

Friday, May 28, 2010

Electromagnetic Mopping

A Simple And Environmentally Safe Method to Clean-up, Manipulate And Collect the Gulf Spill Oil.

The methods we describe can be used to both clean up the spill and potentially stop the leak at the source as well. It has two components to it, which are described in the sections below.

Part 1 -- Oil spill removal and containment

The idea is simple; take ferrite dust filings and add them to the viscous oil in ocean water. It turns out that the dust filings mix well with the oil and forms what is essentially a somewhat loose colloidal suspension that floats on water. This then renders the mixture susceptible to magnetic forces. Some time has been taken to demonstrate this first part in the lab in advance. See demonstration video. In principal the filings could also be coated in an environmentally safe hydrophobic solution to improve the efficiency of the process. Nevertheless, the bare filings work surprisingly well in a desktop demonstration without any coatings. A permanent magnet or an electromagnet is then used to drag the solution across the surface of the water to a collection point. A demonstration was performed using a permanent magnet with surface field ~ 1.5 Tesla. This process quickly and efficiently pulled the oil and the filings across the surface of the water. An important effect (which was easily demonstrated) is that the filings start to accumulate near the pole of the magnet (as expected) and easily separate from the oil leaving behind a pool of oil, which can then be pumped and collected away. For example, this could be used to drag oil away from an ecologically sensitive location. As the filings accumulate at the pole of the magnet the oil is squeezed out like water from a sponge. The filings can then be collected and easily reused right away. This method in practice provides a way to manipulate and control the flow of the spill. There are a vast number of possible ways to handle this magnetic mixture by utilizing magnetic forces.

Large scale permanent magnet bars with surface magnetic fields ~ 1 Tesla can be made rather quickly and straightforwardly. Electromagnets, which are also readily available, would add control flexibility for easily adjusting how strongly one could pull, push or squeeze this magnetic mop. The ferrite filings are environmentally safe and most of them will be recollected and reused during the process. Thus, this method addresses long-term environmental effects as well.

Part 2 – Closing the Source Leak

To address the leak at the source, a four-wall box made of permanent magnetic material with a lid that includes a pipe can be placed in position around the leak. Instead of pumping mud or other material into this box, a much more dense mixture of colloidal magnetic material (filings and oil) can be pumped from the surface into the side or bottom of the box. As the magnetic and gravitational forces act, this material will form a magnetic gasket around the pipe as the filings separate from the oil and cling to the box. The

pressure from the leak will find the path of least resistance through the piped hole that flows to the surface where the oil is collected in a controlled manner. The basic principal here is not to necessarily stop the leak but to control the flow from the ocean floor, thus utilizing the natural forces rather than trying to counteract them one mile below the ocean surface. Using this method to control the flow from the source of the leak provides time to develop an engineering solution for stopping the flow entirely in a controlled manner. This concept could work well in several arrangements but underlying principle is that the magnetic forces around the source of the leak will capture the ferrite and form a strong clog around the leak with the help of gravity as well -- a magnetic gasket of sorts. This method has the added advantage of using some of the spilled oil from the surface as part of the solution for forming the necessary colloidal mixture.

ADDENDUM: Part 3 – Electromagnetic vacuum application

My vision for this application clearly goes beyond the spill in the Gulf. In principle one can also consider a further application that includes the coating of the ferrite filings with an environmentally safe oil absorbent material (many of which may already be readily available from industry) for use on land or water free surfaces (contaminated wild life etc.). In this case the magnetic force can be used to vacuum these contaminated surfaces (see second video).

ADDENDUM: Part 4 – Applications

One simplified application of this process would be to pump the magnetic mixture directly into the source so that the resultant oil that makes it to the surface is readily magnetizable. In this case it can be readily manipulated with magnetic booms and various magnetic souces.

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