Review of Air Quality Effects from the Proposed Bus Hub at Bowie High School, El Paso, TX

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Prepared by:
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BACKGROUND

The El Paso Independent School District (EPISD) school buses are distributed between three main sites: the Central (or Main) site, the West Annex and the Northeast Annex. EPISD is proposing to move buses from the Central/Main current depot to a new facility adjacent to Bowie High School. In addition, another 12 buses would be relocated from the West Annex to the new Bowie High School facility. Buses currently located at the Northeast Annex would remain there (Table 1). Currently, Bowie High School does not support high density bus storage onsite and new facilities have been proposed adjacent to the high school, in particular, its sports complex.

Table 1. Current and Proposed Bus Locations[1]

	Proposed (To)				
	Facility	Bowie	Northeast	West	**Total**
Current (From)	Central	112	--	--	**112**
	Northeast	0	89	--	**89**
	West	12	--	87	**99**
	Total	**124**	**89**	**87**	**300**

The high school is located in the Chamizal neighborhood in the South Central part of the city next to the border with Mexico, a short distance from the Bridge of the Americas (BOA). This bridge links El Paso with Ciudad Juarez. The attendance zone for the high school is south of I-10 and roughly bounded on the west by Rio Grande and Luna Street to the east (Figure 1). The school serves grades 9 through 12 and serves approximately 1350 students.

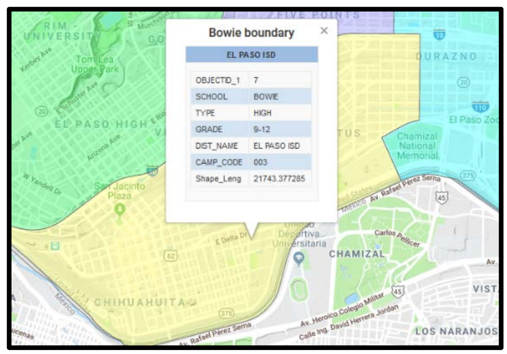

Figure 1. Attendance area for Bowie High School (Source: https://www.episd.org/domain/229)

The proposed bus hub will be located at the west end of the school area, in proximity to the high school stadium (Figure 2). The new facility will include a large bus storage area, maintenance (approximately 50,000 sf) and service facilities for the buses and other district vehicles, and an additional maintenance area of roughly 20,000 sf.

Figure 2. General Layout of Proposed Facility

The purpose of this report is to examine the potential localized air quality effects of transitioning approximately 124 buses and extended maintenance and service operations to the new bus facility. As part of this analysis, we calculated estimated emissions for the proposed bus hub and contrasted these estimates to emissions estimates generated for the other two bus hubs. We translated the air quality effect of the bus hub to passive cigarette-equivalents to place the emissions in context.

[1] EPISD. “EPISD Response.” El Paso: El Paso Independent School District, Feb 2018.

MAIN FINDINGS

1. Changes in air quality

There are a number of different factors relevant to understanding the localized pollutant effects of the proposed relocation, including the distribution of old to new buses, the school's adjacency to other significant pollutant sources, and the occurrence of dust events. Each of these factors is likely to affect localized air quality on a daily and cumulative basis. High pollutant levels have been observed both inside and outside of school buses not only under normal driving conditions,[2,3] but also under idling.[4] Many older buses emit pollutants not just from the tailpipe but also from the crankcase. The emitted pollutants are created as a result of incomplete engine combustion. Diesel engines, by far the most prominent type of engine in school buses, produce both gaseous and solid pollutants during the combustion process. The gas pollutants include carbon monoxide, nitrogen oxides and hydrocarbons. The solid pollutants are primarily particulate matter, referred to as PM10 and PM2.5, which are smaller than human hair (Figure 3). Smaller particles known as ultrafine particles, also generated through combustion processes, can have particularly serious health consequences.

The health effects of exposure to high levels of poor air quality are well established in the literature, and are particularly acute for school aged youth, even at levels well below established standards.[5] In particular, the health effects associated with diesel pollutants include increased risks of respiratory illness (e.g., asthma and lung inflammation), heart and pulmonary problems, cancer, and premature death. Youth are highly vulnerable to diesel-related pollutants because of their developing immune and pulmonary systems. [6,7] Hispanics, in particular, are at greater risk for PM2.5 associated hospital admissions and Hispanic children are at greater risk (compared to the elderly) for PM2.5 asthma associated hospital admissions.[8]

