



# CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

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<b>Project Title</b> <b>An Investigation of Radioisotopes and E. coli Levels at Santa Monica Beach</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The goal of this project was to determine how water circulates through the Santa Monica beach and how rain effects this circulation. The radium levels are a marker for coastal water circulation. Salinity was studied as a supplement to the other components. E. coli bacteria levels were measured using water samples taken from the pore water and the water column.</p> <p><b>Methods/Materials</b> Water samples, both pore water and water column, were collected at four points along the Santa Monica Beach during dry and wet weather. Water samples were filtered through a manganese cartridge which was attached to a RaDeCC coincidence counter that measured for the presence of Radium 223 and Radium 224. Ten milliliters of the water samples were placed on Coliscan Easygel petri dishes to grow E. coli bacteria colonies. Salinity of all water samples was measured using a conductivity meter.</p> <p><b>Results</b> E.coli bacterium was only present in the water samples taken immediately during or after rainfall. The Pico-Kenter storm drain had extremely high levels of E.coli bacteria during the rainfall. High bacteria concentrations were found during periods of rainfall. The concentration of 223Ra was highest at the storm drain outlet. It was determined that rainfall does not have an effect on the radium. 223Ra and 224Ra were used to calculate the pore water residence time. The residence time of the different sample sites ranged from 0.4 to 2.2 days. This is a fast and dynamic exchange for the bay that may account for the wide distribution of bacteria throughout the water column after rainfall. The salinity of the storm drain was considerably lower than that of the water column.</p> <p><b>Conclusions/Discussion</b> Radium, E.coli, and salinity were measured. 223Ra and 224Ra were studied because their short half-lives make it possible for their decay to be detected by a time-delayed counter, RaDeCC. Radium can be used as a clock to determine how long it has been since the water left contact with the beach. E.coli produces both <math>\beta</math>-galactosidase and <math>\beta</math>-glucuronidase. The former enzyme turns a colony pink, and the later turns a colony blue when the colonies are grown on the Coliscan easygel plates. Colonies with both of these enzymes will turn purple. Since E.coli is the only bacteria that produces both enzymes, these colonies are the only colonies that turn purple. It has been shown that there is no correlation between bacterial concentration and radium levels.</p>	
<b>Summary Statement</b> I studied the circulation of water at the Santa Monica beach utilizing radioactive decay, salinity, and bacterial count.	
<b>Help Received</b> The Southern California Academy of Science provided financial support and a research training program that allowed me to work with Professor Doug Hammond in the Radium Lab in the Geochemistry Department at the University of Southern California. Dr. Hammond who was my project mentor and Rick	