the EHP should have access to a mobile phone for when they are working out of the office
- stationery, such as paper, pens and files.

Tools and Equipment

It is important that the council provides the EHP with the tools and equipment to do the work that is required and a secure place to store them. This could be a lockable shed or room within a building.

A list of tools required by the EHP will be provided by the council. This may include:

- a mop and bucket
- long and short-handled shovels
- metal and grass rakes
- a crowbar
- a hammer

- a masonry chisel
- screwdrivers (small, medium, large)
- a file (half round bastard)
- a cement trowel
- adjustable spanners (small, medium, large)
- a large Stilson Pipe wrench
- multi grips
- a 100mm plunger
- a hacksaw and spare blade
- a tap reseating tool
- a set of manual operation pipe cleaning rods
- a tool box
- a wheelbarrow
- consumable items: washers, suitable 0-rings, tap gaskets, thread tape, PVC glue, grease
- pest control safety equipment: PVC gloves, PVC apron, PVC boots, lightweight overalls, cloth hat, respirator and appropriate canister, goggles
- a whipper-snipper and grass cutter may be considered
- pest control equipment and materials
- dog handling equipment such as muzzles, leashes, slip knot rope.

Some of these items may be made available to community members through a community loan system. Examples of equipment which could be lent under such a scheme would be a wheelbarrow, grass cutter, whipper-snipper, rakes and shovels. Tools and equipment must be stored in lockable secure storage. In communal storage, a lockable cupboard should be provided for EHP equipment. Where this is not available, a lockable shed will need to be supplied.

It is the community council's responsibility to replace stocks of pesticides and other consumables as required.

You can get advice on supplies from the EHO, the Shire or from the EHP trainer.

2.2 THE ENVIRONMENTAL HEALTH PRACTITIONER'S ROLE

In order to do the job properly, the EHP must be well organised. This means that:

- regular maintenance is done
- records and tools are stored so that they can be easily found so that they can be used when needed
- equipment and tools are kept in good working order so that time is not wasted fixing them when environmental health jobs need to be done.

3 Planning the environmental health program

The routine work of an environmental health program must be planned ahead.

Developing a **work plan** allows the EHP to manage his or her time effectively. Without a good plan a lot of time can be wasted and very little gets done.

A work plan is like a road map. It gives people direction in their work. A good plan should show:

- what is going to be done
- when it is to be done
- how it is to be done.

A work plan should also show what equipment, materials and people will be needed so that the work can be done.

Some of the EHP's jobs will need to be done daily and others will need to be done as soon as the problems are reported. As well as this, there will be regular weekly and monthly tasks to be done.

Any EHP's work plan should include:

- an outline of what these jobs are
- the days they are to be done
- the tools and equipment needed for each job.

It is important that the council knows of the plan and approves it and that through the council the community will know what jobs will be coming up and how it will involve them.

From time-to-time there will be emergencies, such as a blocked toilet or a broken sewage pipe, which must be fixed immediately. The EHP's plan must allow some spare time each week so that routine jobs can be allocated new times when emergency work has to be done.

All plans should be worked out so that the jobs can be done within the hours for which EHPs are paid. Otherwise, they may get discouraged when they cannot get the work done or when they are doing work for which they are not being paid.

Yearly plans

It is a good idea at the beginning of a year to plan when all the major tasks, such as dog treatment and checklisting, will be done during the year. These jobs can then be marked on a special chart on which blank spaces are provided for each month of the year. This is called a yearly planner. The jobs to be done are written in the space on the chart at the date on which they are to be done.

