

# Cleaning and disinfection of pipelines

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## *Why is it important to disinfect pipelines ?*

When a pipeline is laid or upgraded, some contamination almost always gets into the pipes from the soil, mud and water in the trench, and from the feet or boots of the workers who are laying or repairing the pipeline. It is important to kill any germs which are in the pipeline before it supplies water to the community.

Where the source of water is a spring, germs from latrines or animal excreta sometimes seep into the soil and get into the spring, even though it may be a long way from these sources of contamination. In these cases, it is difficult to find out where the contamination is coming from and the germs have to be killed by putting disinfectant into the spring every day. Whatever the source of water for a piped system, the water may need continuous treatment and disinfection in order to provide a safe drinking water supply.

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## *Making up a chlorine solution*

There are various ways of disinfecting pipelines, but the most common is to use chlorine. The two forms of chlorine suitable for disinfecting pipelines are calcium hypochlorite and sodium hypochlorite. These are described in Fact Sheets 2.19 and 2.20.

Normally, a 0.2 per cent solution of chlorine should be made up using either sodium hypochlorite (liquid bleach) or calcium hypochlorite (HTH).

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## *Safety for operators handling chlorine*

The operation and maintenance of equipment for dosing of chlorine from cylinders should only be undertaken by trained and authorized personnel.

Chlorine is a hazardous substance. In solution it is highly corrosive and splashes can cause burns and damage the eyes.

When handling concentrated chlorine solutions, appropriate precautions should be taken. Ideally, gloves and protective eye glasses should be worn. In the event of splashes and especially splashes to the eyes, it is important immediately to rinse thoroughly with water.

All containers in which chlorine is stored should be labelled, identifying the contents, and with a hazard warning in a form which is readily understood locally.

Storage sites for chlorine in any form should be secure against unauthorized access and especially against children.

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## *Sodium hypochlorite or liquid bleach*

Liquid bleach is normally bought in bottles or sachets. Check that the contents are sodium hypochlorite and water only. The normal concentration of chlorine in liquid bleach is five per cent, but this may be lower if the bottle has been opened or stored for a long time (Fact Sheet 2.20 gives further details). Make up the solution as described in Box 1.

### **Box 1. Using sodium hypochlorite (liquid bleach) to make a chlorine solution**

- Fill three plastic buckets with clean water to about 5 cm from the top to allow for the bleach to be added. Most commercially available buckets hold 12.5 litres, but the quantity of water should be checked.
- Add enough liquid bleach to each bucket to make up a 0.2 per cent solution of chlorine.

Example : Capacity of bucket, 12.5 litres water = 12500 millilitres.

Need 0.2% or 0.2 grams of chlorine per 100 millilitres of water,

therefore  $\frac{12500 \text{ ml}}{100 \text{ ml}} \times 0.2 \text{ grams} = 25 \text{ grams}$  chlorine is needed per bucket.

Liquid bleach is assumed to contain 4% or 4 grams of chlorine per 100 millilitres,

therefore  $\frac{25 \text{ grams}}{4 \text{ grams}} \times 100 \text{ millilitres} = 6.25 \times 100 \text{ millilitres} = 625 \text{ millilitres}$  of

4 grams liquid bleach must be added to 12.5 litres of water to make a 0.2 per cent solution of chlorine.

So, 625 millilitres of liquid bleach must be added to each bucket of water.

- Mix the water and bleach well, before use.

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## *Calcium hypochlorite or HTH*

Calcium hypochlorite or high test hypochlorite (HTH or HTHC) comes as white granules and can often be bought from a local ministry of health office or from commercial warehouses and pharmacies. Calcium hypochlorite is much stronger than liquid bleach and does not lose strength so quickly. Calcium hypochlorite comes in various forms which can have from 20 to 70 per cent chlorine. Fact Sheet 2.19 covers calcium hypochlorite in more detail.

The best type of calcium hypochlorite to use is high test hypochlorite (HTH or HTHC), as this normally contains 50 to 70 per cent chlorine. Always check with the supplier or on the side of the container to be sure of the percentage chlorine content. Make the chlorine solution as described in Box 2.

