

COMPLETED PROJECTS FROM FY2012 – final reports available on wrc.osu.edu

Dr. Dominic Boccelli, Assistant Professor in the School of Energy, Environmental, Biological and Medical Engineering at the University of Cincinnati recently completed a project titled “**An Integrated Framework for Response Actions for a Drinking Water Distribution Security Network**” funded by the Ohio Water Resources Center via an OWDA sub-award. The specific objectives of this project will help to realize the long term goals of developing the computational and algorithmic framework necessary to achieve an integrated, real-time set of applications associated with distribution system contaminant warning systems.

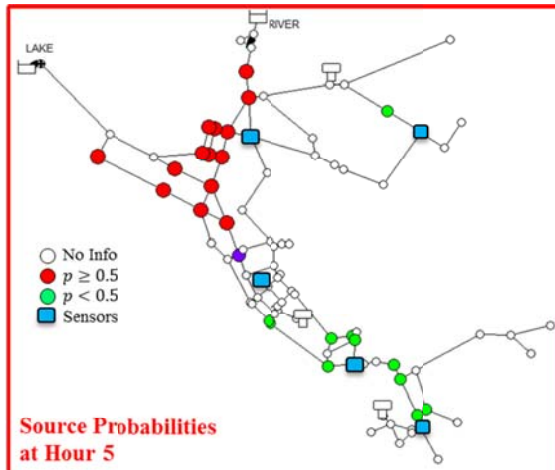


Figure 1 Estimated source probabilities at hour 5 of the simulation; red symbols represent locations with probabilities of being a source greater than 50%, green symbols represent locations with probabilities of being a source lower than 50%.

This research developed a forecasting and confirmatory sampling algorithm, and was evaluated with the test network shown in Figure 1. Using a virtual distribution network with five contaminant sensor locations, the algorithm estimated the probabilities of contaminated (red) and safe (green) locations within the network based upon a simulated intrusion event. This information was used to forecast the potential spread of the intrusion event, and estimate the amount of additional information to be gained by performing confirmatory sampling at unmonitored locations to assist in confirming the injection event. For this particular network and intrusion scenario, the top two sampling locations were the tanks (IDs 1 and 2), which are shown in Figure 2. The locations of the remaining top 10 sampling locations are also shown and demonstrate that the better sampling locations tend to be grouped together. The resulting algorithms will provide the foundation for developing more robust response

activities when attempting to mitigate the impact of a potential intrusion event.

Researcher: Dr. Boccelli's primary research interests are in the areas of Water Resources, Water Quality, and Environmental Systems Analysis. His research activities are focused on developing decision support tools based on fundamental principles of environmental engineering and science to assist engineers, managers, and policy makers in making technology, design, and regulatory decisions. More explicitly, these tools will incorporate various mathematical modeling and optimization techniques to attain the desired objectives. Additionally, given his academic and research experience, his research includes laboratory and field experiments, where appropriate, to develop an improved understanding of the processes used in the decision making process. This two-pronged research philosophy has arisen from his research and experience in both Environmental Engineering and Chemistry.

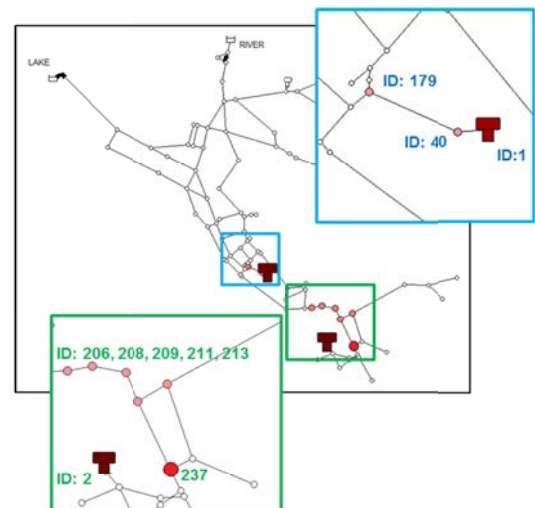


Figure 2 Plots demonstrating the spatial location of the confirmatory sampling nodes that resulted in the greatest increase in information associated with the simulated intrusion event.