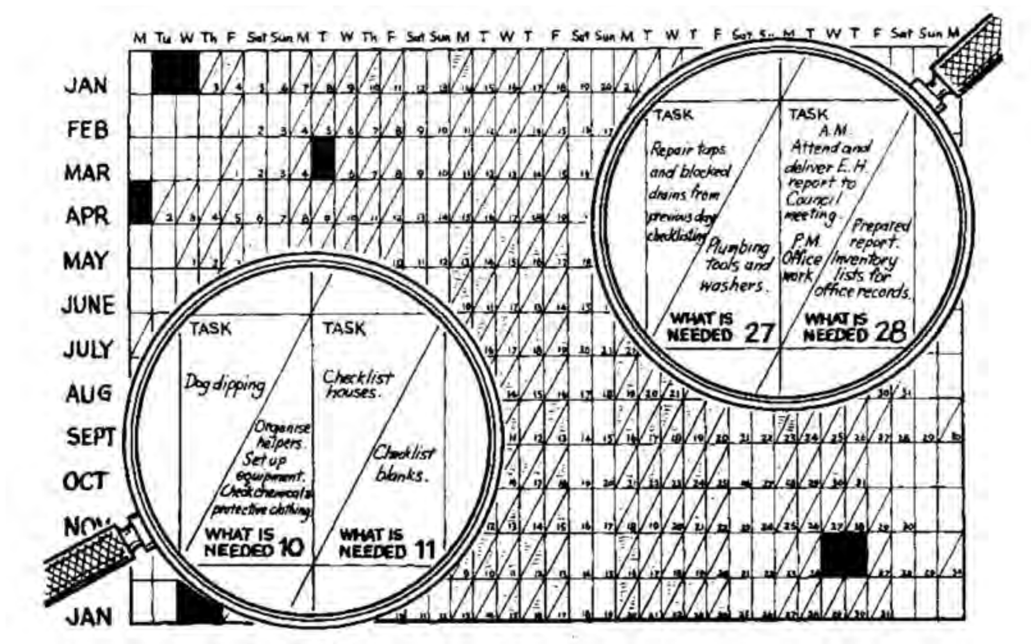


Fig. 7.1: Yearly planner.

Weekly plans

Weekly plans also should be prepared. These plans contain the routine and major tasks (from the yearly planner) which the EHP decides to do on each day from Monday to Friday and the times at which they are going to be done. At the end of each week, the weekly plan for the following week should be prepared.

Planning an environmental health work program for a community requires a lot of thought, especially if it is a large community or there is need to plan the work of more than one EHP.

The planning process will need to include:

- consultation with the community and its council on what they think should be done
- all the routine environmental health work which the EHP knows must be done, for example, checklisting, dog dipping and rubbish collection.

The routine work must be accepted as being important by the council and must take priority (first place) over any additional non-emergency tasks the Council may wish to be done.

It is the EHP's job to prepare the plan and explain it to the council. The EHP may, at times, need to convince the council and other people in the community about the importance of completing priority tasks before tackling others.

It is important to follow the work plan. There are many ways to plan a work program and these suggestions may be useful:

(a) The EHP will need to think about:

  » All the environmental health facilities that need to be checked. For example, sewage lagoons, rubbish tips and water tanks; and

  » Any environmental health problems which have been reported by the community or noted during checklisting will also need to be included.

  This information can be used to make decisions about:

  » What tasks need to be done and how often; and

  » How much time needs to be left to deal with unexpected problems which have been reported or found. These decisions are placed on the planner showing when they are to be done. Time should be left on the planner for emergency jobs.

(b) If there are several EHPs, they should meet regularly to discuss the work that needs to be done and who is going to do it.

(c) Routine tasks which must be included in the plan include:

  » checklisting

  » equipment inventories and maintenance

  » regular environmental health jobs. For example, checking sewage lagoons and rubbish tips, pest control operations and dog dipping

  » health education/promotion activities

  » ordering replacement materials, such as pesticides, plumbing parts

- office duties, such as filing, completing records, including daily timesheets and diaries
- reporting to council and attending meetings
- maintaining contact with the Environmental Health supervisor and/or the local EHO.

Meetings should be held at the start of most working days to work out the details of how and when the jobs listed on the plan will be done.

4 Checklisting

When an EHP goes out and looks for problems he/she will need to complete the **checklist** for each building or facility visited. This is called **checklisting**.

Every yearly plan and many weekly plans will need to include tasks related to checklisting.

This is a very important part of the work. Often people will not report problems such as leaking taps. Sometimes people do not even know there is an environmental health problem.

Checking for problems, through checklisting, is important if the community and its environment are to be kept clean and safe.

How is checklisting done?

