APPENDIX A
CONSTRUCTION TOXIC AIR CONTAMINANT ANALYSIS

29080 Fairview Avenue Residential Project Construction TAC Assessment Hayward, CA

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Introduction

The purpose of this report is to address air quality community risk impacts associated with the 29080 Fairview Avenue Residential project in the city of Hayward, California. The project proposes to develop 33 single-family homes on an 8.88 acre land parcel.

Community risk air quality impacts could occur due to temporary construction emissions from the construction site and exposure of school children and residences in the vicinity. This analysis addresses those issues following the guidance provided by the BAAQMD.

Setting

The project is located in Alameda County, which is in the San Francisco Bay Area Air Basin. Toxic Air Contaminants (TACs) are a broad class of compounds known to cause morbidity or mortality (usually because they cause cancer) and include, but are not limited to, the criteria air pollutants. TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter near a freeway). Because chronic exposure can result in adverse health effects, TACs are regulated at the regional, State, and federal level.

Diesel exhaust is the predominant TAC in urban air and is estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average). According to the California Air Resources Board (CARB), diesel exhaust is a complex mixture of gases, vapors, and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some of the chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by the CARB, and are listed as carcinogens either under the State's Proposition 65 or under the Federal Hazardous Air Pollutants programs.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of diesel particulate matter (DPM). Several of these regulatory programs affect medium and heavy duty diesel trucks that represent the bulk of DPM emissions from California highways. These regulations include the solid waste collection vehicle (SWCV) rule, in-use public and utility fleets, and the heavy-duty diesel truck and bus regulations. In 2008, CARB approved a new regulation to reduce emissions of DPM and nitrogen oxides from existing on-road heavy-duty diesel fueled vehicles.[1] The regulation requires affected vehicles to meet specific performance requirements between 2014 and 2023, with all affected diesel vehicles required to have 2010 model-year engines or equivalent by 2023. These requirements are phased in over the compliance period and depend on the model year of the vehicle.

The BAAQMD is the regional agency tasked with managing air quality in the region. At the State level, the CARB (a part of the California Environmental Protection Agency [EPA]) oversees regional air district activities and regulates air quality at the State level. The BAAQMD

[1] Available online: http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm. Accessed: November 21, 2014.

has recently published California Environmental Quality Act (CEQA) Air Quality Guidelines that are used in this assessment to evaluate air quality impacts of projects.[2]

Sensitive Receptors

There are groups of people more affected by air pollution than others. CARB has identified the following persons who are most likely to be affected by air pollution: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks. For cancer risk assessments, children are the most sensitive receptors, since they are more susceptible to cancer causing TACs. Residential locations are assumed to include infants and small children. The closest sensitive receptors to the project site include single-family residences to the east of the project site and the Stonebrae Elementary School adjacent to the western project boundary.

Significance Thresholds

In June 2010, BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA. These Thresholds were designed to establish the level at which BAAQMD believed air pollution emissions would cause significant environmental impacts under CEQA and were posted on BAAQMD's website and included in the Air District's updated CEQA Guidelines (updated May 2011). The significance thresholds identified by BAAQMD and used in this analysis are summarized in *Table 1*.

Table 1. Air Quality Significance Thresholds

Description	Construction Thresholds	Operational Thresholds	
	Average Daily Emissions (lbs./day)	Average Daily Emissions (lbs./day)	Annual Average Emissions (tons/year)
Single-Source Health Risks and Hazards for New Sources and Receptors			
Excess Cancer Risk	>10 per one million		
Chronic or Acute Hazard Index	>1.0		
Incremental annual average $PM_{2.5}$	>0.3 $\mu g/m^3$		
Cumulative Health Risks and Hazards (Combination of all substantial sources within 1,000 foot zone of influence) for New Sources and New Sensitive Receptors			
Excess Cancer Risk	>100 per one million		
Chronic Hazard Index	>10.0		
Annual Average $PM_{2.5}$	>0.8 $\mu g/m^3$		

[2] Bay Area Air Quality Management District. 2011. BAAQMD CEQA Air Quality Guidelines. May 2011.

