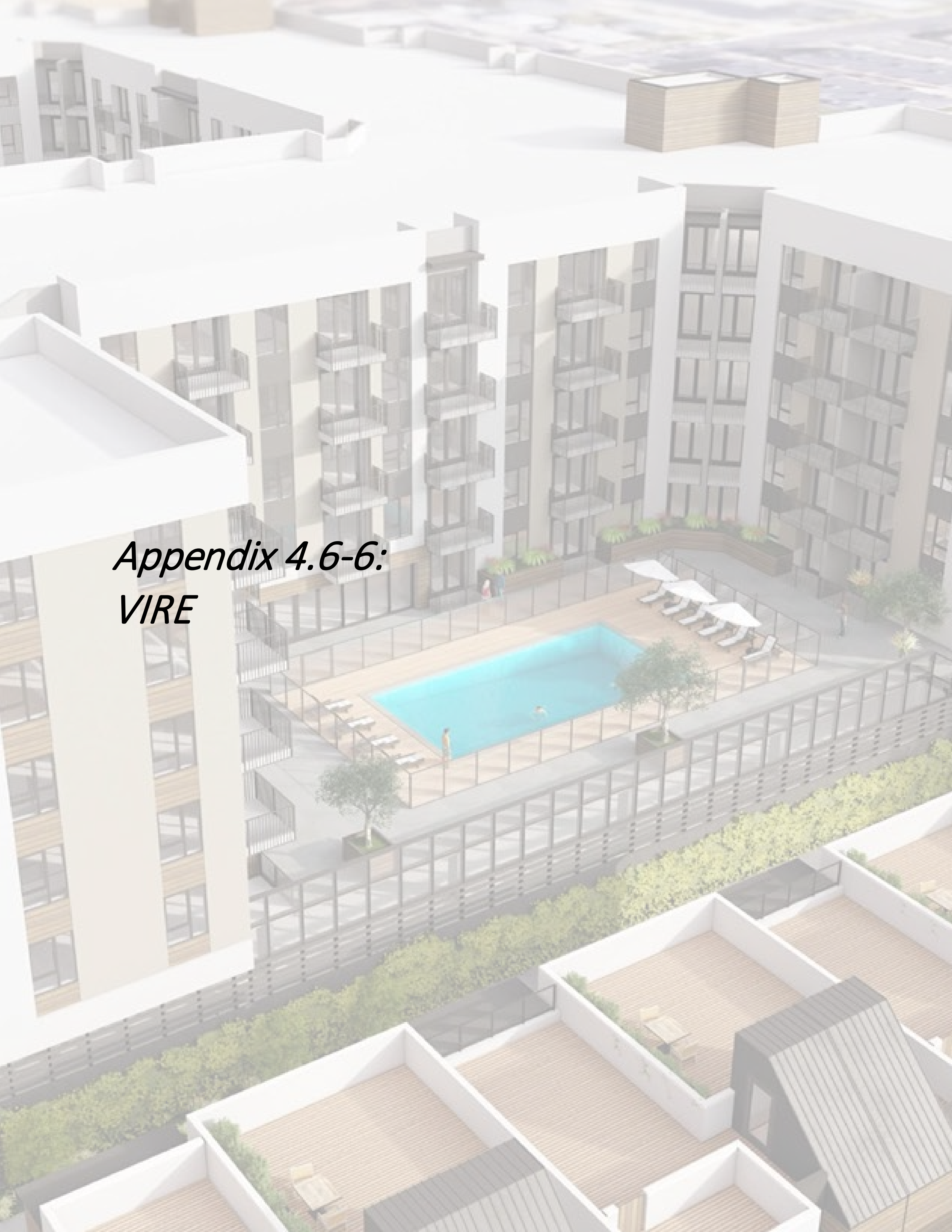
Appendix 4.6-6: VIRE



TECHNICAL MEMORANDUM

To: Greg Tsujiuchi and Lisa Kranitz, City of Gardena

From: Jason Sheasley and Jennifer Steen

Date: September 7, 2023

Subject: **Vapor Intrusion Risk Evaluation for Normandie Crossing Project Peer Review Updates Peer Review**

Kimley-Horn has conducted a follow-up third-party peer review of the Project's Vapor Intrusion Risk Evaluation (VIRE) Technical Memorandum (Hillmann Engineering, Inc., August 2023) on behalf of the City of Gardena to verify that Kimley-Horn's March 15, 2023 third-party peer review Technical Memo (TM) recommendations have been incorporated. The revised August 2023 Technical Memorandum addressed the third-party peer review comments and thus is in compliance with the TM recommendations. The analysis, as revised, meets the applicable provisions of CEQA and the State CEQA Guidelines and is adequate for inclusion in the Project EIR.

Please do not hesitate to contact Jennifer Steen at 714.705.1340 or Jennifer.Steen@kimley-horn.com with any questions.

