

## Using Fuzzy Logic and Geological Testing to Site a Small Modular Reactor in Southern Saskatchewan

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### Summary

This research is to determine the optimal surficial geology parameters for siting a small modular reactor (SMR) in Saskatchewan. To develop the criteria required to determine geologically sound sites, existing digital databases of the geology, along with cross-sections, borehole logs, detailed overburden geotechnical maps and reports were obtained. Elements were extracted from these documents that were deemed important to siting in relation to building codes and soil stability reports. From these elements a two-step approach was developed.

Initially a series of soil data maps were created in ArcGIS. Slope, hydraulic conductivity, clay percentage, wind erosion potential and water erosion potential were selected, and individual fuzzy logic maps were created with a resolution of 1:1889. These maps were then formatted with the reclassify tool into 6 classes with graduating colours from green (class 1) being the most suitable place to site the SMR to red (class 6) being the least suitable site for an SMR. These maps were then combined through the overlay raster function and a final map was produced that collectively showed ideal locations using all the chosen criteria. This graphically eliminated areas and provided an easy to use system to establish a general siting.

Once a general area is selected using step one, then a more in-depth investigation of the site can be initiated. Using the elements that were realized from the literature review, a surficial geological siting index was developed. This index used a rating system based on different testing and site-specific results for every 10 meters of depth. It then added up the results and graded the layer on its acceptability for SMR siting. Once completed the investigator can then evaluate the site based upon each 10 meter layer and determine what engineering needs would be required in developing the SMR infrastructure.