Project Construction Activity

Construction equipment and associated heavy-duty truck traffic generates diesel exhaust, which is a known TAC. These exhaust air pollutant emissions would not be considered to contribute substantially to existing or projected air quality violations. Construction exhaust emissions may still pose health risks for sensitive receptors such as surrounding residents. The primary community risk impact issues associated with construction emissions are cancer risk and exposure to $PM_{2.5}$. Diesel exhaust poses both a potential health and nuisance impact to nearby receptors. A health risk assessment of the project construction activities was conducted that evaluated potential health effects of sensitive receptors at these nearby residences from construction emissions of DPM and $PM_{2.5}$.[3]

Construction Period Emissions

Construction activity is anticipated to include grading and site preparation, trenching, building construction, architectural coating, and paving. Construction period emissions were modeled using the California Emissions Estimator Model, Version 2013.2.2 (CalEEMod). The construction schedule provided by the client was used in the model. The proposed project land uses were input into CalEEMod, which included 33 dwelling units entered as "Single Family Housing" on an 8.88-acre site over a period of about 13 months. Construction period emissions were modeled using CalEEMod along with the anticipated project construction activity. The number and types of construction equipment and diesel vehicles, along with the anticipated length of their use for different phases of construction, were based on a site-specific construction schedule provided by the applicant.

The project would require up to 500 cubic yards (cy) of soil export, which was entered into the model. In addition, 112 cement truck round trips based on anticipated hauling of 500 cubic yards (cy) of cement during the building construction phase, were entered into the model. During paving, 126 trips based on 625 cubic yards (cy) of asphalt were entered into the model.

Emissions (assumed to be DPM) for the off-road construction equipment and for exhaust emissions from on-road vehicles, with total emissions from all construction stages were found to be 0.1249 tons (250 pounds). The on-road emissions are a result of haul truck travel during grading activities, worker travel, and vendor deliveries during construction. A trip length of 0.5 mile was used to represent vehicle travel while at or near the construction site. Emissions from on-road vehicles traveling at or near the site were modeled as occurring at the construction site. Fugitive $PM_{2.5}$ dust emissions were calculated by CalEEMod as 0.0836 tons (167 pounds) for the overall construction period.

Dispersion Modeling

The EPA Industrial Source Complex-Short Term (ISCST3) dispersion model was also used to predict concentrations of DPM and $PM_{2.5}$ concentrations at existing sensitive receptors

[3] DPM is identified by California as a toxic air contaminant due to the potential to cause cancer.

(residences) in the vicinity of the project construction area. The ISCST3 dispersion model is a BAAQMD-recommended model used in modeling analysis of these types of emission activities for CEQA projects.[4] The ISCST3 modeling utilized four area sources to represent the on-site construction emissions, two for exhaust emissions and two for fugitive dust emissions. To represent the construction equipment exhaust emissions, an emission release height of 6 meters (19.7 feet) was used for the area source. The elevated source height reflects the height of the equipment exhaust pipes plus an additional distance for the height of the exhaust plume above the exhaust pipes to account for plume rise of the exhaust gases. For modeling fugitive $PM_{2.5}$ emissions, a near-ground level release height of 2 meters (6.6 feet) was used for the area source. Emissions from the construction equipment and on-road vehicle travel were distributed throughout the modeled area sources. Construction emissions were modeled as occurring daily between 7 a.m. to 4 p.m., when the majority of construction activity would occur. Figure 1 shows the project site and nearby sensitive receptor (residences and school) locations where health impacts were evaluated.

The modeling used a four-year data set (1990-1994) of hourly meteorological data from Union City that was prepared for use with the ISCST3 model by CARB for use in health risk assessments. Annual DPM and $PM_{2.5}$ concentrations from construction activities for the years 2018 and 2019 were calculated using the model. DPM and $PM_{2.5}$ concentrations were calculated at nearby sensitive receptors. Since the project is on an elevated terrain, the model incorporated terrain elevation based on USGS DEM Terrain Elevation Model Data referenced to NAD27. Receptor heights of 1.5 meters (4.9 feet) were used to represent the breathing heights of residents on first floor levels of nearby residences. Receptor heights of 1.2 meter were used to represent the breathing height of an elementary school student.

