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To: Katherine Hess
Community Development Administrator
City of Davis

From: Gary Rubenstein
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Subject: Qualitative Assessment of Near-Roadway Air Quality Impacts on the University Research Park, Davis, California

Enclosed please find our assessment of near-roadway air quality impacts on the University Research Park project. As described in more detail in the assessment, the potential for exposure of future occupants of the project to significant health hazards from I-80 is below the screening cancer level risk threshold. In other words, the near-roadway health risk experienced by residents of the University Research Park project is not expected to be significant. Implementation of the proposed Project design features would further reduce the already less-than-significant impacts.

Please let me know if you have any questions or need additional information.

Introduction

The University Research Park project is a proposed residential project of rental apartments over ground-floor tech space, within the City of Davis, California. The proposed project will consist of approximately 160 apartment units situated in four buildings with an additional 26,912 square feet of open-plan tech space. The project also contains vehicle and bicycle parking and open spaces.

The project is situated on a 4.5-acre site immediately adjacent to and south of Interstate 80 (I-80), west of the Pole Line Road overpass. The Project has been designed with a 15-foot wide vegetative barrier along the north side, between I-80 and the project. Vegetative barriers have been shown to provide benefits for the dispersion of roadway air pollutants.[1]

We have been asked to consider the potential for exposure of future occupants of the Project to significant health hazards from I-80, assess whether future project occupants would potentially be exposed to significant hazards from I-80 and, if so, whether the impacts may be mitigated to a level of insignificance. This assessment reflects potential exposures to a variety of roadway emission sources, including combustion emissions and fugitive emissions from tire and brake wear. See Public Resources Code Section 21155.1(a)(4).

As explained below, the potential for exposure of future occupants of the project to significant health hazards from I-80 is below the screening cancer level risk threshold. In other words, the near-roadway health risk experienced by residents of the University Research Park project is not expected to be significant. Implementation of the proposed Project design features would further reduce the already less-than-significant impacts.

Background

There has been public concern over near-road air quality as an environmental issue, resulting from a body of health studies linking adverse health effects to near-roadway exposures in some situations. See, e.g., California Air Resources Board's "Land Use Handbook."[2] These effects are attributed to increased exposure to particulate matter, gaseous criteria pollutants, and air toxics that can be emitted by vehicle activity.

This memo evaluates the issue of near-roadway air quality and the potential for exposure of future occupants of the Project to significant health hazards from I-80 using generally accepted methods employed by lead agencies under CEQA for projects adjacent to freeways and high-traffic roadways. These methods are based on the following guidance documents, which are discussed in greater detail below:

- California Air Resources Board's "Land Use Handbook" (2005)
- Bay Area Air Quality Management District "Roadway Screening Analysis Calculator" (2012)
- USEPA/CARB Emission Standards for 2007 and Later Heavy-Duty Engines and Vehicles and CARB Truck & Bus Rule
- USEPA's Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality (2016)

[1] *Strategies to Reduce Air Pollution Exposure Near High-Volume Roadways*. California Air Resources Board. April 2017. Pp. 32-33. https://www.arb.ca.gov/ch/rd_technical_advisory_final.PDF

[2] https://www.arb.ca.gov/ch/handbook.pdf

- CARB's Technical Advisory: Strategies to Reduce Air Pollution Exposure near High-Volume Roadways (2017)

Potential mitigation for near-roadway air quality impacts is also discussed within the context of each guidance document.

In summary, while the University Research Park Project would be located near a freeway:

- The project would not result in an increased health risk to residents of a magnitude that would warrant a site-specific health risk assessment (HRA).
- The potential health risk to project residents is lower than that presumed in the analyses underlying existing guidance because vehicle emission standards have become more stringent since those analyses were initially prepared, resulting in significantly lower emission rates of toxic air contaminants from mobile sources.

Analysis

The University Research Park project is located within the Yolo-Solano Air Quality Management District (YSAQMD). YSAQMD published its Handbook for Assessing and Mitigating Air Quality Impacts in July 2007 (YSAQMD CEQA Handbook).[3] YSAQMD's CEQA Handbook does not identify nor require assessment of near-roadway air quality impacts. Therefore, it does not provide a protocol for analyzing the potential for exposure of future occupants of University Research Park to significant health hazards from I-80.

