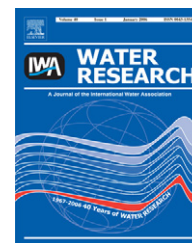


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REVIEW

Discolouration in potable water distribution systems: A review

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ABSTRACT

A large proportion of the customer contacts that drinking water supply companies receive stem from the occurrence of discoloured water. Currently, such complaints are dealt with in a reactive manner. However, water companies are being driven to implement planned activities to control discolouration prior to contacts occurring. Hence improved understanding of the dominant processes and predictive and management tools are needed.

The material responsible for discolouration has a variety of origins and a range of processes and mechanisms may be associated with its accumulation within distribution systems. Irrespective of material origins, accumulation processes and mechanisms, discolouration events occur as a result of systems changes leading to mobilisation of the accumulations from within the network. Despite this conceptual understanding, there are very few published practicable tools and techniques available to aid water companies in the planned management and control of discolouration problems. Two recently developed and published, but different approaches to address this are reviewed here: the PODDS model which was developed to predict levels of turbidity as a result of change in hydraulic conditions, but which is semi-empirical and requires calibration; and the resuspension potential method which was developed to directly measure discolouration resulting from a controlled change in hydraulic conditions, providing a direct assessment of discolouration risk, although intrinsically requiring the limited generation of discoloured water within a live network. Both these methods support decision making on the need for maintenance operations.

While risk evaluation and implementation of appropriate maintenance can be implemented to control discolouration risk, new material will continue to accumulate and hence an ongoing programme of maintenance is required. One sustainable measure to prevent such re-accumulation of material is the adoption of a self-cleaning threshold, an hydraulic force which a pipe experiences on a regular basis that effectively prevents the accumulation of material. This concept has been effectively employed for the design of new networks in the Netherlands. Alternatively, measures could be implemented to limit or prevent particles from entering or being generated within the network, such as by improving treatment or preventing the formation of corrosion by-products through lining

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or replacing ferrous pipes. The cost benefit of such capex investment or ongoing opex is uncertain as the quantification and relative significance of factors possibly leading to material accumulation are poorly understood. Hence, this is an area in need of significant further practical research and development.

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1. Introduction

A large proportion of the customer contacts that drinking water supply companies across the world receive stem from the occurrence of discoloured water. Fig. 1 shows a typical break down of customer contacts for a UK water company, while Fig. 2 shows an example of discoloured water supplied to a customer in Holland.

Discoloured water incidents as shown in Fig. 2 greatly affect customer's confidence in tap water quality and the quality of service provided by water companies. Although good customer perception is a major driver for water companies (van Dijk and Van der Kooij, 2005), thorough understanding of the mechanisms and processes that lead to discolouration are currently lacking or at least not applied widely. Hence, water companies can only respond to discolouration complaints in

a reactive manner. Within modern customer focussed water companies such reactive maintenance is no longer acceptable, particularly within the regulatory framework of the UK. Water companies urgently need a practicable understanding of the processes and mechanisms leading to discolouration incidents and to develop management tools and techniques. This paper reviews the techniques to assess the discolouration risk and the strategies available to control this.

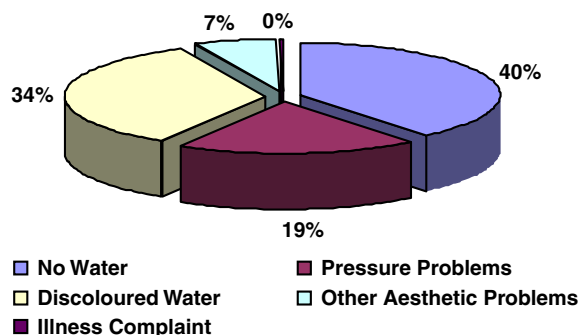


Fig. 1 – Typical break down of reasons for customer contacts for a 5 year period for a UK water company.



Fig. 2 – Example of discoloured water leading to customer complaints.

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