HILLMANN
CONSULTING

TECHNICAL MEMORANDUM

Vapor Intrusion Risk Evaluation

16829-16839 South Normandie Avenue
Gardena, California

Prepared for:

16911 Normandie Associates LLC
134 Lomita Street
El Segundo, CA 90245

Hillmann Project: C3-9697

August 11, 2023

At the request of 16911 Normandie Associates, LLC (Normandie), Hillmann Consulting, LLC (Hillmann) conducted a Vapor Intrusion Risk Evaluation (VIRE) for the property located at 16829-16839 South Normandie Avenue in Gardena, California (the Site). The purpose of the VIRE was to assess whether the presence of volatile organic compounds (VOCs) detected in soil gas under the Site could pose a potential health risk or hazard to future residents at a residential complex to be built at the Site. This assessment was completed to the specifications outlined in the California Department of Toxic Substance Control's February 2023 Draft Supplemental Guidance.

Background

According to a site investigation report conducted for the Site (Partner, 2021), the subject property consists of three parcels of land comprising approximately 1.35 acres located on the southwest corner of the intersection of South Normandie Avenue and 169th Street within a mixed industrial and residential area of Gardena, California. Until November 2021, the subject property was developed with three light-industrial buildings. In addition to the structures, the subject property was improved with asphalt-paved and unpaved parking areas.

An environmental investigation conducted at the Site by Partner Engineering and Science, Inc. (Partner; 2021) revealed the presence of VOCs in soil gas at the Site. The VOCs detected in soil gas and maximum detected concentrations are summarized in Table 1.

Plans exist to develop the Site into a residential complex that will span this property and the adjacent 4-acre property at 16911 South Normandy extending south to 170th St as depicted in Figure A. The new residential development is slated to consist of 328 apartments in a 7-story building plus 75 townhomes. The ground and second floors of the apartment building will include a parking structure, an entrance lobby, a fitness center, trash/recycling room, and various electrical/mechanical closets. Residential apartments will be located on the third floor of the apartment building and above. The townhomes will be 3 stories plus roof deck with a slab on grade garage. The apartment building spans the 16829 and 16911 South Normandie properties roughly equally while 7 of the townhomes will be built on the 16829 South Normandie property and the others on the 16911 South Normandie property. The analysis and conclusions of this report pertain to the entire apartment building and any townhomes constructed on the 16829 South Normandie Property.

It is conceivable that VOCs detected in soil gas under the Site may escape to the surface. Thus, the chemical volatilization and eventual escape into ambient air is considered to be a potential exposure pathway for future onsite residents. Vapor intrusion occurs when VOCs from contaminated soil gas migrate upwards toward the ground surface and into overlying buildings through gaps and cracks in foundation slabs. The route VOCs take from a subsurface source to the air inside a building is referred to as the vapor intrusion pathway.

Introduction

For the vapor intrusion pathway to be complete, there must be a pneumatic connection between the source (impacted soil, soil gas or groundwater) and the occupied building. The pneumatic connection between the source and the occupied building is essential since it is the medium through which VOC vapors move by diffusion from higher to lower concentrations. Soil gas flowing through the air medium also carries contaminants wherever it moves, by advection (i.e., soil gas flow), in particular from the sub-slab region into buildings. The pneumatic connection between the contaminant source and indoor air is not present when the residential units are constructed over stilts or a parking structure.

In an effort to gauge the level of protection the parking structure will provide the future residential units, this VIRE evaluated health risks and hazards under two distinct exposure scenarios as described below:

1. **Slab-on-Grade Building**: Under this exposure scenario it is assumed that all buildings will be built at slab-on-grade; and,
2. **Over Parking Structure**: Under this exposure scenario it is assumed that future onsite residential units will be constructed over a parking structure.

This VIRE estimated indoor air chemical concentrations that may result from the flux of VOCs under the two exposure scenarios evaluated. For both exposure scenarios it was assumed that future residents will be exposed to indoor air while at the Site. The exposure duration for future occupants was assumed to be 24 hours per day, 350 days per year for up to 26 years.

Vapor Intrusion Risk Evaluation Methodology

Risk characterization involves estimating the magnitude of the potential adverse health effects that could occur due to chronic, long-term exposure to chemicals identified in soil gas at the site and its immediate vicinity. The risk characterization is based on the results of the dose-response (toxicity) and exposure assessment.

It is known that chemicals may migrate through environmental media from their source to a point where human receptors may be exposed. Therefore, it was necessary to determine if the detected VOCs – given their residual concentrations, locations, soil physical characteristics, weather conditions, etc. – could potentially migrate up to the surface (where human receptors may be exposed).

