DIESEL EMISISONS HEALTH RISK ASSESSMENT

GUASTI PLAZA SPA SEIR

CITY OF ONTARIO, CALIFORNIA

Prepared for:

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INTRODUCTION

This report presents an assessment of potential toxic air contaminant impacts associated with proposed residential occupancy within a portion of the Guasti Plaza Specific Plan in Ontario, California. The analysis area is bounded by the I-10 Freeway to the north, Archibald Avenue to the west, the Union Pacific Railroad Company (UPRR) tracks to the south, and Turner Avenue to the east. Airport Drive, surface parking and one of the ONT airport terminals are located directly south beyond the railroad tracks. Freeway trucks and diesel-powered trains are emitters of diesel particulate matter (DPM). DPM is a known carcinogen. Aircraft burn mainly kerosene. Incomplete combustion of kerosene produces visible smoke. Such emissions, however, are not an identified toxic air contaminant (TAC). Airport activities do use diesel-powered equipment in freight idling. However, airport activity diesel exposure risk assessments have found that Guasti Plaza risk levels are very low. Most bus traffic around ONT uses “clean” natural gas. The freeway and the train tracks are therefore the only TAC sources considered in this health risk assessment (HRA).

This HRA was prepared in accordance with the California Office of Environmental Health Hazard Assessment’s (OEHHA) *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (OEHHA 2003a), and the South Coast Air Quality Management District (SCAQMD) *Health Risk Assessment Guidance for Analyzing Cancer Risks from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis* (SCAQMD 2003). As recommended by SCAQMD and California Air Resources Board (CARB) guidance, the HotSpots Analysis and Reporting Program (HARP) model was used to conduct the HRA.

The primary objective of this HRA is to estimate upper-bound incremental excess cancer risks and non-cancer health hazards associated with the proposed residential occupancy. Approved Guasti Plaza land uses will generate negligible amounts of TACs. This HRA thus analyzes the effects of the ambient DPM environment upon the project, and not of the project upon the environment. According to OEHHA, the four steps involved in the risk assessment process are 1) hazard identification, 2) exposure assessment, 3) dose-response assessment, and 4) risk characterization. The following report details the findings of this multiple step analysis process.

EXISTING CONDITIONS

Toxic air contaminants are gases, liquids, or particles that are emitted into the atmosphere and, under certain conditions, may cause adverse health effects, including cancer, acute non-cancer, and chronic non-cancer effects. OEHHA has compiled the health risk effects for all toxic air pollutants into one document entitled *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (OEHHA 2005), which was used to convert exposure to a corresponding health risk.

In the summer of 2008, the SCAQMD released draft findings of the *Multiple Air Toxics Exposure Study (MATES-III) in the South Coast Air Basin*. Mates-III contains extensive general

information regarding regional ambient air toxics levels in the South Coast Air Basin (SCAB). MATES is a multi-level analysis of the probability that exposure to hazardous substances at a given level over a given period of time will make people sick. Health risks may be expressed in terms of cancer probabilities, but may also refer to non-chronic acute illness such as asthma. Probabilistic predictions often incorporate worst-case assumptions that do not reflect real-world human behavior. For example, the standard residential exposure assumption is that a receptor breathes at the 80^{th} percentile rate while located at one single outdoor location for 24-hours per day, 350 days per year, for 70 years, without moving from that spot. Because of actual human mobile behavior, the air pollution exposure risk should properly be evaluated on a regional basis rather than on a unique source-receptor relationship. This standardized exposure assumption is designed to provide a uniform basis for risk assessments as a function of a specific location, and does not constitute an actual personal risk.

MATES-III estimates that the average excess cancer risk level from exposure to air toxics for the SCAB as a whole is approximately 1,200 in one million. Mobile sources (e.g. cars, trucks, trains, ships, aircraft, etc.) represent the greatest contributor. About 84 percent of all risk is attributed to diesel particulate matter (DPM). Those estimates were based on the monitoring data collected at ten fixed sites from 2004-2006. The closest MATES-III fixed-site air toxics monitoring station was in Fontana (Arrow Highway). The estimated cancer risk at that station was the highest of any monitoring station at 1,400 in a million. The risk map published in the MITES-III final report (2008) places Guasti Plaza at approximately 1,250 in a million. This is the estimated excess cancer risk (compared to a human lifetime risk of 300,000 in a million from all causes) from breathing ambient air. This value assumes remaining outside for 24-hours per day for 70 years, and that no emissions reductions in DPM will result over the next 70 years.