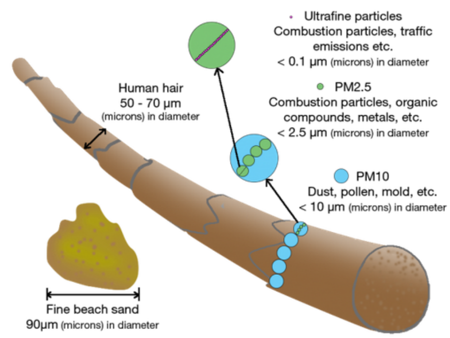

Figure 3. Comparison of particle sizes

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[2] Tainio, M., Tuomisto, J.T., Hanninen, O., Aarnio, P., Koistinen, K.J., Jantunen, M.J., Pekkanen, J., 2005. Health effects caused by primary fine particulate matter (PM2.5) emitted from buses in the Helsinki metropolitan area, Finland. Risk Analysis 25, 151-160

[3] Sabin, L.D., Kozawa, K., Behrentz, E., Winer, A.M., Fitz, D.R., Pankratz, D.V., Colome, S.D., Fruin, S.A., 2005. Analysis of real-time variables affecting children's exposure to diesel-related pollutants during school bus commutes in Los Angeles. Atmospheric Environment 39, 5243-5254

[4] Zhang, Q.F., Fischer, H.J., Weiss, R.E., Zhu, Y.F., 2013. Ultrafine particle concentrations in and around idling school buses. Atmospheric Environment 69, 65-75.

[5] HEI, Health Effects Institute (2010).Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects .Special Report 17. Health Effects Institute, Boston, MA.

[6] Sabin et al. Op.cit.

[7] Song, S., Paek, D., Lee, K., Lee, Y.M., Lee, C., Park, C., Yu, S.D., 2013. Effects of ambient fine particles on pulmonary function in children with mild atopic dermatitis. Archives of Environmental & Occupational Health 68, 228-234

[8] Grineski SE, Herrera JM, Bulathsinhala P, Staniswalis JG. Is there a Hispanic Health Paradox in Sensitivity to Air Pollution? Hospital Admissions for Asthma, Chronic Obstructive Pulmonary Disease and Congestive Heart Failure Associated with NO_2 and $PM_{2.5}$ in El Paso, TX, 2005–2010. *Atmospheric environment (Oxford, England : 1994)*. 2015;119:314-321. doi:10.1016/j.atmosenv.2015.08.027.

The distribution of buses

From the EPISD bus inventory likely air quality effects of the proposed bus fleet re-distribution can initially be assessed by grouping buses into emissions categories. As can be seen from Figure 4, bus model years across all three hubs ranged from 2002 to 2018. All things equal, buses older than MY 2007 are more likely to have higher emissions. Newer bus engines are more likely to have lower emissions because of changes in emissions standards.[9] **The Central location currently houses the greatest proportion of older buses; the School District proposes to assign these buses to Bowie High School.**

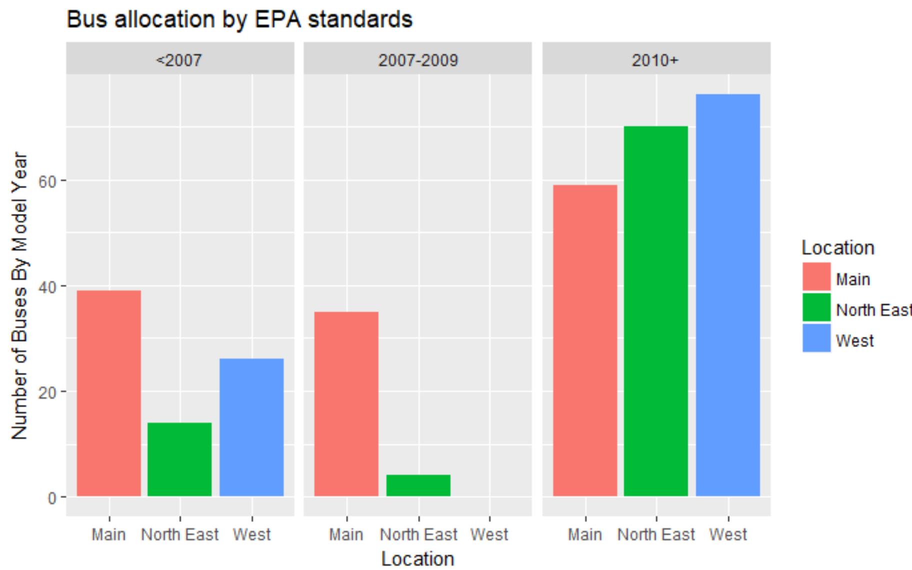

Figure 4. Current Inventory

In addition to the 112 buses proposed for relocation to Bowie High School, the EPISD has stated that 12 buses from the West Annex will also be moved to Bowie. The EPISD does not identify which buses will be relocated. However, if the 12 oldest buses relocate to Bowie, then the facility will be disproportionately housing older buses relative to the other two bus hubs.[10] If 12 of the newest buses were moved, the Bowie High School hub would still have a disproportionate share of older buses.

