August 2022 | Air Quality Survey

SUN VALLEY GARAGE AIR QUALITY SURVEY

Los Angeles Unified School District

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List of Acronyms

AERMOD	- American Meteorological Society/Environmental Protection Agency Regulatory Model
AQS	- Air Quality Survey
AT	- Averaging Time (years)
BR/BW	- Breathing Rate normalized to Body Weight
CAAQS	- California Ambient Air Quality Standard
CARB	- California Air Resources Board
CF	- Conversion Factor
CNG	- Compressed Natural Gas
CO	- Carbon Monoxide
CPF	- Cancer Potency Factor
DPM	- Diesel Particulate Matter
EF	- Exposure Frequency (days/year)
ED	- Exposure Duration (years)
EMFAC	- Emission Factor Model
HARP2	- Hotspots Analysis and Reporting Program, version 2
LDA	- Light Duty Automobile
LDT	- Light Duty Truck
LHDT	- Light Heavy-Duty Truck
LST	- Localized Significance Threshold
MER	- Maximum Exposed Receptor
NOx	- Nitrogen Oxides
NO_2	- Nitrogen Dioxide
OEHHA	- Office of Environmental Health Hazard Assessment
PM_{10}	- Particulate matter ≤ 10 micrometers (micron) in size
$PM_{2.5}$	- Particulate matter ≤ 2.5 micrometers (micron) in size
REL	- Reference Exposure Level
SBUS	- School Bus
SCG	- Southern California Gas Company
SFV	- San Fernando Valley
South Coast AQMD	- South Coast Air Quality Management District
SVG	- Sun Valley Garage
TK	- transitional kindergarten
TOG	- total organic gases
USEPA	- United States Environmental Protection Agency
WAF	- worker adjustment factor

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1. Introduction

The Los Angeles Unified School District (District) commissioned an Air Quality Survey (AQS) to assess criteria air pollutant and toxic air contaminant emissions associated with on-site vehicular activity and related fuel dispensing operations at the existing Sun Valley Garage (SVG). SVG is located at 11247 Sherman Way in the Sun Valley neighborhood in the City of Los Angeles. Sun Valley Magnet School and ISANA Cardinal Academy are located immediately adjacent to SVG.

To address concerns that the existing SVG vehicle activity and fuel dispensing could impact the nearby schools, an AQS was prepared to determine if pollutant emissions from the SVG constitute an actual or potential public health risk to students and staff that attend Sun Valley Magnet School or ISANA Cardinal Academy (schools or school sites).

This AQS included conducting the following tasks:

- 24-hour traffic counts were collected for 3 days to determine temporal profile of vehicles operating at the SVG.
- Emissions from District fleet operations (gasoline-fueled, CNG-fueled, and diesel-fueled vehicles) and fuel dispensing were identified and characterized, based on information provided by the District. The evaluation included passenger vehicles, school buses, District trucks and vans.
- Refined modeling was conducted using an air dispersion model (AERMOD) to quantify maximum ground-level concentrations for receptors at the school sites. Meteorological data was used from the nearest South Coast Air Quality Management District (South Coast AQMD) station with similar meteorological conditions to represent local weather conditions and prevailing winds.
- Cancer and non-cancer risks to students and staff attending Sun Valley Magnet School and ISANA Cardinal Academy were determined based on the results of the AERMOD modeling. The assessment considered exposure through the inhalation pathway. Cancer Potency Factors (CPFs) were used to determine carcinogenic risk and Reference Exposure Levels (RELs) were used to determine non-carcinogenic risk.
- Concentrations of criteria air pollutant emissions from SVG were compared with their corresponding California ambient air quality standards (CAAQS) or localized significance threshold (LST).
- Calculated risks with thresholds established by the South Coast AQMD and Office of Environmental Health Hazard Assessment (OEHHA).

The AQS and dispersion modeling methodologies used in the preparation of this report included all relevant and appropriate procedures developed by the US Environmental Protection Agency (USEPA 2005a) and OEHHA (2004; 2015). These methodologies and assumptions were used to ensure that the assessment effectively quantified school-based impacts associated with emission sources. It should be noted that these health impacts were based on conservative (i.e., health protective) assumptions. The USEPA and OEHHA

1. Introduction

note that conservative assumptions used in a risk assessment are intended to ensure that the estimated risks do not underestimate the actual risks (USEPA 2005a; OEHHA 2015). Therefore, the estimated risks do not necessarily represent actual risks experienced by populations at or near a site. The use of conservative assumptions tends to produce upper-bound estimates of risk and usually overestimates exposures.

For this school-based risk assessment, the following conservative assumption was used (OEHHA 2004; OEHHA 2015):

- It was assumed the maximum exposed receptors (both students and staff) stood outside at the site for 8 hours per weekday (8:00 AM to 4:00 PM, Monday to Friday), 180 days per year for 7 years (6^{th} grade through 12^{th} grade students at Sun Valley Magnet School or TK through 5^{th} grade students at ISANA Cardinal Academy) or 250 days per year for 25 years (staff).

Thus, the estimated risks in this AQS are conservative.

2. Sun Valley Garage Site Description

The Sun Valley Garage (site or SVG) is located at 11247 Sherman Way in the Sun Valley neighborhood of Los Angeles. The SVG is approximately 0.4-mile west of the Burbank Airport and is bounded by Sun Valley Magnet School to the north, Bakman Avenue to the west, Sherman Way to the south, and ISANA Cardinal Academy and Sun Valley Health Center to the east. The site and vicinity are depicted in Figure 1.

The site is currently operating as a school bus yard for the District and includes gasoline and diesel fuel dispensing at the northeast portion of the site. The District is planning to convert one of the two existing diesel storage tanks and associated dispensing equipment to gasoline to better accommodate the District's current gasoline throughput at the facility. No change to the current gasoline throughput is planned.

There is also a compressed natural gas (CNG) compressor system at the southern boundary of the site that is owned and maintained by the Southern California Gas Company (SCG). There is currently a total of 165 CNG fuel dispensers at the SVG, including one fast-fill dispenser and 164 slow-fill dispensers located throughout the parking lot. Refined CNG provided by SCG is largely methane gas (80 to 99 percent), with minor amounts of ethane, propane, butane and carbon dioxide (all 0.1 to 5 percent) (SCG 2015). Natural gas is generally an odorless gas and is not considered to be a toxic air contaminant. Typically, an odorant such as mercaptan is added to CNG in trace amounts to ensure natural gas leaks do not go undetected. Since the individual CNG constituents and odorant are not considered toxic air contaminants by OEHHA, there would be no anticipated health risks from these sources to nearby sensitive receptors. An addendum to this AQS was prepared to determine the fugitive air emissions related to CNG storage and fueling and is provided in Appendix E.

