

# **THE LONG TERM MIGRATION OF SUBSTANCES FROM IN-SITU APPLIED EPOXY RESIN COATINGS**

## **EXECUTIVE SUMMARY**

Trials of epoxy resin relining for the rehabilitation of water mains in the UK started in the late 1970s and by the late 1990s epoxy lining had become the most popular non-structural rehabilitation method. Currently five manufacturers hold approvals for epoxy resins for the in-situ lining of water mains.

The Committee on Products and Processes for use in Public Water Supply (the CPP)<sup>1</sup> noted that there is a lack of leachate data from in-situ relined pipes after varying periods of time in service. Whilst the use of epoxy resins for mains rehabilitation is declining, the long service life of these products (of the order of 30 years or longer) means that applied linings have the potential to affect water quality for decades. To fill this gap in leachate data, DWI appointed WRc-NSF to examine the leaching of chemicals from existing epoxy resin in-situ relined water mains based on samples taken from consumers' taps.

Initially the existing information on leaching from epoxy resins was reviewed. The review covered pre-approval test results, audit test results and any other relevant information.

Water companies were contacted to attempt to identify suitable zones for sampling covering all combinations of: five epoxy resins; hard and soft water; low and high free chlorine concentration; and three ages of linings – 1-2, 3-6 and 7-10 years. It was not possible to identify sampling sites covering all possible combinations. A sampling plan was devised to cover as many combinations as possible – this included eight water undertakers' areas of supply. Two sets of samples were taken – the first during April to May 2006 and the second during August to September 2006, when water temperatures were warmer. Most of the locations sampled in the first phase were included in the second phase of sampling. A total of 120 samples, including field blanks, were taken.

Suitable streets for sampling were identified in consultation with water company staff. Samples were taken from domestic drinking water taps. The tap was fully opened and the water run to waste for at least three minutes to flush water that had been standing in the domestic pipework. Samples were taken for Total Organic Carbon (TOC) and general survey Gas Chromatography – Mass Spectrometry (GC-MS) analysis. After the samples had been taken the free chlorine concentration was determined using a test kit and the water temperature was measured using a digital thermometer. These readings, together with the address of the property and other pertinent information, were recorded. In each water supply zone, at least one field blank sample was taken. The blank samples were taken upstream of any relining.

The average water temperature during Phase 1 was 11 °C and during Phase 2 this had risen to 16.5 °C. Samples were assigned to the 'High' and 'Low' chlorine category in relation to the median chlorine concentration.

<sup>1</sup> The CPP was disbanded in March 2007.

There was no technically or statistically significant difference in TOC results between the samples and the field blanks for either phase of sampling. This suggests that any leaching from the pipe linings is at a low level.

The GC-MS results for Resins A, B, D and E did not show any evidence of leaching of components of the resins. The chemicals detected were those that are commonly found in drinking water samples; i.e. disinfection by-products and environmental contaminants such as phthalates. Overall, there does not appear to be a real difference between the results for samples and field blanks in the case of these resins. Repeat sampling during warmer water temperatures did not indicate any substantial change in leaching characteristics.

Evidence of leaching of 4-t-butylphenol (4-TBP) from Resin C was found – 4-TBP and various halogenated derivatives were detected in some (but not all) samples taken from taps fed from mains lined with Resin C. The highest concentration of 4-TBP found was 2.2 µg/l. Resin C is the only one of the five resins considered that contains 4-TBP as a component.

Comparison of the review of results from laboratory tests and the field survey indicates that laboratory test results may overstate the leaching of components from epoxy resins.