Development of Liquor-Based Canned Cocktails: Healthy, Bubbly, & Yummy
(Technical Paper)

How Has Society's Acceptance of Nuclear Energy Been Changed Due to Films and the Numerous Representations of Nuclear Energy Within?
(STS Paper)

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Chemical Engineering

By
John Fitzgerald

November 1, 2021

Technical Team Members:

Bryan Murphy
Cat Sano
Reagan Scagloine
Steven Nguyen

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.

ADVISORS

MC Forelle, Department of Engineering and Society

Eric Anderson, Department of Chemical Engineering

Introduction

Nuclear energy, is it the solution to our clean energy needs or a technology that will lead to humanity's downfall? Nuclear energy has had a charged history with it being plagued with controversies and mixed public perception from its inception. For example, when initially utilized for energy, it was immediately associated with nuclear weapons to discourage its acceptance and even now is still dealing with perceptions of being weaponizable (Cravens, 2002). This divided history is in part due to films and their utilization and dramatization of nuclear energy to drive plots and create conflict in films. Films are one of, if not, the most influential forms of media; therefore, films containing depictions of nuclear energy should have an effect on societal opinions about nuclear energy. Many films cover nuclear energy in a semi-realistic tone adding to audience's acceptance of the film's perceptions of nuclear energy rather than the reality. One critical example of film's power in altering perceptions was the 1979 movie, *The China Syndrome*, revolving around safety hazards at a nuclear power plant almost leading to a nuclear meltdown. Although claiming to be a scenario that could really happen, the film took some liberties to dramatize the encounter. The nuclear industry refuted these claims in an attempt to downplay the publics acceptance of the film's perceptions by stating that the film was "sheer fiction" and "character assassination of an entire industry" (Burnham, 1979). Less than two weeks after the film's release, the Three Mile Island accident occurred, causing a partial meltdown of the reactor — a very similar incident to the one portrayed in *The China Syndrome*. This incident closely linked the fiction of the film with the reality of the event and further cemented to the public that nuclear energy was dangerous and that films' portrayals of nuclear energy were factual despite their dramatization.

This is just one example of how films throughout the years have taken different stances on nuclear energy due to a variety of political and social reasons such as different major nuclear scares like the Three Mile Island Accident, Chernobyl, and the Fukushima Daiichi Nuclear Disaster. By analyzing a number of films firsthand, reading numerous research articles, and interpreting various quantitative data, I will attempt to concretely conclude the overall impact that cinema has had on nuclear energy's perception, market, and policies, as well as to determine the effect that nuclear energy has had on the film industry.

Technical Topic

Motivation

Hard seltzer sales, such as White Claw, are growing at a much faster rate than beer sales, due to its popularity among Gen Z and Millennials who have established a drinking culture with seltzer brands. Trends such as the Smirnoff Ice challenge and colloquialisms such as "No laws when you're drinking Claws," contribute to the growing sales of canned seltzers and the expansion of product lines to include flavored seltzers (Goldfine, 2021). The trending drink in correlation with the onset of the pandemic has further skyrocketed sales. The pandemic contributed to a heightened apprehension to consume alcohol in public spaces, such as bars and clubs, and generated a shift towards at-home drinking as well as online food and beverage shopping to avoid viral exposure. Thus, canned cocktails have high market potential and potential for growth due to its convenience and reminiscence of buying drinks at a bar. Furthermore, canned cocktails have largely marketed themselves to health-conscious populations and the gluten-free community who are shifting towards drinking low-alcohol fruit-flavored beverages (*Ready To Drink Cocktails Market Size Report, 2022-2030*, n.d.).

As people have grown accustomed to drinking canned cocktails in the comfort of their homes, there is a growing desire for more sophisticated liquor-based products that can offer a better-tasting bar cocktail adjacent beverage. Most common seltzers have a lingering aftertaste from the malt-base that many consumers find unsettling. Our product aims to improve the taste by using a distilled liquor base instead. While this change will increase production cost, many consumers would be willing to pay a premium to remove the unpleasant aftertaste and our product will remain competitive. Additionally, in developing a liquor base there is broad versatility and a wide range of products that can be marketed from a more streamlined process. Different flavorings can be added to the liquor base and sold as different cocktails. We envision this product being consumed both at home and at formal events, where a more polished, mobile drink can replace live mixing of cocktails that may cause anxiety about the transmission of covid.

