Air Pollution in the Orchard School District & The Charcot Extension Project: A Response

Orchard School District

BREATHE CALIFORNIA of the Bay Area

Santa Clara University in Partnership with Orchard School District & Breathe California of the Bay Area
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Executive Summary

Air pollution has a tangible and undeniable affect on human health, specifically on the lung growth of children and the unfortunate development of respiratory issues such as asthma. Oftentimes, such pollution is caused by traffic density and a lack of mitigation strategies to combat the resulting issues. In an effort to further understand such impacts on children's health, this project measured air pollution levels around the Orchard School District and analyzed the results. We ultimately found that the air pollution levels around the Orchard School are higher than the average to which we compared the measurements, and that current levels of air pollution (UFPs) at Orchard School exceed the threshold associated with known health impacts in children. Furthermore, the City of San Jose plans to implement the Charcot Extension Project, which would extend Charcot Avenue and cut right through part of the Orchard School property. The project would increase traffic density in the area and potentially further inhibit the healthy lung growth of the students at the school. In order to further understand the community's perceptions on this project plan, we conducted a 25 question online survey, of which the community members' participation was completely voluntary. Overall, we found that community members of Orchard School have negative perceptions on air pollution, and are aware of health issues that it can bring. In addition, we also found that community members are aware of the Charcot Extension Project, understand its goals and plans, and are still adamantly against its construction. In conclusion, we recommend that the community of Orchard School continue to facilitate a space with local partners (e.g., Breathe CA, BAAQMD, and SCU) to share knowledge and express opinions on the Charcot Extension Project. We also recommend that Orchard School begins to further research and integrate mitigation strategies now to better the current air quality.

Section 1: Introduction

In recent years, there has been a growing scholarly discourse on the intersection of air pollution at and around schools, demographics of students, and health impacts of traffic related pollutants (Gaffron & Neimeier, 2015; Green, Smorodinsky, Kim, Mclaughlin, & Ostro, 2004; Mohai, Kweon, Lee, & Ard, 2011; Morello-Frosch et al., 2002; Pastor, Morello-Frosch, & Sadd, 2006). School location has been found to be a major determinant of exposure to traffic related air pollutants because children spend a substantial amount of their time at school campuses (Green et al., 2004). Not only this, but the location of schools near heavy traffic roads can have detrimental impacts on the health of students attending those schools, and those students who are attending schools with high exposures to outdoor air pollution are disproportionately from low-income and racial or ethnic minority communities (Gaffron & Neimeier, 2015; Pastor et al., 2006). This intersectional issue is one of major importance for the future of our world's schools and children, especially those who are most disadvantaged.

Orchard Elementary School, a public school in San Jose consisting of roughly 900 elementary and middle school students, is one of the oldest school districts in the state of California, having been established in 1862. This school is currently facing issues of environmental justice, which the EPA defines as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (US EPA 2009). Additional research proposes that the 'justice' part of environmental justice contains three elements: (1) distributive equity of environmental risk; (2) the recognition of environmental participants' diversity and experiences; and (3) participation in any and all political processes to create and manage environmental policy wherever found (Scholsberg, 2007). In other words, environmental justice calls for not only distributive justice among environmental costs, benefits, and policies, but for equal involvement for all participants in the procedures that create environmental costs and benefits.

The school and the surrounding district are facing a critical environmental justice issue with the City of San Jose's plan to implement the Charcot Extension Project, adding a freeway that cuts through the school's campus and would bring 40,000 cars directly adjacent to the playground. A total of 892 students in K-8, 94% minority students, will be put at risk to the health impacts of increased air pollution.. Therefore, this project aims to analyze air pollution and demograhics at and around Orchard School and understand community attitudes and thoughts on mitigation strategies to be able to build Orchard community's local knowledge and resilience to further propagation of the Charcot Extension Project.

The Bay Area is considered one of the most polluted metropolitan regions by average year-round concentration of particulate matter (PM2.5). Orchard Elementary is already situated between Freeway 880 and Oakland Rd, a 7-lane wide arterial highway, therefore we hypothesize that our data collection will show that the community is already experiencing negative effects from air pollution. In fact, data from CalEnviroScreen shows that the census tract Orchard Elementary is located in is populated by 82% people of color and is in the 95th percentile for pollution burden.

The Charcot Extension Project is emblematic of a larger, more serious national injustice that needs to be addressed, not just in our backyard of northern San Jose, but in our country as a whole. This project is symbolic of the fact that air pollution in schools is a problem that has

impacted children in every single state in our country, particularly in our own state of California. While this is in fact a national level problem, we as a research team are narrowing down to focus on a local example where this problem can be seen. Furthermore, the Charcot Extension Project is just one way the intersection of environmental issues and social justice issues presents itself in our country.. It is undeniable that those who bear the greatest brunt of environmental issues are those who have contributed to the problem the least. These are often communities of color with lower income levels and fewer access to resources. Orchard School and the Charcott extension project serve as an emblem of this much larger national issue.

It is crucial to monitor and track areas where air quality is worst, especially areas where children spend a majority of their time. Our study will work to address this by collecting air pollution data using two CPC 3007s, air pollution measuring devices, for three weeks at peak times when school children are the most exposed to air. Peak times studied will include morning drop-off and afternoon pick-up, although future studies should include recess and lunchtime for more robust data. One study in Southern California analyzed air pollution and lung function in fourth graders. As described by Gauderman, et al., (1999) children in fourth grade living in the most polluted areas of Southern California experienced significant deficits in their lung function growth as a result. Such deficits were generally greater for children who spent more time outdoors. The study they performed indicated that where there are high concentrations of pollutant particles, there are significant negative effects of lung function growth in children. Breathing polluted air brings health complications such as increased cardiorespiratory morbidity/ mortality, as well as respiratory issues and decrements in overall lung function. These health concerns are particularly prevalent in children, due to the amount of time they spend playing outdoors, their higher ventilation rates than adults, and partially due to the size and state of development of their lungs (Gauderman, et al., 1999). In another study published in Environment Health Perspective, children in Southern California living in areas with high levels of ozone and particulate pollution matter were more likely to develop asthma. Furthermore, children with asthma that live in these areas with high levels of pollution were far more likely to experience symptoms of asthma much more powerfully than children with asthma that lived in areas with low levels of pollution (Wilhelm, et al., 2008).

The school and neighboring community is incredibly concerned about the additional potential burden the Charcot Extension would bring. Interviews and surveys will be administered to parents, teachers, and other community members to collect a detailed description of attitudes regarding current traffic density levels and the extension plan. It is important to bring forward the community's perspective because of the environmental justice nature of this project. Data acquired from surveys and interviews will be used to discuss future plans for Orchard Elementary in fighting this environmental justice issue. We hope that the implementation of our project will empower the whole community to get involved and take action. This will be helpful to assess how the school can create a space for future leadership and participation and the community's next collaborative steps to stop the Charcot Extension.

Section 2: Literature Review

Part I: Environmental Justice

Since its creation in the 1980's, the term environmental justice has been used to describe the fair treatment and significant involvement of all persons, regardless of any personal characteristic or demographic, in respect to the creation, execution, and enforcement of environmental laws, policies, and developments in order to promote a clean and healthy environment. There are numerous cases in the Bay Area, United States, and around the world that demonstrate the disproportionate burden of environmental negatives on minority populations and the struggle of those facing these burdens to build a world in which they are treated equitably and respectfully by those in positions of power. A substantial and increasing volume of reports, articles, and movements establish that environmental burdens are disproportionately placed on low-income, less educated, racial or ethnic minority, ESL (english as a second language), and indigenous communities. However, not as much research has been done on the effects of environmental injustice on children, especially as it relates to school location, programs, funds, and other school characteristics. Children have little to no choice on where they live and go to school, often unaware of environmental burdens they may be exposed to daily and the impacts that those burdens may have on their health and academic performance.

While the state of California has been a leader in the effort for reducing air pollution that has negative consequences on the health of humans and the environment, there are numerous communities that are exposed to such high rates of air pollution that it threatens public health. These communities are overwhelmingly low-income and minority, leaving the most vulnerable in these already disadvantaged communities at most risk (Gaffron & Neimeier, 2015). In 2006, Pastor and colleagues conducted a study that found that low-income and nonwhite California students were exposed to higher levels of respiratory disease from traffic-related air pollution, and that this exposure was related to lower performance on standardized tests and increased school day absences (Pastor et al., 2006). A more recent study found that higher rates of traffic related PM2.5 emissions at and around schools are "significantly positively correlated with the following metrics: percent share of Black, Hispanic, and multi-ethnic students and percent share of students eligible for subsidized meals," and correlated "negatively with the schools' Academic Performance Index, the share of White students, and average parental education levels" (Gaffron & Neimeier, 2015, pp. 2009). Additionally, the presence of heavily trafficked roads and California public schools with high rates of non-white, English learning, and low-income students are inherently linked (Green et al., 2004; Gunier et al., 2003).

Our case at Orchard school focuses on the proposal and future implementation of the Charcot Extension project. The school is 94 percent students of color, 46 percent of its students qualify for free or reduced lunch, and it's diversity score is at .64 while the whole State of California's score is .41 (Public School Review, 2020). Many students are of minority race and/or are of low-income status, leaving them more vulnerable than their white, affluent counterparts to environmental burdens. Orchard is already burdened by its general location in San Jose because of the existing high rates of air pollution and its close location to multiple major roadways. The Environmental Impact Report done on the extension determined that this project would not have any significant or unavoidable impacts to air pollution, but this study was done with modeling that members of Orchard PTA deem inadequate (City of San Jose, 2019).

Even though members of the community have voiced extreme concerns at meetings on the extension and to city council and have demonstrated that the project is in direct contradiction to San Jose's Climate Smart and Vision Zero development goals, the city still currently plans to execute the extension. The question then is why would the government approve a plan that would put hundreds of children and thousands of other community members at risk of traffic-related air pollution health impacts and potentially increased traffic-related accidents?

Part II: Traffic-Related Air Pollution

As the world becomes more populated and cities become more dense, more people are living closer to major roadways, and thus are exposed to higher accident incidents and higher rates of pollutants being carried in the air. Traffic from motorized vehicles (e.g. motorcycles, cars, trucks, and planes) is one of the most significant contributors to ambient air pollution, especially in California. So much so that it has various detrimental impacts on public health and the environment. These fuel burning vehicles and other generators, such as waste incinerators, produce minute airborne particles such as PM10, the largest of the three, PM2.5, the middle, and ultrafine air pollution particles (UFPs) that are around 0.1 micron in diameter or about one-thousandth the width of a human hair. Since the Clean Air Act was first enacted, thousands of studies have been done, showing that the tiniest of PM particles are the most dangerous (US EPA 2009). Because UFPS are so microscopic, humans have inadequate natural defenses so they can enter the respiratory system and bloodstream and harm vital organs, including the brain (Polidori et al., 2012).

UFPs are not currently measured or regulated by the United States Environmental Protection Agency, thus not requiring air districts to monitor these tiny particles. Even though UFPs are important components of PM2.5 and PM10, the effects of UFPs are just beginning to be documented as more toxic than larger particular matter, especially for particularly vulnerable populations including children (Heinzerling et al., 2015). The US EPA has acknowledged that further monitoring of UFPs is required to even consider independent regulation for this particle size fraction (US EPA, 2010). Around the United States, pilot programs are being introduced to address these requirements of the US EPA; New York, Los Angeles and the Bay Area are some of the cities that local and federal agencies are stationed to measure UFPs (BAAQMD, 2015). In the Bay Area, the Bay Area Air Quality Management District (BAAQMD) has been studying UFPs since 2010, and have created multiple reports documenting areas, sources, amounts, and health impacts of UFPs (2010; 2014; 2015). Their reports estimate that UFPs contribute to more than 800 premature deaths a year in the areas, and total the value of the losses related to UFPM exposure to over $7 billion. Of all counties, Santa Clara County (SCC) experiences the second largest impacts after Alameda, which is in contrast to the overwhelming impacts of PM2.5 on SCC. This shows that UFPs are a localized issue and require regional mitigation strategies.

PM2.5 is responsible for around 95 percent of global public health impacts from air pollution and the vast majority of the global 3 to 4 million annual deaths attributed to air pollution (UCS, 2019). It is of exceptional concern in California because it encompases seven of the ten most polluted US cities in terms of PM2.5 pollution, with the Bay Area being in the nations top 10 polluted areas based on short term and year long particle pollution (ALA, 2018). Orchard School is located in a census tract that is exposed to traffic related pollutants (88%) such as diesel particulates (92%) and PM2.5 (53%) (OEHHA, 2017). Since Orchard is located next to

a busy freeway and main expressway that exposes the school to emissions from thousands of vehicles a day, traffic related air pollution is of main importance to reduce as much as possible because of the documented negative health impacts on children. While there are other pollutants that are of concern in the area such as ozone, solid and hazardous waste, and groundwater threats, ambient air particulates represent high levels of the overall pollution burden in the census tract, the Bay Area, and even California in general (OEHHA, 2017). Because of the high levels of present air pollution in the Bay Area and the serious health consequences, those who are most vulnerable such as children, the elderly, and those sensitive populations who already have adverse health effects, such as asthma, must be carefully considered in issues regarding air pollution.