Consistent with a request from the City of Davis Planning Department for a similar project, the potential air quality impacts of Interstate 80 on the health of future occupants of the proposed Project have been evaluated using guidance issued by the Bay Area Air Quality Management District. The most recent BAAQMD guidance for analyses of this type is found in Section 5.2.5 of the BAAQMD's May 2017 *California Environmental Quality Act Air Quality Guidelines*.[4] The Guidelines recommend the use of a 1,000 foot radius surrounding a proposed new receptor (such as the proposed project) to identify existing sources of toxic air contaminants and fine particulate (PM2.5) emissions that could potentially impact the project. In the case of the University Research Park Project, we believe that I-80 is the only existing significant source of emissions that could potentially impact the occupants of the project.

For on-road mobile sources of emissions, such as freeways, the Guidelines recommend the use of the BAAQMD's Roadway Screening Analysis Calculator[5] to estimate potential worst-case health risks from mobile sources at new receptor locations.[6]

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[3] http://yolosolanoair.wpengine.com/wp-content/uploads/2016/06/CEQAHandbook2007.pdf

[4] http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf

[5] http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools

[6] The BAAQMD does not recommend the use of the Roadway Screening Analysis Calculator for "California State Highways", and instead recommends their "Highway Screening Analysis Tool". However, the Highway Screening Analysis Tool differs from the Roadway Screening Analysis Calculator in that it displays results for specific highway segments located within the BAAQMD boundaries; since the project site is not within the BAAQMD, no results can be displayed for the project site. Furthermore, there are no segments of I-80 within the BAAQMD boundary that have the same predominant east-west orientation and comparable traffic flows as the project site. Consequently, within the tools available to apply the BAAQMD methodology, we believe that the Roadway Screening Analysis Calculator is most appropriate for the project site.

In performing this analysis, we used the following input assumptions to the Calculator:

- County: Solano[7]
- Roadway Direction: East-West
- Side of the Roadway: South
- Distance from Roadway: 110 feet
- Annual Average Daily Traffic (ADT): 136,700[8]

The distance of the nearest receptor to the edge of the nearest travel lane was determined from the easement lines and from aerial photography. The site plan shows that an easement lies adjacent to the freeway and the nearest buildings could be no closer than approximately 142 feet from the northernmost property line (See Figure 2). Aerial photography shows that the property line (indicated by the existing fencing running parallel to the freeway) is approximately 110 feet from the edge of the nearest travel lane (See Figure 3), resulting in a minimum total setback distance of approximately 252 feet.

The results of the screening analysis are shown in Figure 1 below.

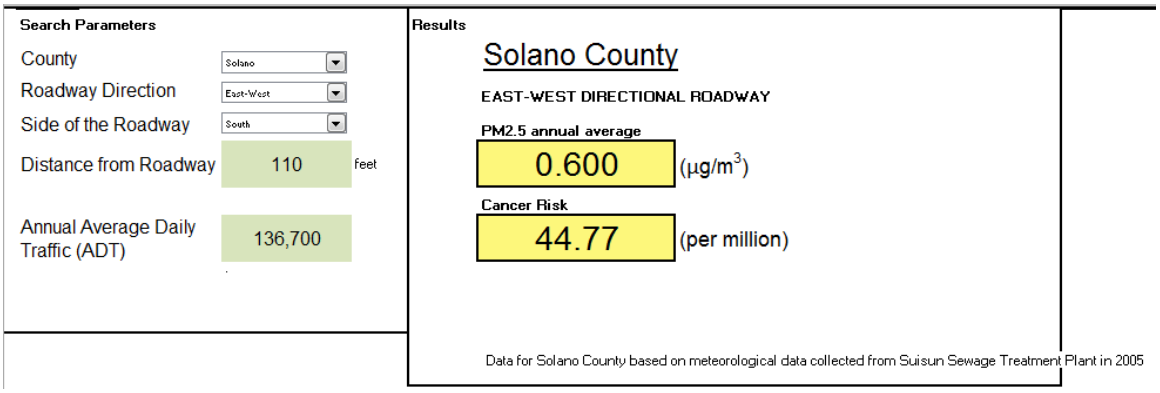

Figure 1. BAAQMD Roadway Screening Calculator Results

These values are health-conservative (overstated) for the following reasons:

- Distances from the roadway to the development input to the Screening Analysis Calculator are supposed to be distances from the center of the roadway to the development. In our analysis, to be conservative, we used a distance of 110 feet from the edge of the nearest travel lane to the fence line of the property, even though the development will not extend to the north end of the property closest to the freeway.