Screening-level emission estimation methods were used to predict potential indoor and outdoor air chemical concentrations that may result from the flux of chemical vapors potentially released from soil gas sources detected under the site. The estimated flux and indoor or outdoor air concentrations were then used to evaluate potential health risks that may result from exposures that could occur at the parking lot.

Slab-on-Grade Building Exposure Scenario

California Department of Toxic Substances Control (DTSC) guidance recommends that multiple lines of evidence be used when evaluating the potential risk and hazards posed by vapor intrusion. DTSC recommends that the indoor air chemical concentrations that can result from vapor intrusion be estimated using the following equation:

$$AF = \frac{C_{indoor}}{C_{soil\ gas}}$$

Where:

AF = Attenuation factor (unitless)

C_{indoor} = Indoor air concentration (micrograms per cubic meter [ug/m^3])

$C_{soil\ gas}$ = Soil gas concentration (ug/m^3)

Using the above equation, the indoor air chemical concentration can be estimated by multiplying the known soil gas concentration by the default attenuation factor (AF).

In accordance with Cal-EPA (2023) guidance, a default AF of 0.03 was used in the vapor intrusion evaluation. This conservative AF is based on an empirical attenuation factor study predominantly comprised of single-family homes, constructed with basements, located in areas with colder climates that are not reflective of Site characteristics (Ettinger et al., 2018). Furthermore, this AF of 0.03 does not account for Site-specific conditions such as soil type, soil moisture content, or sample depth which can significantly increase the amount of vertical attenuation.

The model assumes that the concentrations in indoor air are proportional to the flux throughout the soil column, and that a gas infiltrating into the building through the foundation floor is uniformly and instantaneously mixed within the air space above the lowest occupied floor of the building. Because this model ignores a number of possible mitigating factors, it is likely that it over-predicts the chemical flux to indoor air. However, because of its simplicity, this approach provides a simple method to estimate the likely maximum rate at which chemicals would be transported to the surface soils and into a building.

The indoor air chemical concentrations estimated to result from the volatilization of VOCs could be considered to represent a "worst-case" estimate. In the calculations, it was assumed that single chemical compounds are volatilizing, traveling alone through the vadose zone and escaping to ambient air. In reality, all chemicals detected at the site are competing with each other for available soil-pore space. It is well known that chemical volatilization and migration is limited by the vapor saturation in the vadose zone. Indoor air VOC concentrations estimated using the AF of 0.03 are presented in Table 2.

Residential Units Constructed over Parking Structure Exposure Scenario

Under this exposure scenario it was assumed that the future residential units will be built over a parking structure. Under these conditions, future onsite residents may be exposed to VOC vapors released from soil gas sources.

For this assessment, it was assumed that the parking structure to be constructed at the base of the building will be designed with enough ventilation to dissipate combustion engine exhaust emissions from the vehicles that will operate in the parking structure. Nonetheless, it is conceivable that VOC vapors from subsurface sources may escape to outdoor air through subsurface conduits around the parking structure. Then, from outdoor air the VOC vapors could enter the future building through open doors, windows or the building's ventilation system. If this sequence of events were to take place at the subject property, future occupants of the building would be exposed to VOC vapors released from deep sources. While these sequences of events are not likely to occur at the site, this potential exposure pathway is evaluated in this VIRE.

Maximum soil gas concentrations detected at the Site are summarized in Table 1. For the purposes of this evaluation, it was assumed that the maximum VOC concentrations detected at 5 feet below ground surface (bgs) represent the VOC fraction that would be migrating to the surface.

Potential migration of vapors from soil gas to outdoor air was estimated using the Shen model as recommended by the United States Environmental Protection Agency (USEPA; 1988). This model was selected because it provides the maximum vapor flux that can be expected from volatile chemicals in soil gas. The Shen model assumes that the source of vapors is non-diminishing and continuous. However, it is known that the VOC pool in soil gas is constantly being reduced by volatilization and reaction with soil chemicals; therefore, the results of the Shen model are conservative estimations. The mathematical expression of the Shen model is:

$$Fi = \frac{Di \cdot Cs \cdot Pt^{\frac{4}{3}}}{d}$$

Where:

Fi	=	Flux of component i, in micrograms per centimeter squared per second ($ug/cm^2/sec$)
Di	=	Chemical diffusion coefficient in air, in centimeters squared per second (cm^2/sec)
Cs	=	Soil gas concentration, in micrograms per cubic centimeter (ug/cm^3)
Pt	=	Total soil porosity, unitless
d	=	Depth to vapor source, in centimeters (cm)

Chemical-specific diffusion coefficients were obtained from the VLOOKUP table of the Johnson and Ettinger model. The distance below ground surface to top of vapor source (d) was assumed to be equal to the depth where the soil gas samples were collected (5 feet). All input parameters and equations used in the volatilization modeling are shown in Table 3. The maximum VOC flux rates, as predicted by the Shen model, are also shown in Table 3. The estimated VOC vapor flux provided the basis for estimating air concentrations in outdoor air as described below.