Process Overview

This Capstone project will design a unit-operations process to ferment and distill cane sugar-based liquor for implementation in low-calorie carbonated canned cocktails. Our initial step is to produce a high concentration of ethanol within our mash. Sugar will be added with Safspirit C-70 yeast in a fermenter to produce ethanol and carbon dioxide (BEng & BSc, n.d.). The fermenter would be connected to a heat exchanger, keeping the fermentation temperature around 25℃-33℃, the ideal range for the yeast strain used. The yield of ethanol produced will be kept around 10-15% purity, as too much ethanol would kill the yeast and prevent fermentation, while too little ethanol would result in slower fermentation. The ethanol mash will then be transported to scrubbing and filtering units to remove any impurities and eventually sent through a continuous feed distillation process (Holl, 2022). This process consists of a distillation column, reboiler,

condenser, and reflux drum. Steam will be used in conjunction with the heat exchange units to control the temperature of the columns. The ethanol mash will be injected into the column and vaporize on the trays traveling up the column where it will recondense and vaporize into a purer product. The bottoms product will consist almost entirely of water and other byproducts due to their higher boiling points (*Distillation of Mash and Rectification of Alcohol*, n.d.).

As ethanol is continuously distilled, the alcohol percentage/purity will increase to reach a goal of 90% purity. Fruit flavorings will be purchased and combined with the purified ethanol, water, stevia, and preservatives (sodium citrate) to create a product of 4-7% ABV (alcohol by volume) (*How Is Hard Seltzer Made?*, n.d.). Once thoroughly combined, the drink will then be carbonated with food-grade carbon dioxide and sent to canning. We intend to sell 3-4 flavors in a mixed pack of 12 canned cocktails. The general outline of the block flow diagram is seen below.

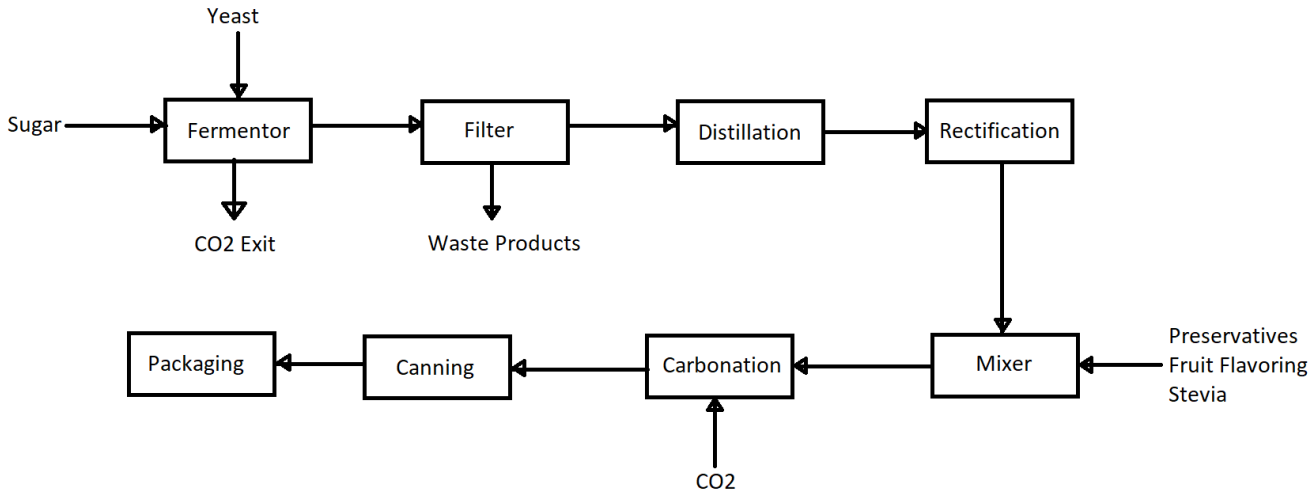

Figure 1. General Process Flow Diagram of Creating Canned Cocktails

Process Modeling and Calculation Methods

Our group will follow previous literature and current plant designs to help guide our design process. The project will be advised by Eric Anderson, Professor of Chemical Engineering at the University of Virginia. We will model our fermentation process using MatLab

and Excel and will switch to Aspen v11 Plus for distillation. This modeling will begin with the introduction of sugar for our fermentation process and finish with our ready-to-drink canned cocktail. All inputs, outputs, side products, byproducts, and waste will be considered and properly accounted for so no stream or material is without a source and sink. This modeling will include factors such as scale, size of the plant, cost of operation, ingredients, and disposal. Additionally, to accompany our process modeling we will also consider and report any and all safety hazards or risks associated with our plant and the chemicals involved. Our team will write a Design Basis Memorandum in the Fall of 2022 and finish the technical design in Spring of 2023.

