Water Treatment
Treating Water

Winifred Robinson
Well Martin here, was kind enough to give us a feel of the technology that goes into treating the water that eventually comes out of our taps. Because, even when you've collected yourself a reservoir full of the stuff, there's more to it than that.

Martin Lunn (on Location at Hanningield)
Well behind me is Hanningfield reservoir, it's a manmade reservoir, and it's filled up from the river Blackwater and Chelmer, The water's actually a lowland river water, so there's lots of nutrients in there, lots of algae and some dirt. and it's our store of water to start treating in the giant Hanningfield treatment works.

The site covers an area of some 28 hectares and provides drinking water to about 600,000 people. To become drinking water, the water needs to pass through several treatment stages.
As many of these are hidden from view I'll illustrate some of those stages with the aid of computer animation.

The first part of the process is where we add ozone to the water, and this helps to disable the algae microscopic green plants.

Once killed-off, the algal cells are carried forward with other microscopic particles to the next stage for removal The microscopic particles of dirt have an electric charge, which prevents them settling out and so this charge is neutralised by adding an iron salt, ferric sulphate. The iron coagulates the particles of dirt and the dead algal cells in what's called the flash mixer. As the coagulated water leaves the flash mixer, polyelectrolite is added to start the process known as flocculation. This is a process where the coagulated particles come together to form a more visible floc.

These are then removed in settling tanks.
The next part of the process, is where we soften the water. The water from these rivers is very hard, so we need to take out some of the chalk substances out to make the water softer. We do this by adding lime to the water but when you add lime, or Calcium Hydroxide as it's called , to hard water you make chalk and a softer water,.

The process we use is known as 'pellet reaction', which takes place in large steel vessels.

Hard water enters at the bottom of the vessel where lime dissolved in water is added. This causes the calcium to precipitate as a chalky calcium carbonate. Fine grains of silver sand are added, onto these the chalk is deposited – forming large pellets and leaving partially softened water.

The water leaves the softening tanks, and now comes into the sand filters.

As the water passes through the sand, all the dirt particles are left in the sand, and we collect the clear water underneath. However, the sand blocks up after a while. So every forty eight hours, we have to drain the filter, and we wash it by blowing air and water up from underneath the sand.

The water now would look just like drinking water you'd get from the tap, but we still have to remove a few other things. Our water because it's coming from arable farmland, it contains minute pesticide residues

So once again we add ozone to remove these from the drinking water. This very powerful oxidant blows apart the pesticide molecules and it leaves the water free of most organic chemicals. This second exposure to ozone takes place in large tanks so that the water flowing through the tanks can meet the gas at three points. This ensures that the gas can act effectively without having the risk of too great a concentration in one place.

Any remaining material is now collected by passing the water through granular activated carbon – this is charcoal which has been specially treated to give it a very large surface area for adsorbing organic molecules.

We've now come to the end of the treatment process and it only now remains to chlorinate the water to disinfect it before it goes off on its way to our customers

Winifred Robinson
So Claire the water treatment process we've just seen there, how universal a process is that?

Claire Jackson
It's fairly typical for the sort of raw water that they're treating at Hanningfield. If you're looking at lowland river sources, then obviously you've got more to remove in the way of micro pollutants, and you're going to have a more complex treatment. The regulations actually, stipulate the level of treatment, depending on the raw water source. So if you've got a very good raw water with ground water for example that's got very little in there apart from a need for disinfection, you're going to have minimal treatment. There's certainly for, lowland river sources such as Hanningfield, you are going to have ozone, possibly activated carbon, certainly coagulation, certainly filtration, using one type of media or another.

Winifred Robinson
I suppose what the public worry about, is they worry about what goes in to take things out?

Claire Jackson
Yes we often get that thrown at us, you know why are you adding water, chemicals to our water, you know, we want pure water. In actual fact those chemicals are very essential for doing the job. If you don't have a coagulant like the iron salts that Martin was describing, you won't be able to pull together all of the particles of dirt, the bacteria, algae cells and colour. If you if you've got a very high coloured water, the coagulant actually removes the colour from the raw water source there. You've got to have a disinfectant, otherwise you run the risk of bacteria getting into the distribution system, people will be going down with cholera and other nasty diseases.

Winifred Robinson
Martin I think the thing that would have worried people seeing that film, is the fact that you're using ozone, which is a lethal gas, is there nothing you can use instead of that?

Martin Lunn
Ozone would be a lethal gas if you breathed it in. When we actually add it to the water, it's very transient, it only stays in the water for about twenty minutes because it's so active. If any gas does escape, we've got destructors for it. But it, you need a powerful oxidant to break down the modern pesticides that can get into the water, therefore we have to use ozone, but it is absolutely safe to the public.

Winifred Robinson
Claire, what does technology have to offer that might help us to improve and maintain water supplies in the future?

Claire Jackson
If we're looking to more difficult raw waters, then we're probably looking towards membrane technology, as the thing of the future. Possibly the simplest way of describing this is that you have a very, very thin fabric that's got a very, very small pore size within it, and you apply

pressure on one side, and that pushes the water through the fabric, but it keeps all of the nasty things that you want to take out on the other side.

Winifred Robinson
You say that we're looking to do this, are we actually doing it yet? Is anyone doing it anywhere in the world?

Claire Jackson
We are using membrane technology in the UK, in two or three areas. One is to remove nitrates, and that is actually happening in the East Anglian region, where you've got high nitrates in ground water.

Winifred Robinson
Because of agriculture?

Claire Jackson
Because of agricultural use. If there's no low nitrate water available to blend, and reduce the levels then, they are actually using membrane technology to remove nitrate. We're also using it in quite a lot of areas to remove a rather nasty little parasite that sometimes appears in drinking water, called Crypto sporidium, and again membranes provide, an absolute barrier, to remove Crypto sporidium.