Drilling muds are used in oil and gas exploration to facilitate the penetration of the drill through various rock formations. The mud, which can be either water- or oil-based, is pumped down through the hollow drill shaft to the cutting tip and returned through the annular space around the shaft to the surface loaded with bits of rock called cuttings. On a drilling rig, the mud is separated from the cuttings by sieves and centrifuges and pumped back down the drill shaft. As drilling fines (particles so small they cannot be removed by the centrifuges) build up, a small slip stream of these fines is removed and replaced with fresh liquid.

In off-shore drilling, when using oil-based fluids the cuttings and fines must be stored on the rig and brought on-shore for treatment since they contain more than the 1 wt% oil that would allow their disposal in the ocean. Reduction in oil content using flammable solvents or open flames is not allowed on an off-shore rig. High pressure liquid CO$_2$ treatment technologies have been demonstrated for removing oil from cuttings but there are serious processing problems in applying these technologies to fines since they have the consistency of modeling clay.

This past spring, a group of students in the 10.26/10.29 projects laboratory demonstrated that it is feasible to reduce the oil in fines from about 11 to 1 wt% using high-pressure CO$_2$. The apparatus consists of a mixer/settler where liquid CO$_2$ is mixed with the fines, allowed to settle, and sent to a separator where the CO$_2$ is vented off leaving behind the oil. We wish to explore novel stirring methods and a range of process variables to increase throughput and reduce the amount of CO$_2$ needed.