Checklist forms are used to record the problems as the EHP finds them in the community. The checklist forms can be used on:

- dwellings
- toilet blocks
- sewage ponds
- rubbish tips
- other community facilities, such as playgrounds, stores, community hall, roads, streets and general areas.

The checklist form contains a list of all the environmental health items in a house or other facility. For example, a house checklist will include plumbing, hygiene matters, pests, rubbish, structural conditions and provide a space for the EHP to record any other comments. Space is provided on the form for the EHP to show problem items with a mark.

When an EHP finds a problem, he/she should mark the form by placing a tick or cross against the problem item. The EHP should use the information on the checklist to:

- plan his/her work
- provide reports to the community
- keep records of environmental health problems.

Checklisting requires the EHP to visit people's houses and other community buildings. It will be necessary to get permission from householders and the Council. It is also important to let them know when checklisting is to be done.

The EHP may have to stop during checklisting to fix an emergency problem.

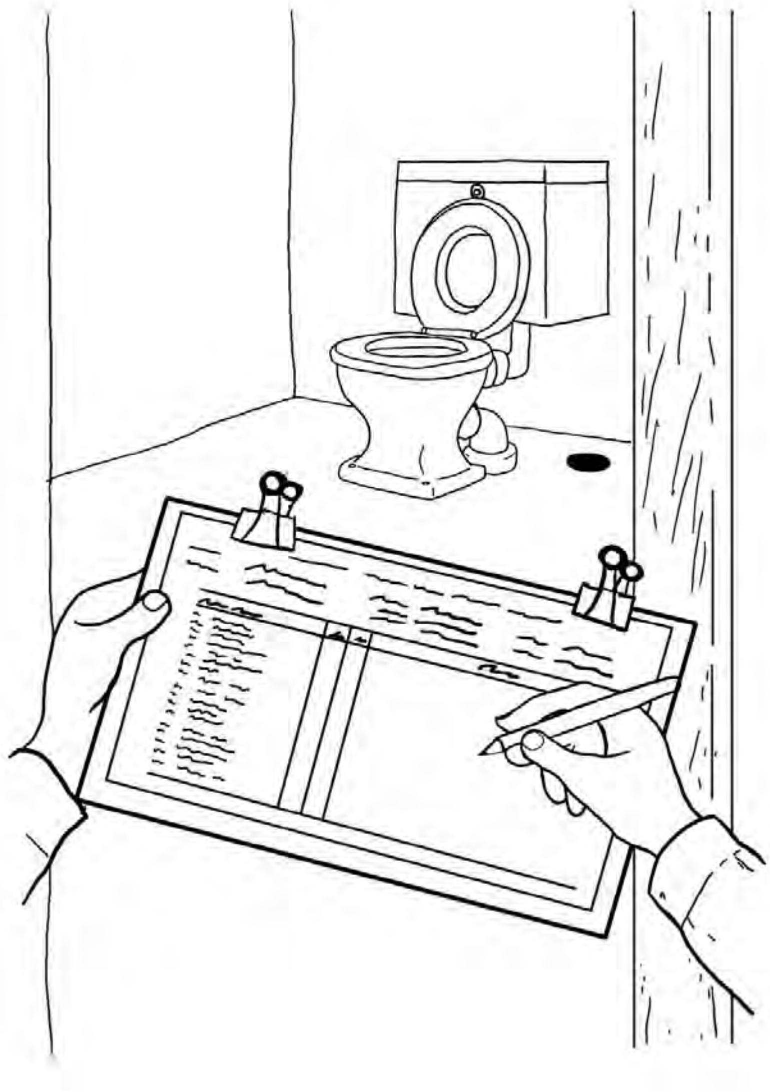


Fig. 7.2: Checklisting.

Once the checklists have been filled out it is very important that the EHP:

- uses them to plan what work needs to be done. All jobs which need to be done should be written on the planner and special note should be made of tasks which need to be done urgently
- makes sure that the problem gets fixed, even if it means organising a contractor to do the work
- files the checklist in the filing cabinet after the jobs have been written onto the planner.