According to information provided by the District Transportation Department, the SVG school bus fleet is predominantly CNG buses (~70 percent), 16 percent gasoline-fueled buses, 10 percent diesel-fueled buses, and 4 percent propane fueled buses.

2. Sun Valley Garage Site Description

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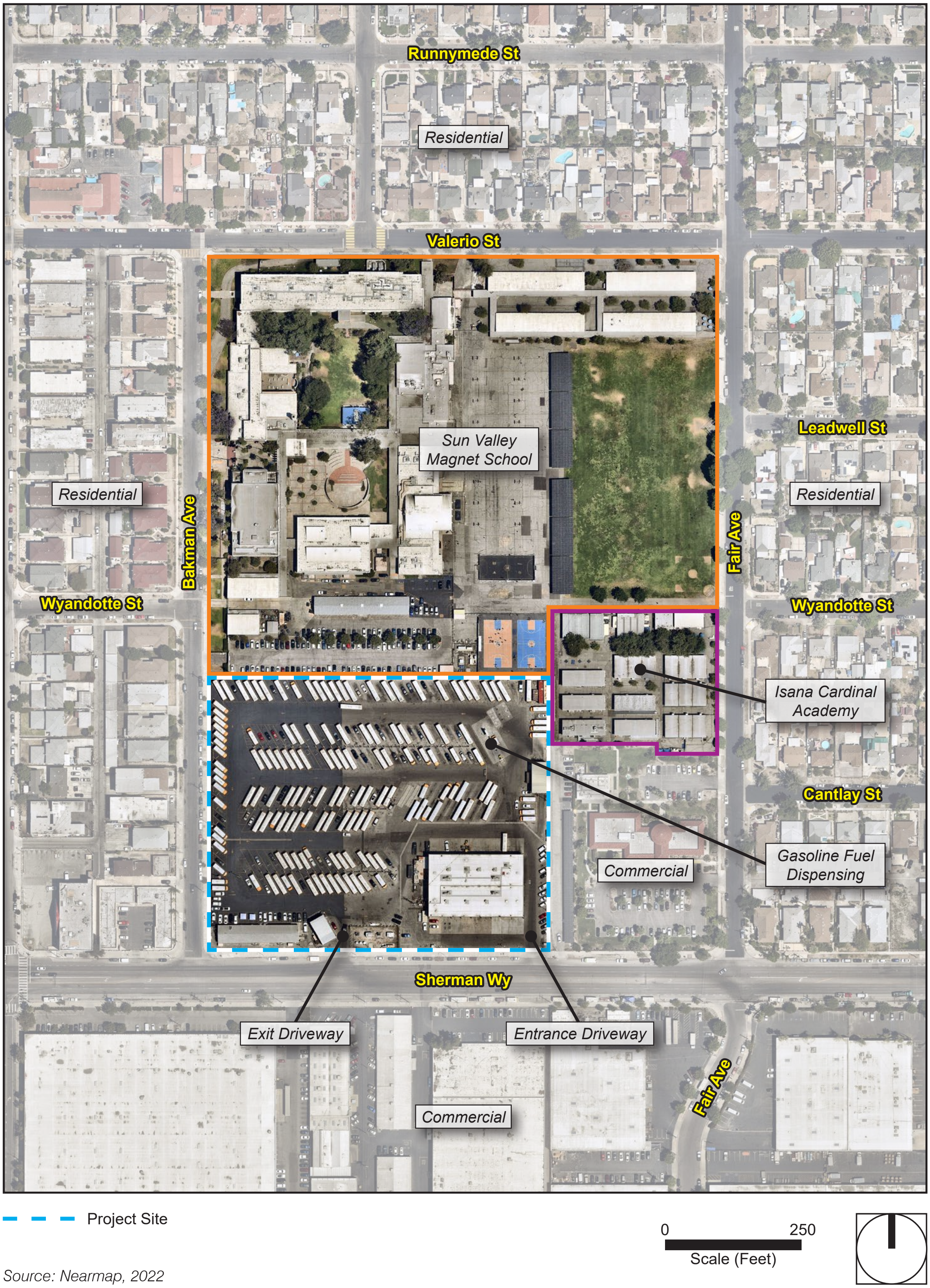
Figure 1 - Site Location



Source: Nearmap, 2022

2. Sun Valley Garage Site Description

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3. Vehicle Movement

To determine the temporal activity of vehicles at SVG, 24-hour traffic counts were collected over 3 consecutive school days from June 6 to June 8, 2022. Vehicles were observed entering and exiting the site using the two driveways fronting Sherman Way and were broken into four categories: passenger vehicles; small trucks and vans; large trucks/maintenance trucks; and school buses. Based on the collected traffic count information, the vast majority of vehicles entering the site use the eastern-most driveway and exit the site using the western-most driveway. The peak hour vehicle counts for each vehicle category evaluated is provided in Table 1.

Table 1 Peak Hour Vehicle Counts

Vehicle Category	Peak Hourly Vehicle Traffic – Entering Site (vehicles per hour)	Peak Hourly Vehicle Traffic – Exiting Site (vehicles per hour)
Class 1, Passenger Vehicles	88 (5AM-6AM)	31 (4PM-5PM)
Class 2, Small trucks and vans	24 (5AM-6AM)	16 (3PM-4PM)
Class 3, Large trucks	10 (7AM-8AM)	6 (7AM-8AM)
Class 4, School Buses	53 (9AM-10AM)	96 (6AM-7AM)

The full 24-hour traffic counts and temporal profile for each vehicle category is provided in Appendix A.

3. Vehicle Movement

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4. Emissions Inventory

The AQS evaluated the impact of potential long-term (chronic) and short-term (acute) exposure to air toxic emissions generated by vehicles traveling on-site, bus idling, and from gasoline fuel dispensing. Additionally, potential impacts were evaluated from exposures to criteria air pollutants emitted from on-site vehicle activity (particulate matter, carbon monoxide, and nitrogen dioxide).

Contaminant release information and associated chemical species were identified for each emission source through a review of available documentation. The toxic air contaminants emitted from each source are listed in Table 2.

