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Water Quality Risk Prediction and Control in Water Distribution Network

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ABSTRACT

Supplying clean drinking water is critical role for water works. The long-lasting discoloration problem that occurred in a city in 2019 caused serious difficulties in citizen's lives. Discoloration happens from aged pipe and causes distrust and interruption of drinking water. Discoloration is hard to predict since many factors are corelated with it. It has been found that discoloration is caused by sediment and rust in the water supply pipe network which is rising as the flow rate changes. In the event of a sudden change in the water velocity, there is a risk that the flow floats rust stains attached on the wall of pipe. This study investigates and predict water quality risk in the water supply network due to discoloration and suggest ways to mitigate and respond effectively.

Numerical simulation software was used to analyze flow rate with the WaterGEMS software. G block in a city in South Korea was target area. The flow rate distribution in the studied area is 0.58 m/s maximum flow rate, 0.15 m/s average flow rate, and 0.0005 m/s minimum flow rate. Overall the slow flow rate distribution is shown. There are 32 pipes with flow rates less than 0.17 m/s at the average value. The demand pattern peak value, i.e. the number of pipes with a maximum flow rate of less than 0.35 m/s per day, is 47, equivalent to 89%. These pipes bear risk sections because they are more likely to be deposited and are less likely to be self-cleaned when particles are deposited.

In the case of abnormal conditions, suspended solids, rusts, and antagonists are considered to be at high risk of being supplied to the consumers, as 89% of the pipes have a low normal flow rate and a maximum daily flow rate of less than 0.35 m/s, and these pipes are more likely to be deposited by particles.

a) b)

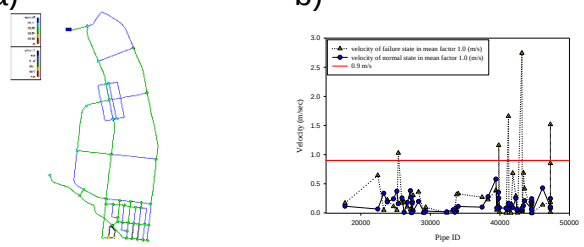

Fig. 1. Pipe network diagram of block for a), velocity profile for b)