Part III: Health Impacts

The health and safety of children in schools has become a major topic in recent years, and has spurred the development of programs and policies in order to protect children from various environmental exposures that can detrimentally impede their ability to learn and interact with their peers successfully (CHEJ, 2001). Parents and students expect that schools, where children spend hours a day, are safe spaces, but that is not the case as thousands of public schools in the US are situated within 500 feet of major roadways with significant traffic (Hopkins, 2017). A majority of people take in small amounts of toxic mixes of air pollution on a regular basis, but those who live, work and go to school next to heavily trafficked roads often get larger and more consistent amounts. More is obviously worse for health, especially for children.

Studies show that children's lungs are not as fully developed as adults', leaving them vulnerable to ambient air pollution during crucial periods of physical and psychological development which can lead to lifelong negative health impacts (McConnell et al., 2010; Ostro et al. 2006; Pastor et al., 2006; Mohai et al., 2011; Wilhelm et al., 2008; Wjst et al., 1993). The Committee of the Environmental and Occupational Health Assembly of the American Thoracic Society reported that exposure to high levels of PM_{10} and smaller particles, often produced by petroleum using traffic, are related to hospital admissions in children due to respiratory issues, school absences, decreases in lung air flow rates, and increased use of asthma medication (1996). Similarly, children exposed to PM_{10} have the lowest scores on neurological tests such as reduced performance on verbal and nonverbal intelligence and memory tests (Suglia et al., 2008). Further evidence from The Children's Health Study shows that exposure to regional air and traffic-related pollutants are related to increased asthma prevalence, bronchitis risk, decreased lung function, and airway inflammation (Chen et al., 2015). While studies are able to show relations between these health impacts, there is not yet enough exposure data to establish the full health impacts because there is so little ultrafine monitoring.

Children's lungs can take in 20 to 50 percent more air and, thus, more dangerous air particles than adults' (Kleinman, 2000). On top of that, children spend more time outside, often exercising, which only increases the amount of air and possible pollutants being inhaled. While childrens' bodies are still growing and changing, ambient pollutants can damage the development of respiratory function, as well as cognitive function crucial to academic performance (Calderón-Garcidueñas et al., 2007). Schools located in areas with the highest levels of air pollution have the lowest attendance rates, which is a potential indicator of poor health, and the highest proportions of students who failed to meet state educational testing

standards (Mohai et al., 2011). Because children spend half of their childhood in school and are often unable to individually choose where they go to school, it is incredibly important to recognize and minimize exposure to environmental negatives at and around schools. The health impacts of air pollution on children are generally troubling, but what is also troubling is that these pollutants are particularly bad for asthmatics, and not only do low-income and minority children have higher rates of asthma, but they are more likely to attend schools near heavily trafficked areas. The next question to be answered from this knowledge is: what can be done by scholars, governments, impacted communities, and others to remediate disproportionate environmental burdens so that negative health impacts are mitigated?

Part IV: Mitigation Measures

In 2003, the state of California passed Senate Bill 352 Schoolsites: Sources of Pollution which banned the construction of new schools on land within 500 feet of the closest traffic lane of a freeway or other busy traffic corridor (Polidori et al., 2012). However, there is no current legislation regarding the assessment of existing schools, or infrastructure changes surrounding existing schools. Moreover, while research on air pollution in schools is expanding, many parent and school groups are largely unaware of the problem (Hopkins, 2017). Therefore, many districts have no incentive for efforts to mitigate air pollution inside schools already impacted by substantial traffic, even though studies at schools in California show that high quality air filters that the EPA recommends make a significant difference. Within the last 10 years, air purification systems have been piloted in schools around the country to reduce air contaminant exposure. The coupling of a register system and a high performance panel filter have been found to reduce close to 90 percent of pollutants such as PM2.5 (Polidori et al., 2012). The technology has begun to be established better, with the installation and management being fairly simple, but costs range largely based on the present HVAC system and ventilation. Heading studies' and the EPA's advice, the South Coast Air Quality Management District has identified funds to cover the cost of filters at 80 schools near freeways (Hopkins, 2017).

In 2015, the EPA released a guide for reducing road pollution at schools that include reducing indoor air pollution through systems such as the filters and site-related strategies for reducing near-road pollution exposure. Of the latter methods, it includes transportation policies such as idle reduction policies and encouraging active transportation (bike riding and walking) and roadside barriers such as sound walls and vegetation (EPA, 2015). There are measures that Orchard school, and many other schools, could be implementing now to reduce existing air pollution and could reduce additional pollution if the Charcot Extension moves forward (See Table 1.) While these guidelines are a start in addressing ways in which schools and local governments can mitigate air pollution in schools, there are also movements in schools nationally and even internationally that are fighting for firm action from governments in the protection of air quality for children in schools.

Table 1: Potential air pollution mitigation strategies and possible benefits and disadvantages.

Potential Air Pollution Mitigation Strategies	Benefits	Disadvantages
Educate faculty and staff on ventilation and indoor air quality best practices	Teachers are trained to be knowledgeable on ways in which they can help to reduce indoor air pollution. This can transfer to students who may employ similar techniques at home such as making sure air vents remain unobstructed, doors/windows are kept closed during peak pollution periods, and indoor sources of air pollution are reduced.	Results wholly depend on the quality of training and cooperation on part of the staff. Productiveness may decrease over time. This is only reducing the amount of air pollution allowed indoors, not really decreasing air pollution in general.
Double pane windows and air seals	May reduce the amount of unfiltered air entering the classroom and other buildings. May significantly reduce outdoor noise pollution. Energy-efficient window design often allows for smaller and less costly HVAC systems, thus freeing funds that can be allocated to the efficient window technologies (Efficient Windows Collaborative, 2011).	If ventilation is poor, **indoor pollutant concentrations may build over time** indoors. This is only reducing the amount of air pollution allowed indoors, not really decreasing air pollution in general. The **cost** will vary based on the model and insulation, but is expected to pay anywhere between $450 and $600 per **double-paned window** on a new installation (Efficient Windows Collaborative, 2011).
Filters	Reduces particles from outdoor and indoor sources. MERV 11 air filter effectively removes 15 (0.3μm) -58 (1.0μm)% , MERV 13 removes 30-85%, and MERV 16 removes 90-99% (Polidori, 2012). Anything above a 13 MERV rating is considered to be a High-Efficiency Particulate Arrestance (HEPA) filter, often used for hospitals and scientific research lab applications.	Maintenance, upgrades, and replacement required. They may be costly. The total annual costs of these are: 11: $102 to 130; 13: $150 to 210; 16: $370 (Polidori, 2012). This only addresses indoor air pollution.
Improve HVAC system design and add Filters	Larger reductions in particle concentrations are possible. When using a HVAC-based high-performance panel filter, reductions of indoor concentrations of Black Carbon, UFP, and PM2.5 were close to 90% (Polidori, 2012).	This may be costly. Magruder Elementary (K-8) in York County serves almost 600 students. They spent $3,250,000 in 2015 to replace all HVAC equipment & controls (The York County School Division, 2016). This only addresses indoor air pollution.
Implement anti-idling/idle reduction policies	Reduces emissions of particles. Personal-vehicle idling generates around 30 million tons of CO2 annually in the U.S. Following an anti-idling campaign introduced at four schools, the average difference in PM2.5 at the school with the most buses decreased from 4.11 μg m−3 to 0.99 μg m−3 ($p < 0.05$) (Ryan et al., 2013). Schools may post anti-idling signs or work with the school board on a district wide campaign.	Lack of vehicle climate control. May be difficult and timely to enforce.
Upgrade school bus transportation	Reduces emissions of particles. Students may be and feel safer from traffic-pedestrian accidents which can have an impact on a student's attendance and their overall academic performance. This can have an effect on the quality of a student's education, enable students to attend higher-quality schools that might have been previously inaccessible, and allow for participation in enriching before- and	This may be costly. The average cost of transportation per student is already $914 per year. Introducing more busses would obviously cost the amount of buying more busses and resources needed to run these busses. An electric school bus is about $120,000 more expensive than a diesel version (Descant, 2018).

	after-school activities (Urban Institute Student Transportation Working Group, 2017). Diesel retrofit technologies can be added to existing diesel school buses in order to reduce emissions, including installing devices in buses' exhaust systems and upgrading certain engine components. This can be more cost-effective than other interventions. Electric school buses, which have only been commercially available since 2015, are zero-emission vehicles. As a result, electric options are by far the most environmentally friendly school buses. They also are the cheapest fuel option and require the least maintenance. Estimates from the public bus sector indicate that lifetime costs of a diesel bus are $1.4 million, versus an electric's $1 million (Holder, 2018).	More effective routing is specific to school sites. A group of MIT researchers created an algorithm for Boston Unified School District that eliminated 50 bus routes at the start of the 2017-2018 school year, saving the district roughly $5 million upfront (McGinty, 2017).
Encourage active transportation (e.g. walking & biking) to school	Reduces emissions of particles. May improve health with exercise.	Walkers and bicyclists may be exposed to traffic- related pollution or other hazards during trips.
Design school site to minimize exposure to pollutant sources	Reduces exposure to particles and gases.	Effectiveness is specific to the school site. This may be difficult and costly for existing schools.
Use solid and vegetative barriers	Reduces concentrations of particles. Reduces vehicle pollution downwind of roadways up to 60% (EPA, 2015). Vegetative barriers may increase shade and improve aesthetics.	This may be costly. Best design may be specific to the school site.-- At Orchard School, this may create an unsafe alley if along Silk Wood Ln. Maintenance and water needs for vegetative barriers.
General greenery	Reduces concentrations of particles. Greenery may increase shade, improve aesthetics, and provide a source of food (if a producing garden) for students, which can aid food insecure children and their families.	This may be costly. Best design may be specific to the school site. Maintenance, collection, and water needs.

El Marino Language School in Culver City, Los Angeles is situated next to the 405 freeway, which is known as one of the largest and busiest freeways in the US at 13 lanes and with as many as 375,000 vehicles daily, and ocean winds blow traffic-related pollutants towards the school. Parents and teachers joined forces and realized the impacts that air pollution could have on the children going to school there. They borrowed a university's ultrafine particle counters, attended board meetings, and campaigned for a bond measure to raise funds for a filtration and air-conditioning system. It took more than two years for the filters and AC system to be retrofitted and it cost $2.5 million. While this does not help the quality of air that the children are playing and eating outside in, air quality in classrooms has improved (Hopkins, 2017). This shows that there are options for Orchard school to improve the current quality of air and that strong coalition movements have the power to create positive change. If the Charcot Extension is passed, there are mitigation strategies such as a pedestrian bridge to reduce the risk of traffic incidents, HVAC replacement, and sound walls that can be developed with time, money, and help from the city and state government.

As further articles and movements surrounding air quality, environmental justice and health in schools are being created around the world, this project aims to act as a case study for further exploration on this issue broadly and as a local issue to support the voices of those most affected. In this paper, we will document the base levels of air pollutants at and around Orchard School, understand levels of air pollution in relation to the area's demographics, gather local community perceptions on air quality and the Charcot Extension Project, and recommend ways in which those involved can build spaces for community knowledge and participation in issues of environmental justice.

Section 3: Research Questions

Our first research question focuses on collecting and analyzing quantitative data to assess the current state of air pollution risk at the school. We will be using CPC 3007s to collect data at peak hours of child exposure for 3-4 weeks at critical campus locations. From this, we hope to build baseline data to more accurately assess potential risk from the Charcot Extension Project. Our second research question brings in community voices to this environmental justice issue. Orchard School is part of a census tract with 82% minorities, and is in the 95th percentile for air pollution burden. We will use surveys to gather qualitative evidence for attitudes regarding current conditions and future air pollution exposure for students. Our third research question focuses on future steps for the community post-study to share knowledge and work together as participants fighting for environmental justice and equal rights to clean air. This will include leading a PTA discussion following our data collection results to present or findings and discuss potential mitigation solutions if applicable. Table 2 situates these research questions with what we expect to find, already existing data on the topic, methods we will use to answer the question, assumptions, and how we plan to analyze the data we collect.

Table 2: Research Questions.