Table 2 Toxic Air Contaminants Emitted by Source

Source	Contaminant
CNG-fueled School Buses	Acetaldehyde, Benzene, 1,3-Butadiene, Ethylbenzene, Formaldehyde, Propylene, Styrene, Toluene
Diesel-fueled Vehicles (large trucks and school buses)	Diesel particulate matter (DPM), Benzene, Formaldehyde, 1,3-Butadience, Acetaldehyde, Acrolein
Gasoline-fueled Vehicles (passenger vehicles, small trucks and vans, large trucks and school buses)	Acetaldehyde, Acrolein, Benzene, 1,3-Butadiene, Ethyl Benzene, Formaldehyde, Hexane, Methanol, Methyl Ethyl Ketone, Naphthalene, Propylene, Styrene, Toluene, Xylenes
Gasoline Dispensing (refueling, spillage and passive tank venting and loading)	Benzene, Ethyl Benzene, Napthalene
CNG Dispensing and Storage	No toxic air contaminants emitted

The California Air Resources Board (CARB) has developed the EMFAC emission factor model to account for the emission standards representative of the California fleet. EMFAC2017 was used to identify pollutant emission rates for total organic gases (TOG), diesel particulate matter (DPM), carbon monoxide (CO), nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) for the current year (2022). The PM_{10} emission factor for diesel-fueled vehicles was used as the surrogate for DPM.

EMFAC2017 is currently the USEPA approved version of EMFAC. However, EMFAC2017 does not provide emission rates for CNG-fueled school buses. Therefore, running and idling emission rates for CNG school buses were determined using EMFAC2021.

The fleet mix for each vehicle category was initially based on vehicle information provided by the District's Transportation Department. Where vehicle information was unavailable, a representative fleet distribution was based on EMFAC2017 fleet mix information. The vehicle fleet mixed used in the evaluation is provided in Table 3.

4. Emissions Inventory

Table 3 Vehicle Mix

Vehicle Category	EMFAC Category	Fuel-type
Class 1, Passenger Vehicles	LDA, light duty auto	gasoline
Class 2, Small trucks and vans	LDT1, light duty truck 1	gasoline
Class 3, Large trucks	LDHT1, light-heavy duty truck 1	69 percent of vehicles gasoline-fueled, 31 percent diesel-fueled
Class 4, School Buses	SBUS, school bus	16 percent of buses gasoline-fueled, 10 percent of buses diesel-fueled, Remaining buses CNG-fueled

A transient lot speed of 5 miles per hour was considered for all vehicles entering and exiting the site, with an assumed lot ingress/egress time of 5 minutes. For school buses, an idling time of 15 minutes was considered and added to the running emission rates to produce a composite emission rate.

Emission rates for the gasoline dispensing source were provided by the District as part of their permit to construct and operate application to South Coast AQMD. Emissions for refueling, hose permeation, spillage, tank loading and passive venting/breathing were included in the evaluation. The maximum proposed gasoline throughput of 50,000 gallons per month was used to calculate air toxic emission rates.

Appendix B contains the emission rate calculations for each source considered in the assessment.

5. Air Dispersion Modeling

Air quality modeling using the AERMOD atmospheric dispersion model was performed to assess the impact of emitted compounds on individuals who may work and/or attend the schools. The model is a steady state Gaussian plume model and is recommended by South Coast AQMD for estimating ground level impacts from point and fugitive sources in simple and complex terrain. For this assessment, adjacent volume sources were utilized to model emissions generated from mobile source activity. One set of the volume sources was created to characterize each vehicle class (four total sets of volume sources). Additionally, each of those sets were divided into a set representing vehicles entering the eastern portion of the site and a set representing vehicles exiting the western portion of the site. A source release height of 0.60 meter was used based upon CARB published *Risk Characterization Scenarios* (CARB 2000). Gasoline dispensing was modeled using guidance from South Coast AQMD and CARB relating to refueling, hose permeation, spillage, tank loading, and passive tank venting/breathing. The model's hour-of-day scalar option was invoked to predict concentrations from variable hourly emissions from vehicular traffic, based on temporal traffic profiles provided in Appendix A, and to predict concentrations the hours students and staff would be exposed to source emissions.

The model requires additional input parameters, including chemical emission data and local meteorology. Meteorological (met) data provided by South Coast AQMD for the Burbank Airport met station (2012-2016) was used to represent local weather conditions and prevailing winds. According to the data from the Burbank Airport met station, the prevailing wind direction in the area of the site is to the north. The wind rose and overall model setup are provided in Appendix C.

The modeling analysis also considered the spatial distribution and elevation of each emitting source in relation to the sensitive receptors. To accommodate the model's Cartesian grid format, direction-dependent calculations were obtained by identifying the Universal Transverse Mercator coordinates for source and receptor locations. In addition, national elevation dataset information for the site area were obtained and included in AERMOD to account for complex terrain.

For Sun Valley Magnet School and ISANA Cardinal Academy, a uniform cartesian grid of ground-level discrete receptors was generated in AERMOD to cover the two school sites. The maximum AERMOD-predicted pollutant concentrations from the model output files were then used to determine the potential health risks for the maximum exposed receptor (MER) at each school site. The air dispersion model output is presented in Appendix C.

5. Air Dispersion Modeling

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6. Risk Characterizations

6.1 CARCINOGENIC CHEMICAL RISK

Carcinogenic toxic air contaminants are not considered to have threshold levels (i.e., dose levels below which there are no risks). Any exposure, therefore, will have some associated risk. The South Coast AQMD has established a maximum incremental cancer risk of 10 in a million ($1x10^{-5}$) and the OEHHA also sets a typical risk management level as 10 in a million (OEHHA 2015).

Health risks associated with exposure to carcinogenic toxic air contaminants can be defined in terms of the probability of developing cancer as a result of exposure to a chemical at a given concentration. The cancer risk probability is determined by multiplying the chemical's annual concentration by its cancer potency factor (CPF), a measure of the carcinogenic potential of a chemical when a dose is received through the inhalation pathway. It is an upper-limit estimate of the probability of contracting cancer as a result of continuous exposure to an ambient concentration of one microgram per cubic meter ($\mu g/m^3$), averaged over a lifetime (OEHHA 2015).

A review of available guidance was conducted to determine applicability of the use of early life exposure adjustments to identified carcinogens. The USEPA provides guidance relating to the use of early life exposure adjustment factors (Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, EPA/630/R-003F; USEPA 2005b) whereby adjustment factors are only considered when carcinogens act "through the mutagenic mode of action." The USEPA has identified 19 compounds that elicit a mutagenic mode of action for carcinogenesis. None of the gaseous compounds considered in this AQS elicit a mutagenic mode of action. For diesel particulates, polycyclic aromatic hydrocarbons and their derivatives, which are known to exhibit a mutagenic mode of action, comprise less than one percent of the exhaust particulate mass. To date, the USEPA reports that whole diesel engine exhaust has not been shown to elicit a mutagenic mode of action. Therefore, early life exposure adjustments were not applied in this risk assessment.