Estimated emissions at Bowie High School under the proposed plan can be estimated using emissions

[9] For example, clean diesel engines today are roughly 85% cleaner than 2006 engines. Federal standards are: NOx (1.2 g/brake-hp/hr); PM (0.01 g/brake-hp/hr); non-methane hydrocarbon (0.14 g/brake-hp/hr); CO (15.5 g/brake-hp/hr).

[10] The School District has indicated that they intend to purchase 18 new conventional buses (16 in 2018; 2 in 2019). There is no indication as to which of the current buses will be replaced. However, the typical cost-effective lifespan of a school bus is 15 years. Therefore, it is reasonable to assume that newly purchased buses in 2018 will be used to replace the 2002 (1 bus) and 2003 (2) buses. The deposition of the remaining 15 proposed newly purchased buses (13 in 2018 and 2 in 2019) is unclear given that the cost-effective lifetime of the remaining current fleet will not have been reached.

factors from MOVEs[11] combined with estimated idling times.[12] Under relatively conservative (i.e., low) assumptions about idling times, the results in Table 2 indicate that – for all pollutants – the proposed move will create additional emissions higher than experienced at the other two bus hubs. **Yearly emissions generated at the Northeast hub will be approximately 36% lower than estimated yearly emissions generated at the proposed Bowie High School location. The West hub will experience yearly emissions approximately 25% lower than those experienced at Bowie under the proposed plan.**

Table 2. New localized pollutant load (lbs per yr) (Proposed Bowie High School)

	Emissions					
(% relative to Bowie)	**PM2.5**	**PM10**	**CO**	**NOX**	**HC**	**VOC**
Main (Moved to Bowie)	225.6	305.0	1041.4	3516.6	396.6	438.3
Northeast Hub (36% Lower)	143.0	195.5	671.1	2238.2	254.2	279.9
West Hub (25% Lower)	168.2	228.8	772.7	2645.7	293.7	323.7

Using a Box Model with a few simple assumptions, the estimated hourly emissions (grams/hour) at Bowie High School can be expressed in concentrations (ug/m3), which can then be expressed into numbers of passive cigarette-equivalents for the exposure time period (i.e., when the buses are idling).[13] **The estimated concentrations produced by the proposed plan at Bowie High School are roughly equivalent to anywhere between three and eight passively smoked cigarettes per per exposure period for PM2.5 for a student in proximity to Bowie high school.** The exposure period was estimated using a lower and upper bound for bus idling time at or within the bus hub. The lower estimate is for a 15-minute idle time and the upper estimate is for a one-hour idle time. It is reasonable to expect that all of the buses will idle some period while warming up in the morning and returning in afternoon.[14] It is also reasonable to expect that buses undergoing servicing at the bus hub facility will generate additional emissions. Thus, these lower and upper bounds are reasonable. The same equivalency can be calculated for NO2 by assuming an approximate NO2/NOx ratio.[15] **If the ratio is varied between 0.25 and 0.35, the resulting NO2 exposure is approximately equivalent to six to 12 passively smoked cigarettes each day.**

Thus, students may experience the equivalent of between 9 to 20 passively smoked cigarette-equivalents as a result of the PM and NO2 pollutants generated during idling by buses at, near or within the proposed bus hub. It is important to note that this exposure comes on top of the exposure

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[11] Dec 2017 update to MOVEs2014a, https://www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves

[12] Rome, C (2011) An analysis of school bus idling and emissions, Georgia Institute of Technology, Atlanta: 220pps and NCDC. (2010, August). *Diesel Emissions Quantifier Default Values.* Retrieved June 30, 2011, from U.S. EPA: National Clean Diesel Campaign: http://www.epa.gov/cleandiesel/documents/420b10035.pdf

[13] Saskia C. van der Zee, Paul H. Fischer, Gerard Hoek, Air pollution in perspective: Health risks of air pollution expressed in equivalent numbers of passively smoked cigarettes, Environmental Research, Volume 148, 2016, Pages 475-483, ISSN 0013-9351, https://doi.org/10.1016/j.envres.2016.04.001.

[14] It should also be noted that NOx emissions have been estimated to increase by a factor of 6 if the air conditioning is operating (Source: EPA. (2010, December). *MOVES2010 Highway Vehicle Temperature, Humidity, Air Conditioning, and Inspection and Maintenance Adjustments.* Retrieved June 23, 2011, from U.S. EPA: http://www.epa.gov/otaq/models/moves/420r10027.pdf

[15] Richmond-Bryant, Jennifer, R. Chris Owen, Stephen Graham, Michelle Snyder, Stephen McDow, Michelle Oakes, and Sue Kimbrough. "Estimation of On-Road NO2 Concentrations, NO2/NOX Ratios, and Related Roadway Gradients from near-Road Monitoring Data." Air Quality, Atmosphere & Health 10, no. 5 (June 1, 2017): 611–25. https://doi.org/10.1007/s11869-016-0455-7.

to localized air pollutants generated from the adjacent high volume roadway source already present at the high school.

