Fact sheet no 3: Application of sensor results for modelling and managing of health risks in water

Introduction

Urban waste water contains pathogenic viruses. Even the most advanced treatment does not remove all the viruses. Therefore viruses are present in the environment and pose a health risk to the population. The traditional water quality indicators do not correlate with pathogenic viruses and traditional analyses are costly, time consuming and require a highly skilled laboratory.

In this project we have aimed to develop a novel, cost effective, portable on-site detection system capable of monitoring for enteric viruses in fresh water bodies.

Objective

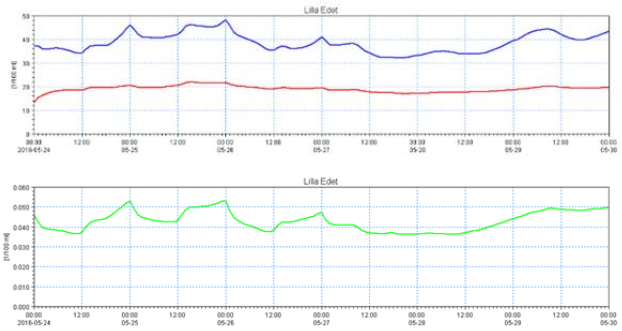
When the sensor has made a measurement and the result has been transmitted to the user, action needs to be taken if the virus concentration is above an acceptable value.

This is particularly important for drinking water supplies. In addition, in cities with combined sewer and drainage systems urban flood water will contain human waste water, which pose an infection risk.

The objective of this part of the project was to demonstrate the applicability of the sensor for drinking water and waste water management applications.

Modelling of infection risks from raw water

We have developed a model for microbial contamination the river Göta älv, Sweden, which is the raw water source for the water supplies of several municipalities along the river. The model can predict the concentration of pathogens, including viruses, along the river, based on measurements of the concentrations in discharge from waste water treatment plants. Predicted concentrations at the raw water intakes are used for assessing the health risk. If too high, action such as intensifying treatment or switching raw water source can be taken.



Calculated concentration of E. coli (blue) and Enterococci (red) and predicted concentration of norovirus (green) in Göta älv at Lilla Edet, 24-30 May, 2016

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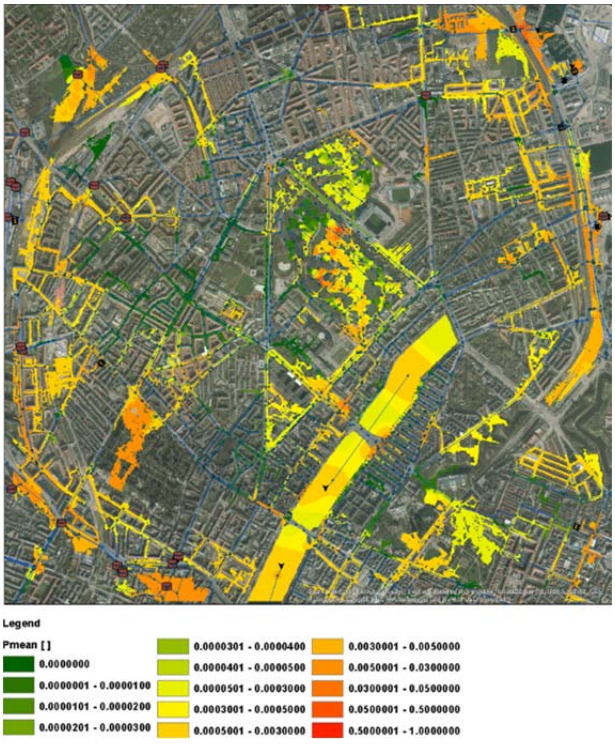
Modelling risk during urban flooding

We have developed a hydraulic flood model for parts of Copenhagen, Denmark, which can estimate pathogen concentrations. Based on measurements (e.g. by the sensor) of undiluted waste water, concentrations in the flood water and the infection risk it poses to the population can be estimated. The estimates are then applied as decision support for flood management.



Infection risk map (Paverage.) from Nørrebro, Copenhagen for children during urban flooding.

Recommendations

Risk based water management is internationally recognized as the best way of achieving acceptable water quality. It is possible to model infection risks during contact with waste water contaminated water. Analyses, including sensor outputs, combined with hydraulic models and risk models provide a tool for advanced risk assessments.

Drinking water is best managed by water safety planning (WSP), and sanitation and waste water by sanitary safety planning (SSP).

We recommend that drinking water and waste water utilities apply hydraulic models in combination with analyses, including sensors for the risk assessments needed to perform WSP and SSP.

At national or regional levels, defining acceptable risks and requirements to the utilities documentation of risks via the safety plans will improve the protection public health and optimize use of resources.

References

http://www.aquavir.eu/

Mark, O., Jørgensen, C., et al. (2015). A new methodology for modelling of health risk from urban flooding exemplified by cholera - Case: Dhaka, Bangladesh. Flood Risk Management. DOI: 10.1111/jfr3.12182

Heinicke et al (2016). A transport and inactivation model for indicator organisms and pathogens in the river Göta älv, Sweden. Poster presentation at 10th Nordic Drinking Water Conference, Reykjavík.

Other fact sheets 1: Aquavir – Development of a Portable Automated Water Analyser for Viruses. 2: The AquaVir Sensor System. 4: Development of a "European" map of viruses in water. 5: Standardization in the Aquavir project

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