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Drinking Water Engineering and Science Discussions

Interactive comment on "Dynamic hydraulic models to study sedimentation in drinking water networks in detail" *by* I. W. M. Pothof and E. J. M. Blokker

Anonymous Referee #1

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An aptly titled and generally well written paper of a good standard for conference proceedings. However I would not recommend this paper as a standalone journal publication primarily due to the brevity in result analysis and discussion of the findings. The paper is really in two parts. Initial mathematical derivation is well dealt with but then some loosely connected turbidity field data is attached without detailed explanation that reportedly indicates support of the theoretical findings. In summary three different hydraulic models are presented and used to analyse a network to identify zones of low magnitude flows, including flows that fluctuate at low levels so effectively creating 'stagnant zones'. The findings from the hydraulic models are then used to identify the locations of accumulated material that may be mobilised creating a discolouration event.

The lack of any measured flow data however prevents scientific validation of these hydraulic models and therefore leaves in doubt the possible correlations to the turbidity data. Using the derivations, particle settling velocities are determined. This however is not novel, for example Boxall et al in 2001 reported these findings and concluded that the ubiquitous presence of particles in distribution networks is due to cohesive properties. This paper however restricts the theoretical conclusion and therefore key findings, to non-cohesive particles. Yet their evidence of ubiquitous turbidity indicates this is not reliably the case. Without knowledge of the two associated papers from the same conference detailing this work the turbidity data presented is not clear. Figure 4 shows the spatial distribution of turbidity measurements. How were these derived, is there any historic evidence to suggest why different levels of discolouration were observed, what does 'no result' mean (no data or no turbidity?), what does 338.9071 FTU relate to (and number of decimal places?)? In Fig 6, do these locations match Fig 4? If so, then location 'h' has velocities approaching 0.1 m/s so effectively self-cleaning by the paper assertions, yet it has high levels of turbidity. Or is the conclusion from the paper that in flow reversal zones material accumulation may occur even when flows are in excess of the theoretical 'self-cleaning velocity? Furthermore the authors indicate that it is shear stress (the force on the pipe wall, a function of diameter, roughness and velocity) that causes material mobilisation. If so, why then are velocities considered as the key determinant? The authors do highlight some of these issues that cast doubt on the findings (p128, ln 25 onwards) such as uncertainties associated with distribution system modelling, turbidity data analysis and the likelihood of cohesive particle behaviour. Yet without more detailed investigation and due to the limited data presented in this paper, it is likely the results, and therefore conclusions, will remain speculative.

Boxall,J.B., Skipworth, P.J. and Saul, A.J. (2001) 'A Novel Approach to Modelling Sediment Movement in Distribution Mains Based on Particle Characteristics'. Water Software Systems: v. 1: Theory and Applications (Water Engineering & Management). B. Ulanicki, B. Coulbeck and J. P. Rance, Research Studies Press, Hertfordshire, UK. 1: 263-273

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