

AN INVESTIGATION OF LEACHING FROM FLEXIBLE RISING MAINS LEADING FROM BOREHOLE PUMPS

EXECUTIVE SUMMARY

Many water undertakers have used flexible rising mains as the preferred option to fixed piping systems for rising mains leading from borehole pumps. These flexible hoses are usually made from fabric-reinforced polyurethane. They offer several advantages over fixed installations.

Formerly such rising mains were treated as traditional materials under the requirements of Regulation 25(1)(c) of the Water Supply (Water Quality) Regulations 1989. Water undertakers would replace existing flexible rising mains with new lengths of flexible hose as required, on a like for like basis. Regulation 31 of the current Water Supply (Water Quality) Regulations 2000 (2001 in Wales) does not contain a comparable provision for the continued use of product on a 'traditional' basis. This has meant that water undertakers can no longer replace flexible rising mains on a like-for-like basis.

The former Committee for Products and Processes used in Public Water Supply (CPP) received and considered formal applications for approval of flexible rising mains, following the introduction of the new regulations. GC-MS general survey test results obtained from leaching tests undertaken on these products have shown persistent high concentrations of large numbers of unknown organic compounds over the three 72 hour extraction periods of the tests.

The general objective of this project was to analyse samples of water from two sites where flexible rising mains had been in use for some time to determine the quantity and nature of any leachates present. Following this initial sampling, the riser was replaced with a new one and the leachates were monitored over a period of weeks. This work was carried out in co-operation with two water undertakers.

Water companies were contacted to identify those that had flexible rising mains installed and that were willing to co-operate in the project. Two suitable sites were identified – one chalk aquifer and one greensand aquifer. Each of these sites had existing 152 mm (6 inch) diameter flexible rising mains of the same type and manufacturer.

At each of the two identified sampling sites the following general experimental protocol was followed.

- With the existing hose in service, a sample was taken under flowing conditions after one hour's flushing (as a 'control') then a further sample was taken following 72 hour's stagnation.
- The borehole was taken off line, i.e. no longer feeding the public water supply and the flexible riser was replaced with a new section of flexible hose.
- After flushing with water for one hour a control sample was taken. A stagnation period was imposed, after which a sample was taken immediately.

The flushing, stagnation and sampling was repeated to give a time-series over a period of 56 days.

- Samples were analysed for Total Organic Carbon and GC-MS general survey.

At both sites, only low levels of leaching were observed from the original liners that had been in use for many years. After the introduction of new liners, large numbers of unknowns were detected in the stagnation samples. These compounds tended to be present at lower concentrations or were undetectable in samples taken after flushing for 60 minutes.

The major unknowns were identified as a series of oligomers¹ differing in molecular weight by 72 mass units, the main compounds having molecular weights of 288, 360, 432, 504 and 576. Examination of mass spectra provided in earlier test reports on leaching from similar materials showed that these same compounds were present. These compounds are likely to be oligomeric cyclic ethers although their identities cannot be confirmed conclusively due to a lack of pure standards.

Overall there did not appear to be a difference in leaching characteristics between chalk- and greensand-derived waters.

Chemicals were still detected in stagnation samples several weeks after the new liners were installed. This suggests that it would be not be practical or effective for the manufacturer to rinse the risers as part of the manufacturing process.

Concentrations of leached chemicals in samples taken after flushing tended to be low. This suggests that a suitable control method would be to flush newly installed risers, with the output going to waste, for 24 hours² prior to reconnection to the public water supply.

¹ A compound intermediate between a monomer and a polymer, normally having up to about ten monomer units.

² This time is based on the TOC die-away curve for flushing the riser at site F that had been stagnant for 28 days.