Recent guidance from OEHHA recommends a refinement to the standard point estimate approach with the use of age-specific breathing rates to assess risk for susceptible subpopulations such as children. For the inhalation pathway, the procedure requires the incorporation of several discrete variates to effectively quantify dose for each age group. Once determined, contaminant dose is multiplied by the cancer potency factor in units of inverse dose expressed in milligrams per kilogram per day $(mg/kg/day)^{-1}$ to derive the cancer risk estimate. Therefore, to accommodate the unique exposures associated with the proposed school population, the following dose algorithm was used.

$$\text{Dose}_{\text{AIR,per age group}} = (\text{C}_{\text{air}} \times \text{EF} \times [\frac{\text{BR}}{\text{BW}}] \times \text{A} \times \text{WAF} \times \text{CF})$$

Where:

6. Risk Characterization

$Dose_{AIR}$	=	dose by inhalation (mg/kg-day), per age group
C_{air}	=	concentration of contaminant in air (μg/m³)
EF	=	exposure frequency (number of days /365 days); - 250 days/yr for staff; 180 days/yr for students
BR/BW	=	daily breathing rate normalized to body weight (L/kg-day)
A	=	inhalation absorption factor (default = 1)
WAF	=	worker adjustment factor (4.2)
CF	=	conversion factor ($1x10^{-6}$, μg to mg, L to m³)

The inhalation absorption factor (A) is a unitless factor that is only used if the cancer potency factor included a correction for absorption across the lung. The default value of 1 was used for this assessment. To represent the unique characteristics of the school population, the assessment employed the USEPA's guidance to develop viable dose estimates based on reasonable maximum exposure, defined as the "highest exposure that is reasonably expected to occur" for a given receptor population. Lifetime risk values for the student population were adjusted to account for an exposure frequency (EF) of 180 days per year for an exposure duration (ED) of 7 years (6th to 12th grade students at Sun Valley Magnet School; TK through 5th grade students at ISANA Cardinal Academy) (OEHHA 2004; OEHHA 2015). To assess staff-related risk, exposures were adjusted to account for an EF of 250 days per year and an ED of 25 years (OEHHA 2015). In addition, a worker adjustment factor (WAF) of 4.2 was applied for students and staff to account for increase day-time exposures during work hours (OEHHA, 2015).

To calculate the overall cancer risk, the risk for each appropriate age group is calculated per the following equation:

$$\text{Cancer Risk}_{\text{AIR}} = \text{Dose}_{\text{AIR}} \times \text{CPF} \times \frac{\text{ED}}{AT}$$

Where:

$Dose_{AIR}$	=	dose by inhalation (mg/kg-day), per age group
CPF	=	cancer potency factor, chemical-specific $(mg/kg\text{-}day)^{-1}$
ED	=	exposure duration (years); 25 years for staff; 7 years for students
AT	=	averaging time period over which exposure duration is averaged (always 70 years)

The CPFs used in the assessment were obtained from OEHHA guidance. The cancer risk is calculated separately for the students and staff, because of age differences in sensitivity to carcinogens and age differences in intake rates. The final step converts the cancer risk in scientific notation to a whole number that expresses the cancer risk in "chances per million" by multiplying the cancer risk by a factor of $1x10^6$ (i.e., 1 million). The determined cancer risks attributed to each chemical exposure and summation of those risks are presented in Appendix D.

6.2 NON-CARCINOGENIC HAZARDS

An evaluation was conducted for the potential non-cancer effects of chronic and acute toxic air contaminant exposures. Adverse health effects are evaluated by comparing the annual receptor level ground level concentration of each chemical compound with the appropriate Reference Exposure Level (REL). Available RELs promulgated by OEHHA were considered in the assessment.

The hazard index approach was used to quantify non-carcinogenic impacts. The hazard index assumes that chronic and acute sub-threshold exposures adversely affect a specific organ or organ system (toxicological endpoint). Target organs presented in regulatory guidance were used for each discrete chemical exposure. Each chemical concentration or dose is divided by the appropriate toxicity value to calculate the hazard index. The ratios are summed for compounds affecting the same toxicological endpoint. A health hazard is presumed to exist where the total equals or exceeds one.

CARB's Hotspots Analysis and Reporting Program (HARP2), Risk Assessment Standalone Tool was used to calculate the chronic, 8-hour, and acute (1-hour) health risk values at each school site (CARB 2022), and the determined hazard indices are provided in Appendix D.

6.3 CRITERIA AIR POLLUTANTS

The State of California has promulgated ambient air quality standards for various pollutants. These standards were established to safeguard the public's health and welfare with specific emphasis on protecting those individuals susceptible to respiratory distress, such as asthmatics, the young, the elderly, and those with existing conditions that may be affected by increased pollutant concentrations. A list of criteria air pollutants considered in the assessment and their associated air quality standards are presented in Table 4.

Table 4 California Ambient Air Quality Standards

Pollutant	Standard	Health Effects
Carbon Monoxide (CO)	>9.0 ppm (8 hr avg.) >20.0 ppm (1 hr avg.)	1) Aggravation of angina pectoris and other aspects of coronary heart disease. 2) Decreased exercise tolerance in persons with peripheral vascular disease and lung disease. 3) Impairment of central nervous system functions. 4) Possible increased risk to fetuses.
Nitrogen Dioxide (NO_2)	≥0.030 ppm (annual avg.) ≥0.18 ppm (1 hr avg.)	1) Potential to aggravate chronic respiratory disease and respiratory symptoms in sensitive groups. 2) Risk to public health implied by pulmonary and extra-pulmonary biochemical and cellular changes and pulmonary structural changes.
Particulates (PM_{10})	>50 $\mu g/m^3$ (24 hr avg.) >20 $\mu g/m^3$ (annual avg.)	1) Excess deaths from short-term exposures and the exacerbation of symptoms in sensitive individuals with respiratory disease. 2) Excess seasonal declines in pulmonary function especially in children.
Particulates ($PM_{2.5}$)	>12 $\mu g/m^3$ (annual avg.)	1) Excess deaths from short-term exposures and the exacerbation of symptoms in sensitive individuals with respiratory disease. 2) Excess seasonal declines in pulmonary function especially in children.

Notes: ppm: parts per million; $\mu g/m^3$: micrograms per cubic meter
Source: California Code of Regulations, Title 17, Section 70200.

6. Risk Characterization

Pollutant emissions are considered to have a significant effect on the environment if they result in concentrations that create either a violation of an ambient air quality standard, contribute to an existing air quality violation, or expose sensitive receptors to significant pollutant concentrations. Should ambient air quality already exceed existing standards, South Coast AQMD has established significance criteria that identify incremental air concentrations for selected pollutants. Table 5 outlines the significance thresholds considered for sites that are within an air basin where criteria pollutants exceed air quality standards.

