Idle Less for a Healthy School Environment

Travis Michael Connors
Goals of the Internship

- **Goals**: Tailor, implement, and evaluate the “Idle Less for a Healthy School Environment” program for Pima County to reduce the number of idling vehicles and mean idling duration outside school campuses during student pick-up times

- Associated with two deliverables
  - Evaluation report
  - Program implementation guide
Pima County Department of Environmental Quality

- **Purpose**: preserve and protect the environment of Pima County for the long-term benefit of residents’ health and wellness
  - Achieved by operating programs to monitor air and water quality, hazardous and solid waste, pollution prevention, and provide education outreach to various audiences

- **Structure**: County-level, environmental quality sector
The Environmental Protection Agency (EPA) developed materials for program implementation nationwide to reduce student exposure to toxic vehicle exhaust. “Idle-Free Schools for a Healthy School Environment”

PDEQ wanted to tailor this program specifically for our region. “Idle Less for a Healthy School Environment”

- Reasoning: Less demanding and more practical

Process: Revise EPA materials for Pima County and conduct a pilot study at one school to assess efficacy prior to implementing at other schools throughout Pima County
Importance of Reducing Idling

- **Mobile Source Air Toxics (MSATs)** are a subset of air toxics that are emitted from mobile sources
  - Cars, trucks, buses, trains, boats, construction, etc.

- Many MSATs are also **Priority Air Toxics**, which are the air toxics that present the greatest threat to human health and the environment\(^1\)

- MSATs have the potential for serious adverse health effects and are responsible for \(~50\%\) of the cancer risk nationwide\(^1\)

- Nationwide, mobile sources represent the largest contributor to air toxics\(^1\)
Children are exceptionally susceptible to air pollutants

Children’s developing lungs have a smaller surface area and a higher inhalation rate

- Early childhood: 20-40 breaths/min
- Late childhood: 15-25 breaths/min
- Adults: 12-18 breaths/min

Increased exposure and potentially permanent damage to lung function

Exposing children to MSATs during important times of physiological development can lead to long-lasting health problems, dysfunction, and disease
In 2004, the Denver Department of Environmental Health obtained grant funding from EPA to conduct a Community Based Air Toxics Study.

- Measured levels of air pollution in Denver.

One monitor was on the roof of a school located close to one of the major highways running through Denver.

- The data collected there showed noticeable spikes in pollution during the 3-4pm hour, coinciding with when students are released from school\(^1\).

- The concentrations of some air toxics were higher during the 3-4pm hour than they were for the 5pm rush hour\(^1\).
Idling Issue at Innovation Academy
“Idle Less for a Healthy School Environment” - Process

Modified EPA materials
Pledge cards, observation sheets, etc.

Acquired stakeholder
Pima County Schools Superintendents Office

Identified school
Innovation Academy

Conducted baseline measures (pre-campaign field observations)
Current level of vehicle idling during 3-day period during 2:45pm – 4pm (after school pickup)

Identified and trained school staff leader
Landi Roark

Questionnaire administered

Educational outreach via school presentations
S.T.E.M. Night

Conducted follow-up data collection (post-campaign field observations)
Current level of vehicle idling during 3-day period during 2:45-4pm (after school pickup)

Data analysis
Responsibilities and Tasks

- Modified the EPA’s materials
  - Pledge cards, data collection sheets, etc.
  - Sent home to parents to educate on program

- Led presentations various audiences
  - Innovation academy staff
  - Pima County Schools Superintendent’s Office
  - Science, Technology, Engineering, and Math (S.T.E.M.) night

- Worked directly with Landi Roark, who was our identified school staff leader of the program
  - Assisted her 3rd and 5th grade students with data collection and analysis
  - Helped make the program a Southern Arizona Research, Science, and Engineering Foundation (SARSEF) student project
Responsibilities and Tasks (2)

- Conducted and led the pre- and post-campaign field observations
  - 3 days during each period
  - Collected data on vehicle type (v/t), idling (y/n), arrival time, and departure time
  - Students assisted in the post-campaign data collection period
  - PDEQ staff assisted during both periods

- Developed and administered a questionnaire to parents to collect qualitative data
- Assess knowledge on impact of idling and current idling behaviors
Responsibilities and Tasks (3)

- Using measured vehicular idling times, calculated estimated various probable pollution exposures
- EPA and Pima Association of Governments (PAG) provided equations and estimates to calculate various air pollution and vehicular statistics
- Conducted parts of the analysis with the students leading to the SARSEF presentation

**EPA provided estimates**:

- **Vehicle type V (cars)**:
  - Idling fuel use = 0.0053 gal/min
  - Carbon monoxide = 1.55g CO/min
  - Nitrogen oxide = 0.030g NOx/min
  - Volatile Organic Compounds = 0.081g VOC/min
- **Vehicle type T (SUVs, trucks, minivans, vans)**:
  - Idling fuel use = 0.0118 gal/min
  - Carbon monoxide = 2.03g CO/min
  - Nitrogen oxide = 0.031g NOx/min
  - Volatile Organic Compounds = 0.13g VOC/min
- One cigarette smoked = ~67g CO

**PAG provided estimate**:

- ~20 pounds of carbon dioxide (CO2) per gallon gas used (all vehicle types)

*Note: all emitted pollution estimates are approximations based on data collected in EPA Air Toxics Study1*
Data Analysis: EPA and PAG Equations

- **Gallons of gas used by idling vehicles per day and academic year**
  - \( \text{(mean vehicles per day)} \times \text{(mean idling duration)} \times \text{(idling fuel use per minute)} \)
  - \( \text{(mean vehicles per day)} \times \text{(mean idling duration)} \times \text{(idling fuel use per minute)} \times \text{(} \# \text{ of school days in academic year)} \)

