



**CALIFORNIA STATE SCIENCE FAIR  
2002 PROJECT SUMMARY**

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| <b>Name(s)</b><br><b>Laura A. Vogelsang</b>   | <b>Project Number</b><br><b>J0934</b> |
| <b>Project Title</b><br><b>Fire, A Force of Nature: The Effect of Ash Leachate on Soil Components</b>   |                                       |
| <p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b><br/>My objective was to study the chemistry of ash leachate solutions, a by-product of the combustion of wood by forest fires, and its effect on key soil constituents.<br/>Hypothesis: Ash leachate (AL) stabilizes clay particles leading to flocculation or aggregation.</p> <p><b>Methods/Materials</b><br/>Preparation of Ash Leachate (AL) Solution: Ash was collected at actual forest fire sites (Miranda Fire, 2001 and Weaverville Fire, 2001), or produced under controlled burn conditions in a Jotul III Wood Stove, and deionized water mixed with ash (5:1). Determination of Ash Leachate Chemical Composition: Ash leachate solution was analyzed using instrumental analysis. Experimental Model for Determination of AL Effect on Soil Components: A test tube model was developed using 0.5, 1, and 2 grams of kaolin mixed with 40 milliliters of either deionized water, which is the control (CTL), or AL solution and incubated for 0.25, 0.5, 1 and 2 hours. At the end of the incubation period 20 ml of the suspension is removed, transferred to a pre-weighed crucible, oven-dried and weighed.</p> <p><b>Results</b><br/>The ash leachate composition was defined using standard instrumental analysis. Composition of leachate changes with intensity of burning; grey ash (Jotul III) leached more ions than black (Miranda). Rainfall on ash (Weaverville) removes ions. The ash leachate was used as the test solution mixed with Kaolin suspension vs. the control solution of deionized water demonstrating a profound effect on the 2 gm AL treatment group with dispersion of Kaolin particles up to 19X the amount of suspended Kaolin in the treatment group vs. the control group.</p> <p><b>Conclusions/Discussion</b><br/>A model to evaluate the effects of ash leachate on a clay suspension was created and evaluated. Ash leachate solutions were prepared. The composition of leachate changes with intensity of burning; grey ash (Jotul III) leached more ions than black (Miranda). Rainfall on ash (Weaverville) removes ions. The measurements demonstrated a profound effect on the 2 gm AL treatment group with dispersion of Kaolin particles up to 19X the amount of suspended Kaolin in the treatment group vs. the control group. This finding does not support the original hypothesis, but rather the ash leachate appears to result in dispersion of kaolin. Ash leachate can have a powerful effect on clay particles, an important component of soils, and may play a role in soil conservation and/or erosion.</p> |                                       |
| <b>Summary Statement</b><br>I studied the chemistry of ash leachate and its effect on soil constituents.  |                                       |
| <b>Help Received</b><br>Father advised on experimental design; CDF Environmental specialists and rangers, provided onsite ash collection support; Tom Benedict, Mad River Hospital Lab, analytical chemistry support; John Berning, Medical Scientist, aided in computer graphics development.  |                                       |