Table 5 Localized Significance Thresholds

Pollutant	Averaging Time	Significance Criteria
Carbon Monoxide (CO)	8 Hours 1 Hour	Site contributes to exceedance of 9.0 ppm Site contributes to exceedance of 20 ppm
Nitrogen Dioxide (NO_2)	1 Hour	Site contributes to exceedance of 0.18 ppm
Particulates (PM_{10})	24 Hours	Site causes an incremental increase of 2.5 $\mu g/m^3$
Particulates ($PM_{2.5}$)	24 Hours	Site causes an incremental increase of 2.5 $\mu g/m^3$

Notes: ppm: parts per million; $\mu g/m^3$: micrograms per cubic meter
Source: South Coast AQMD, 2015. South Coast AQMD Air Quality Significance Thresholds.

The nearest active air quality monitoring station to the site with available data is the West San Fernando Valley (West SFV) Monitoring Station. Where information was not readily available for the West SFV Monitoring Station, information was obtained for the East San Fernando Valley and Central LA Monitoring Stations. Background concentrations are based on the highest observed value for the most recent three-year period. A summary of the monitoring station data is presented in Table 6.

Table 6 West San Fernando Valley Monitoring Station Summary

Pollutant/Averaging Time	Year			Maximum	CAAQS
	2018	2019	2020		
Carbon Monoxide (CO)					
1-Hour	3.4	2.6	2.4	3.4	20
8-Hour	2.1	2.2	2.0	2.2	9
Nitrogen Dioxide (NO_2)					
1-Hour	0.057	0.064	0.060	0.064	0.18
Particulates (PM_{10})					
24 Hour	81	62	77	81	50
Annual	34.1	25.5	23.0	34.1	20
Particulates ($PM_{2.5}$)					
Annual	22.6	26.3	27.6	27.6	12

Note: PM_{10} and $PM_{2.5}$ are expressed in micrograms per cubic meter (µg/m3). All others are expressed in parts per million (ppm).
Source: South Coast AQMD, 2022. Historical Data by Year.

For carbon monoxide (CO) and nitrogen dioxide (NO_2) background concentrations are below the current air quality standards. Therefore, impacts are considered to be significant when pollutant concentrations, added to existing background levels, result in an exceedance of the CAAQS. For particulate emissions, maximum background concentrations in the vicinity of the site exceed the California Ambient Air Quality Standard

(CAAQS) for the annual average averaging times and the 24-hour averaging time for PM_{10} concentrations. Additionally, for PM_{10} and $PM_{2.5}$ emissions, the site is within a non-attainment area for particulates (CARB 2020). As a result, South Coast AQMD defines a significant impact as PM_{10} and $PM_{2.5}$ concentrations that exceed the specified localized significance threshold (LST) of 2.5 $\mu g/m^3$ over an averaging time of 24 hours. The criteria air pollutant ground level concentrations at the site determined using AERMOD are provided in Appendix D.

6. Risk Characterization

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7. Results and Conclusions

The results of the AQS are provided in Table 7. In comparison to the threshold level of 10 in a million, carcinogenic risks are below the significance threshold value for school staff and students at both locations. For non-carcinogenic effects, the chronic hazard index identified for each toxicological endpoint totaled less than one at both school sites. Therefore, chronic non-carcinogenic hazards are below the significance threshold. Additionally, the acute 1-hour and 8-hour non-carcinogenic hazards were also below the significance thresholds.

Table 7 Results

Source	Cancer Risk (per million)		Chronic Hazard Index	Acute (1-Hour) Hazard Index	8-Hour Hazard Index
	Staff Exposure	Student Exposure			
Sun Valley Magnet School	4.4	2.0	0.073	0.27	0.071
ISANA Cardinal Academy	4.5	2.5	0.073	0.25	0.072
South Coast AQMD Threshold	10	10	1.0	1.0	1.0
Exceeds Threshold?	**No**	**No**	**No**	**No**	**No**

A comparison of the current air quality standards with the results of the modeling analysis for SVG vehicle criteria air pollutant emissions is provided below:

Sun Valley Magnet School Results

- For carbon monoxide (CO), the maximum one-hour concentration of 0.34 ppm and the maximum eight-hour concentration of 0.07 ppm, when added to existing background levels, do not exceed the CAAQS.
- For nitrogen dioxide (NO_2), the maximum one-hour concentrations of 0.0017 ppm when added to existing background levels do not exceed the CAAQS.[1]
- For PM_{10}, a maximum 24-hour concentration of 0.02 micrograms per cubic meter ($\mu g/m^3$) was predicted. The maximum 24-hour concentration does not exceed the South Coast AQMD significance threshold of 2.5 $\mu g/m^3$.
- For $PM_{2.5}$, a maximum 24-hour concentration of 0.02 $\mu g/m^3$ was predicted. The maximum 24-hour concentration for $PM_{2.5}$ does not exceed the South Coast AQMD significance threshold of 2.5 $\mu g/m^3$.

[1] Note: EMFAC2017 generates emission factors for nitrogen oxides (NOx). NOx to NO2 conversion rate was 0.053 derived from a report entitled Final Localized Significance Threshold Methodology (South Coast AQMD 2008).

7. Results and Conclusions

ISANA Cardinal Academy Results

- For carbon monoxide (CO), the maximum one-hour concentration of 0.33 ppm and the maximum eight-hour concentration of 0.11 ppm, when added to existing background levels, do not exceed the CAAQS.
- For nitrogen dioxide (NO_2), the maximum one-hour concentrations of 0.0016 ppm when added to existing background levels do not exceed the CAAQS.[2]
- For PM_{10}, a maximum 24-hour concentration of 0.04 micrograms per cubic meter ($\mu g/m^3$) was predicted. The maximum 24-hour concentration does not exceed the South Coast AQMD significance threshold of 2.5 $\mu g/m^3$.
- For $PM_{2.5}$, a maximum 24-hour concentration of 0.04 $\mu g/m^3$ was predicted. The maximum 24-hour concentration for $PM_{2.5}$ does not exceed the South Coast AQMD significance threshold of 2.5 $\mu g/m^3$.

Conclusion

Based on a comparison to the carcinogenic and non-carcinogenic thresholds established by OEHHA and South Coast AQMD, hazardous air emissions generated from the emission sources at the Sun Valley Garage are not anticipated to pose an actual or potential endangerment to students and staff at the schools and no mitigation measures are required.

[2] Note: EMFAC2017 generates emission factors for nitrogen oxides (NOx). NOx to NO2 conversion rate was 0.053 derived from a report entitled Final Localized Significance Threshold Methodology (South Coast AQMD, 2008).

