Nuclear Material Storage Site Selection Using Geo-Cyber Analysis
Industrial and Systems Engineering:
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Mathematical Model
Our model is similar to the p-median problem. This type of model is a facility location problem that locates P facilities in relation to customers so that the shortest distance is chosen between a facility and repository. It minimizes the product of the weighted Euclidian distance between repositories and facilities and facility production. Based on our proof of concept model, it was determined that the benefit from each added facility decreases exponentially. For our model it is assumed that high level nuclear repositories are un-capacitated and production of high level nuclear waste from nuclear facilities is based off of net megawatts of electrical energy produced by each facility.

Due to diminishing returns and time limitations, our team only considered opening one nuclear material storage facility. In this figure, no points overlap Native American reservations, aquifers, storage facility and a set of nuclear materials storage facilities.

Factors for Facility Site Selection
• Seismic Activity
• Population Density
• Primary Rocktype
• Secondary Rocktype
• Distance to Water
• Distance to Populated Areas
• Transportation Distance

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Possible Site Locations Characterized by Risk

Population Density

Possible Site Locations

Characterized by Risk

Population Density

Figure 5. The bolded criteria above are factors that we used in our model. The additional non-bolded criteria are factors that could be implemented to better the mathematical model.

Conclusions
From running the model, optimal site locations were outputted in three different regions of the US (Montana, Nevada, and Kentucky shown in Figure 3). If one of these points was to be employed, then the course of buying land and starting construction (at the chosen optimal location) would ensue.

Future Considerations
• Implement more factors
• Make more user friendly
• Implement projected 2040 population data
• Take into account utilities of regions of site locations
• Implement Survey
  • IRB approval
  • Make campus wide
  • Obtain large sample numbers

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Citations

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