STS Topic

As fossil fuels are being phased out and clean energy is filling the gap, favorable public opinions on different energy sources is crucial to the source being adopted and utilized on a larger scale. Nuclear energy is highly disputed and has a large spectrum of opinions surrounding it; therefore, it can be hard for governments and companies to consider adopting it as an energy source due to the varied public opinion. This STS topic aims to understand where some of this broad public opinion stems from by analyzing cinemas' portrayals of nuclear energy and its messages. Alexander Cannon in his paper, "A Damaged Reputation: Nuclear Depictions in Entertainment Media," believes that this topic is not only overlooked, but that film's portrayals indeed have a drastic impact on the public's skewed perception of nuclear energy, stating that: "While scholars have analyzed how some forms of media portray nuclear science, entertainment media, specifically, has been almost entirely overlooked. I argue that these portrayals significantly contribute to a widespread common sense that frames nuclear energy as something with catastrophically horrific potential" (Cannon, 2022, p. 1). The current landscape of public

opinions on nuclear energy show that it possesses record high support level (Bisconti, 2022), but that there is still a lot of skepticism still surrounding it, as it has for decades. (Baron, 2020). This means that at present is the perfect time to analyze such a topic to see where these beliefs stem from. Additionally, research has been conducted to show that while these opinions are strong and diverse, they are not set in stone. Given a convincing reason, these public attitudes towards nuclear energy can be swayed in either direction (Bisconti, 2018).

STS Methodology

To begin finding and collecting data for use on answering the proposed STS research question, two distinct analytical methods will be used. The first method will be discourse analysis (Wall, 2015). This method involves closely analyzing texts – in this case movies – produced by agents to understand not just what the texts are saying, but who is saying it and to whom. This method will be primarily used to see how the nuclear industry is marketing itself and how cinema has been marketing its portrayal of nuclear energy to its audiences. For example, current nuclear energy research purposefully marketing itself as a fictitious technology which has become reality (Popa-Simil, 2011). Discourse analysis applied to movies will be used in a smaller capacity due to the scope of the STS topic. This topic aims to only research cinema containing nuclear energy – which only makes up a small subsection of films in the genre (Portelli, 2014) – and its impacts, not cinema's depictions of nuclear weapons, which dominates the nuclear topics in films.

These films will be selected from numerous sources such as discussing the topic with Erin Pappas, a librarian at UVA who handles the Media Collections and would be able to identify essential films, or referencing online compendiums such as in Cristóvão Marinho's article "Filming the atom: Systematically Exploring Images of Nuclear Energy and Their

Messages in Popular Movies" (Marinho, 2021), which organizes numerous films that deal with the subject of nuclear energy. From this list of films, I will research reviews, opinion pieces, and analysis about each film to see how it potentially shaped societal views. Finally, I will research what public opinion for nuclear energy was during certain periods of time and map the different films and their stances on nuclear energy to see if and by how much the film swayed society's attitude on nuclear energy.

The second method used will be literature review and synthesis (Snyder, 2019) consisting of compiling existing research and examining overlaps, gaps, and intersections between the pieces. This method has the potential to outgrow the initial breadth of the proposed STS topic. To prevent this and narrow the focus, this method will be used solely for research into how nuclear energy disasters have affected films, and will not include the reverse of how films have influenced society views of nuclear energy. While research on this topic is present, see (Lindbladh, 2019) and (Kubo, 2019), they each deal with a specific nuclear disaster and how it has affected cinema. This leaves intersections and connections that can be made to provide a generalization of how any nuclear disaster might impact the film industry. This will not only help limit the scope, but also allow for conclusions to be drawn due to the current gaps in research.

Conclusion:

My STS topic is of importance because nuclear energy is considered by some to be the only truly implementable green energy currently, while others see it as a great risk without much of a reward due to the concerns surrounding the use and disposal of radioactive material. Seeing how cinema constructs, solidifies, and dismantles these viewpoints can provide insight into societies appreciation and fears behind nuclear energy. Additionally, this insight can then be implemented to improve nuclear energy by strengthening the advantages, while attempting to

diminish the liabilities of nuclear energy as viewed by the public. Paul Boyer in his article, “A Life in American Cinema: The Nuclear Option”, succinctly states the importance of this project by commenting: “I soon realized that nuclear-age movies were not mere visual window-dressing. They influenced how Americans thought about nuclear issues, and they help one map the larger cultural and political trajectory of the nation’s nuclear history” (Boyer, 2008, p. 2). By analyzing the motives and messages behind these nuclear films and seeing their societal impact, I hope to uncover both the love and fear of nuclear energy.

In addition, our technical topic will produce a complete and detailed design for a unit-operations process to ferment and distill cane sugar-based liquor for implementation in low-calorie carbonated canned cocktails. The ultimate goal of our produced drink will be to bring a diverse group of people together made possible due to the culture that is already present around hard seltzers. These drinks draw in equal crowds and invite all to participate. Unlike the marketing behind beer and wine, hard seltzers have a clean 50-50 split in gender of consumers, where “women love it. Even frat boys and the bro-iest of men love it” (Heil, 2019). This will allow for the largest target audience to come and enjoy our product together no matter who you are.