<u>Adjacency to other major pollutant sources</u>
Figure 5 suggests that the El Paso region continues to experience background PM concentrations close to both the 24-hour and annual NAAQS PM standards. El Paso County is part of Air Quality Control Region 153, currently classified as "Unclassifiable/Attainment" for the PM2.5 annual standard[16] and moderate non-attainment for the PM10 24-hour standard.[17] The "Unclassifiable/Attainment" classification means that the EPA cannot determine, based on the available data, whether or not the area meets the PM2.5 annual standard.[18] Therefore, it is reasonable to consider the effect of exposing the students at the high school to the added pollutants generated by the proposed new bus hub in light of the cumulative effects of exposure to episodic and continuing elevated levels of air pollutants generated by East Paisano Drive (US 62), a major thoroughfare adjacent to the high school.

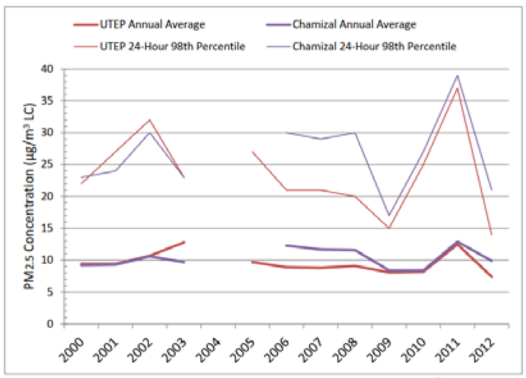

Figure 5. El Paso PM2.5 annual averages and annual 98th percentiles of 24-hour averages, including exceptional events[19]

East Paisano Drive, a regionally significant corridor, and US 85 are the only highways which facilitate east-west traffic, so traffic are expected to increase over time.[20] In 2015, traffic volumes on East Paisano ranged from 22,000 to 29,000 vehicles per day. Volumes are anticipated to grow to between 28,000 and 36,000 vehicles per day by 2025. In addition, there is strong evidence of significant queuing in relationship to the border crossing (Figure 6a), which compounds the problem of on-going exposure to localized pollutants. The literature is quite clear that traffic-generated pollutants do not fall to background concentrations until between 200 m and 400 m from the roadway sources.[21,22] **Because**

[16] Federal Register, Vol 80, No. 10 (2015). In 2012, the annual standard was set to 12.0 mg/m3, which is attained when the 3-year average of the annual arithmetic means does not exceed 12.0 mg/m3.
[17] https://www.tceq.texas.gov/airquality/sip/elp/elp-status
[18] El Paso is in "unclassified/attainment" status with respect to the 24-hour PM10 (150ug/m3) and the PM2.5 annual (12.9 ug/m3) and 24-hour (35ug/m3) standards
[19] TCEQ (2013) El Paso 2010-2012 Particulate Matter Exceptional Events Demonstration, Texas Commission on Environmental Quality: 210pps.
[20] https://ftp.dot.state.tx.us/pub/txdot-info/elp/projects/border_highway_west/eis/draft/chapter_01.pdf
[21] Alex A. Karner, Douglas S. Eisinger, and Deb A. Niemeier, Near-Roadway Air Quality: Synthesizing the Findings from Real-World Data, *Environmental Science & Technology* **2010** *44* (14), 5334-5344
DOI: 10.1021/es100008x
[22] Zhu, Yifang, et al. "Concentration and size distribution of ultrafine particles near a major highway." *Journal of the*

Bowie High School falls within 400m of East Paisano Drive, localized emissions at the High School are expected to be much higher than background concentrations (Figure 6b). Studies measuring high particle number concentrations in the area are also consistent with higher than background localized air pollution levels.[23]

Figure 6a. Queuing as a result of border delays

Figure 6b. Approximate distance (200 m) before air quality begins to fall to background concentrations as the result of traffic generated pollutants on East Paisano Dr.

Exposure to other events

In addition to roadway pollutants, the El Paso region regularly experiences "exceptional" weather events. These events are high wind, dust conditions that can produce high levels of background PM concentrations. TCEQ has identified 13 exceptional events, resulting in very high PM concentration levels, occurring in El Paso between 2010 and 2012. The events increased the estimated 24-hour and annual average PM2.5 and PM10 concentrations. TCEQ has asked that the EPA remove these 13 events from consideration in determining the PM concentration levels for regulatory purposes. However, as the TCEQ report notes, significant dust storms with elevated PM levels are frequent events in the El Paso region.