Outdoor Air VOC Concentration Modeling

A simple atmospheric dispersion model, commonly called a box model, is frequently used to estimate ambient air concentrations of chemicals at locations close to the sources of the chemical emissions. A box model is a simple mass balance equation that uses the concept of a theoretically enclosed space or box over the area of interest. The model assumes the emission of compounds into a box, with their removal rate from the box being proportional to wind speed. Airborne concentrations for this enclosed space can then be calculated and used as the ambient air chemical concentration. The exposure concentration in the theoretical box is calculated using the following equation:

$$Co = \frac{Fi \bullet L}{u \bullet h}$$

Where:

Co	=	Chemical concentration inside box, in micrograms per cubic meter (ug/m^3)
Fi	=	Flux of component i, in $ug/cm^2/sec$
L	=	Downwind length of box, in cm
u	=	Wind speed, in centimeters per second (cm/sec)
h	=	Height of the box, in cm

A wind speed of 412 centimeters per second (8.0 knots) was used. This wind speed is the average wind speed for calm, typical days in Southern California (https://weather-and-climate.com). The downwind length of the box was assumed to be equal to 100 feet (3,048 centimeters). The height of the box was assumed to be 9.14 meters (30 feet). This height was selected to cover the height of a three-story residential building. The parameters and results obtained from the box model are presented in Table 3. The outdoor air VOC concentrations obtained from the box model were used to calculate uptake via inhalation for potential receptors within the assumed residential building.

Toxicity Values

The toxicity assessment characterizes the relationship between the magnitude of exposure to a contaminant of potential concern (COPC) and the nature and magnitude of adverse health effects that may result from such exposure. For the purposes of calculating exposure criteria to be used in risk assessments, adverse health effects are classified into two broad categories: carcinogens and non-carcinogens. Toxicity values/exposure criteria are generally developed based on the threshold approach for non-carcinogenic effects and the non-threshold approach for carcinogenic effects. Toxicity values may be based on epidemiological studies, short-term human studies, and sub-chronic or chronic animal data.

A reference concentration (RfC) is an exposure concentration in air that is not expected to cause adverse health effects over a lifetime of daily exposure in the most sensitive population. All RfCs used in this evaluation to estimate non-carcinogenic chronic health hazards are presented in Table 4.

Health risks for exposures to carcinogens are defined in terms of probabilities. The probabilities quantify the likelihood of a carcinogenic response in an individual that receives a given dose of a particular compound. These probabilities are calculated based on the potential exposure concentration and the inhalation unit risk (IUR) for a chemical.

The IUR, which is expressed in units of inverse micrograms per cubic meter $(ug/m^3)^{-1}$, is the 95% upper confidence limit (UCL) of the probability of carcinogenic response per unit daily exposure to a given chemical concentration over a lifetime. The IUR multiplied by the lifetime exposure concentration of the chemical provides an estimate of the 95% UCL of the theoretical cancer risk for the specific chemical. The IURs used in this evaluation to estimate carcinogenic dose-assessment risks are presented in Table 4.

In this assessment, chronic toxicity criteria were selected in accordance with the DTSC Regulation "Toxicity Criteria for Human Health Risk Assessment" (effective September 2018) (https://dtsc.ca.gov/LawsRegsPolicies/Regs/Toxicity-Criteria-for-Human-Health-Risk-Assessment). Toxicity information was obtained from the DTSC Human and Ecological Risk Office (HERO) Human Health Risk Assessment (HHRA) Note 10, Toxicity Criteria (DTSC, 2019). All toxicity values used in this evaluation are summarized in Table 4.

Risk Characterization

This section discusses the methods used to quantify the exposure concentration (EC) for potential residential receptors at the Site. The estimated ECs for each VOC were used to estimate the potential for carcinogenic health risks and non-carcinogenic adverse health effects. The potential inhalation exposures were calculated using the following equation (USEPA, 2009):

$$EC = \frac{CA \bullet ET \bullet EF \bullet ED}{AT}$$

Where:

EC	=	Exposure concentration, ug/m^3
CA	=	Chemical concentration in air, ug/m^3
ET	=	Exposure time, hours/day
EF	=	Exposure frequency, days/year
ED	=	Exposure duration, years
AT	=	Averaging time, hours (used the equivalent of 70 years for carcinogens and same value as ED for non-carcinogens).

Inhalation intake factors were combined with estimated indoor air chemical concentrations (CA) to obtain the exposure concentration for future onsite residents. Exposure parameters used to characterize future adult and child residents are presented in Table 5.

