Christopher White: Chemical & Biological Engineering
Mentor: Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering
Detection of Oil Under Sea Ice Using NMR Technology

With all of the drilling in the arctic, there is a need to quickly detect oil trapped under sea ice. Oil is challenging to identify under sea ice without drilling because it is very difficult to see, even if the ice is very thin. However, there is a potential for it to be detected using nuclear magnetic resonance (NMR) technology. An Earth's Field NMR (EF NMR) spectrometer could potentially be used as a quick, noninvasive means to detect oil trapped under sea ice. Understanding how an EF NMR spectrometer operates has been a key focus of this research due to the difficulty of obtaining a good signal. The detection of oil under sea ice comes from the comparison of T_2 spin relaxation times between oil and water. At high temperatures oil has a much shorter T_2 time than brine or water and it can easily be differentiated from the other two. Although the T_2 time of oil is short and hence very difficult to measure using EF NMR, measurements were accurately taken at room temperature. The main focus of this project has been to understand how to obtain reliable measurements using an EF NMR spectrometer and to obtain known room temperature T_2 times of oil and sea water to prove its potential. In subzero conditions the T_2 of oil and brine will shift dramatically. The next phase of this project will be to determine if oil and brine are measurable and differentiable in subzero temperatures using an EF NMR spectrometer. Preliminary measurements using a low field spectrometer indicate this will be feasible.