The maximum-modeled DPM and $PM_{2.5}$ concentrations occurred east of the construction site at a residence. The location where the maximum $PM_{2.5}$ and DPM concentrations occurred (and maximum cancer risk) is identified on Figure 1.

<u>Predicted Cancer Risk and Hazards</u>

Increased cancer risks were calculated using the maximum modeled concentrations for 2018 and 2019. BAAQMD-recommended risk assessment methods for infant (3^{rd} trimester through two years of age), child and adult exposure were used. The cancer risk calculations were based on applying the BAAQMD-recommended age sensitivity factors to the TAC concentrations (see *Attachment 1*). Age-sensitivity factors reflect the greater sensitivity of infants and small children to cancer causing TACs. Infant, child, and adult exposures were assumed to occur at all residences through the entire construction period. Child exposures were assumed for the elementary school.

The maximum community risk impacts associated with project construction are shown in *Table 2*. Results of the assessment for project construction indicate the maximum incremental residential infant cancer risk at the maximally exposed individual (MEI) receptor would be 44.7 in one million and the residential adult incremental cancer risk would be 0.8 in one million.

[4] Bay Area Air Quality Management District (BAAQMD), 2012, *Recommended Methods for Screening and Modeling Local Risks and Hazards, Version 3.0*. May 2011.

Assuming infant exposure at the MEI, the cancer risk would exceed the BAAQMD significance threshold of 10 in a million. The maximum-modeled annual $PM_{2.5}$ concentration, which is based on combined exhaust and fugitive dust emissions, was 0.46μg/m^3, which exceeds the BAAQMD significance criterion of 0.3μg/m^3. The maximum modeled annual residential DPM concentration (i.e., from construction exhaust) was 0.2048 μg/m^3, which is lower than the REL. The maximum computed hazard index (HI) based on this DPM concentration is 0.04 which is much lower than the BAAQMD significance criterion of 1.0.

The maximum modeled annual $PM_{2.5}$ concentration at the elementary school site was found to be 0.09μg/$m^{3.}$ The cancer was risk for child exposure was computed to be 1.3 in one million which are below the BAAQMD single-source significant thresholds. The maximum-modeled DPM concentration was 0.0368μg/m^3 and the non-cancer HI based on this DPM concentration was calculated as 0.01, which is much lower than the BAAQMD significance criterion.

Combined Construction Risk Assessment

A review of BAAQMD screening tools did not identify any sources of TACs that could have a significant impact on the future residences of the proposed project or cumulatively to nearby sensitive receptors affected by project construction. There would be no significant cumulative impacts.

Conclusion for Construction Impacts

Cancer risk from construction activities would exceed the single-source significance threshold at the residence with the maximum impact, assuming there is an infant at that receptor site. Exposures for adults would be below the significance threshold. The project construction activities would produce annual $PM_{2.5}$ concentrations above the single-source threshold at nearby residences. Non-cancer hazards would be below the significance thresholds. The cancer risk, hazard index and annual $PM_{2.5}$ concentration would be below the significance thresholds at the Stonebrae Elementary School site. Since cancer risk and annual $PM_{2.5}$ concentrations at the residential MEI exceed the single-source significance threshold, the impact is considered significant. The project would have a *significant* impact with respect to community risk caused by project construction activities. Implementation of Mitigation Measures AQ-1 and AQ-2 would reduce this impact to a level of less than significant. *Attachment 2* includes the CalEEMod outputs, emission summary and health risk calculations.

Table 2. Construction Cancer Risks, $PM_{2.5}$ Concentrations, and Hazard Index at Nearby Receptors

Source	Cancer Risk (per million)		$PM_{2.5}$ Concentration ($\mu g/m^3$)		Acute and Chronic Hazard (HI)	
	Residence	**School**	**Residence**	**School**	**Residence**	**School**
Proposed Project Construction Unmitigated	**Infant = 44.7** Adult = 0.8	Child= 1.3	0.46	0.09	0.04	0.01
Mitigated	Infant= 1.4 Adult= ~0	Child= 0.01	~0	~0	~0	~0
BAAQMD Thresholds Single Source	*10.0*		*0.3*		*1.0*	
Significant?	***No***		***No***		***No***	

Figure 1. Project Construction Site and Locations of Off-Site Sensitive Receptors and TAC Impacts

Mitigation Measures

Mitigation Measure AQ-1: **Include basic measures to control dust and exhaust during construction.**

During any construction period which causes ground disturbance, the applicant shall ensure that the project contractor implement measures to control dust and exhaust. Implementation of the measures recommended by BAAQMD and listed below would reduce the air quality impacts associated with grading and new construction to a less than significant level. The contractor shall implement the following best management practices that are required of all projects:

1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.