There has been a downward trend in public health risk from toxic air pollution in the last decade. The MATES-II report in 2000 concluded that the basin wide average excess cancer risk was 1,400 in a million. The change from MATES-II was a drop of 17 percent. With a continuing acceleration of DPM controls for both on-and off-road sources, risks will continue to decline. However, risks from air toxic exposure will likely be considered unacceptable for an extended period into the future.

TOXIC AIR CONTAMINANT EMISSIONS

Diesel exhaust contains a wide variety of TACs. TAC's include benzene, 1,3 butadiene, carbonyls and others. However, since diesel accounts for 84 percent of air toxic risk, and the risk is almost exclusively due to inhalation. Inhalation of project-related DPM at the Guasti Plaza site was therefore used as surrogate for public health risk from freeway truck and UPRR train activity.

To estimate emissions from freeway truck traffic, existing truck volumes reported by Caltrans were adjusted for minor additional future growth, but the percentage mix of light, medium and heavy trucks was assumed to remain unchanged. Mobile source emission factors were modeled using the Emissions Factors (EMFAC2007) Model (ARB2007). Because the residential exposure scenario is based on 70 years of exposure, emission factors from the EMFAC2007

model were averaged over the exposure period, assuming the start of operations in 2010. The EMFAC2007 model provides emission factors out to the year 2040. After the year 2040, emission factors were conservatively assumed to remain constant.

Train DPM emissions were estimated from NTSB data on train combustion efficiency and current emissions regulations. The average freight train travels 0.13 miles per gallon of diesel burned, and the Tier-2~~1~~ particulate emissions limit is 3.6 grams per gallon. Train activity DPM emissions thus average 27.7 grams per mile. The EMFAC2007 truck DPM emissions rate, assuming implementation of all required on-road pollution control, will be 0.11 grams per mile. Trains will be approximately 250 times "dirtier" than on-road trucks if no additional DPM rules for trains are adopted. For Guasti Plaza, the tracks at 42 trains per day will generate almost the same DPM burden as the freeway seen as follows:

Tracks: 42 trains x 27.7 gram/mile/train = 1163.4 gram/mile

Freeway: 12,000 trucks x 0.11 gram/mile/truck = 1,320.0 gram/mile

Because the tracks are much closer to proposed residential uses, they dominate the calculated health risk.

AIR DISPERSION MODELING

Air dispersion modeling was used to predict the downwind concentration of DPM to which residential receptors could be exposed. Air dispersion modeling is dependent on the emissions of diesel particulate matter, the location of sources, and the site-specific meteorology of the impacted area. The air dispersion modeling was performed in accordance with SCAQMD modeling guidelines. Results of the air dispersion analysis were used in conjunction with diesel particulate matter emission rates to calculate maximum diesel particulate matter concentrations to which receptors could be exposed.

The AERMOD version of EPA's general dispersion model was used to calculate DPM exposure. Freeway and train track line sources were represented by a long string of thin volume sources (a semi-uniform mixing zone created by turbulence from the moving source). Although the AERMOD is a more refined version of the Industrial Source Complex (ISC) family of models, the SCAQMD has not released meteorological data packages needed to run the model. Processed Ontario Airport weather data was purchased from a commercial supplier (Lakes Environmental Software). A nested grid of receptors with 25 meter by 25 meter spacing was supplemented with a regular spacing of receptors along the entire project perimeter. A total of 455 individual line sources and 430 receptor points were incorporated into the model set-up.

EXPOSURE AND TOXICITY ASSESSMENT

For this HRA, the exposure assumptions dictated by OEHHA guidelines were used to assess potential human health risks. In order to determine the total dose to the receptor, the applicable pathways of exposure need to be identified. As stated in the guidelines, the inhalation pathway must be evaluated from all TAC's. Because this risk assessment focuses solely on diesel particulate risks, multi-pathway exposures (i.e., exposure through soil dermal exposure, ingestion of plants, etc.) were not considered in this risk assessment.

Methods used in this HRA are conservative in that they are more likely to overestimate than underestimate the potential human health risks. For example, risks and hazards are calculated for individuals at locations where ground-level concentrations of TACs are predicted by the air dispersion modeling to be the highest. No improvement in train engine DPM emissions was assumed for the next 70 years. Further, individuals are assumed to be exposed in residential exposure scenarios for unrealistically long durations. Furthermore, the toxicity values (i.e., the values for each chemical at which an adverse health risk is predicted) are designed to be health-protective and are therefore also conservative. Thus the risks calculated for the project are anticipated to represent upper-bound risks rather than actual values for any individual.