[7] Since the Roadway Screening Analysis Calculator was developed by the BAAQMD for use on projects located within the BAAQMD, it does not provide an option to select Yolo County. Give the proximity of the project site to the Solano County border, and the prevailing east-west direction of I-80 in both Yolo and Solano Counties, the Solano County option was viewed as most representative of the project site.

[8] From Caltrans 2017 Traffic Volumes (http://www.dot.ca.gov/trafficops/census/), Back AADT volumes for Davis, Richards Boulevard.

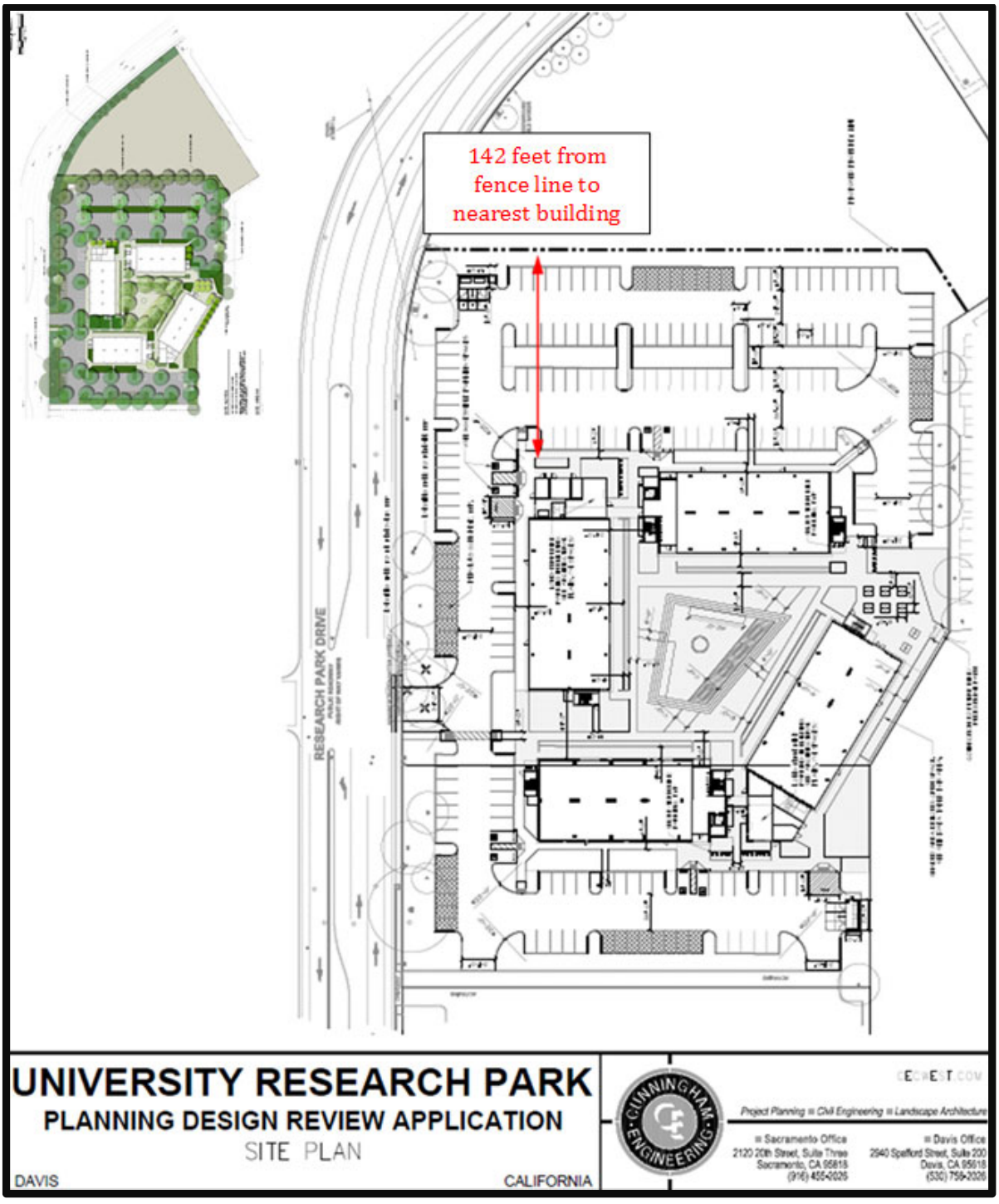

Figure 2. Distance from Fenceline to Nearest Building

