Vehicle Idling at Public Schools:

Opportunity for Improvement

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June, 2017

Abstract

Many schools have implemented policy aimed at reducing vehicle idling because of the health risks, particularly to children, from pollutants in vehicle exhaust. Collection of idling data from a public school environment is meant to identify factors relevant to idling behavior, quantify the amount of idling taking place, and gauge possible benefits of creating a school idling policy. Data collected is meant to be shared with school administrators to raise awareness of idling and to encourage creation of an anti-idling policy.

Introduction

Pollutants in vehicle exhaust are responsible for many common health problems including cancer and respiratory illnesses. Children are particularly susceptible to the harm caused by these pollutants because of developing lungs and a higher inhalation rate (EPA Idle Free Schools, 2016). In addition to aggravating existing asthma conditions, research suggests that air pollution from vehicle exhaust is associated with new onset asthma (Eghbalnia et al., 2013). Asthma is the most common chronic childhood illness, accounting for 12.8 million missed school days each year (ACAAI, 2010). In addition to the particulate matter, hydrocarbons, nitrogen oxide, carbon monoxide, sulfur dioxide, and hazardous toxics vehicle exhaust is a source of carbon dioxide a major greenhouse gas and contributor to climate change (EPA U.S. Greenhouse Gas Inventory Report, 2013).

Nine percent of the CO2 emissions created by private vehicle use are associated with idling (Carrico et al., 2009). Idling represents a significant portion of CO2 emissions that can potentially be reduced through policy and education aimed at changing individual driver behaviors. Vehicle idling is the operation of the engine when the vehicle is not in motion

(Carrico, 2009 and Barkenbus, 2009) and exemplifies unnecessary fuel consumption that could easily be avoided. Increasing awareness of idling facts will allow drivers to make more accurate decisions about fuel consumption, CO_2 emissions, public health, and vehicle operation. While technology and infrastructure will be helpful in the future, simply turning off the vehicle when appropriate and breaking old habits can reduce emissions. The high volume of student drop offs and pick-ups at schools make idling particularly visible and an ideal environment for implementation of policies aimed at reducing idling.

Schools experience heavy traffic and elevated levels of pollutants during student drop off and pick up times (Eghbalnia et al., 2013) A portion of the vehicle exhaust is produced by idling vehicles. The focus of this project is to examine idling during the drop off and pick up times in a school environment. Efforts to reduce elevated levels of vehicle emissions near schools have led many school districts to enforce anti-idling policies; however there are many schools that have not taken steps to reduce idling on their premises. By providing informational materials with idling facts and site specific observational data, school administrators will have tools needed for creating and implementing an idling policy.

Methodology

The participating school for this project is Mt. Shasta Elementary, in Mt. Shasta California. The student population is 240, serving kindergarten through third grade. A map of the traffic pattern for arrival and departure of vehicles show a relatively uncomplicated pattern where vehicles access the student drop off and pick up zone by driving around a neighborhood block (Fig. 1). The school day starts at 8:25 am and students are released at 2:35 pm.

Observational data was collected at the school to determine number of occurrences and duration of vehicle idling during drop off and pick up times. Morning observations began at 7:30 am and continued until 8:45 am while afternoon observations were made from 2:00 pm until 3:15 pm. These time blocks were chosen because they include all but very early or very late arrivals and were based on a pre data collection observation taken during traffic pattern mapping. Five observations were taken for morning arrivals, one for each day of the school week and three observations were taken for afternoon arrivals, a Tuesday, Wednesday and a Friday. All observations were taken during cool to mild temperatures with trace to no precipitation.

Data collected from each observation were: total cars and trucks (includes SUV's and vans), time of vehicle arrival and departure, whether the vehicle idled, and how long the vehicle idled. Following observations mean idle time per vehicle was calculated as well as total idle time for the day and per time period. The percent cars in comparison to percent trucks were noted for calculations of fuel usage during idling.

Results

An ANOVA table was used to determine if there were significant differences between the means of morning and afternoon observations. It was determined that the number of vehicles arriving each day during the same time period did not significantly vary from one day to the next. The mean number of vehicles arriving in the morning was 94 and in the afternoon were 82 (Table 1). Ninety percent of vehicles arriving in mornings idled more than 10 seconds while afternoon idling percentage was slightly lower at 86 percent. The descriptive statistics for morning idle times are in Table 2 and for afternoon idle times in Table 3.

Thirty-two percent of vehicles arrived between 8:05 am and 8:17 am. This 32% accounted for 60% of the total idle time for the morning (Figure 2). The three highest individual idle times also took place during this range of time 8:12 am, 8:13 am, and 8:17 am (Figure 3). These represented 120, 100, and 150 seconds of individual idle time.

The vehicle types by percent were 69% trucks and 31% cars for the mornings. Afternoon vehicle type showed a 4% variation from morning percentages at 73% trucks and 27 % cars. Table 4 shows the amount of fuel consumed by idling vehicles by type for mornings using a formula from transportation.gov where cars consume 0.0053 gallons per minute and trucks consume 0.0118 gallons per minute. .

Discussion

This project was successful in collecting data for use as a base for applying treatments such as implementing specific idle restrictions or making changes to allowed traffic patterns. Also the data gathered is useful for informing school administrators about idling taking place at the school and what policies might be most useful in reducing the amount of idling. For example, because more people tend to park and walk to pick up students in the afternoons than mornings, it may be useful to address morning idling more than afternoon idling in a school idling policy. The results of vehicle type in this project also stress the importance of decisions such as driving a car versus driving a truck, SUV, or van.