To estimate potential incremental cancer risks and the potential for adverse chronic non-cancer health hazards to exposures, the inhalation dose of TAC's were calculated. The equation for dose through inhalation (Dose-inh) is as follows:

$$\text{Dose-inh} = (C \times DBR \times A \times EF \times ED)/(AT)$$

Where:

Dose-inh = Chronic daily intake, mg/kg body weight per day
C = Ground-level concentration of TAC to which the receptor is exposed, micrograms/cubic meter
DBR = Daily breathing rate, liters per kilogram body weight per day
A = Inhalation absorption factor (assumed to be 1)
EF = Exposure frequency, days/year
ED = Exposure duration, years
AT = Averaging time, days (assumed to be 25,550 days for a 70-year cancer risk)

DOSE RESPONSE ASSESSMENT

Dose-response assessment describes the quantitative relationship between the amount of exposure to a substance (the dose) and the incidence of occurrence of injury (the response). The process often involves establishing a toxicity value or criterion to use in assessing potential health risk. The toxicity criterion, or health guidance value, for carcinogens is the cancer potency slope (potency factor), which describes the potential risk of developing cancer per unit of average daily dose over a 70-year lifetime. Cancer potency factors are typically expressed as an upper bound probability developing cancer assuming continuous lifetime exposure to a substance at a dose of one milligram per kilogram of body weight, and are expressed in units of inverse dose as a potency slope (i.e., $(mg/kg/day)^{-1}$). For air toxics risk assessments, cancer inhalation and oral potency factors have been recommended by OEHHA.

Non-cancer health risks (chronic and acute) are characterized by comparing the exposure to a concentration or dose at or below which adverse effects are not likely to occur following specified exposure conditions. These concentrations or doses are called Reference Exposure Levels (RELs). As stated in the OEHHA guidance, it should be emphasized that exceeding the REL does not necessarily indicate that an adverse health effect will occur. Levels of exposure above the REL have a chronic increasing but undefined probability of resulting in an adverse health impact. RELs are designed to take into account exposure of sensitive populations (e.g., the very young, the elderly, those with chronic respiratory disease) and are thus intended to be health protective. Chronic RELs are levels above which prolonged exposure may have an adverse health effects, and acute RELs are levels above which short-term exposure (generally one-hour, but for some substances longer averaging times are used) may have an adverse health effect. To assess whether exposure to a substance has the potential for an adverse health effect the exposure concentration is divided by the REL to calculate a Hazard Index (HI) for that substance.

OEHHA has developed a table of health data for toxic air contaminants that must be used to estimate risk for HRAs conducted in accordance with the OEHHA guidance. The most recent health data for diesel particulate matter were obtained from OEHHA and are incorporated in the analysis. DPM is assumed to have a carcinogenic inhalation unit risk factor of 3.0×10^{-4} $(ug/m^3)^{-1}$ and a chronic REL of 5.0 ug/m^3. A lifetime exposure of 1 ug/m^3 of DPM is thus presumed to create an individual excess cancer probability of 300 in a million. By way of reference, smoking creates a 5,000 in a million probability, and the lifetime risk from all cancer is close to 300,000 in a million.

The SCAQMD in its CEQA Guidelines (1993) has adopted a significance threshold of a 10 in a million risk excess cancer risk as potentially significant. A risk of less than 1 in a million is considered less-than-significant. Intermediate risks should be evaluated on a case-by-case basis and minimized where feasible.

RISK CHARACTERIZATION

Risk characterization integrates the results of the identification of chemicals of potential concern, exposure assessment, and toxicity assessment to describe the risks to individuals and populations in terms of extent and severity of probable adverse health risks. In this HRA, the health risk characterization process involves integrating the exposure intakes and the toxicity values to estimate two types of potential health effects: carcinogenic and non-carcinogenic.

Carcinogenic Risk Characterization Methodology

Carcinogenic risk characterization methodology stems from the current regulatory assumption that chemicals causing cancer may not have a threshold of safety (i.e., a carcinogen produces a risk of causing cancer at any level of exposure). EPA scientists emphasize that background levels of exposure to cancer-causing agents are already initiating the carcinogenic process. This HRA focuses on the incremental potential cancer risk associated with exposure to truck and train DPM emissions and, therefore, does not account for natural background or individual habits/occupations.

In assessing the carcinogenic effects resulting from exposures to environmental contaminants, the lifetime excess cancer risk, which is considered to be the risk of developing cancer above the background risk level, is calculated using the following equation:

$$\text{Inhalation Dose (mg/kg-day)} \times \text{Cancer Potency (mg/kg-day)}^{-1} = \text{Cancer Risk}$$

In accordance with OEHHA guidance, a 70-year inhalation cancer risk evaluation is required for all carcinogenic risk assessments. Cancer risk is calculated by multiplying the inhalation dose by the inhalation cancer potency factor to yield the potential inhalation excess cancer risk. The cancer risk is expressed as increased change during a 70-year exposure period of cancer.