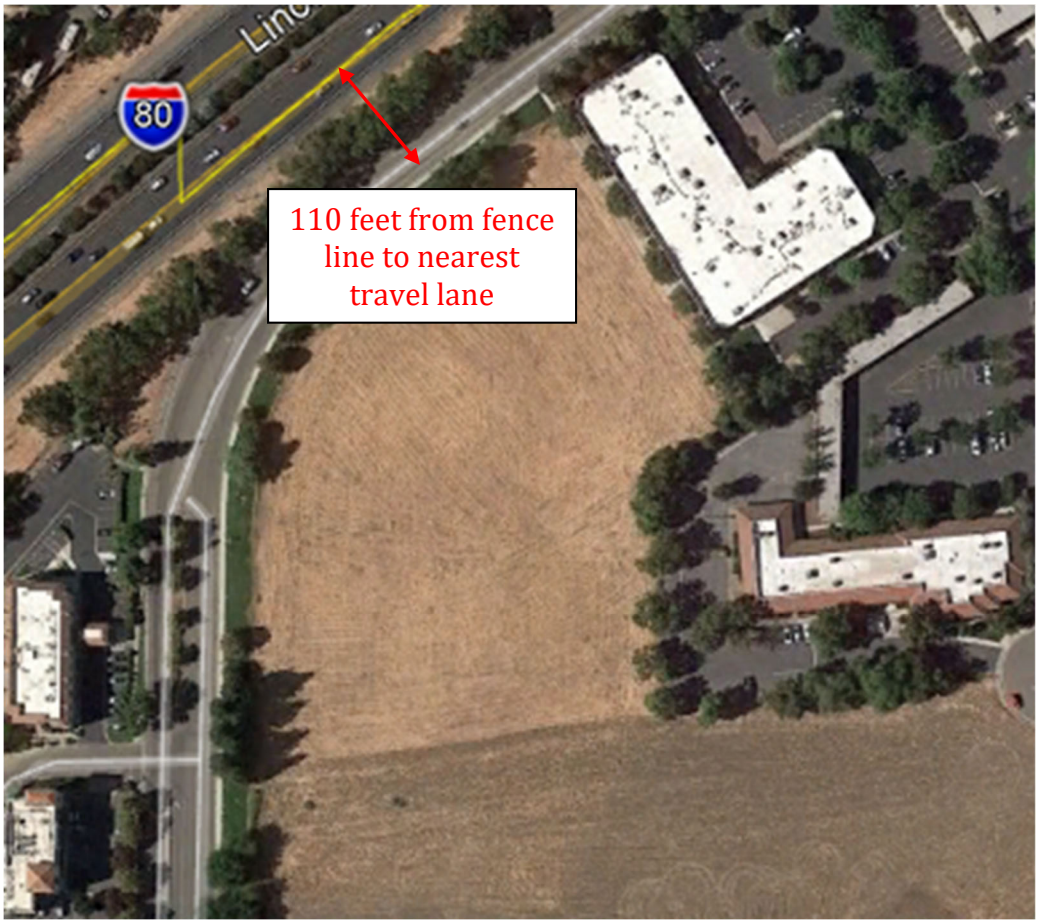

Figure 3. Distance from Fence Line to the Edge of the Nearest Travel Lane

- The 110-foot distance from the roadway to the development does not include the additional 142-foot setback between the nearest building and the property line (see Figure 2).
- The Screening Analysis Calculator uses emissions from vehicles on California roadways in calendar year 2014; emission rates will be lower at the time the project becomes occupied.
- The Screening Analysis Calculator does not reflect the benefits of the 15-foot wide vegetative barrier between I-80 and the project that is a mitigating project feature.

