

Welcome to DWI Research News

In England and Wales, the identification and evaluation of emerging issues relevant to drinking water quality regulation is carried out by the Inspectorate through the management of a programme of research funded by Defra.

We have recently completed our call for interest in the first phase of new research projects for 2009/10 in the areas of nanoparticles, disinfection by-products and haloacetic acids. The DWI hope to issue further expressions of interest calls in the near future.

In this newsletter you will find information on our most recently published research reports. To view older research reports, the DWI have now put in a special archive, links to DWI funded research reports between 2000 to 1986. This can be found at: www.dwi.gov.uk/research/reportpre2000.shtm

Recently published research

A study into the possible association between step changes in water hardness and incidence of cardiovascular disease in the community (DWI 70/2/203)

For many years there has been evidence of an inverse association between drinking water hardness and incidence of cardiovascular disease. Recently the Drinking Water Inspectorate commissioned a comprehensive and systematic review of studies examining the apparent effects of soft water on cardiovascular disease and cancer (Catling et al. 2005). That review concluded that there is evidence to support a protective effect of drinking water hardness against cardiovascular disease from a number of studies. A subsequent meta-analysis of analytical epidemiological studies (Catling et al. 2008) found significant evidence of an inverse association between magnesium levels in drinking water and cardiovascular mortality. This conclusion mirrored a similar review conducted for the World Health Organisation (Monarca et al. 2006).

Therefore the Inspectorate commissioned a study by the University of East Anglia (UEA) to investigate specifically the association between drinking water hardness and cardiovascular mortality in areas that had experienced a step change in water hardness, calcium or magnesium levels in England and Wales.

Only 14 areas were identified in England and Wales that experienced a step change in drinking water hardness over the period 1981 to 2005. Of these, few were areas that had undergone substantial changes with large populations and only one geographical area had a substantial magnesium change.

If the association observed between drinking water parameters and cardiovascular mortality is causal, the time lag between exposure and outcome is unknown. The models described for this study examined for an immediate effect between the step change and cardiovascular mortality.

This study found no evidence of an association between step changes in drinking water hardness, calcium or magnesium and cardiovascular mortality. The study also identified that the quality and availability of essential data including water hardness concentration, areal

extent and population were variable.

A copy of the [full report](#) (pdf 601KB) is available on our website

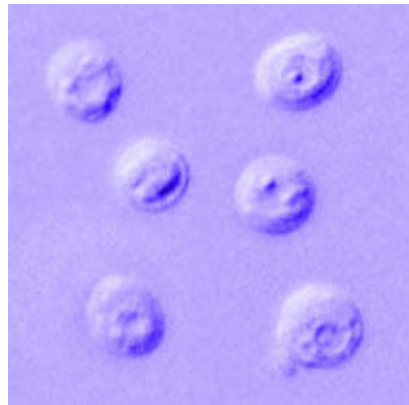
International collaborative cell culture and U/V studies (DWI 70/2/143)

This was an international collaborative research project funded jointly by the Drinking Water Inspectorate for England and Wales, the United Kingdom Water Industry Research, the American Water Works Association Research Foundation, the United States Environmental Protection Agency, Kiwa (Netherlands) and the Water Services Association of Australia.

The aims of the project were to identify an optimum cell culture technique that would be suitable for routine use in disinfection studies and general risk assessment for *Cryptosporidium*; investigate technology transfer and performance testing of the selected protocol(s); and apply the cell culture technique in UV treatment studies at pilot scale or plant scale.

The initial proposals, whilst sound, were ambitious and no laboratory was able to enter into a contract based on the large workloads and the comparative testing of a range of methodologies. It was intended that a number of laboratories, using their own preferred methodologies, should compare performance and an optimum method be identified. That method would then be employed by at least some of the other

participating laboratories to determine whether the technology was readily transferable. In the event, the revised contract only encompassed *Cryptosporidium* oocyst infectivity assessment in a single laboratory by detection of cell culture infection using immunofluorescence.



(*Cryptosporidium parvum* oocysts.
Source of photo: CDC)

The results obtained showed that cell culture/IFA could be used successfully to determine infectivity of oocysts in the specific conditions of the investigation but a number of additional variables, such as using a variety of species of *Cryptosporidium* and natural water matrices, need to be investigated before the widespread adoption of such methods for routine validation of UV methodology.

Using in vitro excystation as a measure of oocyst viability it was shown that UV disinfection in a bench scale pilot plant could inactivate oocysts at turbidities as high as 4.4 NTU although this required relatively high UV doses. The study concluded that more data is needed on different water types and turbidities, and the UV doses required.

DWI's current view, informed by this research is that there is insufficient evidence at this time to use cell culture techniques in the validation of UV as a control for *Cryptosporidium*. System validation should therefore focus on system design and UV dose.