Research Questions	Hypothesis and Expected Findings	Data and Evidence	Methods	Assumptions and Plans for Data Analysis
1. What are current levels of air pollution at Orchard School and the surrounding neighborhood?	The Bay Area is considered one of the most polluted metropolitan regions by average year-round concentration of particulate matter (PM2.5). Additionally, Orchard school is already located between highway 880 and Oakland Road which is a major arterial 7-lanes wide. It is expected that a community located in the Bay Area situated next to major roadways would be exposed to major levels of air pollution.	The data from the Environmental Impact Report of the Charcot Avenue Extension shows that the project will have less than a significant impact on air quality, but the assessments are based on theoretical models, not actual measurements on site. Cal Environmental Screen shows census tract data for Orchard School minority population percentages and air pollution risk.	We will collect air quality data using two CPC 3007s for three weeks for 10 minutes each at 6 locations, seven times a week, during morning drop off and recess/lunch times that children are most exposed to outdoor air. We will also collect vehicle counts at the same times for 10 minutes. We will count vehicles and classify vehicle types. We will use GIS to map community demographics and existing data on air pollution. We will ask survey questions.	Assumptions: that data collection is taking place during peak hours of student exposure, that we have accurate pre-existing baseline data for air pollution in San Jose and Santa Clara to compare our results too. Additionally, we plan to analyze baseline data about the impacts on the community that are potentially associated with the Extension Project.
2. What are community perceptions on air quality and the Charcot Extension?	The community is very concerned about increased exposure and health risks that aren't being addressed by the city. Orchard PTA has drafted a 150 page comment response to the Extension EIR.	Surveys: community members share their opinions on air pollution and the extension project. The purpose: get an understanding of community feelings towards current traffic densities and the modification/mitigation options if the project continues.	We will conduct a survey for teachers, parents, and other community members to share their perceptions of air pollution and safety in their area.	The data acquired from surveying the community will be compiled into an analysis to gain an overall community-wide sense of opinions of the current air pollution levels and the extension project.
3. How can Orchard school, local community members, and community based partners continue to build a space for community knowledge on, participation in, and resilience to the Charcot Extension Project, air pollution, and environmental injustice?	We will engage with parents, teachers, and students to continue to build a space for community knowledge and participation in their community's battle with environmental justice.	The community leaders and school members hope that all they learn can also be applied to and shared with other people who may need additional guidance through similar situations.	We will present our poster and results at a PTA meeting. We will share all of our data and final report with our community based partners so they may incorporate it in their efforts against the Charcot Extension and for possible mitigation strategies at Orchard. We have incorporated survey questions allowing community members to share their knowledge and opinions on the project, and possible mitigation solutions. We work with students on data collection which will provide examples of resources and methods for continued research after completion.	Assumptions: there are differing levels of participation from every group. Some parents, students, and teachers may not think air pollution or the extension are issues for the school or themselves to be engaged in. This is only a 10 week project so we don't expect to have a major influence on the community, but instead hope to provide some tools for future engagement on the issue.

Section 4: Methods

For this project, we utilized a community-based participatory action research (CBPR) approach. This method's main purpose is to increase the value of research for both the researchers and community under consideration. In order to increase community and researcher values, a greater development of appropriate measurements and a greater understanding of the community's perceptions are sought after. More specifically, the CBPR benefits community participants and researchers by establishing and building connections which enable the sharing of knowledge and experiences (Viswanathan et al., 2004). Furthermore, CBPR research projects become more efficient and effective because of their ability to develop a deeper understanding of the community's unique circumstances establishing a more accurate framework for researcher testing procedures and adapting any practices to the community's specific needs (Hall, 1992). While maintaining a CBPR approach, we developed our research guided methods through a mixed methods approach.

Our mixed methods approach examines the real life threat of environmental injustice for community members of OSD by deeply considering the communal and cultural values that exist alongside the more quantitative measures of air pollution. The literature review was conducted to gain further insights into the key variables influencing air pollution and Orchard School District (OSD). Topics of this literature review included, traffic-related air pollution, mitigation measures, and others, which were all seen through an environmental justice frame. We centralized our literature review and additional methods around an environmental justice frame to highlight the disparities and unequal experiences vulnerable communities live through, like those of Orchard Elementary. In order to analyze the current air pollution levels within and surrounding Orchard Elementary, we used a CPC 3007 device. In addition to collecting measurable data on air pollution, we also conducted a survey to gather community perceptions of air pollution and any foreseeable externalities of the Charcot Extension Project. The ideal outcome is that the surveys would help provide community perceptions not directly brought about through air pollution measurements. With a more generalized understanding of community thoughts of air pollution, building their community knowledge becomes easier because it becomes possible to establish a common baseline of information, which could potentially lead to increased participation in community air pollution and environmental justice issues.

Community-Based Participatory Action Research

Part I: Student Volunteers

Six Orchard School student volunteers aided in data collection throughout the project. The students were those that had expressed interest in our project to their teachers and were then referred to us for orientation. Four students were in the seventh grade and two were in the sixth grade at the time of this project. The students were not required to help at every data collection and instead, they participated on their own free will. The students were expected, however, to help with at least one data collection per week and stay involved until the data collection portion was finished. The students also did not receive any extra credit for participating and were not given compensation for their help.

Part II: Air Pollution

CPC 3007 devices were utilized to measure ultrafine particulate matter in the air (particles/cm^3). Ultrafine particulate matter has an average diameter of less than 0.1μm which is smaller than PM10 and PM2.5; with diameters of 10μm and 2.5μm, respectively. Data was collected for ten minutes at six locations within Orchard School District (OSD). The following six locations were chosen as general data gathering sites: OSD front office, corner of Oakland Road & Fox Lane, inside OSD Classroom #46, OSD event center steps, playground closest to Silk Wood Lane, and the baseball diamond next to Oakland Road. These are displayed in Figure 1 below.

Figure 1: Data Collection Map.
Air pollution data collection map of Orchard School and surrounding area. Casa de Lago Mobile Home Park locations include: (1) Front Office; (2) Laguna Dr. and Arroyo Dr. intersection; (3) Laguna Dr. and Buena Vista Dr. intersection; (4) Laguna Dr. and Fountain Circle intersection; (5) Arroyo Dr. closest to the edge of the park; and (6) Creekside Dr. and Westwood Dr. intersection. Orchard School District locations include: (7) Oakland Rd. and Fox Ln. intersection; (8) Front Office on Fox Ln.; (9) inside classroom #46; (10) the baseball diamond; (11); the playground near Silk Wood Ln.; and (12) the steps of the event center.

These locations were chosen based on where students frequently gather and may be most exposed to poor air quality. We have a wide array of locations that represent many different and

wide-spread areas of the school grounds. We also decided to include one location that is in an indoor classroom to be able to compare outdoor and indoor air qualities. Many students gather at the OSD front office before and after school, and it is exposed to two single-lane streets. The corner of Oakland Road and Fox Lane is one of the busiest intersections that runs parallel to Orchard, and many students cross the street here. Room #46 is a normal indoor classroom that students gather in. Many students gather, eat lunch, and play at the event steps. Many students also gather and play at the playground, but it is also located next to the busy Silk Wood Lane road. Lastly, the baseball diamond is where the Charcot Extension is proposed so we wanted to get a baseline of air quality here, and it is located next to Silk Wood Lane and Oakland Road which is another very busy intersection. This data collection was also completed under a weekly schedule for three weeks. Due to President's Day (2/17/2020), OSD had a week off from school. Therefore, data collection was separated into two consecutive weeks, one week off, and then one final week. Data collection schedule at OSD is as follows:

- Tuesday (2/4, 2/11, 2/25), 12:17pm--12:47pm
- Wednesday (2/5, 2/12, 2/26), 7:50am--8:20am
- Wednesday (2/12, 2/19, 2/26), 4:00pm--5:00pm
- Friday (2/7, 2/13, 2/28), 7:50am--8:20am
- Friday (2/7, 2/13, 2/28), 2:40pm--3:10pm

Our research group had access to two CPC 3007 devices, which allowed a pair of researchers to individually survey three sites for ten minutes each. By dividing the six measurement sites into two groups, we were able to complete the data collection concurrently. These two groups were maintained throughout all data collection session: Group 1 included the corner of Oakland Road and Fox Lane, the front office, and inside classroom #46; Group 2 measured air pollution at the baseball diamond, playground nearest Silk Wood Lane, and the event center steps. A ten minute set-up time for the CPC devices was also required, increasing our time at Orchard to 40-50 minutes. OSD Students also aided in data collection, but were limited to recording minimum/maximum particulate matter data points and environmental/weather conditions of each session.

Air pollution at Casa de Lago (CDL) was measured in areas of high traffic (Point 1, main office) and areas to serve researcher inquiry. For example, air pollution at points 2, 3, and 4 were taken to see if there was a gradient of UFP concentrations spanning from Highway 880 to the inner parts of CDL. Point 5 was chosen as the point closest to Oakland Road that still lied within the CDL property. Finally, Point 6 was chosen to measure UFP's in the northern area of CDL which also was slightly more protected by greenery to the northwest. UFP measurements were taken for ten minutes to maintain consistency between OSD and CDL. Traffic counts were also taken and recording cars in one direction was chosen randomly during the first data collection. The same traffic flow direction was used for the following data measurements. We measured UFP concentrations and took traffic counts once a week for three weeks after 4:30pm.

Part III: Traffic Counts

Traffic counts were also taken during the same time intervals as air pollution was measured at OSD front office, the corner of Oakland Road & Fox Lane, the playground closest

to Silk Wood Lane, and the baseball diamond next to Oakland Road (Figure 1). Two OSD students were taking the traffic counts of one direction of traffic flow for a ten minute interval. Traffic was organized into seven categories: heavy truck, medium truck (box truck), small truck (personal), bus, car/van/taxi, plane, and other (RV's, motorcycles, etc.) (Figure 2). Traffic flow was chosen to account for all possible traffic passing OSD. At the Oakland Road and Fox Lane data collection site, traffic counts were taken of traffic driving Southeast from Silk Wood Lane to Fox Lane. At the OSD front office, traffic counts were taken of traffic driving Southwest on Fox Lane from Oakland Road. At the baseball field, traffic flowing Northwest from Fox Lane to Silk Wood Lane was recorded. At the playground closest to Silk Wood Lane, traffic driving down Silk Wood Lane from Oakland Road was recorded.

Part IV: Surveys

A twenty-five question survey was distributed through email, a PTA newsletter, and paper copies for parents and community members over eighteen to complete. This survey asked questions of any perceptions of air pollution, personal experiences with the surrounding air pollution, opinions of current traffic density around OSD, opinions on hypothesized future traffic density around OSD, and demographic details (Appendix B). The survey took anywhere between ten to fifteen minutes to complete and was anonymous. Consent letters and an oral consent to participate was given to the participants by the SCU student researchers.

The survey was used to understand perceptions that exist within the adult community of Orchard School District. The survey allowed us to objectively address what preconceived ideas surrounding air pollution and the Charcot Extension Project and how these ideas may influence overall recognition, or lack thereof, of such issues. The questions were written to address the specific issues of air pollution, traffic density, and their effect of children's health and academic performance. The survey's questions were consciously posed in a way which would not be considered persuasive or authoritative. Such questions were written to be respectful, civil, and appreciative. In that way, we built trust between ourselves and the community members. The combination of our survey findings with our research help provide a deeper understanding of perceptions surrounding air pollution, traffic density, and their effect on children.

Part V: Purpose of Data

The data collected will be used to provide a more specific context of the environmental issues occuring near and within OSD. The air pollution measurements of UFPs will provide context for what the current air pollution is at OSD and also within a CDL. The traffic data taken in conjunction to the UFP measurements will act to provide information on the relative traffic density and flow, which has additional implications for health and safety concerns. The survey data collected will mainly serve as a measurement of community knowledge and participation with environmental issues and the Charcot Extension Project. Collecting and analyzing all this data will hopefully provide us with a representative measure of the current environmental impacts the community is facing and how they view and act on them.

Section 5: Results and Findings

Air Pollution Data.

Average UFP per site location over the entire data recording period. See bottom tabs for spreadsheets of locations grouped by meter device and CDL measurements (link).

Traffic Count Data.

Total number of vehicles passing Orchard School District in respective locations during data collection (link).