The values shown in Figure 1 are below the applicable BAAQMD significance thresholds for cumulative impacts of 0.8 µg/m3 for annual average PM2.5 concentrations and an excess cancer risk of 100 in one million.[9]

[9] The BAAQMD Roadway Screening Calculator does not present calculations for acute or chronic health risk. However, for a continuously emitting source such as a freeway, the annual average cancer risk calculations are likely to be controlling, and a roadway that is below the excess cancer risk threshold would be below the acute and chronic risk thresholds as well

Policy Context

The BAAQMD Highway Screening Analysis Tool can be best understood in the context of evolving policies regarding land uses in proximity to roadways. The following history of applicable policies shows the ongoing refinement of policy in response to improvements in research and continuing emissions reductions.

The California Air Resources Board (CARB) initially articulated a concern about siting new sensitive land uses near freeways and roads, distribution centers, rail yards, ports, refineries, chrome plating facilities, dry cleaners, and large gasoline-dispensing facilities. These concerns were outlined in CARB's 2005 publication, "Air Quality and Land Use Handbook: A Community Health Perspective" (Land Use Handbook). These source types were selected based on CARB's jurisdiction to regulate mobile sources of air toxics as well as certain other stationary sources of toxic air contaminants. CARB's Land Use Handbook provides limited guidance with regard to mitigation, and no guidance with regard to new or modified freeway/road projects or mitigation measures that may reduce the health risk from these sources.

CARB's 2005 guidance with regard to freeways/roadways was generally to "avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day." CARB justified these setback distances based on data showing that exposure is "greatly reduced at approximately 300 feet," and that "health risk attributable to the proximity effect was strongest within 1,000 feet."

The 2005 guidance did not address potential risks from a project that might be sited within 500 feet of a freeway. However, on April 24, 2017, CARB issued the publication "Technical Advisory: Strategies to Reduce Air Pollution Exposure near High-Volume Roadways."[10] The Technical Advisory is a supplement to the 2005 Land Use Handbook and includes guidelines for infill development near freeways and other high traffic locations. The research cited in the Technical Advisory has demonstrated that there can be many benefits of compact, infill development along transportation corridors, as well as promising strategies to help decrease pollution exposure near transportation pollution sources such as freeways. These strategies include more stringent emissions and fuel standards for cars, trucks and buses, discussed further below.

On December 21, 2000, the U.S. Environmental Protection Agency (USEPA) signed emission standards for model year 2007 and later heavy-duty highway engines, which were adopted by CARB thereafter. The new emission standards lowered the allowable emission rate for diesel particulate matter from 0.1 grams/brake horsepower-hour (applicable to 2004–2006 model year engines) to 0.01 grams/brake horsepower-hour (applicable to 2007+ model year engines)—a decrease of 90 percent—for all heavy-duty diesel vehicles with a gross vehicle weight rating (GVWR) of 8,500 lbs or greater. Diesel particulate emissions are often used as a surrogate for mobile source air toxic emissions (MSATs) from diesel vehicles.

Additionally, in December 2008, CARB adopted its Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles,[11] commonly referred to as the "Truck and Bus Rule." The Truck & Bus Rule requires that all in-use heavy-duty diesel trucks with a GVWR >26,000 lbs be equipped with either factory or

[10] Available at *https://www.arb.ca.gov/ch/rd_technical_advisory_final.PDF*.
[11] 13 CCR § 2025.

retrofit diesel particulate filters equivalent to the 2007+ MY standards, with limited exceptions.[12] Heavy-duty vehicles with a GVWR of 14,001 to 26,000 lbs must be phased out over time on a model-year basis.

As a result of these standards and regulations, the California fleet of heavy-duty diesel vehicles (the largest contributor of near-roadway health risk) is being modernized by accelerated turnover and retrofits. The corresponding health risk attributable to freeways and high-traffic roadways has decreased sharply over time, and will continue to do so. This significant reduction in health risk is not factored into the studies on which CARB's Land Use Handbook were based, which represented mobile source fleet data from 1997 to 2004, and therefore reflect a mobile source fleet that was subject to much less stringent standards at the time. Likewise, the health risk assessment on which BAAQMD's Roadway Screening Calculator is based reflects a much older fleet of higher-emitting vehicles. As such, even with regional increases in VMT, the near-roadway health risk experienced by the University Research Park project is not expected to be significant.

