



## Colorado Science and Engineering Fair

## 2024 Individual Project Abstract Form

**Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.**

Title of Project: Testing Pollution and Radioactivity Levels Near Suncor's Petrochemical Refinery in Commerce City, Colorado

Finalist's Name: Zachariah Nagle

School and City: Fairview High School, Boulder

Sponsor's Name: James Nagle

Category: Earth & Environmental Sciences (EAEV)

Division: Senior (9th - 12th grades)

Abstract (250 words or less):

Suncor operates a petrochemical refinery in Colorado, facing scrutiny due to reports of toxic releases into the Commerce City community, which potentially harm residents' health. Elevated rates of respiratory illnesses and EPA findings of increased gas releases from the refinery compared to comparable facilities elevate apprehension. Commerce City's marginalized racial and class demographics further critics' demands for more transparency/accountability. Previous studies highlight high chemical concentrations around the refinery but neglect distance as a variable. Hence, my study examines the correlation between proximity and water pollutant/radiation levels. The study's design involves collecting water and soil samples at increasing distances from the refinery, using aerial distance to the nearest flare stack as a measure. Samples from Sand Creek Park and Boulder Falls provided benchmarks. Water samples underwent Varify™ pollutant tests, with a novel method developed for converting hex codes into RGB values via machine recognition. I then wrote a C++ program to convert these values to HSI and quantify the concentrations using a forecasting function. Despite a lack of statistical significance in linear regression between molecule concentration and distance, multivariable t-Tests revealed significant differences between experimental and control datasets. Thus, I conclude that species' levels in Commerce City vary considerably from control levels, suggesting that the refinery and larger industrial setting have significant impacts on pollution. While molecule concentrations all fall within EPA guidelines, they frequently deviate from the middle of the suggested ranges. Therefore, during "accidental" emissions, concentrations likely surpass guidelines, posing health risks even with limited exposure.

*I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.*

Finalist's Signature: *Zachariah Nagle*

Date: 2-28-2024

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. A signed copy of this form must be included in your notebook.