

At all points along the way the water is continuously tested and monitored to ensure the right amount of chemicals are being added and that the sewage is being treated and cleaned so that it is clean enough to be returned to the environment.

Coastal works

Water from these treatment works is pumped down long pipes, called long sea outfalls, which can be up to three kilometres (1.8 miles) in length. These are carefully designed to release the water into a part of the sea with strong tides and currents so that the water can be quickly diluted and the germs killed.

The water is released into the sea through discharge points towards the end of the outfall. It is diluted by the sea as soon as it comes out, and further dilution rapidly follows.

Modern outfalls are designed to avoid the possibility of bacteria from the discharged water being washed back to shore before the marine food chain and ultra-violet light from the sun have done their cleansing work. Ensuring that we always have clean beaches.



Beautiful beaches

Using sewers properly

People tend to use sewers to dispose of all sorts of solid rubbish and unwanted liquids, which can cause blockages and flooding as well as problems at the sewage treatment works. There are many substances which are put into sewers which shouldn't be there.

Never:

- Pour used oil and fat down the sink, or engine oil down the drain. Oil and fat harden and block the sewers and oil is a lethal pollutant, forming a film on the surface of the water and starving it of oxygen.
- Flush nappies, tights, plastics, rubber, packaging and other non-biodegradable rubbish down the toilet. You should only flush what comes naturally and toilet roll.

Always:

- Wait until cooking fat solidifies and then empty it into your rubbish bin, or use it to mix with seeds or bread to feed the birds.
- Pour cooking and engine oil into a container and dispose of correctly.
- Put solid rubbish in the dustbin where it belongs.
- Keep a separate bin for bathroom waste such as cotton buds, cotton wool, contact lenses, plastics and packaging from sanitary and other 'bathroom' products.

Fact sheet

April 2006

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What is sewage?

Once we have used water we either pull the plug from the sink, flush the toilet or pour it down the drain where it enters the sewerage system.

Sewage is the water found in sewers. It can be a mixture of water which has been used for a variety of purposes in the home, at work or in leisure activities, rainwater from roads, footpaths and roofs and water used for business and industrial purposes.

It contains a wide range of waste products of human, animal, vegetable and mineral origin. It contains three main groups of things as well as water.

- Solids suspended in the water.
- Things dissolved in the water.
- Bacteria and other sewage micro-organisms living in the water.

On average each of us generates between 135 and 180 litres of sewage each day. This sewage is over 99.9% liquid, with less than 0.1% being solid.



The sewerage system

Sewerage is the network of sewers, pipes and pumps that lie unseen beneath virtually every road and street. Sewers carry sewage from where it is produced e.g. the home or factory, to the sewage treatment works to be treated and cleaned.

Sewers are laid, where possible, with a slight downward slope so that the sewage flows by gravity. Sewers can be made of a variety of materials, including bricks, concrete, earthenware and plastic, and they range in size from at least ten centimetres to several meters in diameter.

In some cases, sewage is pumped to a higher level through pipes called rising mains, which are made of metal to enable them to withstand pressure.

There are two types of sewerage systems:

- Combined sewers - carry both sewage and rain water in a single pipe.
- Separate sewers - use two pipes. One takes sewage to a sewage treatment works and the second carries rainwater run-off straight to a nearby stream or river, as rainwater does not require treatment.

Why is sewage cleaned?

Sewage treatment works are designed to remove things from sewage that could harm the environment, so that the water can be returned to a river or the sea. Solids and dissolved substances are removed as they would pollute the river or sea and reduce oxygen levels which are vital for the life and health of rivers.

Sewage treatment



There are six stages in sewage treatment:

Preliminary – removes the large bits, sand and grit.

First settlement – removes the small solids.

Biological – removes things that are dissolved.

Second settlement – removes dead bacteria and their waste.

Tertiary treatment – removes any harmful germs.

Sludge drying – removes water so that it can be recycled.