Part I: Air Pollution Results

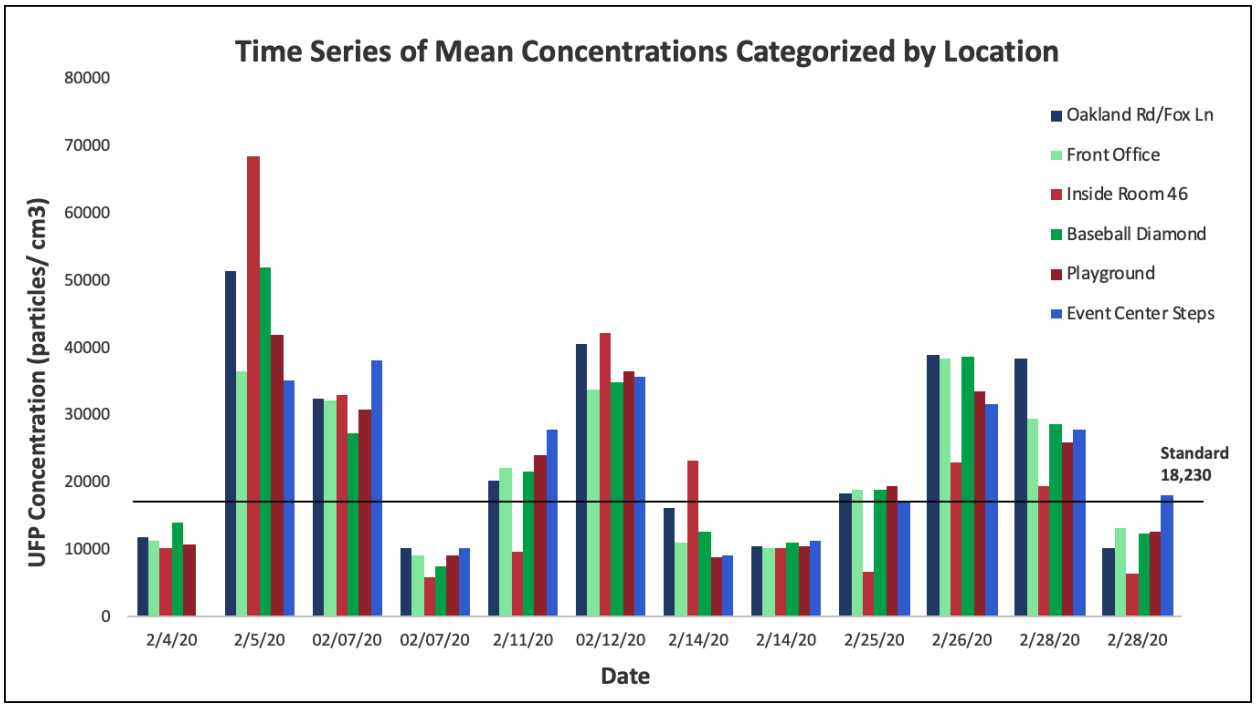

Figure 2: Air Pollution Averages by Date and Location in OSD.
Source: *CPC Data Collection January-February 2020*

Figure 2 depicts a time series across all of the days air pollution data was collected from February 4- February 28th. The ultrafine particle measurements were recorded in particles/cm3, and each bar is coded by location the measurement was taken and shows the mean concentration of that particular 10-minute interval. The black horizontal line shows the standard we are using, derived from a 2016 literature review of ultrafine particles and health impacts. In one study, it was found that outdoor ufp levels were correlated with increased asthma in schoolchildren. The averages recorded in that study were 18,230 #/cc, so we are using this as a baseline number of what may have a potential impact on the kids' health at Orchard School. Unfortunately, ufp and health impacts are still being studied and largely not understood at this point, so getting a

concrete number to compare our data too in terms of the possible magnitude of consequences of our averages was difficult. Additionally, to contextualize our mean concentration findings several studies were reviewed regarding PM2.5 to see if we could correlate our ufp findings with national PM2.5 standards. PM2.5 is actually not directly correlated with the behavior of ultrafine particles, so we left this comparison out.

Almost all of the days we recorded experienced ufp levels above our recommended, and this graph does not depict the "spikes" or maximums that were hit at each location, which are included in the following figure and more accurately describe the total duration each location experienced extra high ufp levels, which we define as greater than 40,000 #/cc.

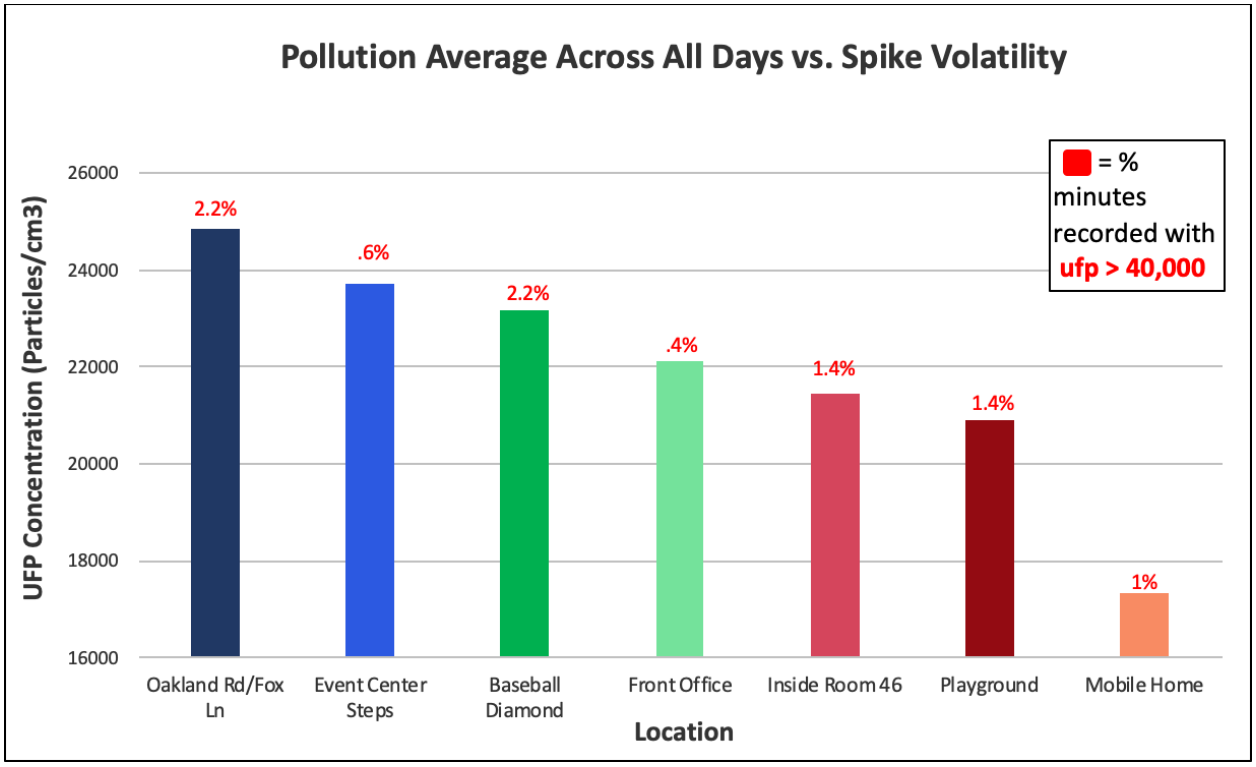

Figure 3: Air Pollution Total Averages by Location vs. Spike Count

Source: *CPC Data Collection January-February 2020*

Figure 3 depicts overall pollution averages across all recorded days, categorized by location, in order from locations experiencing the highest UFP averages to locations experiencing the lowest ufp average concentrations. The intersection of Oakland Road and Fox Lane had the highest concentration average of 24,861 #/cc. This is hypothesized to be because of the nature of recording directly next to a very busy road and the amount of cars utilizing this path during peak hours, particularly during morning drop-off. However, in general all school locations (excluding the mobile home park) experienced a similar range of UFP concentrations between 20,800-24,861 #/cc. The mobile home park location had the lowest average concentrations, but we only collected data here on three days, and at a different time of day than other locations (around 5-6 PM) so it cannot be directly compared to other location data. We hypothesize that the lower concentration may be due to distance from the freeway, wind flow, and the lack of UFP sources directly within the mobile home park as cars are not frequent and

drive at low speeds. Additionally, there exist more barriers between the mobile home park and the freeway including a sound wall and the mobile homes themselves. With these additional obstacles, wind flow was limited and therefore UFP concentrations may not have been as concentrated as they otherwise would be without the barriers. In comparison, OSD has wire fences and plenty of wind during the day which allows UFPs to freely flow in and out of the campus. An alternative hypothesis is that Orchard School experiences higher UFP concentrations because the source of ufp is not just traffic, but potentially the industrial site neighboring it. The industrial site lies across the school on the other side of Oakland Road. Through researcher observations, multiple heavy trucks and machinery operate in this location. The site appears to be a mineral and landscaping material processing and/or redistribution plant due to the frequent truck movement and loading/unloading.

Figure 3 further shows the volatility of air pollution at each location. Percentages marked in red show the percent of time studied that each location was recorded as being in a "spike", with a "spike" in ufp levels categorized as 40,000 #/cc or higher. Certain locations like the Event Center Steps or Front Office had relatively high average concentrations compared to other locations, but were more consistent. In contrast, locations like Oakland Road/Fox Lane and the Baseball Diamond had ufp concentrations greater than 40,000 2.2% of the minutes we recorded. They were the most subject to dangerous spikes. Our only indicator of indoor air pollution was the inside of room 46, which was on the lower end of overall ufp concentrations but was still subject to volatile spikes, possibly because of the lack of air circulation possible indoors.

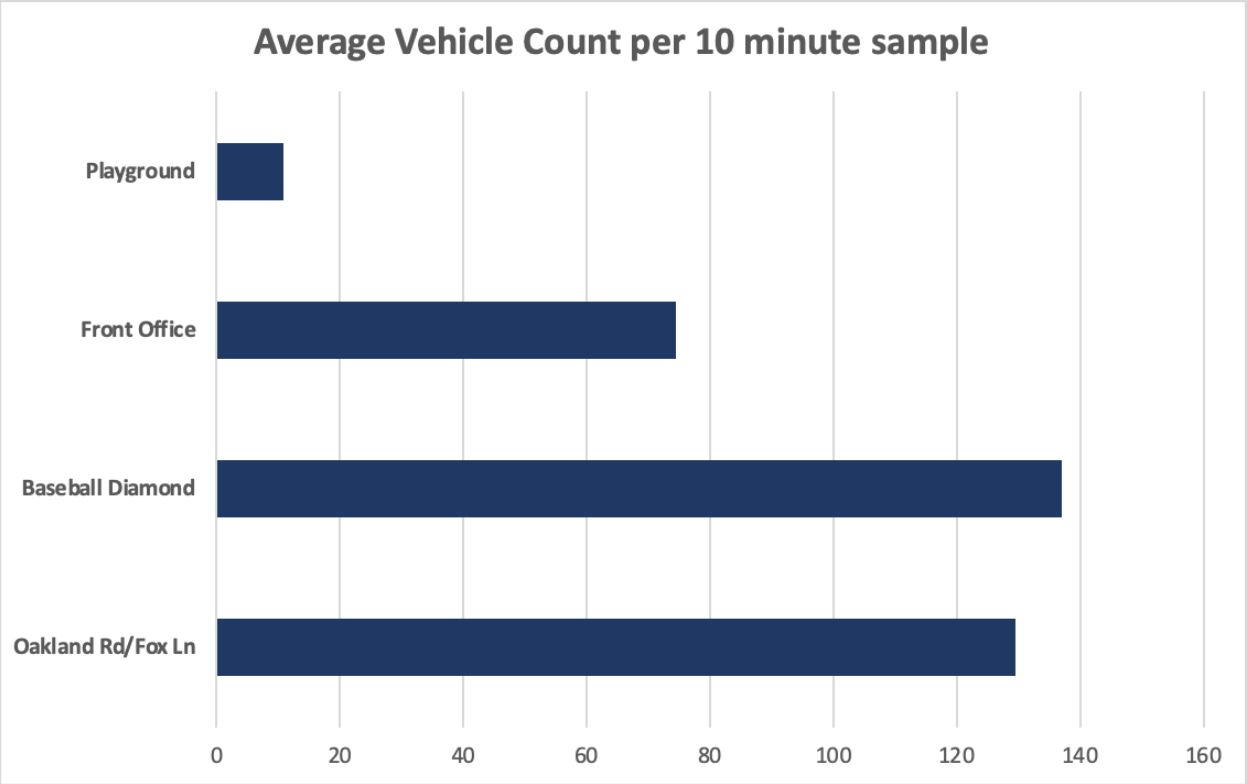

Figure 4: Traffic Counts at OSD Locations.

Figure 4 shows traffic counts for relevant locations, which excludes the Event Center Steps, Inside Room 46, and the Mobile Home Park. Oakland Road/Fox Lane and the Baseball Diamond had very high averages of cars going by, both of which averaged at more than 100 per ten minute interval. Moreover, we only counted cars going one direction because of the amount of researchers we had on hand count traffic, therefore the actual amount of cars passing the area per interval is much higher.

Casa de Lago traffic was significantly less frequent compared to traffic around OSD. Traffic from Oakland Road traveling down Club Drive to Casa de Lago's main office averaged 50 vehicles per ten minute interval with a high of 55 vehicles over one interval. All other traffic count locations had fewer than ten cars travel within the area per ten minute interval.

Part II: Survey Results

Our Surveys asked a variety of questions that all aimed to enhance our analysis on community perceptions on the current air pollution levels and the extension project, demographic and health data, and opinions on possible mitigation measures. These results will begin with demographic data of the survey participants, and then move to perceptions on air quality and traffic, health data, and lastly opinions on the Charcot Extension Project and possible mitigation strategies for the project.

Statistical Survey Responses

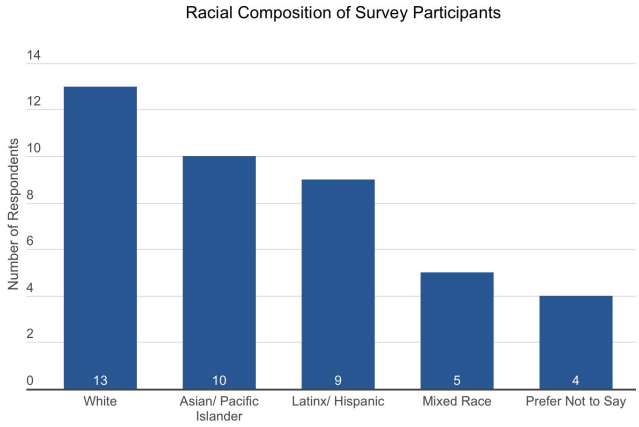

Figure 5.1: Racial Composition.