8. References

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8. References

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Appendix E. CNG Addendum

Appendix

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PLACEWORKS

TECHNICAL MEMORANDUM

DATE	October 7, 2022
TO	Alex Campbell, CEQA Project Manager Los Angeles Unified School District 333 S. Beaudry Avenue Los Angeles, California 90017
FROM	Steve Bush, P.E., Senior Engineer
SUBJECT	Compressed Natural Gas Emissions Addendum Sun Valley Garage Air Quality Survey Project Number LASD1-33

1. Introduction

The Los Angeles Unified School District (District) commissioned an Air Quality Survey (AQS) to assess criteria air pollutant and toxic air contaminant emissions associated with on-site vehicular activity and related fuel dispensing operations at the existing Sun Valley Garage (site or SVG). The emissions are associated with on-site vehicular activity and fuel dispensing operations for the gasoline-fueled, compressed natural gas (CNG) fueled, and diesel-fueled vehicles and buses. SVG is located at 11247 Sherman Way in the Sun Valley neighborhood in the City of Los Angeles. Sun Valley Magnet School and ISANA Cardinal Academy are located immediately adjacent to SVG.

The emission sources evaluated in the AQS emit pollutants with health risk thresholds established by the South Coast Air Quality Management District (South Coast AQMD) and Office of Environmental Health Hazard Assessment (OEHHA). The evaluated sources included tail-pipe emissions from the District bus and vehicle fleet and gasoline dispensing operations. The AQS was completed in August 2022 and concluded that hazardous air emissions generated from the emission sources at the Sun Valley Garage are not anticipated to pose an actual or potential endangerment to students and staff at the two adjacent schools.

In 2022, the District received odor complaints from Sun Valley Magnet School and ISANA Cardinal Academy that could be associated with operations at SVG. Although natural gas is odorless and non-toxic, odorants are typically added in trace amounts to natural gas to assist in identifying pipeline and equipment leaks. A potential source of odors could be fugitive emissions from CNG fueling and operation at SVG. Additionally, a search of the Southern California Gas Company's online methane emissions map shows an identified leak of a natural gas pipeline along Bakman Avenue, immediately west of the SVG and just south of Sun Valley Magnet School.[1] This is a location where elevated levels of

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[1] Southern California Gas Company (SCG), 2022. Methane Emissions Map, accessed at https://www.socalgas.com/stay-safe/methane-emissions/methane-emissions-map on September 16, 2022.

methane were detection during routine inspections but was determined by field technicians to be non-hazardous and is scheduled for repair in December 2022. This pipeline methane leak could also be a potential source of the odors detected at Sun Valley Magnet School.

To address concerns for potential odors and emissions from CNG fueling and storage at SVG, the District commissioned an addendum to the AQS to evaluate CNG and odorant emissions from SVG at the two adjacent schools.

1.1 PROJECT LOCATION AND DESCRIPTION

The Sun Valley Garage is located at 11247 Sherman Way in the Sun Valley neighborhood of Los Angeles. The SVG is bounded by Sun Valley Magnet School to the north, Bakman Avenue to the west, Sherman Way to the south, and ISANA Cardinal Academy and Sun Valley Health Center to the east.

There is a CNG compressor system at the southern boundary of the site that is owned and maintained by the Southern California Gas Company (SCG). There is currently a total of 165 CNG fuel dispensers at the SVG, including one fast-fill dispenser located near the compressor system and 164 slow-fill dispensers located throughout the parking lot. The SVG site and vicinity are depicted in Figure 1 and the CNG equipment area is shown in Figure 2.

1.2 OBJECTIVES

This assessment is designed to meet the following objectives:

» Determine fugitive air emissions related to CNG operation and fueling.

» Determine potential odor emissions due to the odorant added to natural gas.

» Use air dispersion modeling to predict maximum ground-level methane and odorant concentrations at nearby off-site sensitive receptors.

» Compare the results to concentrations of concern and odor thresholds to determine potential impacts.

2. CNG Evaluation

2.1. SOURCE IDENTIFICATION AND OPERATIONS

Emissions at CNG fueling stations typically occur from fugitive equipment leaks and at the disconnection point of time-fill (also known as slow-fill) and fast-fill dispensers.[2] There are two gas compressors within sound attenuating enclosures, gas dryer units, and storage spheres within the CNG compressor area at the southern portion of the SVG. One fast-fill CNG dispenser is located immediately north of the compressor area and dispenses fuel to the District's CNG bus fleet throughout the day, as needed. The

[2] Clark, Nigel N., et. al., 2017. *Pumps-to-Wheels Methane Emissions from the Heavy-Duty Transportation Sector*, Environmental Science & Technology, 2017, issue 51, page 968-976.

CNG equipment area is approximately 450 feet south of the SVG northern property boundary and Sun Valley Magnet School and 430 feet southwest of ISANA Cardinal Academy. There are 164 total time-fill CNG dispensers located throughout the SVG parking lot and along the northern border of the site, adjacent to the Sun Valley Magnet School parking lot. There are 111 separate time-fill dispensing stands, with approximately 53 having two dispensing hoses and the remaining a single dispensing hose.

The CNG facility was installed circa 1994 in accordance with National Fire Protection Association's (NFPA's) standards, with additions to the facility between 2007 and 2012 which complied with the latest NFPA standards. NFPA Code 52 – Vehicular Natural Gas Fuel Systems Code requires 1) all CNG compression and dispensing equipment to be located a minimum of 10 feet from a building, mobile home, public sidewalk, highway, street, or road; 2) overpressure protection devices to be installed in the fueling transfer system to prevent overpressure of the vehicles; 3) protection of piping and hoses; 4) installation of emergency shutdown equipment at various locations within the CNG equipment area and installation of breakaway protection at the fuel dispensers; and 5) installation of emergency shut-off valves on the inlet side of the compressors that shut off the gas supply in the event that an emergency shutdown device is activated or a power failure occurs.

Typical CNG bus operations at SVG involve the existing 143 CNG school buses disconnecting from the time-fill dispensers in the early morning, starting their routes between 5:00 AM and 7:00 AM, returning mid-day and in the afternoon and re-connecting to refuel overnight. However, buses do periodically return and reconnect to the time-fill dispensers during the day. The fast-fill dispenser is used periodically throughout the day by some of the CNG buses. The two compressors mainly cycle on in the evening hours and overnight to get the pressure up to 4,200 pounds per square inch (psi) and then shut off. However, there are times that the compressors cycle on during the day. The amount of time that the compressors are on varies daily. For the purposes of this study, it was conservatively assumed that the two compressors were in operation for approximately 6 hours per day.

