



**CALIFORNIA STATE SCIENCE FAIR  
2015 PROJECT SUMMARY**

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<b>Project Title</b> <b>How Particulate Matter Concentrations Vary by Location and by Combustion</b>	
<b>Objectives/Goals</b> The objectives of my project were to determine if particulate matter (PM) concentrations were affected by indoors and outdoors locations and by different cooking methods. <b>Methods/Materials</b> PM2.5, ultrafine particles (UFP), black carbon (BC), and PAHs (polycyclic aromatic hydrocarbons) were measured using real-time monitors, which used inertial collection and particle counters. PM was measured in a backyard, in a lab and in a house, and near combustion: burning candles, boiling water, deep frying food, BBQs, and use of Panini grills, ovens, and electric grills. The times of distinctive changes of surrounding conditions during combustion were recorded. <b>Results</b> In January, the concentration of PM2.5 in a backyard was higher than PM2.5 concentration indoors and in Fresno Central Monitoring Station outdoors. In November, the concentration of PM2.5 outdoors was still higher than the PM2.5 concentration indoors but not higher than the PM2.5 measured in Fresno Central Monitoring Station. In January and November, PM concentration measured outdoors increased at noon and in the evening. PM2.5, BC, and PAHs increased the most in charcoal BBQ. Concentrations of all components of PM increased more for Panini grill than electric grill. Boiling water and use of ovens affected the components of PM the least. PM2.5 increased the most in charcoal BBQ, Panini grill, and electric grill. UFP increased the most in Panini grill, electric grill, and charcoal BBQ. BC increased the most in charcoal BBQ, Panini grill, and electric grill. PAHs increased the most in charcoal BBQ, deep frying food, and burning candles. <b>Conclusions/Discussion</b> PM concentrations are higher outdoors than indoors. During the higher PM days, the PM measurements varied more depending on location outdoors. Times of more traffic caused higher PM concentrations from motor vehicles. The highest concentrations of PM2.5, BC, and PAHs were observed during outdoor BBQ because of incomplete combustion of charcoal. PM2.5, UFP, and BC concentrations increased more for grilling than deep frying, burning candles, boiling water, and using ovens because grilling can char or burn food. Unlike BC, UFP, and PM2.5, PAHs increased more in deep frying and burning candles than in grilling because of incomplete combustion of carbon-containing fuels, such as oil, fat, and wax.	
<b>Summary Statement</b> My project tests how the concentrations of different components of particulate matter, such as PM2.5, UFP, BC, and PAHs, are affected when we stay indoors, outdoors, or near combustion, such as cooking, using real-time aerosol monitors.	
<b>Help Received</b> My father is an expert in environmental science and operated the real-time aerosol monitors, which were from California State University, Fresno, and also helped construct the graphs.	