It is important to keep the checklists as they will provide the EHP with the past history of environmental health problems at a particular place. Checklists should be filed under their location, for example, 'House No. 6', 'Southern Toilet Block'.

How often should checklisting be done?

Checklisting should be done at least twice a year. However, if the community has lots of environmental health problems, checklisting may have to be done more often until all the problems are found or controlled.

5 Getting the job done

Planning and checklisting are important jobs, but it is even more important that the EHP gets the work done. That is, that the EHP fixes the environmental health problems. This is the only way to make sure that the problems that cause disease or poor health are removed or fixed.

How much work should an EHP do?

The EHP must work the required hours for which he/she is paid. The amount of work which needs to be done may, unfortunately, need more time to finish than the hours for which the EHP is paid. When this happens, the EHP must do the priority (most important) work first and advise the EHP supervisor of the need for extra help.

If the workload remains high, the community may need to consider paying the EHP to work more hours or increase the number of EHPs.

The community may also need to assist by providing workers to help:

- with emergency work
- when the EHPs are busy or
- when the work calls for a team of people, for example, a dog treatment program.

Remember, there are some tasks where the EHP organises or provides advice about the work, but is not responsible for actually doing all of it him/ herself. Such work includes community clean-ups and routine domestic cleaning.

6 Reporting

Reporting is very important because it lets people know what the EHP is doing or has done, and tells them about the environmental health problems in the community.

This can be done by giving:

- **verbal (speaking) reports** to the council, at community meetings, to the Environmental Health supervisor or to the local EHO, and EHP education staff
- **written reports** to the council, to the Environmental Health coordinator of your region and to other agencies identified in an employment contract, such as the coordinator of state or territory Indigenous Environmental Health. Written reports are also important to keep as office records on community environmental health matters.

Written reports need only be short. They should describe:

- the environmental health work being done
- any difficulties being experienced and include suggestions for improvements and/or requests for assistance when needed.

All reports and letters should be dated and signed by the EHP and a photocopy or carbon copy made and kept in the file.

This is a list of some of the important people/agencies to whom the EHP should report.

The community and its Council

This should be a regular task and be done at council or community meetings. By talking at these meetings, the EHP will keep people informed on what is happening so that the community can support the environmental health work. By doing this, the community will also get to know the EHP.

Fig. 7.3: Reporting to community Council.

The Environmental Health supervisor and the Environmental Health Coordinator of your region

It should be a regular task to maintain contact with these people. It is important to tell them about current environmental health activities and to seek technical support, information and assistance when needed. This contact can be made by telephone or during routine visits.

Fig. 7.4: EHP working with EHO.

Indigenous Environmental Health Practitioner teaching staff

Contact with teaching staff is usually made during their routine visits to the community or by telephone. These people can assist the EHP:

- on matters relating to training and running community education sessions
- by providing assistance with getting technical information from health officers and EHP supervisors
- by keeping EHPs up-to-date with courses and in-service training.

Fig. 7.5: Reporting by telephone.

Other agencies

Other agencies which have a direct interest in environmental health matters in the community should be informed on issues which specifically concern them.

These agencies may include the Shire (local government) or the relevant Department of Health.

7 Office work

Office work includes tasks such as:

- completing and/or correcting work plans
- filing
- preparing reports
- routine telephone calls
- ordering supplies and equipment
- preparing correspondence (letters)
- filling out rosters and diaries
- taking inventories of tools and equipment.

Fig. 7.6: EHP's office.

The filing cabinet should be divided into labelled sections for the purposes of filing the EHP's records and copies of correspondence. It is much easier and quicker to find records if each section in the filing system and each file within each section is placed in correct alphabetical or numerical order in the filing cabinet.

There should be one section for checklists. This section can be divided into smaller sections—one for each house or group of houses, such as 'Houses 1 to 5', and community buildings and facilities, such as 'Community toilet blocks'.

There should also be other sections in the filing cabinet for papers which relate to tools, equipment and materials, correspondence, orders, rosters, and plans.

Filing should be done at least once a week, and the office should be kept clean and neat.

