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ENVIRONMENTAL CONSULTANTS

Rotten Robbie #67 Health Risk Assessment

To: JR Beard, LHB & Associates

Date: September 18, 2017

Subject: Rotten Robbie #67 Health Risk Assessment

This memorandum documents the results of a Health Risk Assessment (HRA) for the proposed Rotten Robbie #67 Project located at 1202 Oakland Road in San Jose, California.

Project Location

The Project site is located on the east side of Oakland Road, approximately 650 feet north of Highway 101, in San Jose. The site is generally surrounded by commercial and industrial uses in all directions. There is also a mobile park adjacent to the Project site to the north.

Project Description

The Project site is 1.54 acres currently occupied by existing buildings and fueling dispensers. The proposed Project consists of the removal of the existing buildings and fueling dispensers and the construction of several underground storage tanks, an automobile fueling area, and a cardlock fueling area. It is anticipated that there will be a throughput of 6,000,000 gallons of gasoline annually.

Sensitive Receptors

Sensitive receptors are defined as facilities or land uses that include members of the population who are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Examples of sensitive receptors are residences, schools, hospitals, and daycare centers. The California Air Resources Board (CARB) has identified the following groups of individuals as the most likely to be affected by air pollution: the elderly over 65 years old, children under the age of 14, and persons with cardiovascular and chronic respiratory diseases such as asthma, emphysema, and bronchitis.

Based on a review of the site plan, the nearest sensitive receptor, a mobile home park bordering the Project to the north, is located directly adjacent to the Project site boundary and approximately 50 feet from the nearest proposed gas dispensing facility associated with the Project.

Health Risk Assessment

This HRA evaluates potential health risks associated with the generation of diesel particulate matter during construction activities as well as the emission of benzene resulting from the operation of the proposed Project.

Construction-Generated Air Toxics

Construction-related activities would result in temporary, short-term project-generated emissions of diesel particulate matter (DPM) from the exhaust of off-road, heavy-duty diesel equipment for site preparation (e.g., clearing, grading); soil hauling truck traffic; paving; application of architectural coatings; and other miscellaneous activities. For construction activity, DPM is the primary air toxic of concern. Particulate exhaust emissions from diesel-fueled engines (i.e., DPM) were identified as a toxic air contaminant (TAC) by the California Air Resources Board (CARB) in 1998. The potential cancer risk from the inhalation of DPM, as discussed below, outweighs the potential for all other health impacts (i.e., non-cancer chronic risk, short-term acute risk) and health impacts from other TACs. Accordingly, DPM is the focus of this discussion.

Based on emission modeling conducted for construction of the site, the maximum construction-related daily emissions of fine particulate matter ($PM_{2.5}$) exhaust, considered a surrogate for DPM, would be 2.05 pounds/day during the most intense season of construction activity. (As a point of comparison, the Bay Area Air Quality Management District CEQA significance threshold for $PM_{2.5}$ is 54 pounds/day.) Furthermore, even during the most intense month of construction, emissions of DPM would be generated from different locations on the Project site, rather than a single location, because different types of construction activities (e.g., demolition, site preparation, building construction) would not occur at the same place at the same time. The dose to which receptors are exposed is the primary factor used to determine health risk (i.e., potential exposure to TAC emission levels that exceed applicable standards).

Dose is a function of the concentration of a substance or substances in the environment and the duration of exposure to the substance. Dose is positively correlated with time, meaning that a longer exposure period would result in a higher exposure level for any exposed receptor. Thus, the risks estimated for an exposed individual are higher if a fixed exposure occurs over a longer period of time. According to the Office of Environmental Health Hazard Assessment (OEHHA), health risk assessments, which determine the exposure of sensitive receptors to TAC emissions, should be based on a 70- or 30-year exposure period; however, such assessments should be limited to the period/duration of activities associated with the proposed project. Consequently, an important consideration is that the use of off-road heavy-duty diesel equipment would be limited to the periods of construction, for which most diesel-powered off-road equipment use would occur during the construction season (approximately May 1 to October 15, yet can vary) and only over an 11-month period. Given the temporary nature of construction activities, the concentrations and durations of any TAC exposure that might occur would be very limited. Therefore, considering the relatively low mass of DPM emissions that would be generated during even the most intense season of construction, the relatively short duration of construction activities, and overall and the highly dispersive properties of DPM, construction-related TAC emissions would not expose sensitive receptors to an incremental increase in cancer risk that exceeds 10 in one million or a hazard index greater than 1.0.

