**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.

Anonymous Referee #1

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The paper attempts to predict internal corrosion rate of water pipes, while considering the chemical properties of the water as well as the flow velocity impact on corrosion. Although an interesting effort, the manuscript suffers from some shortcomings that must be addressed before full publication.

Major issues:

1. The manuscript requires extensive English editing.

2. The title addresses iron pipes, while the flow velocity experimentation was done exclusively on steel pipes. There can be a significant difference in corrosion patterns and rates between steel, cast iron and ductile iron. I am not sure what the predominant pipe material in Riga is, but in Europe, North America and Australia, as well as most

Asian and African countries the predominant metallic pipes are cast iron (legacy) and ductile iron. Only a small percentage of water pipes are steel, and they are used most often in earthquake prone areas. Furthermore, the authors imply, but not clearly state (as it should), that the model is developed only for un-lined pipes.

3. The authors endeavour to predict the expected life of the pipe as an outcome of the weakening of the pipe resulting from this corrosion. However, the paper addresses exclusively internal corrosion, whereas in most cases external corrosion is considered the predominant factor in pipe failure.

4. The proposed corrosion rate model is developed as deterministic model, whereas in the literature it is widely accepted that corrosion is largely a random process that manifests itself in corrosion pits. Although it is an acceptable practice to represent stochastic phenomena using empirical deterministic models (with mean and/or maximum values), the authors do not explain the "simulation" aspect of their method. Since there is hardly a need to simulate deterministic phenomena, it is not clear what exactly was simulated and how.

5. The authors concluded that the ratio between maximum and mean corrosion depth is constant and equal 1.8. It appears that this ratio was inferred from the lab experiment. However, the lab experiment was performed on small samples, whereas this constant ratio is assumed for large pipe samples (1 meter square). If one accepts that corrosion pit depth is random, then the authors must prove that this 1.8 ration is scalable from a small to a large sample.

6. It is not clear how the long-term corrosion rates were obtained given that the lab experiment lasted only 12 months. Furthermore, Figure 4 indicates linear long-term corrosion. Was this based on only 2 data points?

7. The authors go into great pains to correlate corrosion rates to flow velocities. However, in a typical distribution pipe, flow velocities change continuously, and often significantly, due to changes in demand. The proper way to consider flow velocity impact on

internal corrosion, would be to consider much shorter time steps (hour?) than the one year time step that the authors seem to have used.

8. In page 89 line 15-16 the authors state that validation samples were collected opportunistically from locations of pipe breaks. This non-random sampling may very well have biased the results towards higher corrosion rates.

9. The description of "model validation" in Page 95, lines 1 through 15 sounds like it might constitute some form of over fitting of the model to the data. The authors must explain more clearly and in more detail what exactly was done. Also, Figure 7 does not help in understanding of what was done exactly.

Minor issues:

10. Page 87, line 4: correct citation.

11. Page 89 line 20-25: provide reference for this ultrasonic method of estimating remaining wall thickness.

12. Page 93, line 5: Either linear or non-linear trend (no such thing as semi-linear).

13. Page 96 line 1-6: would be useful to attempt a plausible explanation for this observation. Is it possible that pH is just a surrogate for other differences in chemical properties between surface and ground water?

14. Page 97 line 7-11. Not clear how 30-35 years were calculated. Was it assumed that the pipe wall thickness was reduced throughout its circumference by 1.8 times mean corrosion depth? If yes, then this is super-conservative approach that may not be justified in all cases.

15. Figure 2 – not necessary.

16. Figure 5 seems to reflect curve-fitting based on 2 (or less) points. What is the confidence in this exercise? Also vertical axis missing units.

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