



# CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

<b>Name(s)</b> <b>Holly V. Haughy</b>	<b>Project Number</b> <b>J1114</b>
<b>Project Title</b> <b>Can Limestone Help Reduce Global Warming?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> When cement manufacturers make one ton of cement, heating and a chemical reaction release 0.87 tons of carbon dioxide into the air. If concrete manufacturers could substitute some ground limestone (no similar CO<sub>2</sub> emissions) in place of cement, it could have a big positive impact on the environment by reducing carbon dioxide emissions. My hypothesis is that you can substitute 20% ground limestone for cement, in a concrete mix, and still make strong concrete.</p> <p><b>Methods/Materials</b> Concrete is made of four ingredients: cement, sand, aggregate, and water. I weighed out the different materials used to make concrete and mixed them. I poured the mixtures into their plastic containers and let them dry. I first made six concrete slabs all the same size. They had no finely ground limestone powder substituted for cement. I wanted to see the variation of the strength. Eleven days later, I took the concrete slabs out of their molds and broke them to measure their strength. I did this by supporting each end and adding to the center until the slab broke. Then I weighed the amount of weight it took to break the slab. The way I'm breaking the concrete is measuring what is called tensile strength. I next made six more batches of the concrete with varying amounts (from 10% to 50%) of finely ground limestone powder substituted for cement. Eleven days later I took the concrete out of their molds and broke them to measure the variation in tensile strength with increasing amounts of limestone substitution.</p> <p><b>Results</b> The data from my project indicate you can substitute up to 30% of limestone for cement in concrete. There was a little bit more variation than I had hoped for, but in the graph you can see a curve indicating the strength decreases a lot after about a 40 to 50% substitution.</p> <p><b>Conclusions/Discussion</b> About 12 million tons of cement is made in California each year. If concrete makers could substitute 30% of ground limestone for cement, 3.6 million tons of cement would not have to be made, which is 3,123,000 tons of carbon dioxide emissions reduction. This could solve nearly one percent (0.9%) of California's green house gas problem. Manufacturers should want to do this because using limestone is about five times less expensive than using cement.</p>	
<b>Summary Statement</b> My project indicates that by substituting limestone for 30% of the cement in concrete mixtures, California could reduce its green house gas emissions by 3.1 million tons per year.	
<b>Help Received</b> The help I received in doing my project was from my mom and Blue Mountain Minerals. My mom supervised me and gave me advice while doing my experiment. Blue Mountain Minerals provided me with materials and a concrete mix design.	