Summary

The combination of regularly occurring exceptional events, particularly as the region experiences additional climate change effects, background concentrations close to the PM federal standards, and high levels of adjacent roadway emissions makes it very likely that students attending Bowie High School currently experience unhealthy levels of local air pollutants. **Adding a bus hub to Bowie High School, under any configuration, is likely to exacerbate what already appears to be persistently high levels of local pollutants. Moreover, the estimated emissions generated at other bus hubs are significantly less than those generated at the proposed Bowie Hub. The Northeast hub will be approximately 36% lower than estimated yearly emissions generated at the proposed Bowie High School location. The West hub will experience yearly emissions approximately 25% lower than those experienced at Bowie.**

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air & waste management association 52.9 (2002): 1032-1042.

[23] Olvera, Hector A., et al. "Ultrafine particle levels at an international port of entry between the US and Mexico: Exposure implications for users, workers, and neighbors." *Journal of Exposure Science and Environmental Epidemiology* 23.3 (2013): 289.

At the minimum, the EPISD should solicit the conduct of a PM hotspot analysis to ensure that local conditions do not exacerbate current conditions. Section 93.101 of 40 CFR defines a PM hotspot analysis as the means used to calculate future localized pollutant concentrations for comparison to the federal standards. Federal standards are focused on *regional* conformance to national air quality standards, the PM hotspot analysis can help to identify the levels of *localized* concentrations. A major new bus or intermodal terminal that involves a significant number of diesel buses or trucks is a candidate for hotspot analysis under section 93.101. In addition, EPA's school siting guidelines also recommend that new or related bus terminals with greater than 100 buses undergo a site assessment.[24] With the region's PM federal standard designations, the local conditions are such that a PM Hotspot Analysis would be a prudent course of action, and is consistent with EPA's school siting recommendations, to ensure that students are not exposed to high and continuing levels of pollutants.

2. Proposed changes in bus fuel and vegetative barriers to "minimize any adverse effects".

As the Deputy Superintendent for Finance for EPISD noted in a presentation in November 2017 entitled "Relocation of Maintenance/Transportation Hub," a major concern for the proposed bus hub relocation is that it will be located "next to a major high school."[25] In order to "minimize any adverse effects, if any, to the Bowie campus" the EPISD Superintendent and Board of Trustees wrote in a letter to Texas RioGrande Legal Aid in November 2017 that EPISD "is committed to using propane-powered buses" and plans to include a green space buffer that will consists of vegetation, including numerous trees, to create a barrier to the Bowie campus. Each of these are discussed below.

<u>Changes in Fuel</u>
Most of the District's buses are Blue Bird buses; Blue Bird partners with Roush Technologies to install propane fuel delivery systems on compatible buses prior to customer delivery. As of 2015, there were approximately a dozen propane-compatible engines certified for on-road use by the U.S. Environmental Protection Agency (EPA) or the California Air Resources Board.[26] Approximately, 2% of U.S. school districts currently use propane buses.[27] Within the El Paso region, the Ysleta Independent School District has approximately 30 buses that currently run on propane; they also have an LPG fueling facility.

The effect on pollutant emissions of switching buses to propane is mixed. If an older model diesel school bus is replaced, the reduction in pollutants can be significant. However, a 2015 study by Argonne Labs estimated that "relative to model year 2010 and newer diesel buses, new propane buses do not offer significant air quality benefits."[28] In another study testing propane buses on certification cycles, PM emissions from an LPG bus were approximately the same as PM emissions from a newer diesel bus with control technologies.[29] Thomas Built buses reviewed the 2017 public data from current model year emissions tests and found that for several pollutants diesel engines now outperform alternative fueled

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[24] https://www.epa.gov/sites/production/files/2015-06/documents/school_siting_guidelines-2.pdf
[25] From documents in EPISD Response to Public Information Request by Texas RioGrande Legal Aid, received February 26, 2018, pg 63
[26] Melendez and Defoe (2015) Status and Issues for Propane in the US: Alternative Fuel and Advanced Vehicle Technology Market Trends, National Renewable Energy Lab, USDOE.
[27] Ibid.
[28] Laughlin, M, and Burnham, A. *Case Study - Propane School Bus Fleets*. United States: N. p.6, 2014, USDOE, Clean Cities Program.
[29] Russell, R. L., Johnson, K., Durbin, T., Davis, N., & Lents, J. (2014). *Regulated Emissions from Liquefied Petroleum Gas (LPG) Powered Vehicles* (No. 2014-01-1455). SAE Technical Paper.

engines in terms of pollutants (Figure 7).

Thus, replacing older diesel buses with propane-fueled buses could reduce the additional pollutant loads at the proposed new hub, but new propane buses appear to be less effective at reducing emissions pollutants than new diesel buses.