Air Toxics Generated during Operations

Out of the toxic compounds emitted from the gasoline stations, benzene, ethylbenzene, and naphthalene have cancer toxicity values. However, benzene is the toxic air contaminant (TAC) which drives the risk, accounting for 87 percent of cancer risk from gasoline vapors (SCAQMD 2015). Furthermore, benzene constitutes more than three to four times the weight of gasoline than ethylbenzene and naphthalene, respectively (SCAQMD 2015). Therefore, ethylbenzene and naphthalene have not been modeled and are instead considered significant in the case that benzene emissions are significant. Additionally, there are substances emitted from gasoline stations, such as toluene and xylene which possess acute adverse health effects (though not cancer risk). However, it is not until the benzene concentrations are more than two orders of magnitude above the 10 per million cancer risk threshold, that the emissions of toluene and xylene begin to cause adverse health effects (SCAQMD 2007; CAPCOA 1997). Therefore, toluene and xylene emissions have not been modeled and are instead considered significant in the case that benzene concentrations are identified at two orders of magnitude above the 10 per million cancer risk threshold.

The air dispersion modeling for the HRA was performed using the U.S. EPA AERMOD dispersion model. AERMOD is a steady-state, multiple-source, Gaussian dispersion model designed for use with emission sources situated in terrain where ground elevations can exceed the stack heights of the emission sources (not a factor in this case). AERMOD requires hourly meteorological data consisting of wind vector, wind speed, temperature, stability class, and mixing height. Meteorological data provided by The Meteorological Resource Center for the Oakland Metropolitan Airport was selected as being the most representative meteorology based on proximity.

Emissions sources in the model include proposed on-site fuel storage tanks and fuel dispensers. The Project proposes several underground fuel storage tanks 24 fuel dispensing positions. The specific processes associated with fuel storage tanks and fuel dispensers that emit air toxics include loading, breathing, refueling, and spillage, as described below:

- Loading – Emissions occur when a fuel tanker truck unloads gasoline into the storage tanks. The storage tank vapors, displaced during loading, are emitted through its vent pipe. (A required pressure/vacuum valve installed on the tank vent pipe significantly reduces these emissions.)
- Breathing – Emissions occur through the storage tank vent pipe as a result of temperature and pressure changes in the tank vapor space.
- Refueling – Emissions occur during motor vehicle refueling when gasoline vapors escape through the vehicle/nozzle interface.
- Spillage – Emissions occur from evaporating gasoline that spills during vehicle refueling.

Loading and breathing emissions exit the underground storage tank vent pipe and are thus treated as a point source. The height and diameter of the vent are assumed to be 3.66 meters and 0.05 meters, respectively. Refueling and spillage emissions are modeled as volume sources with a vertical dimension of 5 meters to correspond to the height of the canopy. For refueling, the release height is assumed to be 1 meter to approximate the height of a vehicle fuel tank inlet, whereas spillage emissions are assumed to be released at ground level since nearly all the gasoline from spillage reaches the ground.

The model was run to obtain the peak 24-hour and annual average concentration in micrograms per cubic meter [$\mu g/m^3$] at nearby sensitive receptors. The receptor grid was extended to cover the zone of impact and was fine enough to identify the points of maximum impact. A grid spacing of 50 meters was used.