Non-Carcinogenic Health Hazard Evaluation

The evaluation of non-carcinogenic health hazards began with a calculation of the hazard quotient or HQ for each chemical. The HQ is defined as the ratio of the exposure concentration (EC) to the reference concentration (RfC). The HQ can be expressed according to the following equation:

$$HQ = \frac{EC}{RfC}$$

Where:

HQ	=	Hazard quotient, unitless
EC	=	Exposure concentration, ug/m^3
RfC	=	Reference concentration, ug/m^3

The estimated HQs are compared to an acceptable hazard level. Implicit in the HQ is the assumption of a threshold level of exposure below which no adverse effects are expected to occur. For example, if the HQ exceeds unity (because site-specific exposure exceeds the RfC), then the potential for non-cancer adverse effects may exist. In general, the greater the value above 1.0, the greater the potential hazard. In contrast, HQs of less than 1.0 indicate that no adverse health effects are expected to occur from exposure to chemicals at the site.

The HQs estimated for the exposure scenarios evaluated here are:

- 10 for the Slab-on-Grade Building exposure scenario (Table 6).
- 0.0004 for the Residential Units over Parking Structure exposure scenario (Table 7).

Only the HQ estimated for Slab-on-Grade Buildings exceed the acceptable HQ of 1.

Cancer Risk Estimates

Cancer risks were estimated as the incremental probability of an individual developing cancer over a lifetime due to exposure to a potential carcinogen (i.e., incremental or excess individual lifetime cancer risk) (USEPA, 1989). Cancer risks were calculated in accordance with DTSC (2015) and USEPA (1989) guidelines.

$$Risk = EC \bullet IUR$$

Where:

Risk	=	Upper bound incremental lifetime carcinogenic risk, unitless
EC	=	Exposure concentration, ug/m^3
IUR	=	Inhalation unit risk, $(ug/m^3)^{-1}$

The excess cancer risks were compared to the risk level considered acceptable by federal and state regulatory agencies. The target cancer risk level identified by the DTSC in the Preliminary Endangerment Assessment (PEA) Guidance Manual is one in one million (1.0E-06). However, the USEPA has established acceptable incremental cancer risk levels to be within the risk range of 1 in 10,000 (1.0E-04) and 1.0E-06; risks greater than 1.0E-04 are generally considered unacceptable. The California Environmental Protection Agency (Cal-EPA) has defined a risk of 1 in 100,000 (1.0E-05) as the “no significant level” for carcinogens under California’s Safe Water and Toxic Enforcement Act (Proposition 65). Further, most California air districts use the 1.0E-05 risk level as the notification trigger level under California’s AB2588 Toxic Hot Spots Program.

The estimated cancer risks for the exposure scenarios evaluated here are:

- 2E-04 for the Slab-on-Grade Building exposure scenario (Table 8).
- 1E-08 for the Residential Units over Parking Structure exposure scenario (Table 9).

Only the cancer risk estimated under the Slab-on-Grade exposure scenario exceeds the acceptable benchmark value of 1E-06.

Summary and Conclusions

According to the results of the Risk Evaluation, the cancer risk estimated under the Slab-on-Grade Building (hypothetical scenario) exceeds the value considered acceptable by the DTSC. However, estimated cancer risks and HQs are within acceptable levels when a building over a parking structure is assumed. In other words, for a residential building separated from soil gas by a parking structure, no significant cancer risks or non-cancer hazards are anticipated to occur as a result of exposures to detected concentrations of VOCs in soil gas at the Site.

Based on the results of the Risk Evaluation, Hillmann makes the following recommendations:

- Future buildings should be protected by adequate vapor intrusion mitigation systems such as parking structure or vapor barriers and subsurface ventilation; This would reduce the estimated cancer risk below the DTSC acceptable value.
- Parking structures should be designed so that sufficient ventilation is provided to reduce vehicle emissions and to reduce indoor air accumulation of VOCs.

It should be noted that the VIRE was based on conservative (health-protective) assumptions, estimates, models, and parameters. Therefore, the results are not absolute estimates of health risks at the Site but are health-protective estimates.

Limitations

The conclusions and recommendations presented in this report are professional opinions based solely upon the data described in this report. They are intended exclusively for the purpose outlined herein and the property's location and project indicated. The scope of services performed in execution of this investigation may not be appropriate to satisfy the needs of users other than 16911 Normandie Associates, LLC. Any use or reuse of this document or the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

Given that the scope of services for this investigation was limited, and that conditions may vary between the points explored, it is possible that currently unrecognized subsurface contamination might be present at the subject property. Should site use or conditions change, the information and conclusions in this report may no longer apply. Opinions relating to environmental and public health conditions are based on limited data and actual conditions may vary from those encountered at the times and locations where data were obtained. No express or implied representation or warranty is included or intended in this report except that the work was performed within the limits prescribed by the Client with the customary thoroughness and competence of professionals working in the same area on similar projects.

