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**Drinking Water
Engineering and Science
Discussions**

Interactive comment on “Development of a iron pipe corrosion simulation model for a water supply network” *by* M. Bernats et al.

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Answers on Major issues (of Anonymous Referee #1):

A1: We are now looking for extensive editor.

A2: In the experiment for obtaining corrosion rate expressions was used coupons of steel material, however authors earlier observation with Riga city water supply network showed that there is no considerable difference between steel and cast iron corrosion rates, since cast iron pipe protective layer is damaged. This assumption also was confirmed by model validation, in which was used both steel pipe (n=2) and cast iron pipe (n=2) samples, to both of which established corrosion expressions applied with same accuracy. On this basis title was extended to all iron materials pipes, of course ductile

iron pipes are out of model apply range due to the conceptual lower carbon content. It is correct that this model is developed only for un-lined pipes, we will underline it in more clear way in the paper.

A3: It is interesting that external corrosion can be predominant in pipe failures, because basing on many years experience of water enterprise of Riga city most of pipe failures happens due to the internal corrosion. After internal corrosion follows failures due to mechanical stress (e.g. transport and ground movement) and only small segment consists from external corrosion. That is why authors concentrated only on internal corrosion in corrosion model.

A4: Authors as well agree that corrosion greatly is random process, but at sufficient time step (months and years) corrosion becomes able to describe with deterministic model. The most important simulation aspects are that corrosion expressions where established for loosed weight not for loosed depth of coupons, thereby excluding corrosion random performance on surface, and by carrying out experiment for sufficient long time phenomena was assumed to be deterministic. The proposed corrosion expressions were validated only in part of water supply network (right bank, indicated with arrows) which accordantly to hydraulic model is supplied by ground water which implies monolith corrosion, the other part of network, where is the pit type corrosion due to the surface water supply, needs additional validation of model.

A5: The maximum and mean corrosion ratio was obtained from measurements of collected pipe samples, e.g. real scale samples, (DN 150 – 500 mm) in process of model validation. For each sample was done 7 depth measurements from which calculated average value was used for validation of corrosion expressions, since 12 month corrosion experiment was expressed in terms of average corrosion (by measuring the loosed mass of coupons). The maximum and mean corrosion depth, and corresponding corrosion rate, was obtained plotting current sample average corrosion rate versus maximum corrosion rate, obtained from point with smallest pipe wall depth.

A6: The long-term corrosion was obtained by observing that slope of weight loss trend stops decreasing at 6th month and line between 6th and 9th month matched good with 12th month value of weight loss, on this basis it was assumed that further corrosion rate do not changes in time and is constant. Unfortunately Fig.4 is not correct and must be replaced with corrected figure (please see in attachment, Fig.4_rev2). Due to the simplicity authors sum up all lost metal quantity in first year and named it as first year constant, while actually corrosion rate becomes constant from 6th month.

A7: In the corrosion rate and flow velocity correlation figure, is used average daily flow velocity of link from which pipe sample for corrosion measurements were taken. By the authors thoughts the daily average flow shows the most broadly cycle of flow pattern of corresponding link, including all maximal hour demands and it magnitudes of day section. The establishing corrosion rate and flow velocity correlation was one of the conceptual goals of the paper.

A8: The corresponding sentence should be corrected, that all pipe samples used in model validation was collected from systematic valve replacement events on water mains, where pipe sample was cut out approximately 1 meter from replacing valve. No one pipe sample used in model validation was obtained from corrosion-cause events.

A9: It is correct that in model validation for Riga city corrosion rate value was increased by 20% for 1.flow region ($v \leq 0.1$ m s-1), in order to ensure that model will have no delayed warnings associate with corrosion expression errors. By increasing corrosion rate value the positive and negative error of corrosion model was shifted only to positive range, including this amount as safety factor. The most graphic way of model validation overestimation can be seen in Figure 5.

Interactive comment on Drink. Water Eng. Sci. Discuss., 5, 85, 2012.

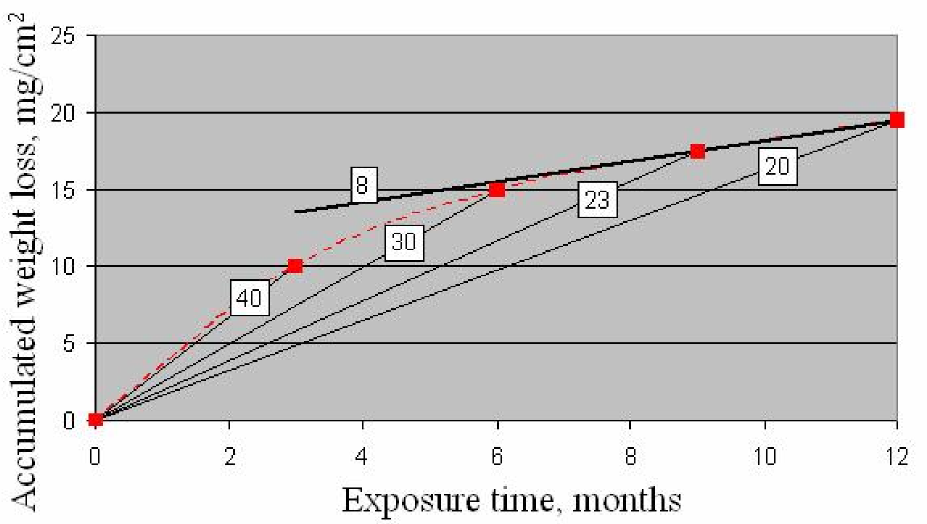

Fig. 1. Fig.4_rev2