

Thesis Portfolio

Scale-up and Design of the Janicki Omniprocessor with Reverse Osmosis Technology
(Technical Report)

**The Negative Impacts of Wastewater Treatment Plant Operation on the Health and
Quality of Life of Neighboring Communities**
(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science in Chemical Engineering

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SocioTechnical Synthesis

The wastewater treatment (WWT) process has the power to alleviate worldwide issues of inadequate sanitation, hygiene, and potable water. The capstone research involves designing and upscaling the Janicki Omniprocessor (JOP). This WWT technology intakes the world's most undesirable product—human waste—and transforms it into three valuable products: potable water, electricity, and fertilizer. This technology will aim to provide sanitation services to one million people, who normally risk disease by disposing of their waste in pit latrines. The JOP offers a final destination for this waste and it will no longer continually leach pollutants into their drinking water sources and air.

Despite this technology's humanitarian goals, its implementation in wastewater treatment plants (WWTPs) can impede on this initiative. Instead, it could continue to create problems for those living closest to the operation. It is essential to consider the human and social consequences of WWTP operation because recent research has revealed that they have negatively impacted the health and quality of life of communities adjacent to WWTP operation. This reality makes the entire process of WWT not only counterproductive to its original intent, but hypocritical. The WWT network will be analyzed using Latour's Actor Network Theory (ANT) and its themes of program of action (POA), delegation, and discrimination as well as evidence geared towards the costs of WWT operation on humans. The method of data analysis is a consequential analysis of specific risks to humans that are associated with living near WWTP operation. Evidence of this is collected from several research articles published in chemistry, environmental science, and technology journals as well as a control case study.

Examining the possible effects that the WWT system has on certain communities will highlight how striving to alleviate large-scale issues can yield unanticipated ones during the

process. As a result of the research and analysis, the thesis will illuminate how the health and quality of life of adjacent communities are disproportionately and negatively impacted by WWTP operation. Governments, WWTPs themselves, and surrounding communities can all take specific actions to foster a more inclusive atmosphere for all actors within the WWT network. When considering both the JOP technology and consequences of living near WWT operation, there is a definite potential to advance the lives of some people yet marginalize others simultaneously. Like any decision to be made in engineering, these desirable and undesirable outcomes must be thoroughly evaluated both before and after eventual implementation. The capstone and STS research will illuminate the importance of defining all actors that could possibly be impacted by a decision or design. It will also highlight how unfavorable, and sometimes harmful, results arise when this responsibility is ignored.