Leaky pipes can allow contaminants into our drinking water

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Leaking water pipes can allow potentially harmful contaminants into our drinking water, new research has shown.

The study, by engineers at the University of Sheffield, is the first to prove conclusively that contaminants can enter pipes through leaks and be transported through the pipe network.

The pressure in mains water pipes usually forces water out through leaks, preventing anything else from getting in. But when there is a significant pressure drop in a damaged section of pipe, water surrounding the pipe can be sucked in through the hole.

It had been assumed that only clean water from the leak would be sucked in, and that even if contaminants were sucked in these would simply be ejected once the pressure returned to normal. The new study has shown, however, that groundwater from around the pipe - which often contains harmful contaminants - can be sucked in, remain in the pipe and travel on through the network.

Dynamic pressure drops happen whenever there is a sudden change in velocity, for example when there are valve or pump failures, or sudden demands on the system, such as when large volumes of water are required for fighting a fire. As a result of engaging with the University of Sheffield research, UK water companies are now training their field staff to limit these pressure drops taking place.

UK drinking water is tested for harmful contaminants and complies with the regulations over 99 percent of the time. But any failure is cause for concern, according to lead researcher Professor Joby Boxall.

Professor Boxall says: "Previous studies have shown that material around water pipes contains harmful contaminants, including viruses and bacteria from faeces, so anything sucked into the network through a leak is going to include things we don't want to be drinking.

"Many of us will have had a 'dodgy tummy' in the past that we couldn't quite explain, often putting it down to something we'd eaten. It now seems possible that some of these illnesses could have been caused not by food, but by water."

The research, funded by the Engineering and Physical Sciences Research Council, used a purpose-built test facility made up of 141m of mains water pipe maintained at pressures representative of UK networks. A section of pipe was damaged, and the leak enclosed by a box containing gravel into which dye was injected to simulate a contaminant.

When that section was subjected to a dynamic pressure drop, up to 60ml of the coloured water was sucked into the pipe. The team were able to measure the dye at the end of the pipeline, 70m downstream, proving that the contaminant remained in and was transported through the network.

Co-researcher Dr Richard Collins says: "Our research shows that contaminants that enter through a leaking pipe could be reaching consumers' taps, and although this will be at very low concentrations, it would fail the safety tests if detected. We also believe that microorganisms, including pathogens, which enter the network in this way could attach to the inner surface of the pipe and multiply. If they are later dislodged by another change in flow, they could then reach our taps

in higher concentrations."

Professor Boxall adds: "The majority of UK water companies have or are now commissioning training versions of our experimental facility, so they can help their staff to minimise future risks to water quality as well as reduce structural damage caused to pipes."

It is uncertain how often dynamic pressures are low enough to cause contaminants to enter our drinking water as internationally, water distribution networks are not monitored at sufficient frequency. However, the limited bespoke studies of operational networks to date, mainly in the US, have shown that these pressure drops do regularly take place.

The UK regulator, Ofwat, deems that leaks within the UK water network have been at an economically sustainable level for the last 15 years - which means that the cost of finding and repairing the leaks would cost more than the value of water lost.

"It's not feasible for the water industry to stop all leaks, and most of the time, leaks don't pose a risk," says Professor Boxall. "This is why the water industry is now focusing on preventing the pressure changes which enable contaminants to enter the system, rather than eliminating the leaks through which they enter."

More information: 'Experimental Quantification of Contaminant Ingress into a Buried Leaking Pipe during Transient Events' by Sam Fox, Will Shepherd, Richard Collins and Joby Boxall will be published in the *Journal of Hydraulic Engineering*, 2015.

Provided by University of Sheffield