Idle Less for a Healthy School Environment

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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

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"Idle Less for a Healthy School Environment" - Overview

- 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

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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]

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Children and Air Pollution

- Children are **exceptionally susceptible** to air pollutants[2]
- Children's developing lungs have a smaller surface area and a higher inhalation rate[1]
  - Early childhood: 20-40 breaths/min[1]
  - Late childhood: 15-25 breaths/min[1]
  - Adults: 12-18 breaths/min[1]
    - Increased exposure and potentially permanent damage to lung function[1]
- Exposing children to MSATs during important times of physiological development can lead to long-lasting health problems, dysfunction, and disease[3]

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Air Toxics Study

- 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]

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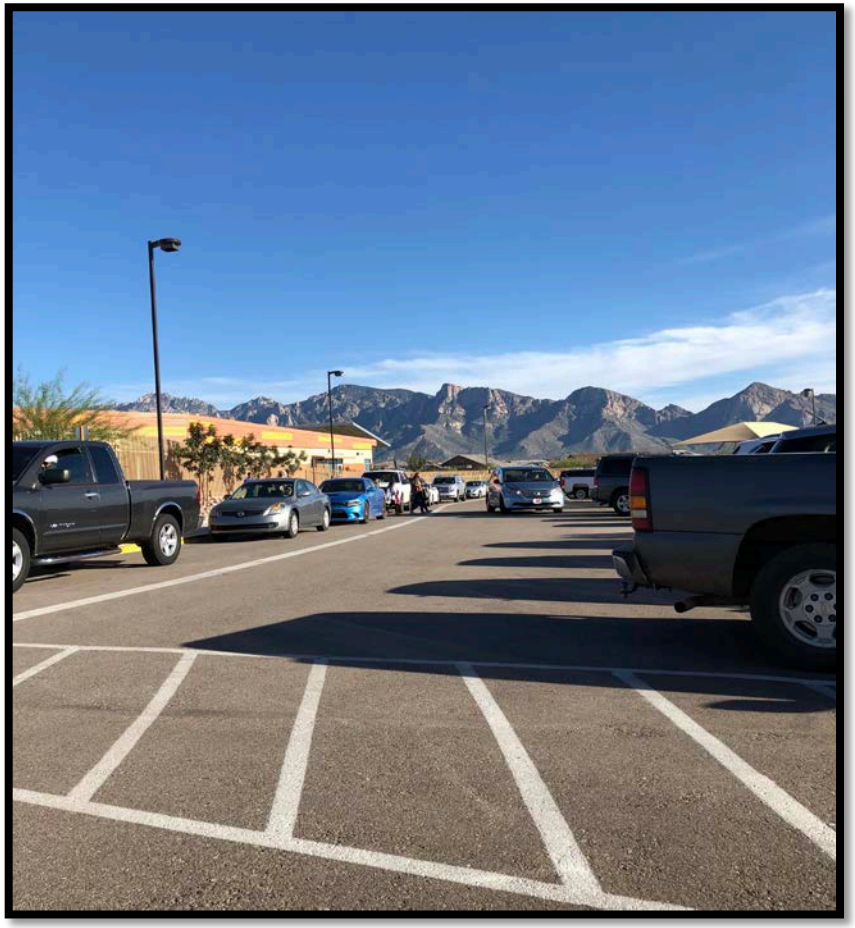
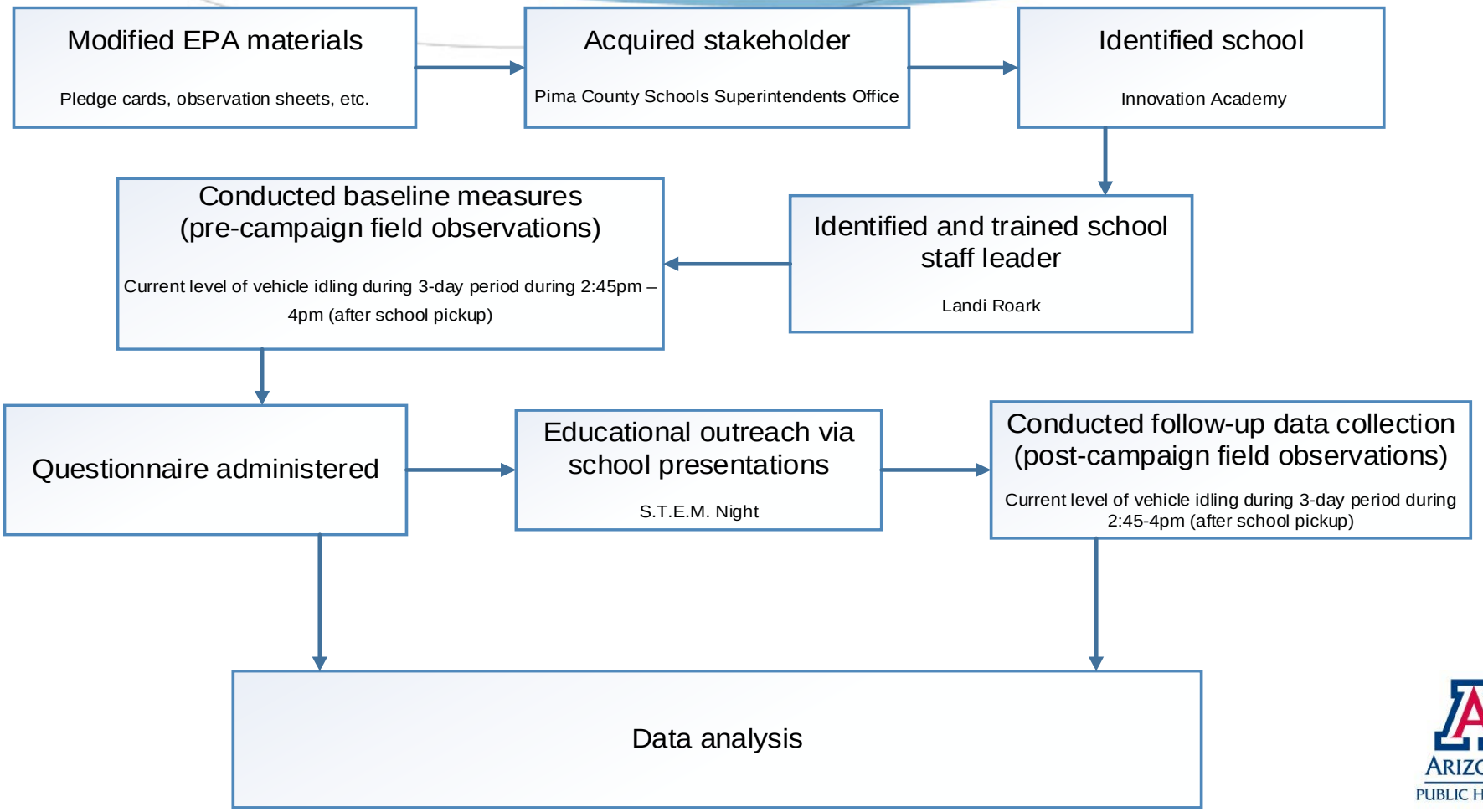
Idling Issue at Innovation Academy