2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.

4. All vehicle speeds on unpaved roads shall be limited to 15 mph.

5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.

8. Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Mitigation Measure AQ-2: **Use Construction equipment that has low diesel particulate matter exhaust emissions.**

The project shall develop a plan demonstrating that the off-road equipment used to construct the project would achieve a fleet-wide average 78 percent reduction in DPM emissions at a minimum. One feasible plan to achieve this reduction would include the following:

> All mobile diesel-powered off-road equipment larger than 50 horsepower and operating on the site for more than two days shall meet, at a minimum, U.S. EPA particulate matter emissions standards for Tier 4 engines or equivalent. Note that the construction contractor could use other measures to minimize construction period DPM emission to reduce the predicted cancer risk below the thresholds. The use of equipment that includes CARB-certified Level 3 Diesel Particulate Filters[5], alternatively-fueled equipment (i.e., non-diesel) , added exhaust devices, or a combination of measures could be used to meet this requirement, provided that these measures are approved by the City and demonstrated to reduce community risk impacts to less than significant.

Effectiveness of Mitigation

Implementation of *Mitigation Measure AQ-1* is considered to reduce fugitive dust emissions by 5 percent. Based on modeling**,** implementation of Mitigation Measure AQ-2 would reduce construction exhaust emissions by over 90 percent and increased infant cancer risk would be reduced to 1.4 chances per million. This cancer risk would be below the BAAQMD thresholds of greater than 10.0 per one million for cancer risk. Annual $PM_{2.5}$ concentration would be reduced to 0.05$\mu g/m^3$, which is below the single source thresholds. Therefore, *after implementation of these recommended mitigation measures, the project would have a less-than-significant impact with respect to community risk caused by construction activities.*

[5] See http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm

Attachment 1: Health Risk Calculation Methodology

A health risk assessment (HRA) for exposure to TACs requires the application of a risk characterization model to the results from the air dispersion model to estimate potential health risk at each sensitive receptor location. The State of California Office of Environmental Health Hazard Assessment (OEHHA) and CARB develop recommended methods for conducting health risk assessments. The most recent OEHHA risk assessment guidelines were published in February of 2015.[6] These guidelines incorporate substantial changes designed to provide for enhanced protection of children, as required by State law, compared to previous published risk assessment guidelines. CARB has provided additional guidance on implementing OEHHA's recommended methods.[7] This health risk assessment used the recent 2015 OEHHA risk assessment guidelines and CARB guidance. While the OEHHA guidelines use substantially more conservative assumptions than the current BAAQMD guidelines, BAAQMD has not formally adopted recommended procedures for applying the newest OEHHA guidelines. BAAQMD is in the process of developing new guidance and has developed proposed HRA Guidelines as part of the proposed amendments to Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants.[8] Exposure parameters from the OEHHA guidelines and newly proposed BAAQMD HRA Guidelines were used in this evaluation.

Cancer Risk

Potential increased cancer risk from inhalation of TACs are calculated based on the TAC concentration over the period of exposure, inhalation dose, the TAC cancer potency factor, and an age sensitivity factor to reflect the greater sensitivity of infants and children to cancer causing TACs. The inhalation dose depends on a person's breathing rate, exposure time and frequency of exposure, and the exposure duration. These parameters vary depending on the age, or age range, of the persons being exposed and whether the exposure is considered to occur at a residential location or other sensitive receptor location.