The EPISD has proposed a replacement plan and budget for older buses; the plan does not state that new buses would be propane.[30] The plan also only budgets for replacing 18 conventional school buses by 2021.[31]

Table 3. Proposed bus purchases

Purchase Date	No. Buses	Notes
2018	16	Conventional
2018	8	Special needs
2019	2	Conventional
2019	19	Special Needs
2020	0	---
2020	0	---

In fact, it would appear that replacing older buses with propane would be in conflict with its current replacement principle, as articulated on EPISD's website,[32]

> **What will happen to buses that are retired from EPISD?**
> EPISD has made a conscious decision to replace retiring buses with similar, but updated buses. This allows the District to use older buses for spare parts when newer buses are in need of repairs. Buses that are determined to be no longer viable for use or for parts, may be surplused by the District and sold along with other items deemed no longer needed by EPISD. Proceeds from surplus sales are deposited back into the District's budget.

[30] From documents entitled "Replacement Plan" for years 2017-2021 in EPISD Response to Public Information Request by Texas RioGrande Legal Aid, received February 26, 2018, pgs 27-30.
[31] *Id.*
[32] https://www.episd.org/domain/332

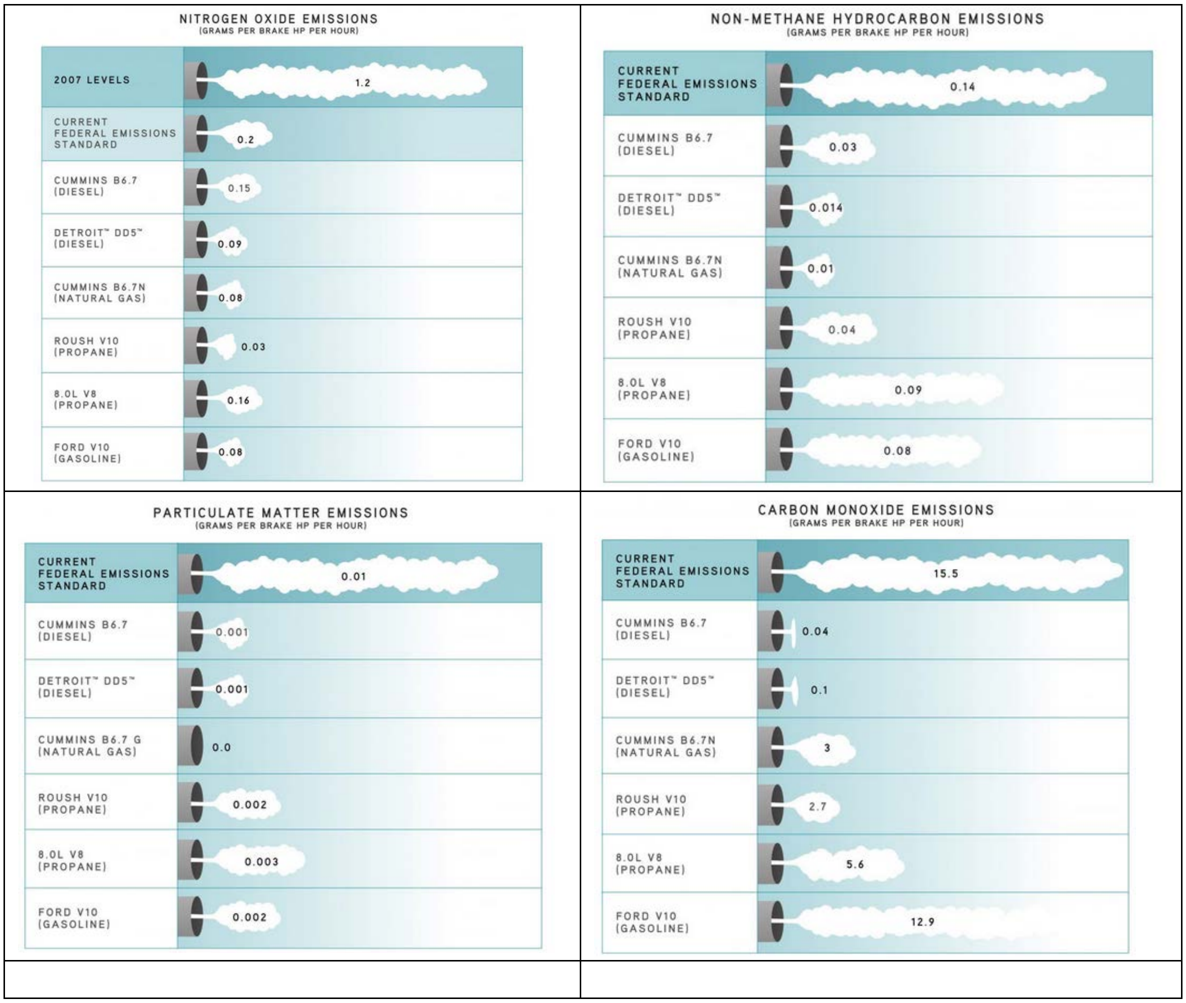

Figure 7. Comparison of emissions for alternatively fueled school buses. Source: https://thomasbuiltbuses.com/bus-advisor/articles/clean-diesel-school-buses-just-as-clean-as-propane-gasoline-cng/

