ARFC MASTER THESIS

BY

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THESIS

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ABSTRACT

Abstract

dedication

ACKNOWLEDGMENTS

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INTRODUCTION

1.1 Background and motivation

1.1.1 Why is Nuclear Waste Disposal research important?

Implementation of a nuclear waste disposal plan and minimizing the cost of the nuclear fuel cycle are crucial to the future use of nuclear power [**?**]. If the U.S. nuclear industry does not find an effective and safe plan to manage the waste, the nuclear industry will continue facing political and social opposition.

[**More]

1.1.2 Possible Methods of Waste disposal

Currently, all of the commercial nuclear waste in the United States (US) are scattered across the country at each reactor site [** Reference]. There has been much debate on what to do with the nuclear waste in the long term. There has been much debate between an open fuel cycle and a closed fuel cycle.

[**Describe Open Fuel Cycle]

[**Describe Closed Fuel Cycle, why does France use it?]

[**Compare them – advantages and disadvantages of each]

[**Describe why an open fuel cycle is more feasible in the US] It was determined in the large multi-disciplinary study of the future of nuclear power that a once-through fuel cycle is more economic and proliferation-resistant than a closed fuel cycle that makes use of reprocessing technology [**?**].

[**Waste Repository is necessary no matter what because every fuel cycle will have non-reprocessable waste]

In this work, the expectation is that the chosen fuel cycle is a once through fuel cycle and the method of long term disposal of spent nuclear fuel (SNF) will be a deep geologic repository.

1.1.3 Previous Work towards repository modeling

Previous work towards the wicked problem of getting spent nuclear fuel from reactor sites to a final waste repository focuses on how different waste acceptance strategies impact economic expenditure [**?**], pre-emplacement surface storage time, waste package size, and repository footprint [**?**]. There has also been efforts to holistically evaluate the entire system to consolidate how each factor impact the cost and safety of moving SNF from reactor sites to the final waste repository [**?**]. Previous work in studying repository loading have used spent fuel assemblies that have an average burn up composition [**?**] to evaluate the heat load in the repository [**?**].

1.2 Objectives

The objective of this thesis is to:

- Create a Cyclus spent fuel conditioning model that packages spent fuel bundles into packages which have user-defined properties.
- Create a Cyclus interim storage facility that gives waste canisters to the repository facility to emplace in the order of a specific waste acceptance strategy.
- Create a Cyclus medium-fidelity repository model that accepts and emplaces canisters that results in the repository remaining below the thermal limit of the host geologic media. It should also give accurate time and spatial dependent temperature values in the repository.
- Use U.S. historical SNF inventory data [**?**] in various simulations that model different loading strategies for moving spent nuclear fuel (SNF) from reactor sites to a

  final waste repository.

1.3 Methods

Explain Cyclus, Cycamore, Cyder etc.

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