The [Executive Summary](#) (pdf 106KB) can be found on the DWI website. The full report can be found on the [UKWIR website](#).

National tap water consumption survey for England and Wales (DWI 70/2/217)

The setting of standards and guideline values for drinking water rests on knowledge of the quantities of tap water that people actually drink. For example, the World Health Organisation (WHO) makes a default assumption that a 60kg adult drinks 2 litre of water per day (lpd)

A survey of tap water consumption in England and Wales was last conducted in 1995 and prior to that in 1978. Since these surveys, habits may well have changed. The purpose of this research project was to update the 1995 survey, and to ask a number of other exposure related questions at the same time, including questions about showering and bathing.

The findings showed the average adult tap water consumption was essentially unchanged between 1995 and 2008. In the spring of 2008 average consumption was 1.284 litres per day (lpd) compared to 1.275 lpd in 1995, a

statistically insignificant increase of just 0.009 lpd.

This is the first survey to compare spring and summer tap water consumption in England and Wales. Average consumption in the summer of 2008, 1.329 lpd, was slightly higher than in the spring 2008, 1.284 lpd. This small increase of 0.045 lpd is not statistically significant.

The study also compared the form in which tap water was consumed between the spring and summer. Not surprisingly, average tap water consumption of boiled water drinks eg tea and coffee, was 0.827 lpd in the spring survey compared to 0.552 lpd on the summer survey. Showing fewer hot drinks are consumed in the summer.

The proportion of tap water in drinks increases with age, such that those 40 or over consume the most tap water, while the youngest age group consumes the least. As with both the previous studies of 1978 and 1995, the survey has shown that men drink more liquid overall, but women drink more tap water.

The survey also looked at water consumption according to people's weight, this has not been examined by previous surveys. The results from both spring and summer phases show that, in terms of overall liquid consumption, those who weigh less consume less.

For the first time, this study has captured the liquid intake from sports bottles. Whilst between 40% and 50% of households

have at least one person who uses sport bottles, on average only 0.025 lpd was consumed from sports bottles. Detailed data are given on the time people spend in the bath or the shower. These are the first data gathered in this respect.

The study also asked a number of questions about perceptions. Possibly the key finding was that in terms of the quality of tap water, the vast majority of households have not had any problems with the quality or appearance of tap water in the last 12 to 18 months.



The findings of the report are reassuring since intake of tap water in England and Wales is less than the estimates used by the WHO to derive guideline values (thus providing additional reassurance in the safety factor that these guidelines ensure). The report also provides useful information on other exposure routes.

Visit our research web pages to view the [Full report](#) (pdf 904 KB), or the [Executive Summary](#) (pdf 188 KB)

A review of research on pressure fluctuations in drinking water distribution systems (DWI 70/2/220)

Research has been conducted in the US into the potential for low and negative pressure transient events to occur in distribution systems. The US studies indicate such events to be relatively infrequent. However maintenance of adequate pressure is one of the main factors safeguarding the quality of drinking water once it has entered the distribution network.

We therefore commissioned WRc to undertake a study to review existing research on transient low and negative pressure events and to conclude on the likelihood of such events occurring in the UK. In this study, researchers collected and analysed some pressure monitoring data, conducted some network modelling and proposed a methodology for further research.

The main findings of this work showed that two mechanisms for producing pressure fluctuations have been identified: a) pressure transients (surge), and b) longer-term pressure events caused by exceptional demand (including bursts).

There is little evidence in the literature of pressure fluctuations that are sufficient to cause ingress into the treated distribution system.

The report provides reassuring evidence that the likelihood of low pressure events in England and Wales is small. Even when low pressure events do occur there is no evidence from this report that they will actually lead to ingress or that there will be any effect on consumers. This report does not cover possible risk to health in detail although most instances of ill-health identified from the literature relate to circumstances that are not relevant to England and Wales.

The report can be viewed on our research web pages:
[Full report](#) (PDF 265KB),
[Executive Summary](#) (PDF 46KB)

Research findings in the pipeline

We shall shortly be making available the research findings on Brominated Flame Retardants. The purpose of this study was to produce an up-to-date assessment of the risk of brominated flame retardants (BFRs) reaching drinking water sources in England and Wales. The study reviews BFRs as a group, building on the existing risk assessments that are available, and focuses on the potential for contamination of sources of drinking water.

To examine the past and present usage of Brominated flame retardants in the UK a survey was carried out which examined data from a number of sources including; The Environment Agency, Water Undertakers,

Flame retardant manufacturers and a number of EU databases.

Future research Proposals

The DWI are currently developing further research projects, and intend to issue additional calls for expressions of interest in the near future. These will be advertised both on the [DWI research web pages](#), and also on the Defra science pages, which runs a [competition email notification service](#).