- **Money wasted idling per academic year**
  - \( \text{(total gallons gas used per day)} \times \text{(current gas price per gallon)} \times \text{(} \# \text{ of school days in academic year)} \)

- **Idling air pollution emitted per day (CO, NOx, and VOC)**
  - \( \text{(mean vehicles per day)} \times \text{(mean idling duration)} \times \text{(air pollution type emitted per min)} \)

- **Idling CO2 emitted per day**
  - \( \text{(total gallons of gas used per day)} \times \text{(20 pounds CO2 per gallon used)} \)

- **Equivalent CO emitted from idling vehicles to cigarettes smoked per day**
  - \( \frac{\text{(total g CO per day)}}{\text{(cigarette g CO)}} \)
Data Analysis at Innovation Academy
## Results – Potential Exposures

<table>
<thead>
<tr>
<th></th>
<th>Pre-Campaign</th>
<th>Post-Campaign</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean idling duration per day</td>
<td>20.8 minutes</td>
<td>17.52 minutes</td>
<td>17%</td>
</tr>
<tr>
<td>Mean # of idling vehicles per day</td>
<td>87</td>
<td>49</td>
<td>56%</td>
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<tr>
<td>Proportion of vehicles idling</td>
<td>17.4</td>
<td>1.13</td>
<td>176%</td>
</tr>
<tr>
<td>Gallons of gas used by idling vehicles</td>
<td>18.03 gal/day</td>
<td>8.58 gal/day</td>
<td>71%</td>
</tr>
<tr>
<td>Money wasted idling per academic year</td>
<td>$8,665.21</td>
<td>$4,123.55</td>
<td>71%</td>
</tr>
<tr>
<td>Idling air pollution emitted per day</td>
<td>CO = 3,414.14g</td>
<td>CO = 1,614.72g</td>
<td>72%</td>
</tr>
<tr>
<td></td>
<td>NOx = 55.25g</td>
<td>NOx = 26.04g</td>
<td>72%</td>
</tr>
<tr>
<td></td>
<td>VOCs = 209.67g</td>
<td>VOCs = 99.42g</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>CO2 = 360.60 lbs</td>
<td>CO2 = 171.60 lbs</td>
<td>71%</td>
</tr>
<tr>
<td>Equivalent CO emitted from idling vehicles to cigarettes smoked per day</td>
<td>51 cigarettes</td>
<td>24 cigarettes</td>
<td>72%</td>
</tr>
</tbody>
</table>
## Results – Questionnaire

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses (85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you ever idle your vehicle?</td>
<td>Yes = 87%</td>
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<tr>
<td></td>
<td>No = 13%</td>
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<tr>
<td>In a typical week, approximately how long do you idle your vehicle?</td>
<td>1 – 15 minutes = 57%</td>
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<td>16- 30 minutes = 16%</td>
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<td>31-45 minutes = 10%</td>
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<td></td>
<td>46-60 minutes = 4%</td>
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<td></td>
<td>&gt; 1 hour = 13%</td>
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<tr>
<td>What factors cause you to idle? (ranking question)</td>
<td>1. Weather (41%)</td>
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<tr>
<td></td>
<td>2. Quick pickup (24%)</td>
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<tr>
<td></td>
<td>3. Convenience (9%)</td>
</tr>
<tr>
<td></td>
<td>4. Comfort &amp; to prevent possible ‘wear and tear’ on engine (5%)</td>
</tr>
<tr>
<td>Do idling vehicles contribute to air pollution and emit air toxins that</td>
<td>21% answered maybe or unsure</td>
</tr>
<tr>
<td>are known or suspected to cause cancer or other serious health effects?</td>
<td></td>
</tr>
</tbody>
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Deliverable 1: Program Implementation Guide

- The program implementation guide will serve as a standard operating procedure (SOP) for PDEQ outreach employees when implementing the program at various schools throughout Pima County
  - PowerPoint presentation to present to administration at target schools
  - Data collection sheets
  - Methods of data collection
  - Questionnaire for parents
  - Calculations for data analysis
  - Educational literature to provide to teachers for training
Deliverable 2: Evaluation Report

- Overview of the program
- Assessment of efficacy and efficiency of the pilot program
- Provide recommendations on how to improve implementation methods and participation to further increase program effectiveness

  Recommendations:
  - Implement the program over a full year to ensure uniform temperatures/seasonal weather during the pre- and post-campaign field observation periods
  - Train students on how to properly conduct the pre- and post-campaign field observation periods so PDEQ staff is not required to be on site
Discussion: Problems and Objectives Met

- Problems encountered: short duration of internship
  - Program is intended to be implemented over the length of a full year
  - Overcame by dedicating a lot of time and effort and having an amazing team to assist me

- All objectives met
  - Modified the EPA materials
  - Acquired stakeholders
  - Selected a pilot school
  - Identified and trained a school staff leader of the program
  - Conducted pre- and post-campaign field observations
  - Questionnaire administered
  - Data analysis
  - Educational outreach
Conclusion

- Overall evaluation of internship: invaluable public health experience
  - Improved interpersonal communication, public speaking, and leadership skills
  - Increased my network of public health professionals
  - Effectively worked cooperatively as part of a team
  - Successfully implemented a multi-faceted program that has the potential to improve children’s health throughout Pima County
  - Furthered my desire to become a public health professional
Acknowledgments

- **PDEQ Staff:**
  - Beth Gorman
  - Skye Siegel
  - Karen Wilhelmsen
  - Adam Kirby
  - Sarah Reitmeyer
  - Jackie Ronstadt

- **Innovation Academy Staff:**
  - Landi Roark
  - Michael McConnell

- **Pima County Superintendents Office:**
  - Matt Stamp

- **University of Arizona:**
  - Dr. Robin B Harris
References