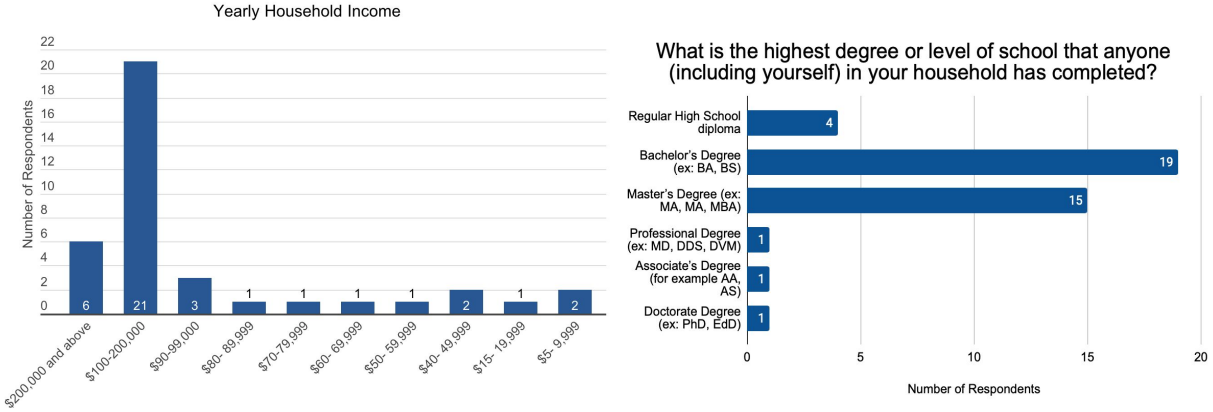

Figure 5.2 Yearly Household Income. Figure 5.3 Education Level of Survey Participants.

We first wanted to get a sense of the community members who were answering the survey. Therefore, we asked demographic questions pertaining to race, level of education, and yearly household income (Figure 5). The community members we surveyed identified as a multitude of races, many identifying as White, Latinx/Hispanic, Asian, and Mixed Race. A majority of participants recorded themselves as having a yearly household income between $100,000 and $200,000 with many other respondents placing themselves in various income levels ranging from $200,000 and above to between $5,000 and 9,999. A strong majority of respondents, or someone in their household, have either Bachelor's or Master's degrees with a few others having High School, Professional, Associates, or Doctorate degrees.

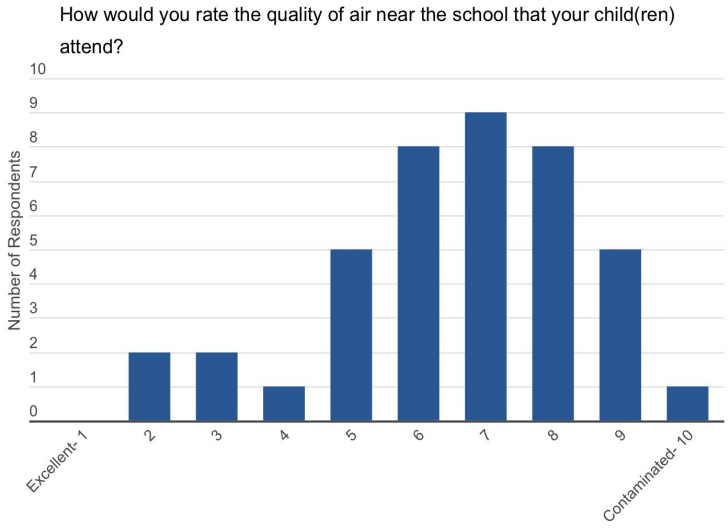

Figure 6.1: Community Perceptions on Air Quality at and around Orchard School.

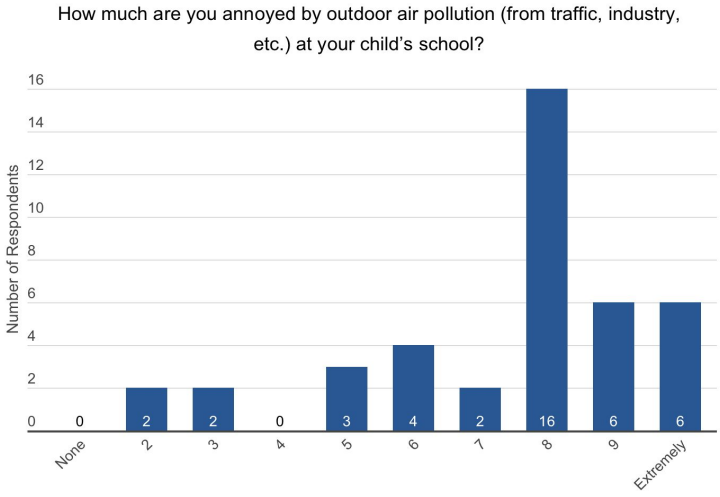

Figure 6.2: Community Perceptions on Outdoor Air Quality and Emission Type at and around Orchard School.

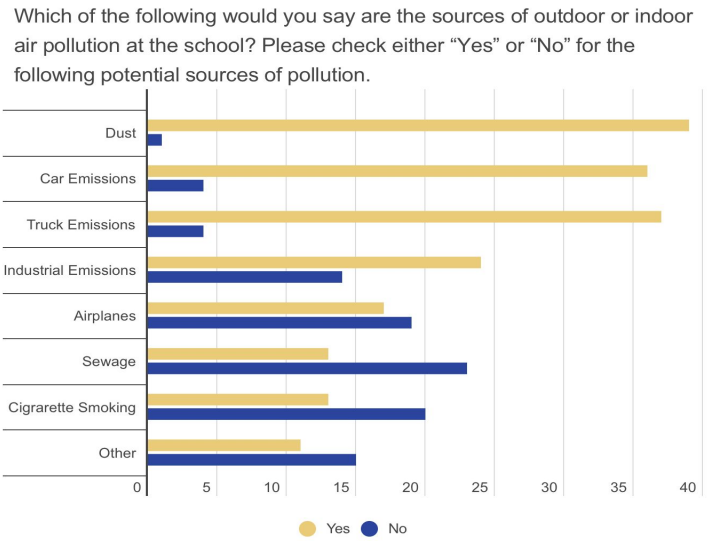

Figure 6.3: Community Perceptions on Emission Type at and around Orchard School.

We wanted to understand the community perceptions on the existing air quality in the encompassing and surrounding area of Orchard School. Therefore, these survey questions aimed to gauge preexisting thoughts on the issue (Figure 6). Respondents generally rate the quality of air near Orchard between 5 and 9 (85%) and the most rating it as a 7 (22%) with 10 being considered contaminated. Respondents are also very annoyed by outdoor air pollution in the area with a large majority (39%) rating their annoyance at a level 8 with many also rating it as a 9 or 10. Within this sphere, there are also questions regarding the presence of types of air pollution in the area. Respondents believe that dust and car, truck, and industrial emissions are the main sources of air pollution at Orchard School; they are least concerned with cigarettes and sewage as pollutants. Overall, respondents believe that air pollution is a present and annoying issue caused mostly by dust and traffic and industrial emissions in the area.

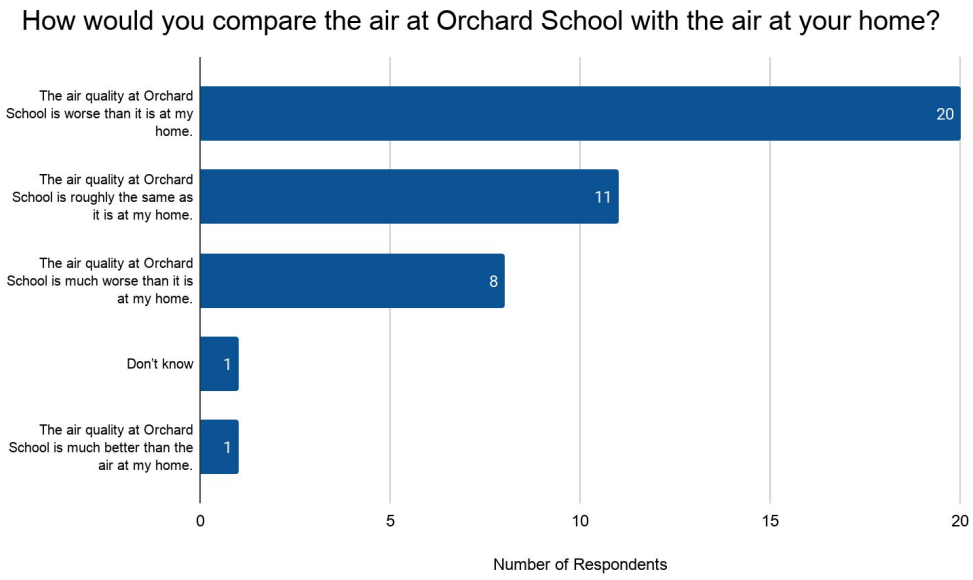

Figure 7: Comparison of air quality at Orchard School and respondents' homes.

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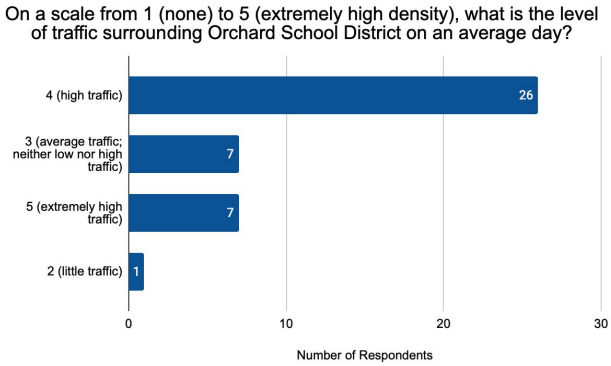

Figure 8.1: Perceptions of Traffic Density

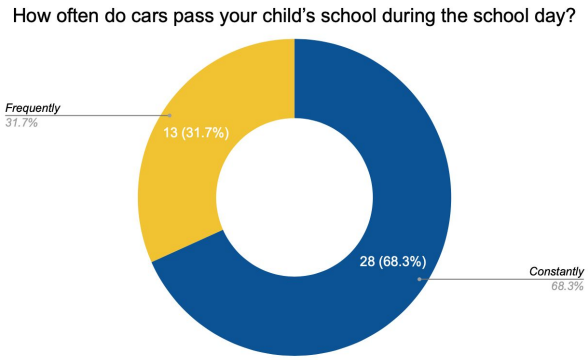

Figure 8.2: Perceptions of Traffic Frequency

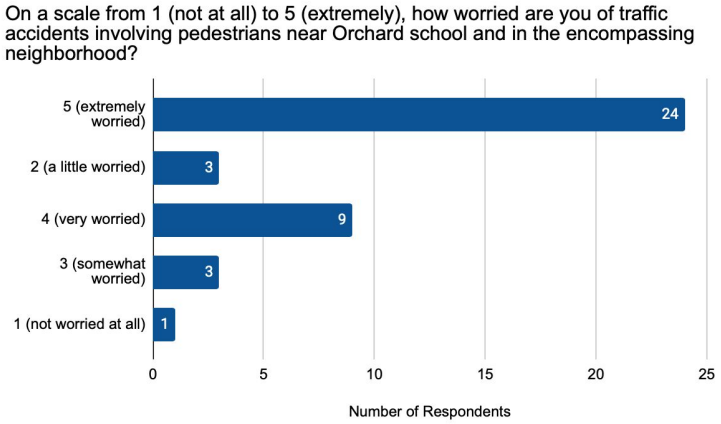

Figure 8.3: Traffic Density and Accidents.

Many survey questions on traffic were asked both in regards to density, type of emissions, and air quality (Figure 8). A majority (63.4%) of respondents perceive the traffic density around Orchard School to be considered high traffic, while an equal percentage believe it to be extremely high or average (17.1% each). All respondents recorded that cars pass by Orchard either frequently (31.7%) or constantly (68.3%) during the school day. Additionally, respondents are particularly worried about traffic-pedestrian accidents around Orchard School. A majority (60%) are extremely worried about this while many others are very worried (22.5%). Because of the perceived high traffic in the area, many respondents are extremely worried about traffic accidents involving themselves, their children, or other pedestrians.