Attachments

Table 1. Soil Gas Analytical Results Summary

Table 2. Calculation of Indoor Air Chemical Concentrations – Slab-on-Grade Building Exposure Scenario

Table 3. Calculation of Outdoor Air Chemical Concentrations – Residential Units over Parking Structure Exposure Scenario

Table 4. Toxicity Criteria for Chemicals of Potential Concern

Table 5. Exposure Parameters for Onsite Receptors

Table 6. Estimated Hazard Quotients from Inhalation of Indoor Air – Slab-on-Grade Building Exposure Scenario

Table 7. Estimated Hazard Quotients from Inhalation of Indoor Air – Residential Units over Parking Structure Exposure Scenario

Table 8. Estimated Cancer Risks from Inhalation of Indoor Air – Slab-on-Grade Building Exposure Scenario

Table 9. Estimated Cancer Risks from Inhalation of Indoor Air – Residential Units over Parking Structure Exposure Scenario

References

California Environmental Protection Agency (Cal-EPA). 2023. Supplemental Guidance: Screening and Evaluating Vapor Intrusion. Final Draft. February.

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This memorandum was prepared by:

Heriberto Robles, Ph. D., D.A.B.T.
Principal Toxicologist

TABLES

Table 1
Soil Gas Analytical Results Summary
16829-16839 South Normandie Avenue
Gardena, California

Volatile Organic Compounds	Max. Conc. (ug/m^3)
1, 2,4-Trimethlbenzene	360
1, 3, 5-Trimethylbenzene	130
4- Isopropyltoluene	90
Benzene	150
Ethylbenzene	4,800
Isopropylbenzene	50
n-Propylbenzene	60
Naphthalene	70
Styrene	210
Tetrachloroethylene	660
Toluene	790
Xylenes, total	25,800

Notes:
ug/m^3 = micrograms per cubic meter

Table 2
Calculation of Indoor Air Chemical Concentrations
Slab-on-Grade Building Building Exposure Scenario
16829-16839 South Normandie Avenue
Gardena, California

Chemical of Potential Concern (COPC)	CAS Number	Maximum Detected Soil Gas Concentration (ug/m^3)	Estimated Indoor Chemical Air Concentration (ug/m^3)
1,2,4-Trimethylbenzene	95636	360	1.08E+01
1,3,5-Trimethylbenzene	108678	130	3.90E+00
Benzene	71432	150	4.50E+00
Ethylbenzene	100414	4800	1.44E+02
Isopropylbenzene	98828	140	4.20E+00
n-Propylbenzene	103651	60	1.80E+00
Naphthalene	91203	70	2.10E+00
Styrene	100425	210	6.30E+00
Tetrachloroethene	127184	660	1.98E+01
Toluene	108883	790	2.37E+01
Xylenes, total	95476	25800	7.74E+02

Notes:
Attenuation factor (unitless) = 0.03
ug/m^3 = micrograms per cubic meter
NA = Not applicable or not available
4-Isopropyltoluene was added to Isopropylbezene

Table 3

Calculation of Outdoor Air Chemical Concentrations

Residential Units over Parking Structure Exposure Scenario

16829-16839 South Normandie Avenue

Gardena, California

Soil Parameters	Value Used	Units	Reference
Total soil porosity (Pt)	0.43	unitless	Default
Downwind length of contamination (L)	3048	centimeters	Default
Wind speed (u)	412	cm/sec	Default
Height of box (h)	914.4	centimeters	Default
Depth to impacted soil (d)	152.4	centimeters	Site Specific

Compound	Diffusivity in air (Di) (cm^2/sec)	Soil-Gas Concentration (Cs) (ug/cm^3)	Chemical Vapor Flux to Outdoor Air (Fi) (mg/sec/cm^2)	Outdoor Chemical Air Concentration (Co) (ug/m^3)
1,2,4-Trimethylbenzene	6.07E-02	3.6E-04	4.7E-08	3.8E-04
1,3,5-Trimethylbenzene	6.02E-02	1.3E-04	1.7E-08	1.4E-04
Benzene	8.95E-02	1.5E-04	2.9E-08	2.3E-04
Ethylbenzene	6.85E-02	4.8E-03	7.0E-07	5.7E-03
Isopropylbenzene	6.03E-02	1.4E-04	1.8E-08	1.5E-04
n-Propylbenzene	6.02E-02	6.0E-05	7.7E-09	6.2E-05
Naphthalene	6.05E-02	7.0E-05	9.0E-09	7.3E-05
Styrene	7.11E-02	2.1E-04	3.2E-08	2.6E-04
Tetrachloroethene	5.05E-02	6.6E-04	7.1E-08	5.8E-04
Toluene	7.78E-02	7.9E-04	1.3E-07	1.1E-03
Xylenes, total	6.89E-02	2.6E-02	3.8E-06	3.1E-02