A health risk computation was performed to determine the risk of developing an excess cancer risk calculated on a 70-year lifetime basis, 30-year, and 9-year exposure scenarios. The chronic and carcinogenic health risk calculations are based on the standardized equations contained in the U.S. EPA Human Health Evaluation Manual (1991) and the Office of Environmental Health Hazard Assessment (OEHHA) Guidance Manual. Only the risk associated with operations of the proposed Project was assessed as construction emissions would be negligible.

Risk and Hazard Assessment

Cancer Risk

Based on the OEHHA methodology, the residential inhalation cancer risk from the annual average benzene concentrations are calculated by multiplying the daily inhalation or oral dose, by a cancer potency factor, the age sensitivity factor (ASF), the frequency of time spent at home (for residents only), and the exposure duration divided by averaging time, to yield the excess cancer risk. These factors are discussed in more detail below. It is important to note that exposure duration is based on continual gasoline dispensing operations at the Project site. Cancer risk must be separately calculated for specified age groups, because of age differences in sensitivity to carcinogens and age differences in intake rates (per kg body weight). Separate risk estimates for these age groups provide a health-protective estimate of cancer risk by accounting for greater susceptibility in early life, including both age-related sensitivity and amount of exposure.

Exposure through inhalation (Dose-air) is a function the breathing rate, the exposure frequency, and the concentration of a substance in the air. For residential exposure, the breathing rates are determined for specific age groups, so Dose-air is calculated for each of these age groups, 3rd trimester, 0<2, 2<9, 2<16, 16<30 and 16-70 years. To estimate cancer risk, the dose was estimated by applying the following formula to each ground-level concentration:

$$\text{Dose-air} = (C_{air} * \{BR/BW\} * A * EF * 10^{-6})$$

Where:

Dose-air = dose through inhalation (mg/kg/day)

C_{air} = air concentration (µg/m^3) from air dispersion model

{BR/BW} = daily breathing rate normalized to body weight (L/kg body weight – day) (225 L\kg BW-day for 3rd Trimester, 658 L/kg BW-day for 0<2 years, 535 L/kg BW-day for 2<9 years, 452 L/kg BW-day for 2<16 years, 210 L/kg BW-day for 16<30 years, and 185 L/kg BW-day 16<70 years)

A = Inhalation absorption factor (unitless [1])

EF = exposure frequency (unitless), days/365 days (0.96 [approximately 350 days per year])

10^{-6} = conversion factor (micrograms to milligrams, liters to cubic meters)

OEHHA developed ASFs to take into account the increased sensitivity to carcinogens during early-in-life exposure. In the absence of chemical-specific data, OEHHA recommends a default ASF of 10 for the third trimester to age 2 years, an ASF of 3 for ages 2 through 15 years to account for potential increased sensitivity to carcinogens during childhood and an ASF of 1 for ages 16 through 70 years.

Fraction of time at home (FAH) during the day is used to adjust exposure duration and cancer risk from a specific facility's emissions, based on the assumption that exposure to the facility's emissions are not occurring away from home. OEHHA recommends the following FAH values: from the third trimester to age <2 years, 85 percent of time is spent at home; from age 2 through <16 years, 72 percent of time is spent at home; from age 16 years and greater, 73 percent of time is spent at home.

To estimate the cancer risk, the dose is multiplied by the cancer potency factor, the ASF, the exposure duration divided by averaging time, and the frequency of time spent at home (for residents only):

$Risk_{inh\text{-}res} = (Dose_{air} * CPH * ASF * ED/AT * FAH)$

Where:

$Risk_{inh\text{-}res}$ = residential inhalation cancer risk (potential chances per million)
$Dose_{air}$ = daily dose through inhalation (mg/kg-day)
CPF = inhalation cancer potency factor ($mg/kg\text{-}day^{-1}$)
ASF = age sensitivity factor for a specified age group (unitless)
ED = exposure duration (in years) for a specified age group (0.25 years for 3rd trimester, 2 years for 0<2, 7 years for 2<9, 14 years for 2<16, 14 years for 16<30, 54 years for 16-70)
AT = averaging time of lifetime cancer risk (years)
FAH = fraction of time spent at home (unitless)