**Box 2. Using calcium hypochlorite to make a chlorine solution**

- Fill three plastic buckets with clean water to about 5 cm from the top to allow for the calcium hypochlorite to be added. Most commercially available buckets hold 12.5 litres, but the quantity of water should be checked.
- Add enough calcium hypochlorite to each bucket to make up a 0.2 per cent solution of chlorine.

Example : Capacity of bucket, 12.5 litres water = 12500 millilitres.

Need 0.2% or 0.2 grams of chlorine per 100 millilitres of water,

therefore  $\frac{12500 \text{ ml}}{100 \text{ ml}} \times 0.2 \text{ grams} = 25 \text{ grams}$  chlorine is needed per bucket.

If calcium hypochlorite contains 50% chlorine or 50 grams of chlorine per 100 grams of powder, then 25 grams (the amount of chlorine needed per bucket) is contained in

$\frac{25 \times 100}{50} \text{ grams} = 50 \text{ grams}$  of powder.

Therefore, 50 grams calcium hypochlorite must be added to 12.5 litres of water to make a 0.2 per cent solution of chlorine.

So, 50 grams of calcium hypochlorite should be added to each bucket of water.

- Mix the water and calcium hypochlorite well and leave to dissolve for an hour. Some white sediment will sink to the bottom of the bucket ; only the clear liquid should be used to disinfect the pipeline and the sediment should be thrown away.

## *Cleaning and disinfecting pipelines*

When laying pipes, each pipe should be washed well with clean water to remove any soil or other material. A nylon bottle brush on a long wire handle can be used to remove soil which is stuck in the pipe and to give the pipe a good general clean-out. A solution of 0.2 per cent chlorine can then be used to rinse out each pipe just before laying in the trench.

When using PVC pipes, make sure that the ends of the pipes to be joined are dry or the PVC cement will not work properly and may cause pipes to leak later.

If pipe laying is stopped for any time, for instance, during workers' breaks or overnight, the open ends of the pipeline should be plugged with a clean wooden or rubber bung to stop animals or dirty water getting in.

When the pipeline is completed, it should be filled with a 0.2 per cent solution of chlorine and left overnight to kill any germs left in it. If the pipeline discharges into a tank or a pressure-break box, then a control valve should be fitted at the inlet to the tank or pressure-break box and closed to stop the chlorine solution running out of the pipeline.

## Fact Sheet 2.27

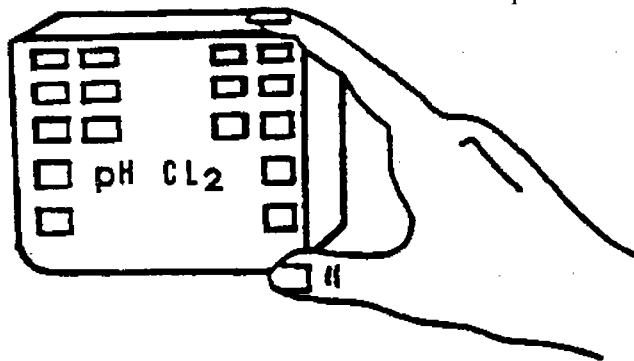
Once the pipeline is ready to be put back into service, the disinfecting solution should be drained and the pipeline flushed with clean water until a chlorine residual of 0.2 - 0.8 mg/litre is reached. The level of chlorine can be monitored using a pocket tester.

Many pipelines, particularly in urban areas which use surface water sources, carry continuously chlorinated water. This water is chlorinated in a treatment plant and should have free chlorine residual of at least 0.5 mg/l. In long pipelines it may be necessary to have re-chlorination tanks to ensure a safe water supply to the more distant points in the system.

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### *Testing for bacteria*

All water supply pipelines should be tested for contamination with faecal bacteria every six months. If, some days after disinfection, a pipeline still has high levels of contamination, it may need to be continuously chlorinated. The level of chlorine in the pipeline should be checked every morning using a pocket tester as shown in Figure 1, to make sure that there is 0.2 - 0.8 mg/litre free chlorine residual in order to kill the germs. In large urban systems with routine chlorination, bacteriological tests should be done monthly and chlorine residual samples should be taken daily.



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**Figure 1. Pocket chlorine tester**