Notes:

ug/m^3 = micrograms per cubic meter

ug/cm^3 = micrograms per cubic centimeter

cm^2/sec = square centimeter per second

mg/sec/cm^2 = milligrams per square centimeter per second

Equations:

$Fi = (Di \times Cs \times Pt^{4/3}) / d$

$Co = ((Fi \times L) / (u \times h)) \times 1{,}000{,}000\ cm^3/m^3$

Table 4
Toxicity Criteria for Chemicals of Potential Concern
16829-16839 South Normandie Avenue
Gardena, California

Chemical	Chronic Inhalation Reference Concentration (RfC) (ug/m^3)	Inhalation Unit Risk $(ug/m3)^{-1}$
VOCs		
1,2,4-Trimethylbenzene	6.0E+01	NA
1,3,5-Trimethylbenzene	6.0E+01	NA
Benzene	3.0E+00	2.9E-05
Ethylbenzene	1.0E+03	2.5E-06
Isopropylbenzene	4.0E+02	NA
n-Propylbenzene	1.0E+03	NA
Naphthalene	3.0E+00	3.4E-05
Styrene	9.0E+02	NA
Tetrachloroethene	4.0E+01	6.1E-06
Toluene	3.0E+02	NA
Xylenes, total	1.0E+02	NA

Notes:
Source = Cal/EPA HHRA Note No. 10, 2019
ug/m^3 = micrograms per cubic meter
NA = Not applicable or not available

Table 5
Exposure Parameters for Onsite Receptors
Slab-on-Grade Building Exposure Scenario
16829-16839 South Normandie Avenue
Gardena, California

Exposure/Site Specific Parameters	Units	Exposure Parameters		
		Adult Resident	**Child Resident**	**Source**
Chemical Concentration in Air (CA)		--	--	chemical-specific
Exposure Frequency (EF)	days/year	350	350	HERD 2019
Exposure Duration (ED)	years	20	6	HERD 2019
Exposure Time (ET)	hr/day	24	24	Default
Averaging Time for Noncarcinogens (AT_n)	hours	175,200	52,560	USEPA 2009
Averaging Time for Carcinogens (AT_c)	hours	613,200	613,200	USEPA 2009

Table 6
Health Hazards from Inhalation of Indoor Air
Slab-on-Grade Building Exposure Scenario
16829-16839 South Normandie Avenue
Gardena, California

COPC	Indoor Air Conc. (ug/m^3)	Inhalation Reference Dose (ug/m^3)	Residential Exposure Scenario		
			Average Exposure Conc. (ug/m^3)		Hazard Quotients (Unitless)
			Adult Res.	Child Res.	Child Res.
VOCs					
1,2,4-Trimethylbenzene	1.1E+01	6.0E+01	1.0E+01	1.0E+01	2.E-01
1,3,5-Trimethylbenzene	3.9E+00	6.0E+01	3.7E+00	3.7E+00	6.E-02
Benzene	4.5E+00	3.0E+00	4.3E+00	4.3E+00	1.E+00
Ethylbenzene	1.4E+02	1.0E+03	1.4E+02	1.4E+02	1.E-01
Isopropylbenzene	4.2E+00	4.0E+02	4.0E+00	4.0E+00	1.E-02
n-Propylbenzene	1.8E+00	1.0E+03	1.7E+00	1.7E+00	2.E-03
Naphthalene	2.1E+00	3.0E+00	2.0E+00	2.0E+00	7.E-01
Styrene	6.3E+00	9.0E+02	6.0E+00	6.0E+00	7.E-03
Tetrachloroethene	2.0E+01	4.0E+01	1.9E+01	1.9E+01	5.E-01
Toluene	2.4E+01	3.0E+02	2.3E+01	2.3E+01	8.E-02
Xylenes, total	7.7E+02	1.0E+02	7.4E+02	7.4E+02	7.E+00
Total Hazard Index					**1.E+01**

Notes:
Hazard Quotients estimated assuming a Vapor Intrusion Attenuation Factor of 0.001.
ug/m^3 = micrograms per cubic meter

Table 7
Health Hazards from Inhalation of Indoor Air
Residential Units Over Parking Structure Exposure Scenario
16829-16839 South Normandie Avenue
Gardena, California