Fugitive Dust from Tire and Brake Wear

The friction of tires against the road surface, and between brake pads and discs or drums on wheels, results in particulate emissions which can contain traces of the metals (and other components) used in the manufacture of these materials. Because these PM emissions are mechanically created, the particles tend to generally be coarser (large) in size than combustion-generated particulates.[13] Some researchers have found the same trace metals in analyses of ultrafine particles (UFPs) in studies near roadways, and have associated these metals with a variety of health effects.[14]

Regardless of whether tire and brake wear emissions are included within PM_{10}/$PM_{2.5}$ concentrations, or as much smaller ultrafine particles, the metals these emissions contain can be harmful to health. Particles within this size range will typically behave in a manner similar to gases, and will be transported by winds. Some deposition of these particles will occur closer to emission sources (in this case, a roadway), while some of the particles may be transported longer distances. The BAAQMD Roadway Screening Calculator results include impacts from brake and tire wear and resuspended dust, so the potential health-related impacts of these particles have already been accounted for in the screening analysis discussed above. However, any project design features that are intended to address other sources of roadway particulate emissions (such as combustion emissions) will also be effective in addressing potential impacts of tire and brake wear emissions.

Policy Recommendations to Improve Near-Road Air Quality

Recently, USEPA and CARB have both recommended certain design features that improve air quality near roadways. In July 2016, USEPA published its Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality. The report recognizes the public health concerns related to near-road air quality and sets forth measures for near-term actions that can be

[12] The Truck and Bus Rule provides limited exemptions where heavy-duty trucks not meeting the 2010+ MY standards may operate in California, such as the "low-use vehicle" exemption under which heavy-duty trucks that operate <1,000 miles/year in 2023 are not subject to the rule requirements.
[13] EMFAC 2014 Volume III – Technical Documentation. California Air Resources Board. May 12, 2015. p. 18
[14] *Very Fine and UltraFine Metals and Ischemic Heart Disease in the California Central Valley 1: 2003-2007.* Cahill, Barnes, et al. Aerosol Science and Technology. May 12, 2011

taken to reduce impacts to be implemented in conjunction with longer-term vehicle emission reductions achieved through vehicle exhaust standards.

The near-term actions recommended in the report include the preservation and planting of roadside vegetation) for urban developers and facilities already subject to high pollution levels near roads. These mitigation methods complement existing pollution control programs and regulations, as well as provide measures to reduce impacts from sources that are difficult to control. Vegetative barriers have been shown to provide benefits.[15] This is the approach being adopted by the Project.

According to the report, roadside vegetation has been shown to reduce exposure to air pollution through the interception of airborne particles and/or through the uptake of gaseous air pollutants by leaf stomata as well as improvements to air pollutant dispersion. Vegetation type, height, and thickness can all influence the extent of mixing and pollutant deposition experienced at the site. The USEPA report identifies species with the following characteristics:

- Minimal seasonal effects (no deciduous plants);
- Low allergen, low BVOC-producing, non-poisonous;
- Urban hardy;
- Low maintenance;
- Drought tolerant;
- Preferably native; and
- Non-invasive.

With regard to physical characteristics of vegetation barriers, the USEPA report identifies, among other things, the following:

- Height (preferably 5 meters or higher);
- Thickness (preferably 10 meters or greater, for vegetative barriers);
- Allowance for some air flow-through (porosity of 0.5 to 0.9, for vegetative barriers);
- No gaps in vegetation; and
- Vegetation extending from the ground to the top of the canopy.

Many of the strategies included in CARB's 2017 Technical Advisory relate to the design of roadways. Other measures are aimed at designing urban buildings with varying shapes, heights, and articulations to improve air dispersion. Similar to the USEPA guidance previously cited, CARB's Technical Advisory identifies the use of vegetative barriers for pollutant dispersion as an available mitigation measure for roadside air impacts.

Finally, CARB's Technical Advisory identifies the use of particle filtration systems and devices, and specifically high-efficiency filtration with mechanical ventilation or portable high efficiency air cleaners. CARB states that these measures can be highly effective for reducing indoor pollution concentrations and can remove between 50 to 99 percent of particles in the air.

[15] See: https://www.arb.ca.gov/research/single-project.php?row_id=65195