"Idle Less for a Healthy School Environment" - Process



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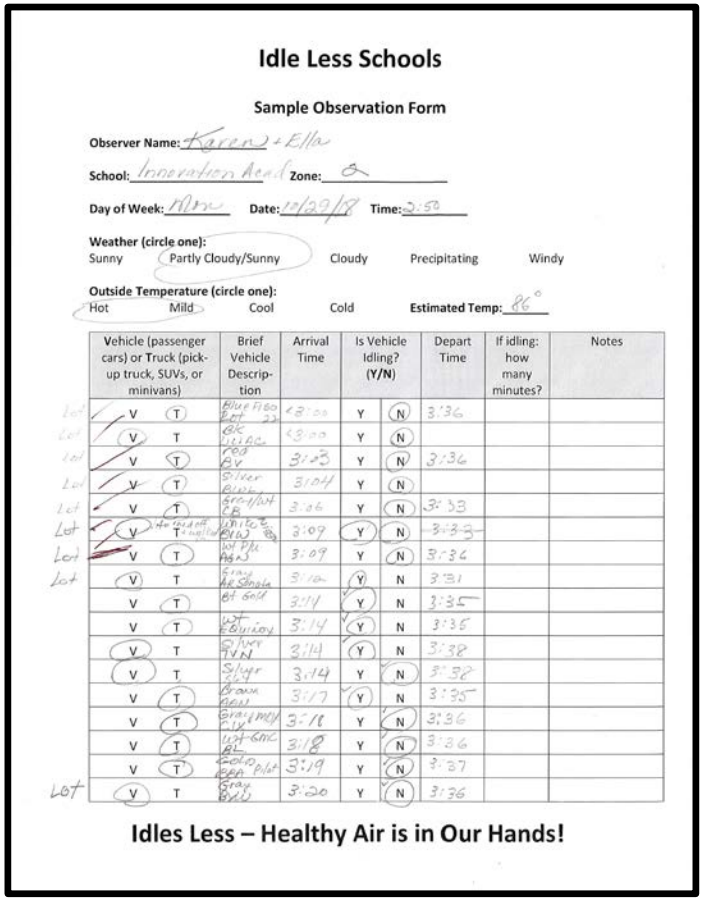
Responsibilities and Tasks

