Water Treatment
Fresh Water Filtration

In the UK each of us uses an average of about 150 litres of water per day! Most of it's taken from rivers, but before it can be piped to our taps, it needs to go through a multi-stage treatment process.

River-water passes through these screens ……and then through a second, finer set of screens called 'Band screens'. Thereafter it's pumped into a reservoir. The water stays in the reservoir for nearly 200 days, so a lot of 'natural treatment' actually takes place here. Solid-material settles out in the still water. Some of the organic matter in the water is oxidised by bacteria, which use dissolved oxygen produced by algae.
Additionally, some of the pathogens that are present are inactivated by Ultra-Violet rays from sunlight.

To minimise the quantity of algae drawn into the Treatment Works, the water's extracted about 15 metres below the surface. It's inevitable that there will be some algae in the water entering the plant, and so the first thing that happens is that the water's exposed to Ozone gas to kill any algae.

Pure ozone is bubbled through the water in specially designed tanks. To ensure adequate treatment, the gas is released at several points. And as the water is forced through the tank, it has to negotiate baffles that ensure it remains in contact with the ozone for as long as possible. The dead algae are held in suspension and are carried forward to the next stage.

Because ozone is a highly toxic gas, any unused ozone (which is a miniscule amount) is collected and converted into oxygen in an 'Ozone Destructor'. This is achieved by passing it over hot copper plates at a temperature in excess of 300-degrees-Celsius.

For safety, there's a comprehensive system of Ozone Detectors and Alarms at numerous points on site.

The starches released from the dead algal-cells form a scum on the water surface. The water along with the scum is then 'Dosed' with ferric sulphate to bring the dead algal-cells together within 'Flocs' of ferric hydroxide.

After 'dosing', the water flows into the large tank of a 'Pulsator'. There are three such units on site. Within each one, a large volume of water is raised by vacuum and then suddenly allowed to come crashing down. The resulting shock-wave forces the 'Flocs' to collect as a sludge blanket towards the bottom of the tank.

Periodically the sludge is pumped out of the tank and sent to lagoons, where the solids settle and supernatant flows back into the reservoir.

The clarified water is pumped, from the top of the Pulsators, into the bottom of large, conical 'Pellet Softeners'.

'Softening' is necessary to stop an excessive build-up of scale on domestic appliances such as kettles and irons.

In the softening process, the hard-water is mixed with a calcium-hydroxide solution and then it rises through a blanket of silver-sand.

A precipitate of calcium-carbonate forms on the grains of sand, rather like a pearl developing in an oyster. After about 3 days, beads of calcium carbonate that are between one to two millimetres in diameter have formed, but because of their size they sink and can be removed.

These beads are very hard and are sold to the construction industry for use in bead blasting.

The now-softened water, leaves the top of the conical tanks, and goes to the 'Rapid-Gravity Sand-Filters'. This one's partially empty so that you can see the outflow trough, which is an important part of the maintenance routine……..though normally the tank is full.
Sand in the bottom of the filter acts as a strainer to remove any remaining solid matter from the water.

When the sand is 'choked' full of solids; the filters stop working and so they're 'Backwashed'.

Backwashing comprises five stages.
First, the water flowing into the filter is stopped and consequently the water level drops.
Air is then pumped up through the one-metre-thick sand-filter. This produces a scouring action and any accumulated solids in the bed are dislodged and rise to the surface as 'scum'.
Clean water is pumped in, and this fluidises the bed of sand such that the dirt is now in suspension above the sand.
The water flow is then increased so that the scum and the dirty water cascade into the outflow trough. The dirty water is sent to lagoons where the solids again settle out and once more, the supernatant flows back to the reservoir.
Once the outflow is seen to be clean, the backwashing cycle is terminated, …….the tank is filled and filtration begins again.
This is the last point in the process where the water's exposed to light.

The clean water from the 'Rapid Gravity Filters' is then pumped into 'secondary ozonation' tanks:
Primarily to break down any pesticides that may be present in the water.

But also the ozone oxidises any trace organic-compounds, and kills any viruses and bacteria.
Furthermore, ozonation destroys potential carcinogens, odours and taste-conferring compounds.

The baffles in the tank are made from stainless steel to avoid any contamination.

After final ozonation, the water passes through Granular Activated Carbon, where any remaining by-products are adsorbed and thereby removed from the water.

Some of the adsorbed material is broken down by bacteria, but eventually the carbon becomes saturated and has to be regenerated, by burning off the adsorbed organics.

By now, the water is very clean and the process is almost complete.

'Chlorine' is added, to kill any remaining pathogenic bacteria present…..

……And the final step occurs underground in a 'Contact Tank'. Here the water is held for a carefully calculated 'residence time' of about four-hours, to allow the chlorine to take effect.

From the tank, it flows into the network of pipelines and service-reservoirs en-route to the consumer.