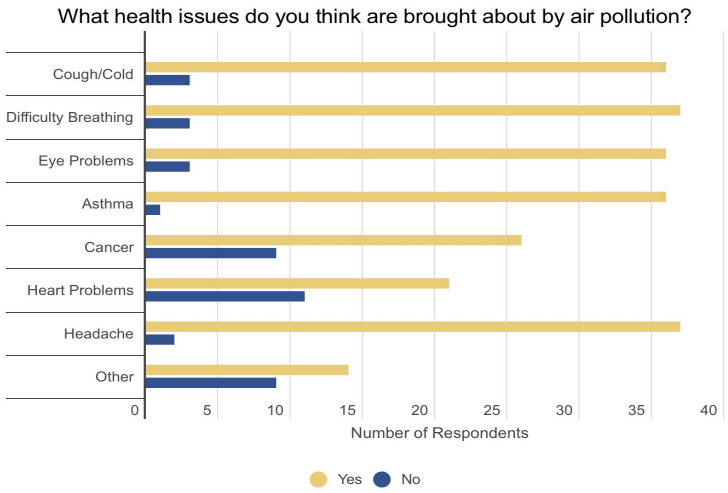

Figure 9.1: Health impacts perceived to be brought on by air pollution

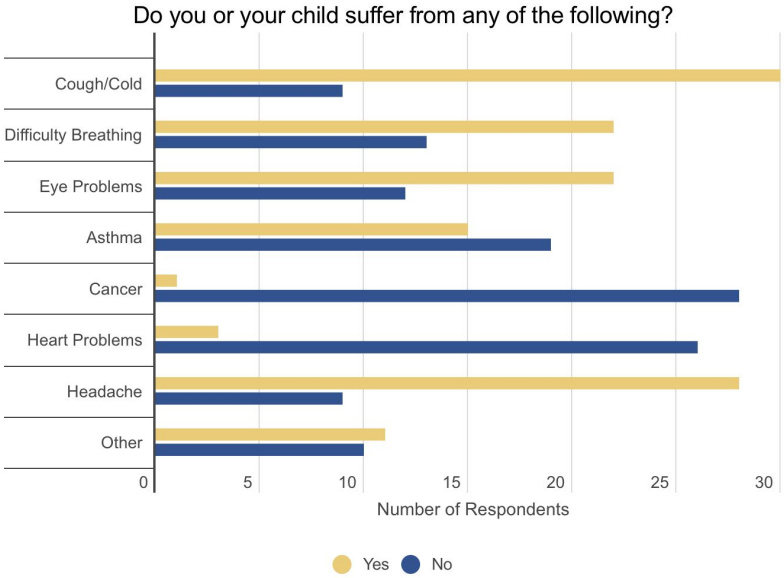

Figure 9.2: Health impacts the community faces at home.

The next set of survey questions asked about perceptions on health impacts brought on by air pollution and any health issues that the respondent or their child(ren) has suffered from (Figure 9). Respondents generally believe that a cough/cold, difficulty breathing, eye problems, asthma, cancer, headaches, and other health issues are brought on by air pollution. Respondents, or their children, generally suffer from a cough/cold, difficulty breathing, eye problems, and headaches; over 50% of the respondents have children that experience some health issue(s) in the realm of: cough/cold, difficulty breathing, eye problems, and headaches. While a majority may not, others still suffer from asthma, cancer, heart problems, and other issues. This shows that many of those in this community face health issues that are also correlated with air pollution. Over 90% of the survey respondents attributed some level of coughs/colds, breathing difficulties, eye problems, asthma, and headache to air pollution.

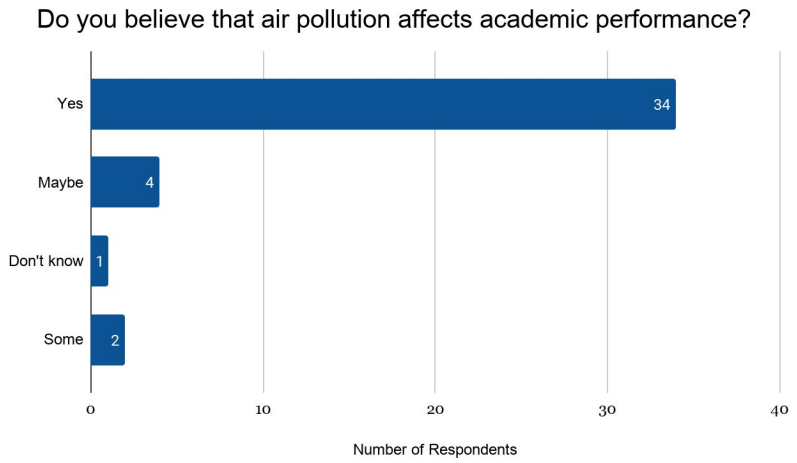

Figure 10: Perception of the correlation between academic performance and air pollution.

Figure 10 shows that an overwhelming majority agree that air pollution impacts the academic performance of students. Along with serious negative physical health consequences, air pollution can have negative consequences on academic performance. 34 out of 41 respondents agreed that air pollution contributes to decreased academic performance. This result symbolizes the fear that parents and teachers have surrounding air pollution's effects on children's health with specific concern on their learning development and brain function. This question was posed in order to quantify the community's fear and understanding of potential impacts that air pollution has on children's academic performance. Overwhelmingly, the members of the community agreed that the more air pollution a school district has, the poorer the academic performance of its students.

Open ended Survey Responses

The following are direct quotes from anonymous survey respondents who wished to express their concerns regarding air pollution, the Charcot Extension Project, and environmental injustice. Survey responses here (link).

- *I would hope the city would value and consider the views of people directly affected by it (students, parents, teachers, residents) and not just continue with the project because it's easier to continue with a plan put in place many years ago.*
- *Children should come before industry.*
- *This project will bring unnecessary traffic that is not part of our community right through our close knit neighborhood taking some of the school property which affects our students and creating a dangerous environment. This project is very much outdated and should not be considered any longer.*
- *It seems the main objective of the Charcot project is to help ease traffic congestion and move the traffic faster. However, various independent studies show the Charcot road extension only help speed up the traffic flow only a few minutes. This does not justify the amount of money and effort in implementing this project. In addition, The quality of life of the neighborhoods surrounding the school will suffer greatly if the project gets a go*

ahead. Hence, we believe the city should cancel the project so the money could be wisely spent improving the roads elsewhere

- *Please do not construct the extension. The students at the school need the field to exercise in and the additional air pollution would make it hazardous to be outside.*
- *Adults who support this project are remiss in their responsibility to create a sustainable future for our children.*

These responses by survey participants all contain themes of concern regarding air pollution, traffic safety for themselves and their children, and general opposition to the extension project. These respondents have a strong desire to keep the extension project out of Orchard School.

Section 6: Discussion

Overall, we found that the air pollution levels at Orchard School were remarkably higher than the standard which we utilized as our main comparison. Furthermore, the UFP air pollution levels were significantly higher at the school's campus than those measured at the Casa de Lago Mobile Home Park. Orchard School is situated in an area with some of the highest air pollution levels in northern California, between 81-90th percentile as identified by CalEnviroScreen, which tracks PM2.5, ozone, diesel particulate matter exposure, and other contaminants to identify communities with the highest environmental burdens in combination with socioeconomic burdens. Although UFP health consequences are readily identified, more studies need to be done to determine what exposure levels have a major impact on health. It is unclear how the average UFP concentrations recorded at Orchard School impact the community currently, but it is an additional concern to their population who is already dealing with dangerous exposure to other air pollutants. Traffic counts documented seem correlated with locations that had the highest UFP levels, therefore it is very concerning that an additional 15,000 vehicles would be placed directly next to the school, as we noticed increased impact from locations that were exposed to 130-137 cars per 10 minute interval.

In addition, our survey results displayed an overall negative perception of air pollution exhibited by the community members of the Orchard School District. In addition, the community members held a comprehensive understanding of the issues air pollution brings to both physical health as well as academic performance. The community's fears regarding air pollution's effects on children's health, specifically cognitive development respiratory ailments, and academic performance were overwhelmingly unanimous. Many questions posed by our survey addressed the quality of the air in and around the Orchard School. The responses to such questions indicated a deep understanding of the problems associated with air pollution as a whole as well as how and why it is an issue not only in our country as a whole but specifically at the school in which their children, or they themselves, spend over thirty-five hours a week. It is important to remember that these responses were provided by adult members of the OSD community which include teachers as well as parents, many of whom serve on board of the Parent Teacher Association. Furthermore, our survey results also revealed that the residents and Orchard School community members are aware of the Charcot Extension Project, understand its goals and plans, and are adamantly against its construction. Not only that, but they also believe the Extension Project would worsen both air pollution, and the negative consequences associated with it, as well as traffic-pedestrian issues. While the city of San Jose may argue that the Project is safe, attainable, and even sustainable, the members of the community have a counter opinion. The results of the survey indicate that the very people who will be impacted most by the implementation of the Charcot Extension Project are the very people who most reject and renounce its plan of construction.

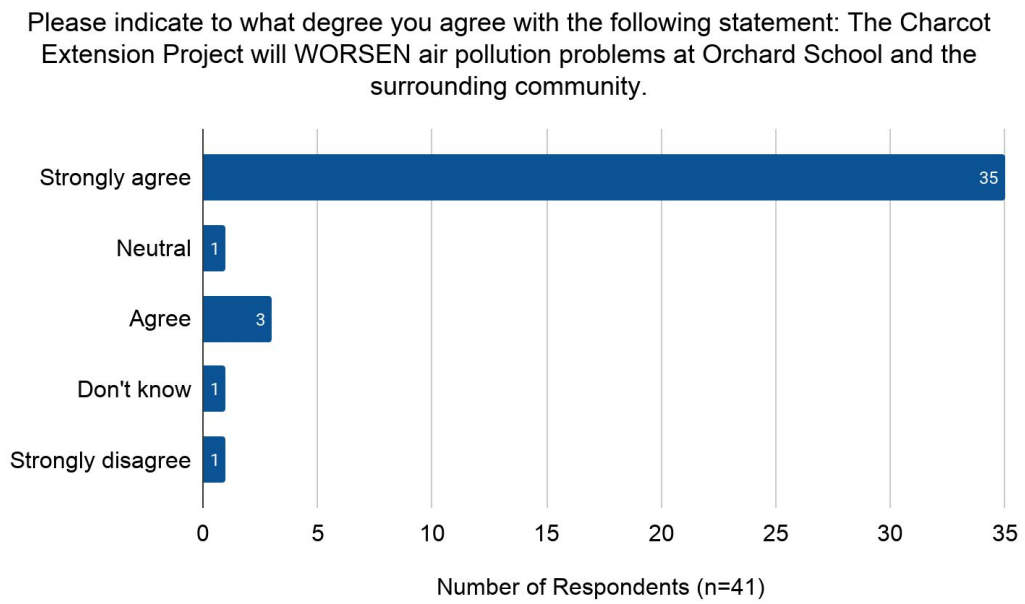

Figure 11: Survey Question 14. Investigating community perceptions about the impacts of the Charcot Extension Project and air pollution.

Figure 11 is survey question #14 which we hold as an emblem of our project as a whole. This question alone could summarize the main goal of our overarching research. It is significant, then, to notice that 27 out of 32 respondents to this question, nearly 85%, agreed that the implementation of the Charcot Extension Project would make air pollution problems at Orchard School worse. This proves that the community impacted most by such an implementation are aware of the issue at hand, understand its consequences, and resist the negative associations with such a project proposal. This will be useful for our partners as the school and its community members are the ones in opposition to the project, and yet they are the ones who will experience the negative consequences.

Section 7: Limitations & Critical Reflection

A main limitation for this project was the time constraint. We were only able to measure air quality for three weeks, with a one week break because of Orchard School's vacation time. Ideally, it would be better to measure for a longer period of time, but since it is only a 10 week course, we were limited. In a longer period of time, we would have been able to conduct more surveys and interviews which could have only added to the fullness of our analysis and results. Additionally, trust is a main component in community engaged research which oftentimes must be built over a long period of time and includes long-term engagement. Because of the 10 week timeline, trust had to be built fairly quickly and may not have been fully developed while conducting this product. Also, this project will not be able to extend for a longer period of time to continually work with this community on this important persistent issue. We do hope that our work can act to help or guide future endeavors of Orchard School and proponents of the Charcot Extension through providing baseline data, an analysis and community perceptions on mitigation strategies, and providing a template and research strategies for future air quality monitoring. Lastly, we had planned to conduct interviews and sent out emails to a few community members, but we either did not hear back or did not hear back in time to actually conduct the interviews. Scheduling interviews is oftentimes an intensive process that required both more time and more people to ask to interview for this project.

The second limitation was the seasonal constraint which meant that we only took measurements during the end of winter. Studies suggest that wintertime conditions allow for greater particle formation, perhaps because of increased condensation of organic vapors coupled with decreased atmospheric mixing depth (Jeong et al., 2004). The BAAQMD has determined that "Santa Clara County experiences many exceedances of the PM2.5 standard each winter. This is due to the high population density, wood smoke, industrial and freeway traffic, and poor wintertime air circulation caused by extensive hills to the east and west that block wind flow into the region."(2019) This means that our results may be more representative of winter months and thus show higher rates of air pollution than if we measured during the summer. However, at this point, we do not know if this scenario is correct because weather and other conditions are always changing. Additionally, all of our pollution data collections were during the month of February. For February 2020, San Jose's air quality was designated as moderate for 8 days out of the 29 (2/1, 2/6, 2/7, 2/8, 2/15, 2/20, 2/21, 2/22, 2/27, 2/28) (AirNow, 2020). All other days were designated good. We only measured two times (2/7 & 2/27) on a moderate day.

The third limitation was the accessibility constraint. Surveys were conducted primarily online and only in English and Spanish. This excludes those who do not have internet access and those who are not fluent in English or Spanish. Additionally, surveys take time to be completed so those who do not have the ability to appropriate free time to doing this are most likely not able to participate. Other factors such as citizenship, lack of a position of power, or general uncomfortableness could inhibit people from taking a survey or being willing to be interviewed.