2.2. EMITTED COMPOUNDS

Methane (CH_4) (i.e., natural gas) is an odorless gas and is not considered to be a toxic air contaminant. According to the material safety data sheet for natural gas provided by SCG, the components in the natural gas within SCG pipelines and CNG facilities is 80 to 99 percent methane, 0.1-to 12 percent ethane, 0 to 5 percent propane, up to 1.5 percent butane, and 0 to 3 percent carbon dioxide.[3] These components of natural gas are not identified by OEHHA as air toxics with risk thresholds. However, methane is considered to be an asphyxiant at very high concentrations (500,000 parts per million) by displacing oxygen in the air, occurring in conditions where methane could accumulate in an enclosed space. This would not occur for conditions at the SVG or at the adjacent schools because the CNG dispensers and equipment are in open-air environments, which allows methane to rapidly disperse into the atmosphere as it is lighter than air. There is no Occupational Safety and Health Administration (OSHA) standard for methane, but the National Institute for Occupational Safety & Health (NIOSH)

[3] Southern California Gas Company, 2015. Safety Data Sheet for Natural Gas product. Date May 2015.

recommends a threshold limit value (TLV) of 1,000 parts per million (ppm) for workers over an 8-hour exposure period.

Odorants are added to natural gas in pipelines as a safety precaution because natural gas in its pure state is completely odorless. These chemicals add a characteristic "gas" smell, thus reducing the risk that leaks would go undetected, and gas could accumulate to hazardous levels. These odorants are added in trace amounts to maintain an average total sulfur content between 0.1 to 0.25 grains of sulfur per 100 standard cubic feet (0.1 gr/100 SCF).[4] By volume, this translates to a sulfur content of approximately 1.6 to 4 ppm. The level of odorant is intended to be high enough to detect a potential leak but low enough that it would not create a short-term acute hazard.

SCG would not provide the concentration or type of odorant that is supplied to SVG in its pipeline. However, SCG typically injects a 50/50 blend of tertiary-butyl mercaptan (TBM) and tetrahydrothiophene (THT), the latter which is not a mercaptan.[5] Neither compound has an OSHA or NIOSH threshold limit value for inhalation exposure. In comparing the odor detection thresholds for each component, TBM has an odor detection threshold as low as 0.0027 parts per billion (ppb) while the odor threshold for THT is at approximately 1 ppb.[6,7] TBM was selected as the surrogate odorant compound for this analysis since the odor detection threshold is much lower than THT and would, therefore, be detected at a lower concentration than THT. Methane and TBM emissions calculations are provided in Appendix A.

2.3. ODOR ANALYSIS

Human response to odors is highly subjective and variable between individuals. Perception of whether an odor is offensive depends on many characteristics, such as odor type, concentration, intensity, and quality. Where some people detect an odor to be strong, others may sense it as weak or even non-existent. The perception of odor not only depends on the characteristics and concentration of the odorant but also the characteristics of the person smelling the odorant.[8] People who live in agricultural

[4] Southern California Gas Company, 2022. Response email sent Noreen Chambers, Senior Account Executive for Southern California Gas Company to Steve Bush, Senior Engineer for PlaceWorks on September 16, 2022.

[5] Southern California Gas Company, 2017. Response to data request for Aliso Viejo Canyon facility, dated May 22, 2017.

[6] American Industrial Hygiene Association (AIHA), 2013.*Odor Thresholds for Chemicals with Established Health Standards, 2nd Edition*.

[7] Tenkrat, D., et. al., 2010. *Natural Gas Odorization*, ISBN: 978-953-307-112-1, InTech, Published August 18, 2010.

[8] Integrated Waste Management Board, 2007. *Comprehensive Compost Odor Response Project.* Produced under contract by San Diego State University. Dated March 2007.

areas may be accustomed to smells associated with livestock or agricultural operations, whereas others may find the same smells to be objectionable. A person's expectation for the presence of odors and the degree to which the odor is objectionable dictates whether a particular smell constitutes a public nuisance.

Meteorology can also affect the dispersion of odors. High temperatures in summer can result in greater emissions because of increased compound volatility. However, odors tend to disperse more readily because of unstable conditions. In the winter, there are lower emissions due to lower temperatures but also less dispersion due to stable atmospheric conditions. Wind direction and the frequency of odor detection also play an important role in determining potential odor impacts by affecting whether a person is desensitized to a particular smell. Consistent exposures to a particular smell may cause desensitization. Consequently, sensitive receptors that are not generally downwind of odor sources may find these odors more objectionable due to less frequent exposure.

Five years of meteorological (met) data were used for this analysis to determine the maximum methane concentrations and potential odor concentrations from the natural gas mercaptans at off-site receptors for different seasons, stability classes, and wind speeds.[9]

2.4. AIR DISPERSION MODELING

Air quality modeling using the AERMOD atmospheric dispersion model was performed to assess the impact of emitted compounds on individuals who may work and/or attend the adjacent schools. The model is a steady state Gaussian plume model and is recommended by South Coast AQMD for estimating ground level impacts from point and fugitive sources in simple and complex terrain. Adjacent volume sources were utilized to model emissions generated from fuel dispensers and compressor enclosures.

The model requires additional input parameters, including terrain data and local meteorology. Meteorological data provided by South Coast AQMD for the Burbank Airport met station (2012-2016) was used to represent local weather conditions and prevailing winds. According to the data from the Burbank Airport met station, the prevailing wind direction in the area of the site is to the north. The wind rose and overall model setup are provided in Appendix B.

The modeling analysis also considered the spatial distribution and elevation of each emitting source in relation to the sensitive receptors. To accommodate the model's Cartesian grid format, direction-dependent calculations were obtained by identifying the Universal Transverse Mercator coordinates for source and receptor locations. In addition, national elevation dataset information for the site area were obtained and included in AERMOD to account for complex terrain. Source emissions were assumed to occur 24 hours per day, 7 days per week in the model. This is a conservative assumption because the compressors typically cycle on overnight and the majority of buses disconnect from the time-fill dispensers in the early morning hours, prior to typical school hours of 8:00AM to 4:00PM. Therefore,

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[9] South Coast AQMD, 2012-2016. *Data Set for Burbank Airport Meteorological Station*.

the predicted pollutant concentrations at the adjacent schools are conservatively modeled to be higher than what would typically be expected for exposures during school hours.

For Sun Valley Magnet School and ISANA Cardinal Academy, a uniform cartesian grid of ground-level discrete receptors was generated in AERMOD to cover the two school sites. The maximum AERMOD-predicted 1-hour pollutant concentrations from the model output files were then used to determine the potential health risks for the maximum exposed receptor (MER) at each school site. The air dispersion model output is presented in Appendix B.