References

Baron, J., & Herzog, S. (2020). Public opinion on nuclear energy and nuclear weapons: The attitudinal nexus in the United States. *Energy Research & Social Science*, 68. https://doi.org/10.1016/j.erss.2020.101567

BEng, J. S. & BSc. (n.d.). *Best yeast for making vodka*. Headlands Distilling Co. https://headlands.com.au/best-yeast-for-making-vodka/

Bisconti, A. S. (2018). Changing public attitudes toward nuclear energy. *Progress in Nuclear Energy*, 102, 103–113. https://doi.org/10.1016/j.pnucene.2017.07.002

Bisconti, A. S. (2022, June 3). Record high public support for nuclear energy, 2022 national nuclear energy public opinion survey finds. *Bisconti Research, Inc*. https://www.bisconti.com/blog/public-opinion-survey-finds

Boyer, P. (2008, November 1). *A life in American cinema: The nuclear option: Perspectives on history*. American Historical Society. https://www.historians.org/research-and-publications/perspectives-on-history/november-2008/a-life-in-american-cinema-the-nuclear-option

Burnham, D. (1979, March 18). Nuclear experts debate 'The China Syndrome.' *The New York Times*.

Cannon, A. (2022). A damaged reputation: Nuclear depictions in entertainment media. *Chemistry & Biochemistry Student Scholarship*. 12, 1-3. https://digitalcommons.providence.edu/chemistry_students/12

Cravens, G. (2002, March 1). *Terrorism and nuclear energy: Understanding the risks*. Brookings. https://www.brookings.edu/articles/terrorism-and-nuclear-energy-understanding-the-risks/

Cressman, D. (2009). *A brief overview of Actor-Network Theory: punctualization, heterogeneous engineering & translation*. https://summit.sfu.ca/item/13593

Distillation of Mash and Rectification of Alcohol. (n.d.). https://bts.net.ua/eng/news/peregonka-brazhki-i-rektifikatsiya-spirta-eng/

Goldfine, J. & Jael, G. (2021, March 23). *How hard seltzer became the alcohol industry's party trick*. https://www.businessofbusiness.com/articles/history-of-hard-seltzer-white-claw-truly-bud-light-cacti-comparison-travis-scott-constellation/

Heil, E. (2019, September 10). *The key to White Claw's surging popularity: Marketing to a post-gender world.* The Washington Post. https://www.washingtonpost.com/news/voraciously/wp/2019/09/10/the-key-to-white-claws-surging-popularity-marketing-to-a-post-gender-world/

Holl, J. (2022, March 1). *A simple guide to how hard seltzer is made*. Wine Enthusiast. https://www.winemag.com/2022/03/01/hard-seltzer-definition-guide/

How is hard seltzer made? Production process explained. (n.d.). https://drinktinto.com/blogs/wine-wisdom/how-is-hard-seltzer-made

Kubo, Y. (2019). Still grieving: Mobility and absence in post-3/11 mourning films. *Journal of Japanese and Korean Cinema, 11*(1), 55–67. https://doi.org/10.1080/17564905.2019.1600695

Latour, B. (2009). *Reassembling the social: An introduction to actor-network-theory*. Oxford University Press.

Lindbladh, J. (2019). Representations of the chernobyl catastrophe in soviet and post-soviet cinema: The narratives of apocalypse. *Studies in Eastern European Cinema, 10*(3), 240–256. https://doi.org/10.1080/2040350X.2019.1608628

Marinho, C. A., Santos, A. A., Neto, J. V., & Quelhas, O. L. G. (2021). Filming the atom: Systematically exploring images of nuclear energy and their messages in popular movies. *Energy Research & Social Science, 79*. https://doi.org/10.1016/j.erss.2021.102158

Oudshoorn, N. & Pinch, T. J. (2005). *How users matter: The co-construction of users and technologies*. 247-270. Massachusetts Institute of Technology.

Popa-Simil, L. (2011). Advanced space nuclear reactors from fiction to reality. *Space, Propulsion and Energy Sciences International Forum, 20*. https://doi.org/10.1016/j.phpro.2011.08.025

Portelli, A., Martin, C., & Guarnieri, F. (2014). The representation of nuclear power in cinema: The contribution of a filmic analysis to understanding the public debate. *24th European Safety and Reliability Conference*, 1993-2000. https://doi.org/10.1201/b17399-273

Ready to drink cocktails market size report, 2022-2030. (n.d.). https://www.grandviewresearch.com/industry-analysis/ready-to-drink-cocktails-market

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Wall, J. D., Stahl, B. C., & Salam, A. F. (2015) Critical discourse analysis as a review methodology: An empirical example., *Communications of the Association for Information Systems, 37*(11). https://doi.org/10.17705/1CAIS.03711