CHARACTERIZING THE PREVALENCE AND MITIGATING POSSIBLE RISKS OF WASTEWATER BORNE ANTIBIOTIC RESISTANCE

NOT IN OUR COMMUNITY – AN ACTOR NETWORK THEORY ANALYSIS OF THE CHLORAMINES CONTROVERSY IN CHARLOTTESVILLE, VIRGINIA

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SOCIOTECHNICAL SYNTHESIS

Antibiotic resistant bacteria have been found in both the University of Virginia hospital system and the Moores Creek wastewater treatment plant. As contact with antibiotic resistant bacteria could be deadly, it poses a health risk to the Charlottesville community, however little is understood about the movement of these bacteria and potential treatment options. The Technical project located areas containing these bacteria in the wastewater system and identified potential treatment interventions within the community. Tightly coupled with the Technical project is the Science, Technology, and Society thesis which conducted an Actor Network Theory analysis on a controversy pertaining to a water infrastructure decision in Charlottesville in order to understand the importance of community interaction with such decisions. These projects are coupled through the understanding that community interaction with water governance will be essential when updating water infrastructure to handle new contaminants like antibiotic resistant bacteria.

Antibiotic resistance is becoming increasingly prevalent in our urban water infrastructure and the surrounding environment. To address the complexity of this issue, the technical project was comprised of two main components. First, the transport and fate of antibiotic resistant bacteria within the Charlottesville wastewater system was investigated through a series of experiments. Samples from multiple points throughout the wastewater system were analyzed for antibiotic resistance. The second component of the technical report consisted of creating a method to analyze potential intervention treatments. This methodology was used to make a recommendation on how to handle antibiotic resistance in the Charlottesville community.

From the first component, evidence of antibiotic resistant bacteria were found in all areas sampled except the final treated effluent and sediments of Moores Creek. These results indicated

that antibiotic resistant bacteria were being adequately treated by the disinfection method used at the wastewater treatment plant. Once this conclusion was reached, possible intervention technologies were collected and categorized into one of three intervention levels: point source within the hospital, on site at the hospital, and at the municipal wastewater treatment plant. The interventions were compared over nine criteria, which were developed through a literature review. This method was used to develop the recommendation for the Charlottesville community that they continue to use UV disinfection at the municipal scale in the Moores Creek wastewater plant and invest in point source interventions to increase patient safety within the hospital.

As contaminants continue to become more prevalent in our waterways, it will require water treatment authorities to work with communities to update water infrastructure. This was the case in Charlottesville, Virginia in 2012 when the EPA required the community to change their water treatment method to meet new regulations. The water authorities in Charlottesville decided to change to chloramines, a decision that was not well received in the community and was eventually overturned in favor of a more expensive water treatment method. In order to understand the role of transparency and community awareness on the successful implementation of water infrastructure in different communities, an Actor Network Theory analysis was conducted on the actors surrounding this controversy over water treatment in Charlottesville. The analysis was conducted through a combination of reviewing current literature, local newspapers that closely followed the controversy, and census data for Charlottesville and Albemarle County.

The analysis focused on a six-month period during which major events from the chloramines controversy took place. Six actors were defined to have a large contribution on the decision over the water treatment method, these include the Rivanna Water and Sewer Authority, Albemarle County, the City of Charlottesville, local consumers, activist groups, and water

infrastructure. For each of these actors, two to three major actants that influenced their decision on the central issue were defined. This analysis showed that depending on the actants of community actors such as consumers and activist groups, community reaction to water infrastructure changes can be highly varied. For the Charlottesville chloramines controversy, the local governing bodies willingness to listen to the community and be transparent over their decision-making process encouraged involvement and activism in the community. In turn, the community was able to make informed decisions over their water treatment process and influence the outcome of the decision.

With earlier consideration and involvement of community actors and their actants by engineers and policy makers, fewer controversies and delayed implementation plans would happen and communities would be able to make informed decisions about their municipal services. These decisions are only going to become more common as new contaminants, such as antibiotic resistant bacteria, began to emerge. Therefore, it is important to understand the best way to communicate and discuss these topics with the public to prevent drawn out controversies and misunderstood decisions.

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