Chronic Non-Cancer Hazard

Non-cancer chronic impacts are calculated by dividing the annual average concentration by the Reference Exposure Level (REL) for that substance. The REL is defined as the concentration at which no adverse non-cancer health effects are anticipated. The following equation was used to determine the non-cancer risk:

Hazard Quotient = Ci/RELi

Where:

Ci = Concentration in the air of substance i (annual average concentration in $\mu g/m^3$)
RELi = Chronic noncancer Reference Exposure Level for substance i ($\mu g/m^3$)

Acute Non-Cancer Hazard

The potential for acute non-cancer hazards is evaluated by comparing the maximum short-term exposure level to an acute REL. RELs are designed to protect sensitive individuals within the population. The calculation of acute non-cancer impacts is similar to the procedure for chronic non-cancer impacts. The equation is as follows:

$$\text{Acute HQ} = \text{Maximum Hourly Air Concentration } (\mu g/m^3) \,/\, \text{Acute REL } (\mu g/m^3)$$

HEALTH RISK ANALYSIS THRESHOLDS

In order to determine whether or not a proposed project would cause a significant effect on the environment, the impact of the project must be determined by examining the types and levels of air toxics generated and the associated impacts on factors that affect air quality. While the final determination of significance thresholds is within the purview of the lead agency pursuant to the State CEQA Guidelines, the Bay Area Air Quality Management District's (BAAQMD's) *Air Toxics NSR Program Health Risk Assessment Guidelines* (2016) recommends that the following air pollution thresholds be used by lead agencies in determining whether the proposed Project is significant. If the lead agency finds that the proposed Project has the potential to exceed the air pollution thresholds, the Project should be considered significant. The thresholds for air toxic emissions are as follows:

- Cancer Risk: Emit carcinogenic or toxic contaminants that exceed the maximum individual cancer risk of 10 in one million.

- Non-Cancer Risk: Emit toxic contaminants that exceed the maximum hazard quotient of 1 in one million.

Cancer risk is expressed in terms of expected incremental incidence per million population. The BAAQMD has established an incidence rate of 10 persons per million as the maximum acceptable incremental cancer risk. This threshold serves to determine whether or not a given project has a potentially significant development-specific and cumulative impact. The 10 in one million standard is a very health-protective significance threshold. A risk level of 10 in one million implies a likelihood that up to 10 persons, out of one million equally exposed people would contract cancer if exposed continuously (24 hours per day) to the levels of toxic air contaminants over a specified duration of time. This risk would be an excess cancer that is in addition to any cancer risk borne by a person not exposed to these air toxics. To put this risk in perspective, the risk of dying from accidental drowning is 1,000 in a million which is 100 times more than the BAAQMD's threshold of 10 in one million.

The BAAQMD has also established non-carcinogenic risk parameters for use in HRAs. Noncarcinogenic risks are quantified by calculating a "hazard index," expressed as the ratio between the ambient pollutant concentration and its toxicity or Reference Exposure Level (REL). An REL is a concentration at or below which health effects are not likely to occur. A hazard index less of than one (1.0) means that adverse health effects are not expected. Within this analysis, non-carcinogenic exposures of less than 1.0 are considered less than significant.

IMPACT ASSESSMENT

CARB identified benzene as a TAC. The majority of benzene emitted in California comes from motor vehicles, including evaporative leakage and unburned fuel exhaust. Benzene is highly carcinogenic and occurs throughout California. Benzene also has non-cancer health effects. As the Project is proposing to dispense gasoline, an analysis of benzene was performed using the EPA-approved AERMOD model.