COPC	Indoor Air Conc. (ug/m^3)	Inhalation Reference Dose (ug/m^3)	Residential Exposure Scenario		
			Average Exposure Conc. (ug/m^3)		Hazard Quotient (Unitless)
			Adult Res.	Child Res.	Child Res.
VOCs					
1,2,4-Trimethylbenzene	3.8E-04	6.0E+01	3.6E-04	3.6E-04	6.E-06
1,3,5-Trimethylbenzene	1.4E-04	6.0E+01	1.3E-04	1.3E-04	2.E-06
Benzene	2.3E-04	3.0E+00	2.2E-04	2.2E-04	7.E-05
Ethylbenzene	5.7E-03	1.0E+03	5.4E-03	5.4E-03	5.E-06
Isopropylbenzene	1.5E-04	4.0E+02	1.4E-04	1.4E-04	3.E-07
n-Propylbenzene	6.2E-05	1.0E+03	6.0E-05	6.0E-05	6.E-08
Naphthalene	7.3E-05	3.0E+00	7.0E-05	7.0E-05	2.E-05
Styrene	2.6E-04	9.0E+02	2.5E-04	2.5E-04	3.E-07
Tetrachloroethene	5.8E-04	4.0E+01	5.5E-04	5.5E-04	1.E-05
Toluene	1.1E-03	3.0E+02	1.0E-03	1.0E-03	3.E-06
Xylenes, total	3.1E-02	1.0E+02	2.9E-02	2.9E-02	3.E-04
Total Hazard Index					**4.E-04**

Notes:
ug/m^3 = micrograms per cubic meter
Particulate Equations:

Average Exposure Concentration_nc (ug/m3) = (CAresidential * ETchild * EFchild * EDchild) / (ATnoncancer))
Noncancer Hazard = (Exposure Concentration_nc / RfC)

Table 8
Cancer Risks from Inhalation of Indoor Air
Slab-on-Grade Building Exposure Scenario
16829-16839 South Normandie Avenue
Gardena, California

COPC	Indoor Air Conc. (ug/m^3)	Inhalation Slope Factor (ug/m^3)$^{-1}$	Residential Exposure Scenario		
			Lifetime Exposure Conc. (ug/m^3)		Cancer Risk (Unitless)
			Adult Resident	Child Resident	Adult & Child Resident
VOCs					
1,2,4-Trimethylbenzene	1.1E+01	NA	3.0E+00	8.9E-01	NA
1,3,5-Trimethylbenzene	3.9E+00	NA	1.1E+00	3.2E-01	NA
Benzene	4.5E+00	2.9E-05	1.2E+00	3.7E-01	5.E-05
Ethylbenzene	1.4E+02	2.5E-06	3.9E+01	1.2E+01	1.E-04
Isopropylbenzene	4.2E+00	NA	1.2E+00	3.5E-01	NA
n-Propylbenzene	1.8E+00	NA	4.9E-01	1.5E-01	NA
Naphthalene	2.1E+00	3.4E-05	5.8E-01	1.7E-01	3.E-05
Styrene	6.3E+00	NA	1.7E+00	5.2E-01	NA
Tetrachloroethene	2.0E+01	6.1E-06	5.4E+00	1.6E+00	4.E-05
Toluene	2.4E+01	NA	6.5E+00	1.9E+00	NA
Xylenes, total	7.7E+02	NA	2.1E+02	6.4E+01	NA
Total Cancer Risk					**2.E-04**

Notes:
Cancer risks estimated assuming a Vapor Intrusion Attenuation Factor of 0.001.
NA = Not applicable or not available
ug/m^3 = micrograms per cubic meter

Table 9
Cancer Risks from Inhalation of Indoor Air
Residential Units Over Parking Structure Exposure Scenario
16829-16839 South Normandie Avenue
Gardena, California

COPC	Indoor Air Conc. (ug/m^3)	Inhalation Slope Factor (ug/m^3)$^{-1}$	Residential Exposure Scenario		
			Lifetime Exposure Conc. (ug/m^3)		Cancer Risk (Unitless)
			Adult Resident	Child Resident	Adult & Child
VOCs					
1,2,4-Trimethylbenzene	3.8E-04	NA	1.0E-04	3.1E-05	NA
1,3,5-Trimethylbenzene	1.4E-04	NA	3.7E-05	1.1E-05	NA
Benzene	2.3E-04	2.9E-05	6.4E-05	1.9E-05	2.E-09
Ethylbenzene	5.7E-03	2.5E-06	1.6E-03	4.7E-04	5.E-09
Isopropylbenzene	1.5E-04	NA	4.0E-05	1.2E-05	NA
n-Propylbenzene	6.2E-05	NA	1.7E-05	5.1E-06	NA
Naphthalene	7.3E-05	3.4E-05	2.0E-05	6.0E-06	9.E-10
Styrene	2.6E-04	NA	7.1E-05	2.1E-05	NA
Tetrachloroethene	5.8E-04	6.1E-06	1.6E-04	4.7E-05	1.E-09
Toluene	1.1E-03	NA	2.9E-04	8.7E-05	NA
Xylenes, total	3.1E-02	NA	8.4E-03	2.5E-03	NA
Total Cancer Risk					**1.E-08**

Notes:
Particulate Equations:
Lifetime Exposure Concentration (ug/m3) = (CA * EF * ED * ET) / (Atcancer)
Cancer Risk = (Exposure Concentration_c * IUR)
ug/m^3 = micrograms per cubic meter
NA = Not applicable or not available