Bacteriological testing

The importance of testing for bacteria in water supplies

The main risk to people using small community water supplies is from faecal-oral diseases such as cholera, typhoid, hepatitis A and other diarrhoeal diseases which are passed from excreta into the water supply. To test for the bacteria which cause these diseases would be very expensive and time-consuming, so the method generally used to check the hygienic quality of a water supply is to test for a certain type of bacteria found in large numbers in excreta.

These bacteria, known as faecal coliforms, are easy and cheap to test for both in a laboratory and with portable test kits. The test shows if there are bacteria from excreta in the water supply and therefore a risk of disease for people drinking the water.

Test methods for faecal coliforms

It is beyond the scope of this Fact Sheet to give detailed descriptions of techniques for faecal coliform testing. If such information is required, you should refer to WHO *Guidelines for drinking water quality*, Volume I (Geneva 1995). This Fact Sheet aims to provide some general information about the most common methods used to analyse water for the presence of faecal coliforms.

When testing for faecal coliforms, it is important to be able to see how many faecal coliforms there are in a standard amount of water. The more faecal coliforms that are in the water, the greater the risk to health.

Two types of test are generally used to check for faecal coliforms in water :

- *Membrane filtration test* - this test uses a fine, sterile filter or membrane. A known quantity of the water to be tested is filtered through the membrane and any faecal coliforms in the water stick in the fine holes in the membrane. The membrane is placed on a culture medium which provides nutrients for the faecal coliforms and the membrane is then kept at 44oC in an incubator for between 14 and 18 hours. After incubation, any faecal coliforms will have grown to form " colonies " which can be seen with the naked eye and counted. The number of colonies is equal to the number of faecal coliforms in the water that was filtered.

This method does not work well when water is very turbid, as the turbidity will block the fine holes in the membrane.

- *Multiple tube test* - this test is sometimes called the " most probable number " method as it uses statistical tables to estimate the number of faecal coliforms in the water. The test is carried out by adding water to a series of tubes containing culture medium. The tubes are then incubated at 44oC for up to 48 hours.

The presence of faecal coliforms is shown by the formation of gas in the tubes and a colour change. The number of tubes which show the presence of faecal coliforms in the culture medium is then compared with statistical tables, and the number of faecal coliforms in the water is estimated.

The multiple tube method is time consuming and normally needs to be done in a laboratory. It can, however, be used to test samples of turbid water.

Choice of method

The choice of a method for testing for faecal coliforms may depend on what equipment and consumables are available in the area. Membrane filters are often not available or very expensive in many countries, so only the multiple tube method can be used. Most portable testing kits for use on-site rely on the membrane filtration method which is simpler to use and gives more rapid results, but some new portable kits now use a multiple tube method.

Guidelines for faecal coliforms in drinking water

Ideally in any water supply, there should be no faecal coliforms. In reality, there are often varying numbers of faecal coliforms in water supplies, so it is important to decide which water supplies need the most urgent action to improve them. This can be done by dividing water supplies into groups depending on the results of testing as follows :

Faecal coliforms	Action needed
0	None
1-10	Action
11-50	Urgent Action
50+	Very Urgent Action

In this way, work on improvement of water supplies can be prioritized to ensure that water supplies which represent the greatest risk to public health can be improved first.