- 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



Idle Less Schools

Sample Observation Form

Observer Name: Karen + Ella

School: Innovation Acad Zone: 6

Day of Week: Mon Date: 12/29/17 Time: 2:50

Weather (circle one):
Sunny Partly Cloudy/Sunny Cloudy Precipitating Windy

Outside Temperature (circle one):
Hot Mild Cool Cold Estimated Temp: 86°

Vehicle (passenger cars) or Truck (pick-up truck, SUVs, or minivans)	Brief Vehicle Description	Arrival Time	Is Vehicle Idling? (Y/N)	Depart Time	If idling: how many minutes?	Notes
V (T)	Blue Fiesta	<3:00	Y (N)	3:36		
(V) T	BK	<3:00	Y (N)			
V (T)	Red RV	3:03	Y (N)	3:36		
V (T)	Silver	3:04	Y (N)			
V (T)	Green/Wht	3:06	Y (N)	3:33		
V (T)	White	3:07	(Y) N	3:33		
V (T)	Wht Pkp	3:09	Y (N)	3:36		
(V) T	Grn Dodge	3:10	(Y) N	3:31		
V (T)	Blk Gmc	3:14	(Y) N	3:35		
V (T)	Wht Explorer	3:14	(Y) N	3:35		
(V) T	Silver TN	3:14	(Y) N	3:38		
(V) T	Silver	3:14	Y (N)	3:32		
V (T)	Brown	3:17	(Y) N	3:35		
V (T)	Gray/Wht	3:18	Y (N)	3:36		
V (T)	Wht Gmc	3:18	Y (N)	3:36		
V (T)	Red Pkp	3:19	Y (N)	3:37		
(V) T	Gray	3:20	Y (N)	3:36		

Idles Less – Healthy Air is in Our Hands!

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**
  - (mean vehicles per day) x (mean idling duration) x (idling fuel use per minute)
  - (mean vehicles per day) x (mean idling duration) x (idling fuel use per minute) x (# of school days in academic year)
- **Money wasted idling per academic year**
  - (total gallons gas used per day) x (current gas price per gallon) x (# of school days in academic year)
- **Idling air pollution emitted per day (CO, NOx, and VOC)**
  - (mean vehicles per day) x (mean idling duration) x (air pollution type emitted per min)
- **Idling CO2 emitted per day**
  - (total gallons of gas used per day) x (20 pounds CO2 per gallon used)
- **Equivalent CO emitted from idling vehicles to cigarettes smoked per day**
  - (total g CO per day) / (cigarette g CO)

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Data Analysis at Innovation Academy

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Results – Potential Exposures

	Pre-Campaign	**Post-Campaign**	**% Difference** $[V_1 - V_{2]} / ((V_1 + V_2)/2)) \times 100$
Mean idling duration per day	20.8 minutes	17.52 minutes	17%
Mean # of idling vehicles per day	87	49	56%
Proportion of vehicles idling	17.4 For every 17.4 vehicles idling, there is 1 vehicle not idling	1.13 For every 1.13 vehicles idling, there is 1 vehicle not idling	176%
Gallons of gas used by idling vehicles	18.03 gal/day 3,209.34 gal/year	8.58 gal/day 1,527.24 gal/year	71%
Money wasted idling per academic year	$8,665.21	$4,123.55	71%
Idling air pollution emitted per day	CO = 3,414.14g NOx = 55.25g VOCs = 209.67g CO2 = 360.60 lbs	CO = 1,614.72g NOx = 26.04g VOCs = 99.42g CO2 = 171.60 lbs	72% 72% 71% 71%
Equivalent CO emitted from idling vehicles to cigarettes smoked per day	51 cigarettes	24 cigarettes	72%

Results – Questionnaire

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

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

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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

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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

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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

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