Based on the available evidence, there is little reason to expect: 1) new buses to be propane, and 2) even if new bus purchases are propane, that bus emissions will decrease. In fact, most emissions levels would be higher under new propane buses (compared to new diesel clean buses).

<u>Vegetative Barriers</u>

The EPISD proposes to use vegetation as a mitigation barrier for the additional air quality effects associated with the proposed bus hub. Despite a paucity of evidence on how and if these barriers work, urban vegetation is frequently proposed as a mitigation tactic for reducing localized air pollutants. A recent review of the state of knowledge on the use of vegetation barriers for air pollutant mitigation indicates that designing effective vegetative barriers is quite complex. A large number of factors must be taken into consideration in order to design an effective vegetation barriers: the hairiness, thickness, porosity, size and stickiness of leaves; the size of the canopy; whether the intent is dilution or dispersion; the proximity to pollution sources; the availability of aloft clean air; the wind speed and direction, and the effects of non-foliated vegetation during wintertime conditions.[33] The choice of

[33] Janhäll, Sara. "Review on urban vegetation and particle air pollution–Deposition and dispersion." *Atmospheric Environment* 105 (2015): 130-137

vegetation and the design of the barrier directly affects the ability to filter unwanted pollutants. For example, placing tall trees alongside heavily traveled roadway corridors can actually increase localized pollutant loads.

The science on the use of vegetative barriers as a primary means of mitigating air pollutants is not sufficiently advanced enough to design a robust barrier that will ensure that localized air pollutants are mitigated from the proposed bus hub.

APPENDIX A: QUALIFICATIONS

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Education

Ph.D., **University of Washington**, Civil and Environmental Engineering, 1994.

M.S., **University of Maine**, Civil and Environmental Engineering, 1991.

B.S., **University of Texas**, Civil Engineering, 1982.

Experience

Professor. Department of Civil and Environmental Engineering, University of California, Davis, 1994-Present
Principal. Sustainable Systems Research, LLC, 2012-Present
Recent Consulting.
Natural Resources Defense Council, *Review of Southern California International Gateway Project Recirculated Draft EIR*
Natural Resources Defense Council, *Coal Dust and Rail: Impacts of Coal Transport from the Powder River Basin*
East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR*
Natural Resources Defense Council, *Ports and Air Quality: Moving Toward Clean Cargo,*
TransForm, *Looking Deeper: A detailed review of the project performance assessment being used to develop OneBayArea,*
Resources Legacy Foundation, *Complete Streets in California: Challenges and Opportunities*,
City of Davis, *GHG Inventory*,
Transportation Project Manager. T.Y. Lin Inter., Falmouth, Maine, 1991-1994
Traffic Engineer. City of San Marcos, Texas, 1985-1987
Engineer. Texas Department of Highways, Austin, Texas, 1978-1987

Professional Appointments

Member, National Academy of Engineering, 2017
Member, Intelligence Science and Technology Experts Group **(**ISTEG**),** National Academies of Sciences, Engineering, and Medicine, 2015-Present
Fellow, American Association for the Advancement of Science, 2014
Guggenheim Fellow, 2015
Editor-in-Chief, Sustainable Cities and Society, 2014-2016
Editor-in-Chief, Transportation Research, Part A, 2007-2012

Selected Publications (161 total)

Rouhani, O., Madani K, A. Mazyaki, M. Arhami, A. Ardalan, D. Niemeier, and M. Ezzati (*under review*) Sustainable development and health, *invited by Lancet*
Gaffron, P. and D. Niemeier (2015) School Locations and Traffic Emissions — Environmental (In)Justice Findings Using a New Screening Method, [Int. J. Environ. Res. Public Health, 12(2), 2009-2025]
Rouhani, O.[G], Knittel, C., D. Niemeier (2014) Road supply in central London: Addition of an ignored social costs, *Journal of Transportation Research Forum,* 53(1):49-64.

Rouhani, O., [G] D. Niemeier (2014*)* Resolving the property rights of transportation emissions through public-private partnerships, *Journal of the Transportation Research, Part D*, 31:48-60.