8 Maintenance and storage of equipment and tools

the EHP is responsible for making sure that all tools and equipment are well organised and maintained in good working condition. They should be stored in a separate secure place so that they are safe and easy to find. This is usually best done in a place which is separate from the office.

Lost tools are expensive to replace and much time can be wasted if they are not available and ready to use when needed.

It is usual for those who have responsibility for looking after tools, equipment and materials to keep an **inventory** (list) of these things.

The EHP should check off the inventory regularly and if any items have been loaned out and not returned, he/she must get them back. Breakages and losses and materials which have been used up should be reported to the community council administration and requests made to replace them.

It is a good idea to have a tool box equipped with the necessary plumbing tools and materials (washers, thread tape, O-rings) ready to be picked up and taken to a job.

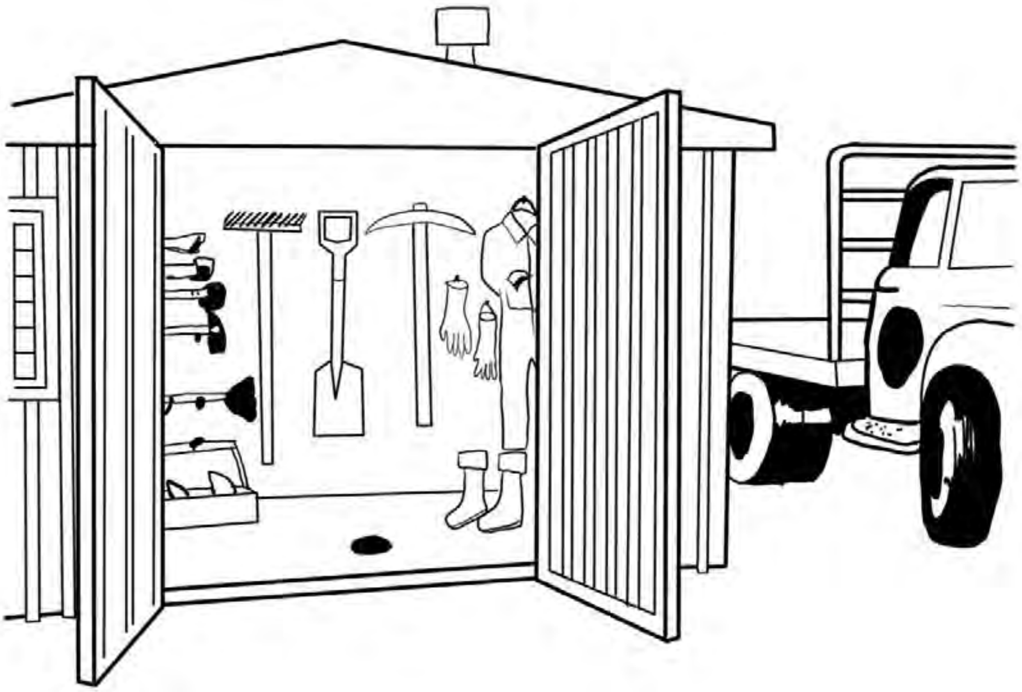


Fig. 7.7: Tool and equipment shed.

9 Community environmental health education

Educating the people in the community about environmental health is an important responsibility for the EHP.

Education sessions should be frequently and routinely held in the community. These might be held in the school, during community meetings or at individual houses.

Education activities should be planned well in advance and always written on the weekly and monthly planners.

How to undertake community environmental health education is described in the following sections.

9.1 WHY COMMUNITY EDUCATION IS IMPORTANT

Often, people do not understand the ways in which environmental conditions affect their health and therefore, don't know why they should have good environmental health practices. If this happens the work of the EHP may not be effective.

The best person to help people to understand about the importance of environmental health is the EHP.

Environmental health work will receive a much better response from the community if the people understand why the work is being done and how it is likely to improve their health. For example, by explaining that dog dipping is being done because it will result in less scabies and skin infections.

It is very important to teach people about the germ theory, parasites and the way that diseases spread, so that they understand why they should practise good environmental health.

It is also important to teach people how to practise good environmental health so that they know what to do to keep themselves, their homes and their community healthy.