2.5. EMISSIONS ASSESSMENT

The fugitive CNG emissions from SVG were modeled to determine maximum 1-hour methane and odorant concentrations (in parts per million, ppm) at the adjacent schools. The results of the air dispersion modeling are summarized in Table 1, *Methane and Mercaptan Concentrations*.

Because the nose can detect odors very quickly and odors are often transient in nature, an averaging period of less than one hour is also appropriate for determining odor impacts. Therefore, an additional calculation was performed to convert the 1-hour maximum concentration to a short-term (i.e., 15-minute average) concentration, using the following formula:

$$\frac{C_{T1}}{C_{T2}} = \left(\frac{T1}{T2}\right)^{-0.35}$$

If T2 = 60 minutes and TI = 15 minutes, then the peak 15-minute average concentration (C_{T1}) is equal to 1.6 times the 60-minute average concentration (C_{T2}). The model output calculations are provided in Appendix C.

Table 1 Methane and Mercaptan Concentrations

RECEPTOR LOCATION	METHANE CONCENTRATIONS	TERTIARY-BUTYL MERCAPTAN CONCENTRATIONS	
	MAX 1-HOUR (PPM)	MAX 1-HOUR (PPM)	15-MINUTE (PPM)
Sun Valley Magnet School	0.057	9.1×10^{-8}	1.5×10^{-7}
ISANA Cardinal Academy	0.022	3.5×10^{-8}	5.6×10^{-8}
Odor Threshold	N/A	2.7×10^{-5}	2.7×10^{-5}
Exceeds Threshold?		No	No

Note: Max 1-hour natural gas concentrations from air dispersion model, converted to tertiary-butyl mercaptan. Tertiary-butyl mercaptan concentrations calculated by multiplying max 1-hour natural gas concentrations by the volume percentage of odorant (1.6 ppm tertiary-butyl mercaptan).

As shown in Table 1, the maximum methane concentration of 0.057 ppm is well below any level of concern (1,000 ppm) and does not pose a risk to students and staff at the adjacent schools. The modeled odorant concentrations are below the limit of odor perception (0.0027 ppb or 2.7×10^{-5} ppm for TBM) for outdoor school occupants. It should also be noted that the peak 15-minute TBM concentration of 1.5×10^{-7} ppm would occur in the parking lot area immediately north of SVG and the concentration of 5.6×10^{-8} ppm would occur at the southwest corner of the ISANA Cardinal Academy site to the east of SVG.

2.6. ODOR COMPLAINTS

A request for odor complaints related to SVG was submitted to South Coast AQMD on September 14, 2022 over the most recent 5-year period from January 1, 2017 to September 14, 2022. A response from South Coast AQMD was received on September 15, 2022, stating that no odor complaints were reported for SVG.[10]

2.7. SHORT-TERM HAZARDS

The South Coast AQMD and other state and federal agencies have not established air quality standards for TBM or THT in ambient air. There are no federal or state OSHA or NIOSH exposure limits for either compound. The material safety data sheet for Spotleak 1039, which is a 50/50 mix of THM and THT and is the odorant used by SCG, states that both compounds are practically non-toxic via the inhalation pathway.[11] Lastly, the 4-hour acute toxicity value for Spotleak 1039 is estimated to be 11,000 ppm, which is much higher than the predicted TBM air concentrations at the nearby school sites (Table 1). Therefore, exposure of students and staff to odors related to natural gas emissions would not pose a short-term or long-term health risk.

[10] South Coast Air Quality Management District, 2022. Response E-mail from Michelle Card, Public Records Coordinator, Information Management at South Coast AQMD to Steve Bush, Senior Engineer at PlaceWorks on September 15, 2022.

[11] Arkema, 2019. Material Safety Data Sheet, Spotleak® 1039. 50/50 Mix of TBM and THT. Used by SCG as an odorant.

3. Conclusions

Fugitive emissions from operations at the SVG were modeled to determine methane and mercaptan concentrations at the two adjacent school sites. Tertiary-butyl mercaptan was selected as the surrogate compound to determine the potential for odors from SVG to impact the school sites. Methane and TBM concentrations at the schools were determined using air dispersion modeling. The model predicted a maximum methane concentration of 0.057 ppm, which is well below the TLV for workers of 1,000 ppm for an 8-hour exposure. TBM concentrations at Sun Valley Magnet School and ISANA Cardinal Academy were all below the odor threshold for TBM of 2.7 x 10^{-5} ppm. No odor complaints attributable to the SVG were filed with the South Coast AQMD over the last five years. It is possible that the natural gas pipeline leak reported by SCG beneath Bakman Avenue and adjacent to Sun Valley Magnet School may be the source of the reported odors. This pipeline is scheduled for repair in December 2022.

It should be noted that the methodology used to estimate fugitive CNG emissions and odorant concentrations were based on conservative assumptions. The USEPA notes that conservative assumptions used in a risk assessment are intended to ensure that the estimated risks do not underestimate the actual risks.[12] For this odor assessment, the following conservative assumptions were used:

- The two CNG compressors each operate for 6 hours per day and throughout the day, while they typically cycle on mostly overnight when students are not present.
- CNG leaks from fuel dispenser disconnection from buses was assumed to occur throughout the day. However, it most frequently occurs in the early morning hours between 5:00AM and 7:00AM when students are not present.
- Tertiary-butyl mercaptan (100 percent) was selected as a surrogate odorant compound for the analysis since it is a reported odorant used by the Southern California Gas Company and the odor detection threshold is much lower than other odorants. However, it was conservatively assumed that the amount of TBM in the natural gas pipeline was much higher than would actually occur in SCG natural gas, since it typically is a 50/50 mix of TBM and THT.

In summary, methane concentrations and potential odors from operation of the SVG are not anticipated to adversely impact students and staff at the schools. The modeling results show that the reported methane concentrations are well below any safety hazards and the mercaptan concentrations are well below odor detection thresholds and short-term hazard levels. Based on the typical odorant amounts added to natural gas and the odors being reported at the adjacent schools, it is possible there could be momentary instances when fugitive methane and odorant concentrations are more than 3 orders of magnitude greater than the concentrations predicted by the modeling and exceed the odor threshold. However, it should be noted that short-term exposures to methane would not pose a potential health hazard at concentrations 5 orders of magnitude greater than the modeled results in Table 1. Therefore,

[12] United States Environmental Protection Agency (USEPA). 2005a. *Guideline on Air Quality Models* (Revised). EPA-450/2-78-027R

the modeling in this study shows that the potential methane or odorant concentrations that off-site staff and students may be chronically exposed to are below levels of concern.

Respectfully submitted,

PlaceWorks

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