



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

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| <b>Name(s)</b><br><b>Amanda B. Diamond</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Project Number</b><br><b>J1010</b> |
| <b>Project Title</b><br><b>Oil Spill Clean Up Using Nanotechnology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |
| <b>Abstract</b><br><b>Objectives/Goals</b><br>My objective is to measure the efficiency of using nanotechnology and magnetism to clean up oil spills and determine if it is a viable alternative compared to other methods used today.<br><b>Methods/Materials</b><br>Materials: Ferrofluid, Neodymium magnet (1.9 x 1.3 x 0.6 cm), Mineral oil, 9 petri dishes, Graduated cylinder, 0.2ml increments, Tap water, Food Coloring, Graduated pipettes.<br>Procedure: Add water to cover the bottom of three petri dishes, then add green food coloring. Use a pipette to float 2.5 mL of mineral oil on the water in each petri dish. In the 1st dish, don't add any ferrofluid (control sample), in the 2nd dish add 1 drop of ferrofluid, and in the 3rd dish, add 5 drops of ferrofluid. Put magnet in Ziploc bag and move it around the petri dish (1 complete revolution). Wipe off the oil on the bag and repeat 1 time. Transfer the contents remaining in the petri dish to the graduated cylinder and measure remaining oil. Repeat this procedure for a total of three trials.<br><b>Results</b><br>My calculated maximum average efficiency was 41% in the dish with 5 drops of ferrofluid. In subsequent follow on testing I was able to obtain efficiencies up to 76% using modified techniques and additional ferrofluid.<br><b>Conclusions/Discussion</b><br>My initial results showed that the efficiency of this method of oil spill cleanup was only 41% in the best case. Most methods used today, for example oil-skimming machines, have a 90% efficiency rate. In subsequent testing with additional ferrofluid, the efficiency of the cleanup procedure dropped significantly to 20%. My observation was that as I used more ferrofluid there was a limit to how much oil the magnet could pick up in each sweep. In addition, ferrofluid is made with oil so the more drops I added, the more I increased the amount of oil that needed to be removed. So modified the procedure - used 4 sweeps with the magnet instead of 2 sweeps. I also put the flat side of the magnet in the oil slick instead of the edge. In these tests, as I added more ferrofluid, the average efficiency increased as high as 76%.<br>Although the application of nanotechnology for oil spill cleanup is still in its nascent stage, I believe it offers great promise for the future. Today, scientists are working on this new method of cleaning up oil spills in order to improve and make it more efficient. |                                       |
| <b>Summary Statement</b><br>Nanotechnology has enabled the creation of a magnetic liquid known as ferrofluid, which, when added to an oil spill allows the oil to be picked up with powerful neodymium magnets, at efficiencies approaching current techniques in use today.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                       |
| <b>Help Received</b><br>My Dad supervised me during my experiments.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                       |