Non-Carcinogenic Hazards

The significance thresholds for TAC exposure also require an evaluation of non-cancer risk stated in terms of a hazard index. Non-cancer chronic impacts are calculated by dividing the annual average concentration by the Reference Exposure Level (REL) for that substance. The REL is defined as the concentration at which no adverse non-cancer health effects are anticipated. The potential for acute non-cancer hazards is evaluated by comparing the maximum short-term exposure level to an acute REL. RELs are designed to protect sensitive individuals within the population. The calculation of acute non-cancer impacts is similar to the procedure for chronic non-cancer impacts.

An acute or chronic hazard index of 1.0 is considered individually significant. The hazard index is calculated by dividing the acute or chronic exposure by the reference exposure level. The highest maximum chronic and acute hazard index associated with benzene emissions from the Project would be 0.02 and 0.526, respectively. Therefore, non-carcinogenic hazards are calculated to be within acceptable limits and a less than significant impact would occur.

Carcinogenic Risk

As previously described, the Project proposes several underground fuel storage tanks and 24 fuel dispensing positions. The specific processes associated with fuel storage tanks and fuel dispensers that emit benzene include loading, breathing, refueling, and spillage.

The average benzene emission factors for the Project's proposed gasoline dispensing activities were calculated based on the annual average emission factors for various exposure periods associated with assumptions for evaluating exposure over three different periods (i.e., 70-, 30-, and 9-year exposure scenarios).

Based on the AERMOD outputs, the expected annual average benzene emission concentrations at the nearest sensitive receptor resulting from operation of the Project would be 0.100 $\mu g/m^3$ at the greatest.

Cancer risk calculations for residences are based on 70-, 30-, and 9-year exposure periods. The calculated carcinogenic risk at the sensitive receptor as a result of the Project is depicted in Table 1. As shown, impacts related to cancer risk from gasoline dispensing would be less than significant at the nearest residences.

Table 1 Maximum Operational Health Risk at the Nearest Residences

Exposure Scenario	Maximum Cancer Risk (Risk per Million)[1]	Significance Threshold (Risk per Million)	Exceeds BAAQMD Significance Threshold?
70-Year Exposure	3.22	10	No
30-Year Exposure	2.47	10	No
9-Year Exposure	1.52	10	No

Notes:
1. Refer to Attachment A.

CONCLUSION

As described, non-carcinogenic hazards resulting from the proposed Project are calculated to be within acceptable limits. Additionally, impacts related to cancer risk from gasoline dispensing operations would be less than significant at the nearest sensitive receptor, a mobile home park just north of the Project site. Therefore, impacts related to health risk from the Project would be less than significant.

If you would like to discuss further, please contact me, Seth Myers at (530) 965-5925 or via e-mail at smyers@ecorpconsulting.com.

Sincerely,

Seth A. Myers

Seth Myers
Air Quality Analyst

References:

BAAQMD (Bay Area Air Quality Management District). 2016. *Air Toxics NSR Program Health Risk Assessment Guidelines*.

CAPCOA (California Air Pollution Control Officers Association). 1997. *Gasoline Service Station Industrywide Risk Assessment Guidelines*.

OEHHA (California Environmental Protection Agency’s Office of Environmental Health Hazard Assessment). 2015. *Guidance Manual for Preparation of Health Risk Assessments*.

OEHHA (California Environmental Protection Agency’s Office of Environmental Health Hazard Assessment). 2003. *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*.

SCAQMD (South Coast Air Quality Management District). 2007. *Emission Inventory and Risk Assessment Guidelines for Gasoline Dispensing Stations.*

SCAQMD (South Coast Air Quality Management District). 2015. *2015 Risk Assessment Procedures for Rules 1401, 1401.1, & 212*.

U.S. EPA (United States Environmental Protection Agency). 1991. *Human Health Evaluation Manual*.