9.2 HOW TO TEACH ABOUT GOOD ENVIRONMENTAL HEALTH

People can learn from:

- verbal (spoken) explanations
- demonstrations (being shown)
- observing (looking at) what others do
- getting information from books, posters, videos, pamphlets and other printed materials
- working things out for themselves.

People **do not** learn well when:

- they do not have the desire to learn
- they are not physically fit, such as when they are sick or tired
- they are emotionally upset, such as when they are angry or frustrated
- when the teacher does not explain things clearly.

People **do** learn best when:

- they want to learn
- things are explained clearly in words they understand
- they feel happy when they are being taught
- they are rewarded when they show that they have learnt what they have been taught. People are usually rewarded when they are praised for their efforts
- things are explained or shown to them a number of times and in a number of different ways
- they have the opportunity for actual hands-on practice, for example, dog treatments and plumbing repairs
- they are not distracted by other things going on around them.
- pictures and diagrams are used to explain difficult ideas
- they can use what they have been taught in their communities and homes
- they can understand the benefits their knowledge will have for them and their community.

EHPs need to understand that people often do not put into practice what they have been taught. This may be because they have not listened properly to the teacher, they have forgotten what has been said or they have not understood.

Even after people know what should be done and why, they often take quite a long time to change their poor environmental health behaviour. This may be because they:

- may not understand that practising good environmental health is important for them
- do not want to appear different to other people
- think it is too much trouble
- do not have the money to buy the necessary equipment
- do not have the confidence that they can change their behaviour. This often happens when people do not think much of themselves
- think other things are more important than health.

EHPs must have patience when they are teaching.

Preparing to teach about environmental health

Before an EHP teaches anything about environmental health to people in the community it is important that the following points are considered.

- It is important that the EHP fully understands what he/she is teaching.
- If an EHP does not fully understand the facts, it is highly unlikely that the learner/s will be able to understand either.
- An EHP **can find out what needs to be taught** by talking to the community to find out about their special needs, or by reading books, pamphlets and course notes on the topic and asking Environmental Health supervisors, Program teaching staff or an EHO.
- Regardless of where the lesson is being given, it will need to be **planned** to make sure that everything that needs to be done will be done.

A lesson plan should:

(a) Have clear objectives.

The EHP should work out **what** it is that needs to be taught, to **whom** and by **what date**.

Example of an objective:

At the end of the lesson, the Year 7 class will understand the causes, effects on health and prevention of scabies.

(b) An outline of the steps to be taken to meet the objectives.

Example:

» Tell the class what scabies are, where they live, how they breed and how they affect people's health.

Teaching aids: Poster, audio-visual presentation

» Tell the class how to get rid of scabies. This would include telling them about the special medicated skin wash which kills scabies, washing clothes, washing and airing bedding.

Teaching aid: Poster, sample of scabies treatment

Practical demonstration: Washing and airing clothes and bedding

» Get the group to discuss how they can apply what they have been taught. Encourage them to talk about any difficulties they may have and work with them to find solutions.

9.3 TEACHING AIDS

Teaching aids are things which help the teacher explain what needs to be taught.

The best teaching aids for the EHP to use are pictures which can help him/her explain what needs to be taught. There are different kinds of teaching aid which have pictures. Examples are flip charts, client one-to-one cards, teaching posters, videos and DVD's, PowerPoint presentations, slides, overhead transparencies and stickers.

Flip charts

These consist of a number of cards with pictures on them bound together in a single file. Each chart is designed to help communicate one or two facts. All the charts together should provide enough information to allow the learner to understand the basic facts about a particular topic, for example, how to get rid of scabies.

Flip charts can be used for teaching from one to about ten people and are particularly helpful when teaching people who cannot read. The message is explained verbally as people look at the picture.

Fig. 7.8: EHP using a flip chart to teach children.

Client one-to-one education cards

These are single cards which are designed to provide the basic facts about a particular topic, such as how flies cause disease. Each card has a number of illustrations which together provide the information which needs to be taught.

These cards are used for teaching only one or two people and are designed to teach people who cannot read.

Posters

These are large pieces of paper which can be pinned up on a wall and which contain pictures and words about a particular topic, such as trachoma. The poster usually does not have many words and it should be possible to understand the message from the pictures.