Noncarcinogenic Risk Characterization Methodology

Noncarcinogenic impacts are determined for acute (inhalation exposure) and for both inhalation and oral chronic exposure. Estimates of health impacts for noncancer endpoints are expressed as a hazard index (HI). An HI of one or less indicates that adverse health effects are not expected to result from exposure to emissions of that substance. HIs are calculated by dividing the exposure concentration by a reference exposure level (REL). Reference exposure levels are defined as the concentration to which a receptor could be exposed below which no adverse health effects are anticipated. DPM has RELs only for chronic exposure.

The following subsections discuss the risks predicted at the point of maximum impact (PMI). Because of train track proximity, the PMI occurs along the southern project boundary. The AERMOD model input/output is provided in a separate CD.

Point of Maximum Impact and Cancer Burden

The highest individual excess cancer risk for the PMI, calculated on the basis of residential risk is 265 in a million. This point is located directly along the southern project boundary. Risk levels drop off rapidly with distance, but still remain far in excess of the 10 in a million threshold of significance. At a point mid-way between the southern and northern site boundary, risk levels are at 100 in a million. Farther north, the increased set-back from the train tracks is off-set to closer proximity to I-10 such that the risk level is around 90 in a million for most of the northern one-half of Guasti Plaza. At the closest point of probable residential occupancy, the calculated risk value is 200 in a million. The risk map for Guasti Plaza is shown in Figure 1.

Risk levels that are 20 times higher than the adopted significance threshold are obviously a serious concern. However, the artificially conservative input assumptions mask the true health risk of living near a set of train tracks. By way of perspective, the health risk assessment for the Ports of Los Angeles and Long Beach found that the 200 in a million risk contour extends perhaps 10 miles from the ports. The ports HRA concluded as follows:

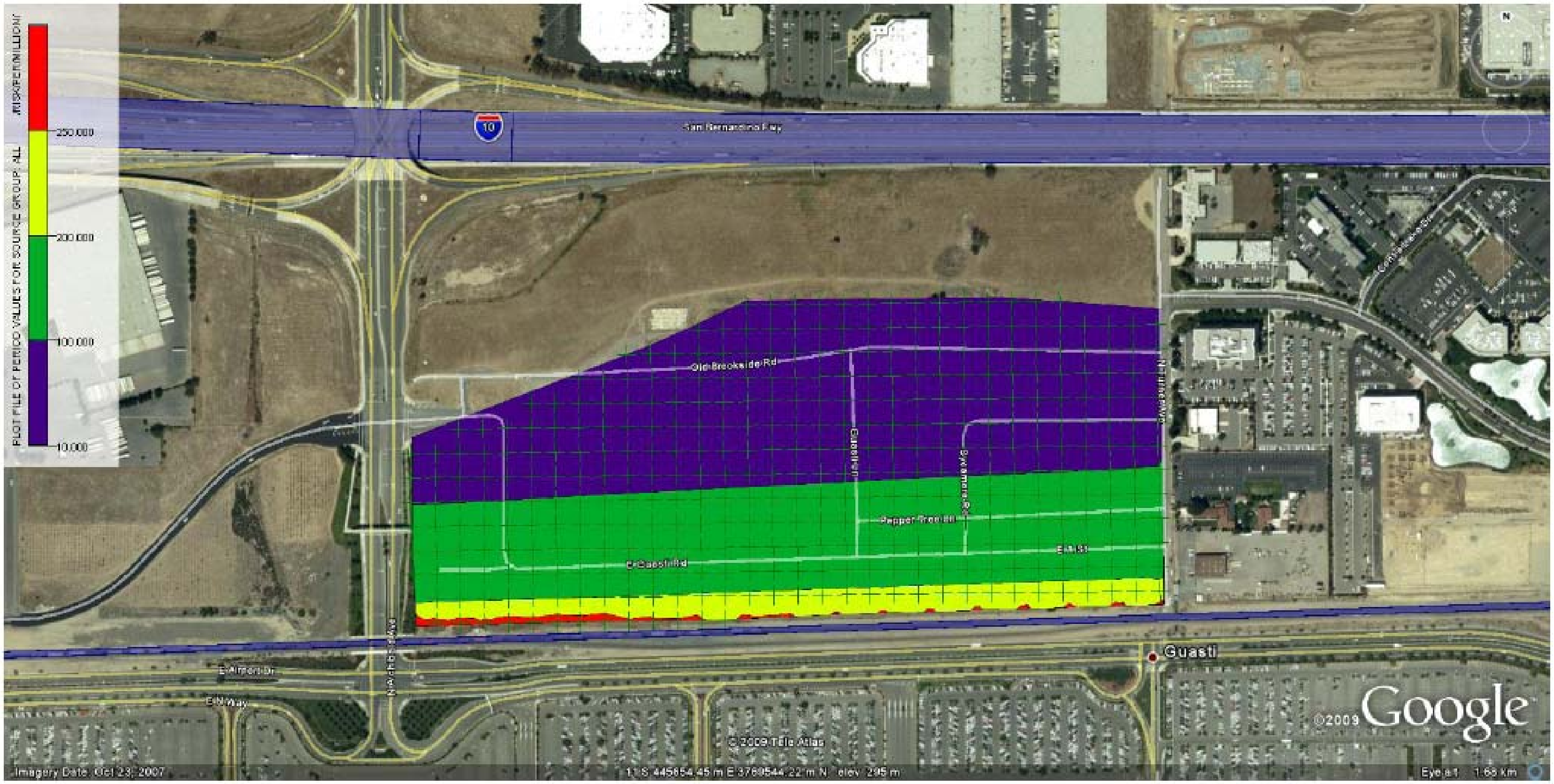
Risk	Acres	Population
> 500 x 10^{-6}	2,500	53,000
200-500 X 10^{-6}	26,500	360,000
100-200 X 10^{-6}	64,500	724,000
10-100 X 10^{-6}	70,000	843,200