The last limitation was a tools constraint. We were only able to use a CPC 3007 provided by Santa Clara University which measures the concentrations of UFPs. UFPs are currently still understudied and there are no state or national standards for these. For references for our concentration number, we were only able to find a few studies that directly measure UFP concentrations, especially in relation to health impacts in children. Additionally, with the CPC 3007 we used, we were unable to gather data on particulate size which also impacts the effects

on general health, and would have helped aid us in comparing PM2.5 and UFPs to better understand impacts.

Section 8: Conclusion & Recommendations

Research Questions Recap

1. What are current levels of air pollution at Orchard School and the surrounding neighborhood in relation to local demographics?
2. What are community perceptions on this issue?
3. How can Orchard school, local community members, and community based partners continue to build a space for community knowledge and participation in issues of environmental justice?

Part I: Conclusion

In conclusion, we found that the current levels of air pollution (UFPs) at Orchard School exceed the threshold associated with known health impacts in children. This is indicative of the fact that the levels of air pollution measured at the Orchard School campus were notably higher than not only the standard utilized throughout our project, but also notably higher than the Casa de Lago Mobile Home Park, where many of the students of Orchard School and their families live. In addition, we expected that the Casa de Lago Mobile Home Park would have the highest location average of air pollution recordings, but our study found that it was actually the intersection of Oakland Road and Fox Lane that had the highest averages and highest exposure to spikes in levels. Furthermore, members of the Orchard School community hold many perceptions, opinions, concerns, and ideas surrounding air pollution that our project wanted to consider and address. Community members of the Orchard School District have significant negative perceptions on air pollution, and are aware of health issues that this can bring. Not only that, but the community members are aware of the Charcot Extension Project, understand its goals and plans, and are adamantly against its construction. Finally, the community of Orchard School will continue to facilitate a space with local partners (e.g., Breathe CA, BAAQMD, and SCU) to share knowledge and express opinions on the Charcot Extension Project.

Part II: Recommendations

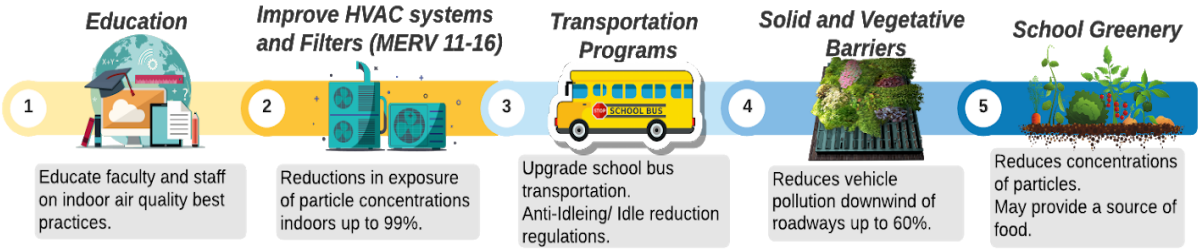

Figure 12: Pertinent mitigation strategies presented as an infographic.

The results of this project's literature review, air pollution measuring, traffic counts, and surveys demonstrates the critical need of not only further community action against the establishment of the Charcot Extension, but action to reduce the current levels of and student exposure to air pollution at Orchard School. While many community members believe that the

Charcot Extension Project would make air quality at Orchard worse, our findings show that air pollution is *already* an issue to be addressed. Therefore, we have recommendations and resources for future actions to be taken to not only help mitigate air pollution in the area, but, most importantly, help improve the lives of students who attend Orchard School.

Our first recommendation is to further research and integrate effective educational strategies into pre-existing or newly introduced curriculum. We believe it is important to not only educate the students themselves on air pollution issues and the health problems associated with them, but it is also important to educate the adult members of the community as well. Even parents should understand the nuances of health issues associated with high levels of air pollution in order to protect both themselves and other members of the community from such issues. Understanding the ramifications of the human causes of air pollution, and how and why they end up where they do, is a first step to slowing the processes of air pollution and the negative impacts associated with them.

Our second recommendation is for Orchard School to begin to further integrate mitigation strategies now to better the current air quality. The possible air pollution mitigation measures mentioned in the Literature Review are measures that Orchard school could be implementing now to reduce existing air pollution and could reduce additional pollution if the Charcot Extension moves forward (Table 5). While these recommendations are a start in addressing ways in which Orchard school can mitigate air pollution in schools, there are also measures that local, state, and national governments should be implementing now to improve air quality for all children in schools. These are only recommendations for Orchard school to introduce to help protect their students from air pollution, but further action needs to be demanded for and taken by larger institutions to affect productive wide-scale change for all students facing pollution at school. Below is a table offering resources to help implement a few strategies.

Table 3: Resources for implementing some mitigation measures.

Potential Air Pollution Mitigation Strategies	Resources for Implementing
Double pane windows and air seals & Improve HVAC system design and add high quality Filters (MERV 11-16)	There may be federal, state, and local grants, loans, and rebates for introducing energy efficient projects which retrofitting HVAC systems may be considered. This report funded by the U.S. Department of Energy is a great guide for figuring out ways to fund energy efficient upgrades for school districts. Examples of Programs: The U.S. Department of Energy (DOE) has created a public/private partnership called EnergySmart Schools to support energy efficiency improvements in K-12 schools. The financing options include revolving investment funds, debt financing, and energy-saving performance contracts. DOE also offers access to software programs that can calculate the life-cycle analysis of an energy-efficient retrofit project. The Bright Schools Program provides assistance and funding in retrofitting energy efficient systems such as HVAC systems.
Implement anti-idling/idle reduction policies	The EPA offers this toolkit for schools to reduce idling. Schools may post anti-idling signs or work with the school board on a district wide campaign.
Upgrade school bus transportation	The Clean Diesel Program provides grants and rebates for projects that protect human health and improve air quality by reducing harmful emissions from diesel engines. This includes rebates for old diesel using school buses. Roughly $40 million was available in 2019 for projects that significantly reduce diesel emissions.
School Gardens	Slow Food USA offers an extensive webpage on school garden resources including a garden guide, grants, and academic research on the positives of school gardens. The UC Division of Agriculture and Natural Resources gives advice on school gardening including planning, grants, and activities. Santa Clara University has introduced BUG (Bronco Urban Gardening) with marginalized schools that supports their garden projects and creates hands-on experiences with students and teachers. There may be future opportunities to work with local organizations and institutions such as SCU to provide food justice for Orchard's community.

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Appendix A

Table 1: Traffic Count Data Table

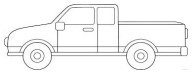
Air Pollution & Traffic Count Tally Sheet

Student Name(s):_____
Location:_____ Coordinates:_____
Time Start:_____ Time End:_____
Elevation:_____Direction From:_____ Direction To: _____
Weather Conditions:_____ Wind Direction:_____
Meter Number _____

Air Pollution

Concentration minimum:_____Concentration maximum:_____
Concentration mean/average:_____
Notes:_____

Traffic Count Tally

Heavy Truck (semi)		
Medium Truck (box)		
Small Truck (personal)		
Bus		
Car/Van/Taxi		
Plane		
Other: please specify		

Appendix B -- English Survey

English Survey

Survey of Community Perceptions of Air Quality and the Charcot Extension Project

Introduction

Thank you for agreeing to complete the Survey of Community Perceptions of Air Quality and the Charcot Extension Project. Your participation is very important and helpful.

We would like you to understand that this survey is about perceptions of air quality and environmental hazards in and around your child's school, Orchard Elementary, and your home; we will not attempt to determine your name or your child's name, academic achievement, or documentation status.

Completing this survey is voluntary. If you are not comfortable answering a question, just leave it blank. DO NOT write your name on this survey. The answers you give will be kept private. No one will know what you write.

Please carefully note that some questions are about your current perceptions of the air quality, while others are about the Charcot Extension Project and its potential impact.

Please read every question carefully, and answer them completely and honestly.

Thank you very much for completing this survey!

1. How would you rate the **quality of air** near the **school** that your child(ren) attend?

Please circle the number that best describes your perception of air quality at your child's school.

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Excellent air quality ***Highly contaminated air***

2. How much are you **annoyed** by outdoor air pollution (from traffic, industry, etc.) at your child's **school**?

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Not annoyed at all ***Intolerable annoyance***

3. How often do cars pass your child's school during the school day?
    a. Constantly
    b. Frequently
    c. Seldom
    d. Never
    e. Don't know

4. How often do heavy vehicles (e.g. trucks/buses) pass your child's school during the school day?
    a. Constantly
    b. Frequently
    c. Seldom
    d. Never
    e. Don't know

5. How many **total lanes** does the largest road have that is within 150 feet (or 50 meters) of your child's **school** have?

Please circle all that apply

    a. One
    b. Two (one in each direction)
    c. Three (left hand turn lane)
    d. Four
    e. Five
    f. Six
    g. It is a major freeway
    h. It is a major expressway
    i. Live near an intersection

j. Other: _____

6. How often do you hear airplanes around your child's school during the school day?

a. Constantly____
b. Frequently
c. Seldom
d. Never
e. Don't know

7. Which of the following would you say are the **sources** of outdoor or indoor air pollution at the school?

Please check either "Yes" or "No" for the following potential sources of pollution.

a. Dust: Yes____ No____.
b. Car emissions: Yes____ No____.
c. Truck emissions: Yes____ No____.
d. Industrial emissions: Yes____ No____.
e. Airplanes: Yes____ No____.
f. Sewage: Yes____ No____.
g. Cigarette smoking: Yes____ No____.
h. Other sources: _____ Yes ____ No____.
i. Other sources: _____ Yes ____ No____.

8. How severe would you say is **air pollution** near your child's school is from:

a. Dust: None____, Low___, Moderate___, High____, Very High___.
b. Car emissions: None____, Low___, Moderate___, High____, Very High___.
c. Truck emissions: None____, Low___, Moderate___, High____, Very High___.
d. Industrial emissions: None____, Low___, Moderate___, High____, Very High___.
e. Aircraft: None____, Low___, Moderate___, High____, Very High___.
f. Sewage: None____, Low___, Moderate___, High____, Very High___.
g. Cigarette smoking: None____, Low___, Moderate___, High____, Very High___.
h. Other _____: None____, Low___, Moderate___, High____, Very High___.
i. Other_____: None____, Low___, Moderate___, High____, Very High___.

9. What health problems do you think are brought about by air pollution?

a. Cough/cold: Yes___ No___.
b. Difficulty breathing: Yes___ No___.

c. Eye problems: Yes___ No___.
d. Asthma: Yes___ No___.
e. Cancer: Yes___ No___.
f. Heart problems: Yes___ No___.
g. Headache: Yes___ No___.
h. Other _____: Yes___ No___.
i. Other _____: Yes___ No___.

10. Do you or your child suffer from any of the following?

a. Cough/cold: Yes___ No___.
b. Difficulty breathing: Yes___ No___.
c. Eye problems: Yes___ No___.
d. Asthma: Yes___ No___.
e. Cancer: Yes___ No___.
f. Heart problems: Yes___ No___.
g. Headache: Yes___ No___.
h. Other _____: Yes___ No___.
i. Other _____: Yes___ No___.

11. Do you believe that air pollution affects academic performance?

a. Yes
b. No
c. Some
d. Maybe
e. Don't know

12. During an average week, what method of transportation does your child most often commute to school by?

a. Walk
b. Bike
c. By car
d. Public transportation
e. Other: _____

13. Are you familiar with the Charcot Extension Project?

a. Yes
b. No
c. A little
d. Not familiar

14. Please indicate to what degree you agree with the following statement: *The Charcot Extension Project will worsen air pollution problems at Orchard Elementary and Middle school, and the surrounding community*.

a. Strongly agree
b. Agree

c. Neutral
d. Disagree
e. Strongly disagree
f. Don't know

15. Please indicate to what degree you agree with the following statement: *The Charcot Extension Project will make it harder for students to go to and attend school*.

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree
f. Don't know

16. Please indicate to what degree you agree with the following statement: *The Charcot Extension Project will worsen air pollution problems in the area where children attend school*.

