



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> <b>Anusha Ghosh</b>	<b>Project Number</b> <b>J0609</b>
<b>Project Title</b> <b>Hydraulic Fracturing Using Sea Water</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of this experiment was to explore the possibility of replacing fresh water with sea water to create an effective hydraulic fracturing fluid. Hydraulic fracturing extracts oil and natural gas from rock formations deep under the earth's crust using millions of gallons of fresh water. Using sea water to replace fresh water will lessen the impact of hydraulic fracturing on the environment. My hypothesis was: Sea water can be used as effectively as fresh water for hydraulic fracturing by varying the amount of gellant.</p> <p><b>Methods/Materials</b> Besides water and sand, there are 3 main ingredients of hydraulic fracturing fluid - guar gum, which is a gellant and makes the fluid viscous, boric acid, which is a cross linker that supports the viscosity of the fluid so that the sand can stay suspended, and baking soda, which adjusts the pH of the fluid so that the cross linker can work. In my first experiment I made hydraulic fracturing fluid using tap water, first by varying the amount of guar gum between 1, 1.25, and 1.5 grams, and then varying the amount of baking soda between 0.1, 0.15, and 0.2 grams. In my second experiment I created hydraulic fracturing fluid using untreated sea water by varying the amount of guar gum between 1.25, 1.35, and 1.45 grams. Then I used sea water treated with calcium chloride and bleach, and found that along with varying the guar gum between 1.25, 1.35, and 1.45 grams, I also had to vary the amount of baking soda between 0.1, 0.15, and 0.2 grams.</p> <p><b>Results</b> In the first experiment I found that 1.25 grams of guar gum, 0.15 grams of baking soda, and 0.08 grams of boric acid produces the best viscosity for fracturing fluid made with tap water. In the second experiment I found that 1.45 grams of guar gum, 0.15 grams of baking soda, and 0.08 grams of boric acid produces the same level of viscosity in untreated sea water as in tap water. However, for treated sea water, the best combination is 1.5 grams of guar gum, 0.08 grams of boric acid, and 0.35 grams of baking soda.</p> <p><b>Conclusions/Discussion</b> Sea water can be made as viscous as tap water by increasing the amount of gellant and, as a result, can be used as effectively as tap water for hydraulic fracturing. Therefore the first part of the hypothesis was proven. However, the second part of the hypothesis was partly proven because baking soda also had to be adjusted in addition to varying the amount of gellant.</p>	
<b>Summary Statement</b> My project explores the possibility of using sea water for hydraulic fracturing.	
<b>Help Received</b> Father helped me complete my experiments; Dr. Lewis Norman and Ryan Carlyle answered questions and helped me through difficulties in the project.	