All the information on a poster should be able to be seen from some distance away and it should be attractive enough to catch people's attention long enough for them to take in the message.

There are **teaching posters** and reinforcement **of message posters**.

Teaching posters are designed to help teachers explain what they want people to understand and learn.

Reinforcement posters are specially designed to remind people of certain important health messages which have already been explained to them.

After people have been taught the health messages in a poster, copies should be pinned up in places where they are likely to see them over and over again. For example in the clinic, community office, community hall, school and shop.

Videos and DVDs

Videos and DVDs are used to teach people new information or to remind them about health information that has already been explained to them.

Videos and DVDs are especially useful when the teacher is trying to encourage a group to talk about the subject which is being taught. For example, the teacher can ask the people in a group what they think about something which has happened in the video or DVD, such as an EHP doing checklisting. He/she can then ask them what they think the EHP is doing and why. The teacher can then go on to discuss with the group their willingness to have an EHP checklist their home.

Health messages can also go out to a lot of people when videos are shown on local community television.

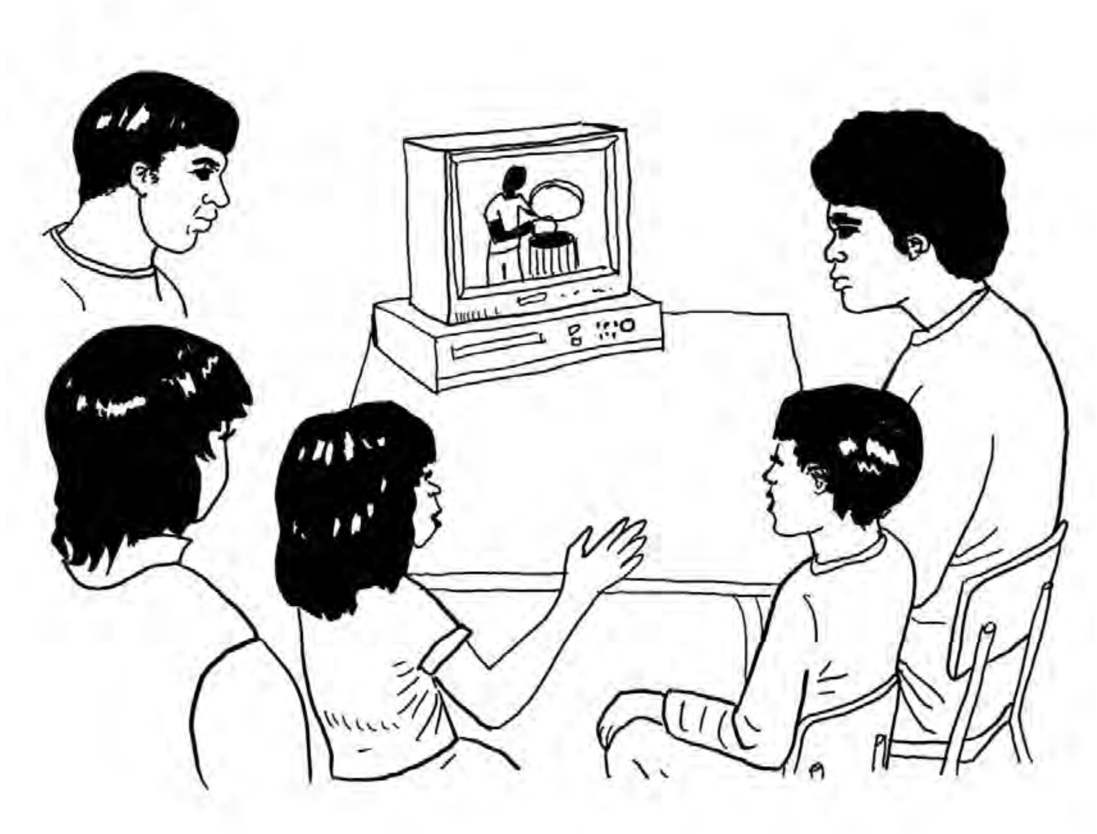


Fig. 7.9: Family watching environmental health video/DVD.

