



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Otana A. Jakpor	Project Number S0816
Project Title Indoor Air Pollution: A Comparison of Fine Particulate Matter (PM2.5) Emissions from Paraffin and Soy Candles	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Air pollution is without a doubt one of the gravest environmental threats the world is facing today in terms of its sheer toll on human lives. Each year an estimated 70,000 Americans lose their lives to air pollution -- a number equal to deaths from both breast and prostate cancer combined. Since Americans spend nearly 90% of their time indoors, more research is needed on indoor air pollution and common exposures such as candles.</p> <p>Paraffin wax is a by-product of petroleum, and similarities have been observed between fine particulate emissions from paraffin candles and diesel exhaust. The purpose of this study is to determine whether or not paraffin candles are a major potential source of indoor air pollution. Furthermore, this study aims to determine whether or not soy candles are a safer, cleaner alternative to paraffin candles.</p> <p>Methods/Materials The concentrations of fine particulate matter below 2.5 microns (PM2.5) emitted from paraffin and soy candles were measured with a DustTrak aerosol monitor in a sealed bedroom. In each test a candle was measured every 15 seconds during burning for 45 minutes, then for another 45 minutes after extinguishing the candle. Eleven trials were completed for each of four types of tests -- paraffin candle, soy candle, match only, and control. A two-sample Z-test was deemed appropriate for statistical analysis, considering the many thousands of data points in this experiment.</p> <p>Results Candles made of paraffin wax emitted 50- to 60-fold higher concentrations of PM2.5 than candles made of soy wax. The soy candles emitted only about twice as much PM2.5 as the matches alone.</p> <p>Conclusions/Discussion The amount of PM2.5 emitted by the paraffin candles was dramatically higher than the amount emitted by the soy candles. After prorating for time and applying a conversion factor, the final result reveals that burning a single paraffin wax candle caused concentrations of PM2.5 that exceeded the National Ambient Air Quality Standard for PM2.5 in outdoor air. It is reasonable to deduce that burning multiple paraffin candles could elevate the amount of fine particulate matter to very hazardous levels.</p>	
Summary Statement I used a particulate counter to find that paraffin candles emitted over 50-fold higher levels of fine particulate matter than soy candles, and burning a single paraffin candle caused levels higher than outdoor air standards.	
Help Received School board member Gordon Bourns helped me locate a particle counter. UCR CE-CERT loaned me the DustTrack Monitor. Statistics advice from teacher Shane Ludwig.	