The current OEHHA guidance recommends that cancer risk be calculated by age groups to account for different breathing rates and sensitivity to TACs. Specifically, they recommend evaluating risks for the third trimester of pregnancy to age zero, ages zero to less than two (infant exposure), ages two to less than 16 (child exposure), and ages 16 to 70 (adult exposure). Age sensitivity factors (ASFs) associated with the different types of exposure are an ASF of 10 for the third trimester and infant exposures, an ASF of 3 for a child exposure, and an ASF of 1 for an adult exposure. Also associated with each exposure type are different breathing rates, expressed as liters per kilogram of body weight per day (L/kg-day). As recommended by the BAAQMD, 95th percentile breathing rates are used for the third trimester and infant exposures, and 80th percentile breathing rates for child and adult exposures. Additionally, CARB and the BAAQMD

[6] OEHHA, 2015. . Office of Environmental Health Hazard Assessment. February.
[7] CARB, 2015. *Risk Management Guidance for Stationary Sources of Air Toxics*. July 23.
[8] BAAQMD, 2016. *Workshop Report. Proposed Amendments to Air District Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants. Appendix C. Proposed Air District HRA Guidelines*. January 2016.

recommend the use of residential exposure duration of 30 years for sources with long-term emissions (e.g., roadways).

Under previous OEHHA and BAAQMD HRA guidance, residential receptors are assumed to be at their home 24 hours a day, or 100 percent of the time. In the 2015 Risk Assessment Guidance, OEHHA includes adjustments to exposure duration to account for the fraction of time at home (FAH), which can be less than 100 percent of the time, based on updated population and activity statistics. The FAH factors are age-specific and are: 0.85 for third trimester of pregnancy to less than 2 years old, 0.72 for ages 2 to less than 16 years, and 0.73 for ages 16 to 70 years. BAAQMD recommends using these FAH factors for residential exposures.

Functionally, cancer risk is calculated using the following parameters and formulas:

Cancer Risk (per million) = $CPF \times Inhalation\ Dose \times ASF \times ED/AT \times FAH \times 10^6$

Where:

CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = $C_{air} \times DBR \times A \times (EF/365) \times 10^{-6}$

Where:

C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

The health risk parameters used in this evaluation are summarized as follows

Parameter	***Exposure Type*** / ***Age Range***	**Infant** / **3rd Trimester**	**Infant** / **0<2**	**Child** / **2 < 16**	**Adult** / **16 - 30**
DPM Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$		1.10E+00	1.10E+00	1.10E+00	1.10E+00
Daily Breathing Rate (L/kg-day)*		361	1,090	572	261
Inhalation Absorption Factor		1	1	1	1
Averaging Time (years)		70	70	70	70
Exposure Duration (years)		0.25	2	14	14
Exposure Frequency (days/year)		350	350	350	350
Age Sensitivity Factor		10	10	3	1
Fraction of Time at Home		0.85 – 1.0	0.72 -1.0	0.72 -1.0	0.73

* 95th percentile breathing rates for 3rd trimester and infants and 80th percentile for children and adults

Non-Cancer Hazards

Potential non-cancer health hazards from TAC exposure are expressed in terms of a hazard index (HI), which is the ratio of the TAC concentration to a reference exposure level (REL). OEHHA has defined acceptable concentration levels for contaminants that pose non-cancer health hazards. TAC concentrations below the REL are not expected to cause adverse health impacts, even for sensitive individuals. The total HI is calculated as the sum of the HIs for each TAC evaluated and the total HI is compared to the BAAQMD significance thresholds to determine whether a significant non-cancer health impact from a project would occur.

Typically, for residential projects located near roadways with substantial TAC emissions, the primary TAC of concern with non-cancer health effects is DPM. For DPM, the chronic inhalation REL is 5 micrograms per cubic meter ($\mu g/m^3$).

Annual $PM_{2.5}$ Concentrations

While not a TAC, $PM_{2.5}$ has been identified by the BAAQMD as a pollutant with potential non-cancer health effects that should be included when evaluating potential community health impacts under CEQA. The thresholds of significance for $PM_{2.5}$ (project level and cumulative) are in terms of an increase in the annual average concentration. When considering $PM_{2.5}$ impacts, the contribution from all sources of $PM_{2.5}$ emissions should be included. For projects with potential impacts from nearby local roadways, the $PM_{2.5}$ impacts should include those from vehicle exhaust emissions, $PM_{2.5}$ generated from vehicle tire and brake wear, and fugitive emissions from re-suspended dust on the roads.