Two million people experience a theoretical excess cancer risk in excess of the SCAQMD significance threshold of 10 in a million due to port activities. It provides some perspective on the project site DPM exposure which demonstrates a level of concern, but also shows that such levels are by no means at all unusual.

Chronic Health Index

The chronic health index (HI) is related to health effects such as recurrent asthma. An index of 1.0 is considered significant. The maximum calculated annual DPM exposure is 0.88 ug/m^3. With a REL of 5.0 ug/m^3 for DPM, this translates into a chronic HI of 0.18 for PMI. Chromic health effects from track proximity are less-than significant.

Figure 1
Guasti Plaza Risk Map



NORTH

70-year Cancer Risk

Project Air Purification Recommendations

Adverse air quality effects of freeway proximity are proposed to be off-set by a highly upgraded ventilation and air purification system. By creating an indoor air quality (IAQ) environment that goes far beyond normal residential standards, the accumulated dose of air pollution to all residents will be lower than for residents living thousands of feet away. Air filtration is expressed in terms of a "minimum efficiency reporting value", or MERV. The application guidelines for MERV ratings are as follows:

MERV	Typical Efficiency	Particle Size Cut-Off	Typical Application	Filter Type
1-4	70%	10 μ	Minimum Residential	Disposable Synthetic
5-8	90%	3-10 μ	Better Residential	Pleated & Treated
9-12	96%	1-3 μ	Superior Residential	Bag or Cartridge
13-16	98%	0.3-1 μ	Hospital & Healthcare	Rigid Cell or Cartridge

Source: National Air Filtration Assoc. User's Guide for ANSI/ASHRAE 52.2 (www.nafa.org)

The residential mechanical ventilation systems are proposed to be equipped with air purification systems that are rated with a MERV of 13 consistent with American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 52.2. MERV 13 systems remove a minimum of 95 percent of DPM, usually higher. MERV 13 systems are routinely used in hospitals and elementary schools to protect particularly sensitive receptor populations.

The average California resident spends 30 minutes per day outside their home and 15.5 hours inside (8 hours away from home). By providing enhanced filtration that cleans ambient air, the DPM exposure dose for project residents can be maintained at substantially less than for other areas of Ontario seen as follows (excess cancer risk per million):

	Guasti Plaza	Other Areas
Background Risk	1,250	1,250
Local Risk	+200	0
Outdoor Total	1,450	1,250
Normal Indoor (75% red.)	362	312
Enhanced Indoor (95% red.)	72	n/a
Ave. Exposure *	115	341

*(0.5 hours outdoors + 15.5 hours indoors)/16

MITIGATION

The following measures are required to reduce railroad proximity health effects to less-than-significant:

- All residential living areas shall be equipped with air filtration systems operating under positive pressure rated at MERV 13 or higher.
- Replacement filters shall be made available through apartment management (or HOA for condos).
- Outdoor recreation areas shall be encouraged along the northern portion of the residential areas with the greatest distance setback from the railroad tracks.
- The dense tree canopy shall be established along the southern site boundary to act as a living bio-filter for particulate air pollution.