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Drinking Water
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Discussions

Interactive comment on "Modeling particle transport and discoloration risk in drinking water distribution networks" *by* Joost van Summeren and Mirjam Blokker

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Dear Referee,

Thank you for your constructive feedback.

We agree to discuss in more detail the available models in the literature. We suggest to include the following points in the text of the Introduction section:

- PSM includes the processes particle settling, resuspension, and wall deposition (across the entire circumference). Wall deposition is probably not important in distribution pipes (as we argue in the preceding first paragraph on p3).

- VCDM assumes that discoloration is related to the attachment and erosion of particles to pipe walls. It provides a mathematical formulation for the simultaneous occurence of erosion of weak material (i.e. with a strength below the actual shear stress) and buildup of strong material (strength above the actual sear stress). VCDM has been validated for transport mains, but not for smaller distribution mains for which it is plausible that gravitational settling dominates (Van Thienen, Vreeburg, et al., 2011).

- We will also refer to a model by Richardt et al. 2009 (please see our response to Referee #1).

- Bed-load transport is excluded in both PSM and VCDM. To emphasize the importance of bed-load transport we would like to add a sensitivity analysis and two new figures to the revised version of the paper, showing:

(i) a domain diagram (in particle diameter-bulk flow velocity space), showing that bed-load transport likely occurs for conditions that are common to Dutch distribution networks, and

(ii) two graphs of the bulk flow velocity and bed-load transport rate as a function of the shear stress (Shields number), suggesting that the amount of material transported via bed-load transport is substantial.

We have already performed the above analysis , it would extend the paper by approximatly one page.

We agree that the formulation we present needs to be calibrated with field data. This is clearly illustrated by the strong dependencies shown in Figures 2 and 3. We would like to empahsize in the Outlook section (p11, line 10).

In response to the comment on practical considerations: I would argue that the influence to flow patterns is included in our approach, because a change in velocity affects the shear stress and, hence, the importance of the processes in a consistent manner.

We agree to mention network type (branched or looped) in the Outlook section. Velocity

pattrens in a branched network –especially when designed to be self-cleaning– are generally different from those of looped networks. This would indeed interfere with the importance of the transport processes.

We agree to improve the Figures by: adding more detailed descriptions, referring to values in the text, and clarify the axes. With “additional common conditions” we meant that the U.K. conditions encompass the blue and green regions in Fig. 2. I will make this obvious in the text and use hatched color patterns for the overlapping colored domains in Fig. 2 and 3.

Thank you for pointing out a mistake in Figure 3 (excess density should be particle density). We will correct this and highlight threshold values and link to the text.

Sincerely,

Joost van Summeren

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