The methods used here are useful, however observational data collected in this environment would be best accomplished with more than one observer. Due to the large number of parents that parked and walked in the afternoon, it was impractical to try and count vehicles out of the observational field of view. Observations and testing to determine if temperature effects idle time would also provide a better scrutiny of idling behavior. In addition, including data on the number of students taking the bus to school and home would be useful for analysis. Finally, to determine if school policy is effective in reducing the amount of idling taking place, observations should be taken after a policy has been implemented.

Figure 1. Mt. Shasta Elementary (blue star) traffic flow. Red arrows show arrival routes, yellow arrows show direction of departure

Table 1. Total vehicles dropping off or picking up student by day of the week

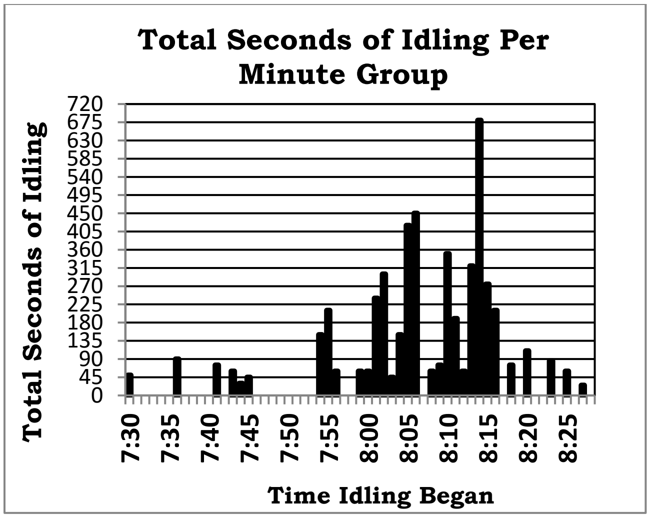
Day of the Week Mornings	n	Day of the Week Afternoons	n
Monday	98	Tuesday	79
Tuesday	87	Wednesday	90
Wednesday	94	Friday	77
Thursday	96		
Friday	95		

Table 2. Descriptive statistics for vehicle idling during morning drop off.

Idle Per Vehicle Omitting Zero Values	
Measured in seconds	
Mornings	
Mean	57.9
Standard Error	5.1
Median	52.3
Mode	30.0
Standard Deviation	28.1
Sample Variance	791.9
Kurtosis	3.0
Skewness	1.6
Range	125.0
Minimum	25.0
Maximum	150.0
Sum	1794.3
Count	31.0
Confidence Level(95.0%)	10.3

Table 3. Descriptive statistics for vehicle idling during afternoon pick up

Idle Per Vehicle Omitting Zero Values	
Measured in seconds	
Afternoons	
Mean	70.6
Standard Error	6.4
Median	63.3
Mode	40.0
Standard Deviation	28.7
Sample Variance	825.4
Kurtosis	-1.0
Skewness	0.7
Range	82.5
Minimum	40.0
Maximum	122.5
Sum	1411.2
Count	20.0
Confidence Level(95.0%)	13.4



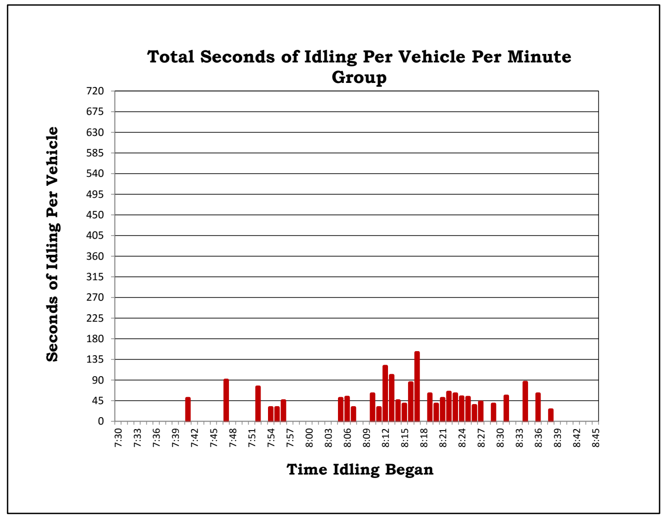


Figure 2. Total seconds idling per start minute minute

Figure 3. Mean individual idle time per start

Table 4. Gas usage from idling calculated from morning observations with a mean of 5070 seconds of idling

	Percent of sample	Ratio of Idle Seconds	Daily gas usage gallons	Gas usage for school year (180 days)
Trucks	69.0	3498.3	0.6881	124.0
Cars	31.0	1571.7	0.1389	25.0

References

American College of Allergy, Asthma & Immunology (ACAAI). 2010. Asthma Fact Sheet. Available: http://www.acaai.org/press/Pages/asthma-facts.aspx [accessed 3 February, 2017].

Barkenbus, J. N. (2009, October 28). Eco-driving: An overlooked climate change initiative. *Energy Policy*, *38*, 762-769

Carrico, Amanda R., et al. "Costly Myths: An Analysis Of Idling Beliefs And Behavior In Personal Motor Vehicles." Energy Policy 37.8 (2009): 2881-2888. GreenFILE. Web. 13 Apr. 2015.

Eghbalnia, Cynthia, et al. "A Community-Based Participatory Research Partnership To Reduce Vehicle Idling Near Public Schools." Journal Of Environmental Health 75.9 (2013): 14-19. GreenFILE. Web.13 Apr. 2015.

Idle Free Schools Region 8 (2016, May 11). In *EPA*. Retrieved November 2, 2016, from https://www.epa.gov/region8/idle-free-schools

"U.S. Greenhouse Gas Inventory Report." *United States Environmental Protection Agency*. EPA, 2013. Web. 20 May 2015.

<http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>.