ATTACHMENTS

Rotten Robbie #67 Project

Benzene Emissions Calculations

Two Underground Storage Tanks	Total Capacity (gallons)	Annual Throughput (gallons)	Emission Factor (lbs/1,000 gallons)	Daily Fuel Movement (gallons)	lbs/day	g/day	g/sec
Loading	63000	6,000,000	0.001260	16,438	0.021	9.39E+00	1.09E-04
Breathing			0.000075	63,000	0.005	2.14E+00	2.48E-05

Fuel Dispensers		Annual Throughput (gallons)	Emission Factor (lbs/1,000 gallons)	Daily Throughput (gallons)	lbs/day	g/day	g/sec
Refueling		6,000,000	0.000960	16,438	0.016	7.16E+00	8.28E-05
Spillage			0.002400	16,438	0.039	1.79E+01	2.07E-04

Sources:

BAAQMD Air Toxics NSR Program Health Risk Assessment Guidelines (2016); SCAQMD Emission Inventory and Risk Assessment Guidelines for Gasoline Dispensing Stations (2007); and CAPCOA Gasoline Service Station Lidustrywide Risk Assessment Guidelines (1997).

Notes:

The Daily Fuel Movement is based on the Annual Throughput

Benzene Health Risk Calculations

Risk Calculations

1 Hour Avg Concentration:	1.000
24 Hour Avg Concentration:	0.700
Annual Avg Concentration	0.100

Cancer Risk

	3rd trimester	0<2 years	2<9 years	2<16 years	16<30 years	16<70 years
DOSEair = (Cair*(BR/BW)*A*EF*10^{-6})	2.15753E-05	6.30959E-05	5.13014E-05	4.33425E-05	2.0137E-05	1.774E-05
Risk = DOSEair * CPF * ASF * ED/AT * FAH	2.46575E-08	5.76877E-07	9.23425E-07	1.56033E-06	3.101096E-07	1.0537E-06

		Risk	in one million
Cancer Risk:	70-year exposure	3.22E-06	3.22
	30-year exposure	2.47E-06	2.47
	9-year exposure	1.52E-06	1.52
Threshold:			10 in one million

	DOSEair		mg/kg-d	Dose through inhalation
	CPF	0.1	$(mg/kg/day)^{-1}$	Cancer Potency Factor for Benzene
BR/BW	BR/BW (3rd trimester)	225	L/kg bodyweight-day	Daily Breathing rate normalized to body weigh
	BR/BW (0 < 2 years)	658		
	BR/BW (2 < 9 years)	535		
	BR/BW (2 < 16 years)	452		
	BR/BW (16 < 30 years)	210		
	BR/BW (16 < 70 years)	185		
	10^{-6}	1.00E-06		Micrograms to milligrams conversions, liters to cubic meters conversion
	Cair	0.1	ug/m^3	Concentration in air (ug/m^3), modeled annual average concentration
	A	1		Inhalation absorption factor
	EF	0.96	days/year	Exposure frequency (days/year)
ED	ED (3rd trimester)	0.25	years	Exposure duration (years)
	ED (0 < 2 years)	2		
	ED (2 < 9 years)	7		
	ED (2 < 16, 16 < 30 years)	14		
	ED (16 - 70 years)	54		
	AT	70	years	Averaging time period over which exposure is averaged
ASF	ASF (3rd trimester - 2 years)	10		Age Sensitivity Factor
	ASF (2 - 16 years)	3		
	ASF (16 - 70 years)	1		
FAH	FAH (3rd trimester - 2 years)	0.32		Fraction of time spent at home (unitless)
	FAH (2 - 16 years)	0.6		
	FAH (16 - 70 years)	0.77		

Chronic Noncancer Hazard

Threshold: 1

Hazard Quotient = C_i/REL_i

HQ = 2.00E-02

C_i	1.00E-01	Concentration (annual average)
REL_i	5	Reference Exposure Level

Acute NonCancer Hazard

Threshold: 1

Acute HQ = Maximum Hourly Concentration/Acute REL

Acute HQ = 5.26E-01

Max Hourly	1.00E-01
Acute REL (Acrolein)	0.19