

Questioning the Impact of Triclosan on our Future

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Provably Clean and Triclosan

The name of my technical project is " Provably Clean: A Formal Analysis of Hand Hygiene During Anesthesia Induction." The project aims to create a framework that uses discrete-time Markov chains and state machines to reduce infections caused by incorrect anesthesiology induction procedures and contamination. This idea connects to my STS research paper through one of the first steps in Anesthesia induction: cleaning the patient. A common cleaning agent is Triclosan, a common external antiseptic. However, Triclosan presents a series of ethical issues because of its deleterious effects on long-term environmental and human health while providing short-term benefits. These impacts and their usage in my capstone project provided the rationale for writing my STS paper, as the capstone project never considered the procedure's long-term effects, solely focusing on protecting the lives of the people on the operating table. Moreover, with my STS paper, I decided that there should be an ethical analysis of my capstone project (not by an IRB) and its effects beyond the University of Virginia.

SIEDS Capstone, "Provably Clean" Abstract

Healthcare-acquired infections (HAIs) are a fundamental problem in operating rooms. Anesthesia providers' hand hygiene during induction is a major contributor to this problem. HAIs can lead to grave consequences such as sepsis and death. Proper infection control practices are expected to be in place. However, multiple people working concurrently results in more hands with less clearly defined roles. This makes the process more complex and prone to error. Moreover, anesthesia induction is a rapid procedure that may make it difficult for practitioners to remember to clean their hands. Previous work sought to address this problem using a novel computational method based on model checking. This allowed an analyst to model an induction process and prove whether the procedure protects critical objects that should be clean throughout

the procedure. In this work, we extended this method's capabilities and used it to evaluate the induction procedure used at a medical center. To accomplish this, we conducted observations and used this information to construct a model of a real anesthesiology induction procedure. We then used the method to evaluate this normative procedure, but we also introduced modifications that included nondeterministic factors such as skipping steps and accidentally touching hands together. By analyzing these models, we discovered that the evaluated induction procedure was robust both normatively and to practitioners skipping hand hygiene steps. However, our method found two ways improperly cleaned equipment could allow serious patient cross-contamination.

Questioning the Impact of Triclosan on Our Future Abstract

This paper focuses on the sociopolitical effects of Triclosan's usage. Triclosan is broad-spectrum antimicrobial that prevents growth or kills bacteria commonly used in food storage, cosmetic products, hospitals, industrial processes, and mouthwash and exist in the urine and blood of 75% of people, according to the CDC. Additionally, research has found that Triclosan is associated with hormonal disruption, cancer, antibiotic/antifungal resistance, and environmental degradation. One of the methods for its negative and positive effects is that when it breaks down in organisms or the environment, it forms reactive products that damage genetic material and cellular structures. The core research question of this paper is: "How has Triclosan interacted with the world in its first- and second-order effects and intended and unintended consequences?" Through this question, the paper presents how society evaluates convenience and the long-term outcomes of its decisions. This paper uses a mixture of literature reviews, analysis, and policy reviews to define its research question within an STS framework. This paper's research uses actor-network theory as a framework, which is a toolbox for analyzing complex systems through material-somatic methods. This paper's research expects to find that Triclosan had and has a

long-term negative impact on the environment and public health. The significance of studying Triclosan's consequences in an engineering context is that Triclosan is a case study of the duty of care, managing unexpected consequences, and the impacts of public policy, factors that engineers should consider during product development.

Lessons Learned from doing Provably Clean and Triclosan Simultaneously:

Doing the “Provably Clean” technical project and the STS paper on the impact of Triclosan offers a perspective on the long-term environmental and health consequences of Triclosan balanced with the benefits that Triclosan provides to the American medical system. These two distinct papers intersect over a shared actant, creating a systematic approach to addressing critical issues of Triclosan. While “Provably Clean” focuses on immediate patient safety, the Triclosan research delves into long-term environmental and human health effects. As mentioned in the paragraph “Provably Clean and Triclosan,” the capstone lacked an ethical discussion of the anesthesia induction methods, as the paper presumes that saving lives is more noble than considering the future consequences that come from lifesaving. Moreover, the intersection of the papers gives more power to define and understand Triclosan’s policy implications. Our Triclosan research, grounded in actor-network theory, examines how decisions shape our world. By understanding Triclosan’s unintended consequences, we inform public policy. Engineers, too, must consider such impacts during product development. Thus, these projects collectively contribute to informed decision-making, both in the short-term and long-term.