Primary settlement tanks

Sewage treatment

1. Preliminary

First the water passes through sieve-like devices, called screens, which trap and then remove the larger objects which, even though they shouldn't, some people flush down their toilets, such as paper and plastics, sanitary items, bandages and cottonbuds.

Then any grit and sand is settled out in a grit trap, or detritor, and removed to prevent them from silting up the treatment tanks and wearing out the pumps and machinery. The screenings and the grit are put into skips and taken to a licensed tip for disposal.



Screens

2. First settlement

The sewage then passes into large settlement tanks which slow the movement of the water right down to allow most of the remaining solids to settle and sink. This material forms sludge at the bottom of the tank which is regularly drawn off. A scraper at the water's surface removes floating matter such as grease, oil and fat.

The partially treated water which spills over the weir around the inner rim of the tank already looks much cleaner, but it still contains substances dissolved in the water which could harm the environment. The sludge and scum are pumped into thickening tanks and the water is removed to make the sludge thicker.

3. Biological phase

From the settlement tanks the water goes to be treated biologically in either a filter bed or aeration tank. Both contain a good oxygen supply and naturally occurring micro-organisms which feed on remaining organic matter dissolved in the water.

Biological filters use deep beds of clinker - special rocks, which contain many holes and have a large surface area to provide a home for the micro-organisms. They live in the slime which builds up on the surface of the clinker and they break down the remaining pollutants in the water as it trickles down through the filter bed.



Filter bed

The aeration method uses a type of biological soup which contains similar micro-organisms to those that live on the clinker. The micro-organisms and water from the settlement stage are put into large tanks, and air is introduced either by pumping it into the tank or by paddles vigorously stirring the mixture. Because of the plentiful supply of air and food in the aeration tanks, the micro-organisms quickly multiply.



Aeration tanks

4. Second settlement

The final stage of treatment is to settle the water once again.

Water from the filter beds is settled to remove the remains of any micro-organisms which are washed off the clinker as the water passes through the filter bed, and the micro-organisms' own waste.

In the aeration method water from the aeration tanks is settled to remove the micro-organisms, some of which are fed back into the aeration tanks to keep the process going. The excess is sent to the sludge tanks.

The water that is removed from the top of the settlement tanks is now clean enough to return to a river or stream. The water still contains some bacteria, as does all water found in the natural environment. The bacteria are enormously diluted by the river. When exposed to ultra-violet from the sun, they die or are eaten as part of the river's natural food-chain.



Final settlement tanks

5. Tertiary treatment

At some sewage treatment works the treated sewage is passed through ultra-violet lights before it finally re-enters the natural water cycle. By passing the water through the ultra-violet lights any disease causing micro-organisms left in the water are made harmless. This treatment usually occurs at our coastal works.

On completion of sewage treatment, the water is suitable for release into rivers and the sea. Because the polluting matter has mostly been removed, it is of no danger to plant and animal life.



Clean rivers

6. Sludge disposal

The sludge that comes from the bottom of the two settlement tanks is then dried. First we let it settle for a while to make it thicker. Then we have three ways to make it dry: in some places we spin it dry, in some places we squeeze it dry and at one of our sites, called Bran Sands, we tumble it dry. The dry sludge is used by farmers as a fertilizer to help their fields grow or it can be used as a fuel.

Occasionally the sludge is thickened and eaten by micro-organisms in a special device to produce methane gas. This can be converted to electricity to provide power for some of the works' processes. Some works produce more electricity than they need so the surplus is sold to the national grid.

A large sewage treatment works can produce many tonnes of sludge every week. In rural areas the sludge is treated and then used, either as a fertilizer, to improve the quality of agricultural land, or put into landfill. The majority of the sludge is treated at either Howdon on Tyneside or Bran Sands on Teesside. At Bran Sands the sludge is retreated, tumble dried and turned into pellets to be used as fertilizer or fuel.



Sludge pellets



Bran Sands