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree
f. Don't know

17. What mitigation strategies do you think would provide the students the most protection from the Charcot Extension Project?

a. Pedestrian bridge
b. Heating, ventilation, and air conditioning replacement within the classrooms
c. Adding double paned windows
d. Distributing face masks
e. Other: _____
f. I don't know

18. How would you compare the air at Orchard School with the air at your home?

a. The air quality at Orchard School is much better than the air at my home.
b. The air quality at Orchard School is better than the air at my home.
c. The air quality at Orchard School is roughly the same as it is at my home.
d. The air quality at Orchard School is worse than it is at my home.
e. The air quality at Orchard School is much worse than it is at my home.
f. Don't know

19. On a scale from 1 (none) to 5 (extremely high density), what is the level of traffic surrounding Orchard School District on an average day?

a. 1 (none/no traffic at all)
b. 2 (little traffic)
c. 3 (average traffic; neither low nor high traffic)

d. 4 (high traffic)
e. 5 (extremely high traffic)

20. On a scale from 1 (not at all) to 5 (extremely), how worried are you of traffic accidents involving pedestrians near Orchard school and in the encompassing neighborhood?

a. 1 (not worried at all)
b. 2 (a little worried)
c. 3 (somewhat worried)
d. 4 (very worried)
e. 5 (extremely worried)

21. What is the distance between your home/place of residence and Orchard School?

a. Within a few blocks
b. In the same neighborhood
c. Less than a mile
d. Between 1-2 miles
e. Between 2-5 miles
f. More than 5 miles

22. What is the highest degree or level of school that anyone (including yourself) in your household has completed?

a. No Schooling Completed
b. Grade 1 – 11; Specify Grade____
c. 12th Grade
d. Regular High School diploma
e. GED or alternative credential
f. Associate's Degree (for example AA, AS)
g. Bachelor's Degree (ex: BA, BS)
h. Master's Degree (ex: MA, MA, MBA)
i. Professional Degree (ex: MD, DDS, DVM)
j. Doctorate Degree (ex: PhD, EdD)

23. What was your household's estimated total income in the last year?

a. Less than $4,999
b. $5,000- 9,999
c. $10,000- 14,999
d. $15,000- 19,999
e. $20,000- 29,999
f. $30,000- 39,999
g. $40,000- 49,999
h. $50,000- 59,999
i. $60,000- 69,999
j. $70,000- 79,999
k. $80,000- 89,999
l. $90,000- 99,999

m. $100,000-200,000
n. 200,000 and above

24. What is your race? (Circle all that are true for you)
    a. White
    b. Black or African American
    c. American Indian or Alaska Native
    d. Asian Indian
    e. Chinese
    f. Filipino
    g. Other Asian: _____
    h. Japanese
    i. Korean
    j. Vietnamese
    k. Native Hawaiian
    l. Guamanian or Chamorro
    m. Samoan
    n. Other Pacific Islander: _____
    o. Some other race: _____

25. Is there anything else that you would like to add regarding the Charcot Extension Project?

Appendix C -- Spanish Survey

Spanish Survey

Encuesta Sobre Las Percepciones Comunitarias sobre la Calidad y Contaminación del Aire

Gracias por haber aceptado completar la encuesta sobre las percepciones de la calidad y contaminación del aire en su comunidad. Su participación es muy importante y útil.
Fecha:
Estimado (a) Padre de familia

Son Katherine, Olivia, Juliette, y Cory. Junto con el profesor Christopher Bacon, estoy llevando a cabo un estudio de investigación para comprender la distribución de la exposición a altas concentraciones de contaminantes peligrosos en el Orchard escuela y de identificar estrategias de mitigación potencialmente útiles y preferidos a nivel local.

Estoy solicitando su participación llenando una encuesta, que durará aproximadamente 10 minutos. Su participación en este grupo es voluntaria. Si usted decide no responder a una pregunta, no participar, o retirarse del estudio por completo en cualquier momento no hay problema, es decir no habrá penalización o castigo ni afectará su tratamiento. Los resultados del estudio de investigación pueden ser publicados, pero no vamos y anotar su nombre ni el nombre de su hijo(s) o hija(s).

Aunque puede que no haya un beneficio directo para usted, el posible beneficio de su acceso a la participación de los resultados preliminares y el desarrollo de estrategias más efectivas para crear comunidades saludables y sostenibles.

Al entregar una copia de una encuesta completada representa su permiso de participar.

Si tiene alguna pregunta relacionada con el estudio de investigación, por favor llámame marcando el siguiente número de teléfono: (011) (408)551-3082, en California o envíe un correo electrónico a cbacon@scu.edu.

Atentamente,
Katherine, Olivia, Juliette, y Cory.
Si usted tiene alguna pregunta sobre sus derechos como sujeto/ participante en esta investigación, o si usted siente que ha sido colocado en situación de riesgo, puede ponerse en contacto con el Presidente del Comité de Sujetos Humanos (011) (408)554.5591.

1. Cómo calificaría la calidad del aire cerca de la **escuela** que su hijo(os) asisten?

   *Esta escala permite que exprese su opinión personal con respecto a la siguiente pregunta de la **calidad del aire** donde usted vive. Usted puede indicar su percepción de la calidad del aire en esta escala de 0 a 10, donde 0 significa aire excelente y 10 aire altamente contaminado. Esta misma escala será utilizada para las siguientes dos preguntas.*

Por favor marque el número que mejor describa su calificación de la calidad del aire de la escuela de su hijo(os).

0	1	2	3	4	5	6	7	8	9	10

Excelente Calidad de Aire ***Aire es altamente contaminado***

2. Que tanta irritación te cause la contaminación del aire (del tráfico, industria, etc.) en la escuela de tu hijo/a.

Marque con un círculo el número que mejor describe su nivel de molestia.

0	1	2	3	4	5	6	7	8	9	10

No me irrita en lo absoluto ***Irritacion Intolerable***

3. ¿Con qué frecuencia pasan **automóviles** durante el tiempo escolar?
   a. Constantemente
   b. Con frecuencia
   c. Casi Nunca
   d. Nunca
   e. No se

4. ¿Con qué frecuencia pasan automóviles **grandes (camiones/autobús)** durante el tiempo escolar?
   a. Constantemente
   b. Con frecuencia
   c. Casi Nunca
   d. Nunca
   e. No se

5. ¿Cuento **carriles en total** tiene la carretera más grande que está dentro de 150 ft (46 metros) de la **escuela** de tu hijo/a.?

Circule todas las opciones que apliquen.

a. Una
b. Dos (una en cada direccion)
c. Tres (carril para dar vuelta a la izquierda)
d. Cuatro
e. Cinco
f. Seis
g. Es una autopista interestatal (como 880, 280)
h. Es una autopista expressway (como Almaden, Lawrence, San Tomas Expwy)
i. Vivo cerca de una intersección.
j. Otra: _____

6. ¿Con qué frecuencia escucha aviones cerca de la escuela de tu hijo/a durante el día escolar?

a. Constantemente
b. Con frecuencia
c. Casi Nunca
d. Nunca
e. No se

7. ¿Cual de estos, usted diría, son **fuentes** de contaminación interior y exterior en la escuela?

Por favor marque "Sí" o "No" para las siguientes fuentes de contaminación.

a. Polvo: Si____ No____.
b. Emisiones de Auto: Si____ No____.
c. Emisiones de Camión: Si____ No____.
d. Emisiones Industrial: Si____ No____.
e. Aviones: Si____ No____.
f. Aguas Residuales: Si____ No____.
g. Fumar Cigarrillos: Si____ No____.
h. Otras Fuentes: _____ Si____ No____.
i. Otras Fuentes: _____ Si____ No____.

8. ¿Qué tan severa, usted diriá, es la **contaminación del aire** cerca de la escuela de su hijo/a es:

a) Polvo:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.
b) Emisiones de los vehículos:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.
c) Emisiones industriales:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.
d) Aviones:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.

e) Alcantarillado maloliente:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.
f) La fuma de cigarrillos:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.
g) Otra fuente:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.
h) Otra fuente:
Muy bajo____, Bajo____, Moderado____, Alto____, Muy alto____.

9. ¿Que problemas para la salud, usted cre, trae el aire contaminado?
   a. Tos/Resfriado: Si ___ No___.
   b. Dificultades para Respirar: Si___ No___.
   c. Problemas de Vista: SI___ No___.
   d. Asma: Si___ No___.
   e. Cancer: Si___ No___.
   f. Problemas Cardiacos: Si___ No___. .
   g. Dolor de Cabeza: Si___ No___.
   h. Otro _____: Si___ No___.
   i. Otro _____: Si___ No___.

10. ¿Usted o su hijo/a padece de algunos de estos?
   a. Tos/Resfriado: Si___ No___.
   b. Dificultades para Respirar: Si___ No___.
   c. Problemas de Vista: Si___ No___.
   d. Asma: Si___ No___. .
   e. Cancer: Si___ No___..
   f. Problemas Cardiacos: Si___ No___.
   g. Dolor de Cabeza: Si___ No___.
   h. Otro _____: Si___ No___.
   i. Otro _____: Si___ No___.

11.¿Usted cree que el aire contaminado afecta el desempeño académico?
   a. Si
   b. No
   c. Algo
   d. Tal Vez
   e. No Se

12. ¿Qué método de transportación usa su hijo/a para atender a la escuela en una semana regular?
   a. Camina
   b. Su Bicicleta
   c. Por Automovil
   d. Transportacion Publica
   e. Otra: _____

13. ¿Es familiar con el Proyecto de Extensions Charcot (Charcot Extension Project)?

a. Si
b. No
c. Un Poco
d. No soy familiar

14. Por favor indique a qué grado está de acuerdo con las siguientes declaraciones : *El Proyecto de Extensión Charcot, empeorará los problemas de contaminación del aire en Orchard Elementary y Middle School, y la comunidad alrededor.*

a. Muy en acuerdo
b. En acuerdo
c. Neutral
d. En desacuerdo
e. Muy en desacuerdo
f. No se

15. Por favor indique a qué grado está de acuerdo con las siguientes declaraciones : *El Proyecto de Extensión Charcot causará más dificultades para que los estudiantes vayan y atiendan a la escuela.*

a. Muy en acuerdo
b. En acuerdo
c. Neutral
d. En desacuerdo
e. Muy en desacuerdo
g. No se

16. Por favor indique a qué grado está de acuerdo con las siguientes declaraciones : *El Proyecto de Extensión Charcot empeorará los problemas de contaminación del aire en áreas donde niños atiende a la escuela.*

a. Muy en acuerdo
b. En acuerdo
c. Neutral
d. En desacuerdo
e. Muy en desacuerdo
h. No se

17. ¿Que estrategia de mitigación cree que les provee a los estudiantes con la mayor cantidad de proteccion del Proyecto de Extensión Charcot?

a. Un puente para peatones
b. Reemplazar los sistemas de ventilación, aire acondicionado y calentamiento en los salones.
c. Añadir ventanas de doble panel
d. Distribuir mascaras
e. Otra: _____
f. No se

18. ¿Cómo compararía el aire de su hogar con el de la escuela Orchard?
    a. La calidad del aire de la Escuela Orchard es mucho mejor que la de mi hogar.
    b. La calidad del aire de la Escuela Orchard es mejor que la de mi hogar.
    c. La calidad del aire de la Escuela Orchard es casi igual a la de mi hogar.
    d. La calidad del aire de la Escuela Orchard es peor que la de mi hogar.
    e. La calidad del aire de la Escuela Orchard es mucho peor que la de mi hogar.
    f. No se

19.¿ En una escala del 1 (nada) a 5 (densidad extremadamente alta), que nivel de tráfico hay alrededor del Distrito Escolar Orchard en un dia normal?
    a. 1 (nada de trafico)
    b. 2 (un poco de trafico)
    c. 3 (trafico normal; ni alto ni bajo)
    d. 4 (alto trafico)
    e. 5 (trafico extremadamente alto)

20. ¿En una escala del 1 (ninguna) a 5 (extremadamente), qué tan preocupado/a esta sobre accidentes de tráfico, cuales involucran peatones, cerca de la Escuela Orchard y el barrio circundante?
    a. 1 (ninguna preocupación)
    b. 2 (un poco preocupado/a)
    c. 3 (preocupado/a)
    d. 4 (muy preocupado/a)
    e. 5 (extremadamente preocupado/a)

21. ¿Cual es la distancia entre su hogar/lugar de residencia y la Escuela Orchard?
    a. Unas cuantas cuadras
    b. En el mismo vecindario
    c. Menos de una milla
    d. Entre 1-2 millas
    e. Entre 2-5 millas
    f. Mas de 5 millas

22. ¿Cual es el grado o nivel de escuela más alto que alguien (usted incluido) ha completado en su hogar?
    a. Ningún nivel completado de escuela
    b. Grados 1 – 11; Especifice el grado____
    c. Grado 12
    d. Diploma Regular de Preparatoria
    e. GED o credencial equivalente
    f. Título Universitario de Preparación Básica (por ejemplo AA, AS)
    i. Un Bachillerato (por ejemplo: BA, BS)
    j. Título de Maestría (por ejemplo: MA, MA, MBA)
    k. Título Profesional (por ejemplo: MD, DDS, DVM)

l. Doctorado (por ejemplo: PhD, EdD)

23. ¿Cuál fue el ingreso estimado total de su hogar del año pasado?
    a. Menos de $4,999
    b. $5,000- 9,999
    c. $10,000- 14,999
    d. $15,000- 19,999
    e. $20,000- 29,999
    f. $30,000- 39,999
    g. $40,000- 49,999
    h. $50,000- 59,999
    i. $60,000- 69,999
    j. $70,000- 79,999
    m. $80,000- 89,999
    n. $90,000- 99,999
    o. $100,000-200,000
    p. 200,000 o mas

24. ¿Con qué raza se identifica? (Circle all that are true for you)
    a. Caucasico
    b. Afroamericano
    c. Amerindio o Nativo de Alaska
    d. Indio Asiatico
    e. Chino
    f. Filipino
    g. Otro tipo de Asiático: _____
    h. Japones
    i. Koreano
    j. Vietnamese
    k. Nativo de Hawaii
    l. Guamanian o Chamorro
    m. Samoan
    n. Otro tipo de Isleño del Pacífico: _____
    o. Otra Raza: _____

25. ¿Hay alguna otra cosa que le gustaría añadir sobre el Proyecto de Extensión Charcot?