Normally, people do not learn facts from just being shown a video or DVD. They need to have things explained by the EHP as well. They also need to talk about and practise what they are taught.

PowerPoint presentations, slides and overhead transparencies

If there is a projector for PowerPoint, slides or transparencies and electric power in the community, these media devices can be used to help get health messages across to large groups of people.

These are expensive education aids and usually can only be borrowed from an education resource centre.

Stickers

Stickers are used to remind people about important health messages. They are often displayed in places where EHPs want people to put into practice something which they have been taught. For example, a sticker reminding people to put rubbish in a bin can be placed on a rubbish bin near where people drop a lot of litter.

Fig. 7.10: Environmental health stickers remind people what to do.

9.4 DEMONSTRATIONS AND PRACTICE

In addition to using teaching aids, a very good way of teaching people good environmental health practices, such as dog dipping, is by showing them the right way to do things. This kind of teaching is called **demonstrating**.

This method is particularly effective when the teacher also gives the learner the opportunity to **practice** what has been demonstrated. People learn better when they do the job themselves. For example, after showing how to dip a dog, encourage the learner to actually dip the dog him or herself.

Fig. 7.11: Demonstrating environmental health maintenance.

It is often a good idea to show people that good environmental health practice improves health. For example, an EHP and the Community Nurse may have run a program to get rid of scabies in the community. This program may have included screening for scabies, the treatment of affected people, dog dipping and education about the causes, health affects and prevention of scabies.

To be able to show that this program has worked, the EHP could ask the local Community Nurse to work out from the clinic records how many people came in for scabies treatment, including infected sores:

- during the month before the program started
- during the month immediately following the finish of the program.

If the program has been done well, there should be a drop in the number of people going to the clinic for treatment connected with scabies. If this has happened, it is important to tell the community about it.

9.5 WHERE TEACHING CAN BE DONE

EHPs can teach community members in different places. Here is a list of some of them:

Community meetings

Whenever the EHP thinks that community members need to know about an environmental health problem in the community, he/she should tell them about it at a community meeting. The EHP should tell them about the causes of the problem and what can be done to fix it. When the people know these things they will be in a good position to make decisions which will improve the situation.

People's houses

There are many times when an EHP will need to explain things to individual family members. Some teaching needs to be done with great care so as not to shame people. If there is any chance of this happening, it is best to visit their homes and talk to them on their own.

While working in communal areas

EHPs can often find opportunities to talk to people about environmental health matters when they are just having friendly chats with them outside the store, their homes, around camp fires at night or in the streets.

These times are good for telling them about the work EHPs do and why they are doing it. This helps them understand better the need for a clean healthy community.

Whenever possible the EHP should correct children who are seen to be behaving in a way which is likely to cause the spread of disease-causing germs and parasites. For example, they should be corrected when they litter, do not wash their hands after going to the toilet, play near leaking sewage pipes, or break water equipment. The more this is done in a friendly way, the better children will learn.

The school

EHPs can make arrangements with the school to teach environmental health topics to children.

It must be remembered that teachers work out their teaching programs well ahead of time, so it is wise to make these arrangements early in the school year. At the same time, talk to the class teacher about what needs to be taught and make sure that it fits in with his/her teaching program.

EHPs can offer to give talks in the classroom or to teach by taking students into the community and showing them how to recognise environmental health problems and the steps they can take to get them fixed.

10 Community development

The Indigenous Environmental Health Program is a **community development program**. That is, it is designed to help Indigenous people take charge of their community's environmental health management. It is about encouraging people in communities:

- to decide for themselves what needs to be done
- to take action to see that it is done.

It is the job of EHPs to encourage their fellow community members to make these decisions and to take the necessary action.

It will not be easy work because often people will not understand why environmental health is so important. The EHP will need to have a lot of patience and understanding. There will be times of frustration and disappointment. This is always a part of community development work because people, regardless of who they are and where they come from, are not quick to change their old ways. Eventually when people see that they stand to benefit greatly when their homes and communities are clean healthy places in which to live, they will start to change. For the EHP this can be very rewarding.

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