Karner A., D. Niemeier (2013) Civil Rights Guidance and Equity Analysis Methods for Regional Transportation Plans: A Critical Review of Literature and Practice, *Journal of Transport Geography,*33:126-134

London, J., Karner, A., D. Rowan, D. Niemeier, J. Sze, G. Gambirazzio (2013*)* Racing Climate Change: Collaboration and Conflict in California's Global Climate Change Policy Arena, *Global Environmental Change*, 23(4):791-799

Heres Del Valle, D., Niemeier, D. (2011). CO_2 emissions: Are land-use changes enough for California to reduce VMT? Specification of a two-part model with instrumental variables. *Transportation Research, Part B*, 45(1):150-161.

Niemeier, D., Bai, S., Handy, S. (2011). The impact of residential growth patterns on vehicle travel and pollutant emissions. *Journal of Transport and Land Use*, 4(3):65-80.

Lee, A., Niemeier, D. (2011). Environmental justice and transportation, *A Dictionary of Transport Analysis*. Button and Nijkamp (*eds)*, Pergamon.

Gao, O., Niemeier, D. (2011). Mobile emissions, *A Dictionary of Transport Analysis*. Button and Nijkamp (*eds)*, Pergamon.

Rowan, D. Karner, A., Niemeier, D. (2010). Miles per gallon illusions and CAFE distortions: When even the transport experts have trouble. *Transportation Research Record,* 2191:8-15.

Karner, A., Eisinger, D., Niemeier, D. (2010). Near roadway air quality: Synthesizing the findings from real-world data. *Environmental Science and Technology*, 44(10):5334-5344.

Torres, R., Nelson, V., Momsen, J., Niemeier, D. (2010). Experiment or transition? Revisiting food distribution in Cuban agromercados from the “special period”. *Journal of Latin American Geography*, 9:1-12.

Timoshek, A., Eisinger, D., Bai, S., Niemeier, D. (2010) Mobile source air toxic emissions: Sensitivity to traffic volume, fleet composition, and average speed*. Transportation Research Record*, 2158:77-85.

Hixson, M., Mahmud A., Hu, J., Bai, S., Niemeier, D., *Handy*, S., Gao, S., Lund, J., Sullivan, D., Kleeman, M. (2009). Influence of development policies and clean technology adoption on future air pollution exposure. *Atmospheric Environment,* 37(36):5047-5068.

Silvis, J., Niemeier, D. (2009). Social networks and dwelling characteristics that influence ridesharing behavior of seniors. *Transportation Research Record*, 2118:47-54.

Rowan, D., Niemeier, D. (2009). From kiosks to megastores: The evolving carbon market. *California Agriculture,* 63(2):96–103.

Gould, G., Niemeier, D. (2009). Review of regional locomotive emission modeling and the constraints posed by activity data. *Transportation Research Record*, 2117:24-32.

Chen, H., Bai, S., Eisinger, D., Niemeier, D., Claggett, M. (2009), Predicting near-road $PM_{2.5}$ concentrations: Comparative assessment of CALINE4, CAL3QHC, and AERMOD. *Transportation Research Record*, 2123:26-37.

Karner, A., Eisinger, D., Bai, S., Niemeier, D. (2009) Mitigating diesel truck impacts in environmental justice communities. *Transportation Research Record*, 2125:1-8.

Van Houtte, J., Niemeier, D. (2008). A critical review of the effectiveness of I/M programs for monitoring PM emissions from heavy duty vehicles. *Environmental Science and Technology,* 42(21):7856-7865.

Niemeier, D., Gould, G., Karner, A., Hixson, M., Bachmann, B., Okma, C., Lang, Z., Heres Del Valle, D. (2008). Rethinking downstream regulation: California’s opportunity to engage households in reducing greenhouse gases. *Energy Policy*, 38:3436-3447.

Gao, H., Niemeier, D. (2008). Using functional data analysis of diurnal ozone and NO_X cycles to inform transportation emissions control. *Transportation Research, Part D*, 13(4):221-238.

Lin, J., C. Chen, Niemeier, D. (2008). An Analysis on Long-Term Emission Benefits of a Government Vehicle Fleet Replacement Plan in Northern Illinois, *Transportation*, 35(2):1572-9435.

Kear, T., Eisenger, D, Niemeier, D., Brady, M. (2008). US vehicle emissions: Creating a common currency to avoid model comparison problems. *Transportation Research, Part D*, 13(3):168-176.

Hendren, P., Niemeier, D. (2008*)* Identifying Peer States for Transportation System and Policy Analysis. *Transportation*, 35:445-465.

Bai, S., Nie, Y., Niemeier, D. (2007). The impact of speed post-processing methods on regional mobile emissions estimation. *Transportation Research, Part D,* 12: 307-324.

Yura, E., Kear, T., Niemeier, D. (2007). Using CALINE dispersion to assess vehicular $PM_{2.5}$ emissions. *Atmospheric Environment,* 41(38): p. 8747-8757.