RMC PACIFIC MATERIALS, LLC. (CEMEX)

ELIOT QUARRY SMP-23 RECLAMATION PLAN AMENDMENT

PUBLIC HEALTH RISK ASSESSMENT OF SITE RECLAMATION

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COMPASS LAND GROUP

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1.0 INTRODUCTION

Compass Land Group ("Compass") has prepared this Public Health Risk Assessment of Site Reclamation ("HRA") in support of the RMC Pacific Materials, LLC. ("CEMEX") Eliot Quarry SMP-23 Reclamation Plan Amendment Project in unincorporated Alameda County, California ("Project"). This HRA evaluates the potential air quality related public health risks associated with the proposed Project's reclamation activities. Public health risks are compared against significance thresholds adopted by the Bay Area Air Quality Management District ("BAAQMD"). This HRA is intended to support the lead agency's evaluation of air quality related public health impacts pursuant to the California Environmental Quality Act ("CEQA").

The sections that follow provide a description of the Project, scope of the risk assessment, BAAQMD significance thresholds, exposure assessment, and risk analysis for use in Project CEQA review.

1.1 Project Description

Project Overview

CEMEX owns and operates the Eliot Quarry, a ±920-acre sand and gravel mining facility, located between the cities of Livermore and Pleasanton, at 1544 Stanley Boulevard in unincorporated Alameda County. See Figure 1, Project Location and Site Map. CEMEX and its predecessors-in-interest have been continuously mining for sand and gravel at the Eliot Quarry since at least 1906. In addition to mining and reclamation, existing permitted and accessory uses at the Eliot Quarry include aggregate, asphalt and ready-mix concrete processing, as well as ancillary uses such as aggregate stockpiling, load-out, sales, construction materials recycling, and equipment storage and maintenance. CEMEX's mining operations at the site are vested per pre-1957 mining activities and Alameda County Quarry Permits Q-1 (1957), Q-4 (1957), and Q-76 (1969). Surface mining reclamation activities at the site are currently conducted pursuant to Surface Mining Permit and Reclamation Plan No. SMP-23 ("SMP-23"), approved in 1987. Reclamation plans are mandated by state law under the California Surface Mining and Reclamation Act (Cal. Public Resources Code Section 2710 et seq.). Thus, not implementing a reclamation plan at this site is not an option.

Under the Project, CEMEX proposes a revised Reclamation Plan that serves to adjust reclamation boundaries and contours, enhance drainage and water conveyance facilities, incorporate a pedestrian and bike trail, and achieve current surface mining reclamation standards. Reclamation activities will generally begin as mining activities cease in each area. However, the reduction in mining emissions has not been taken into account in this HRA consistent with guidance from the County. As discussed later in this report (e.g., at Section 5.2), reclamation emissions from the proposed Project are not considered new. The planned post-mining end uses are water management, open space, and agriculture (non-prime).

Consistent with prior approvals, the Project will develop Lake A and Lake B, which are the first two lakes in the Chain of Lakes pursuant to the Alameda County Specific Plan for Livermore-

Amador Valley Quarry Area Reclamation adopted in 1981 ("Specific Plan"). Upon reclamation, Lake A and Lake B, along with their appurtenant water conveyance facilities, will be dedicated to the Zone 7 Water Agency ("Zone 7") for purposes of water storage, conveyance and recharge management.

Lake A reclamation will include installation of a surface water diversion from the Arroyo del Valle ("ADV") to Lake A; conversion of a berm that crosses the west side of the lake to a small island to allow water to flow across the lake; installation of a water conveyance pipeline from Lake A to future Lake C (located off-site to the northwest); and an overflow outlet to allow water to flow back into ADV when Lake A water levels are high to prevent flooding in the localized area. The final surface area of Lake A will be 81 acres as compared to 208 acres in SMP-23. No further mining will occur in Lake A.

Lake B reclamation will include installation of a pipeline turn-out from Lake A, a water pipeline conduit to future Lake C, and an overflow outlet to allow water to flow back into ADV when Lake B water levels are high. The final bottom elevation of Lake B is proposed at 150 feet above mean sea level ("msl"), in order to maximize the available aggregate resource. The final surface area of Lake B will be 208 acres as compared to 243 acres in SMP-23.

To facilitate the southerly progression of Lake B, the Project includes realignment and restoration of a ±5,800 linear foot reach of the ADV. The proposed ADV realignment will result in an enhanced riparian corridor that flows around, rather than through (as currently anticipated in SMP-23), Lake B. The ADV realignment was contemplated in the Specific Plan and subject to environmental review in 1981.

Outside of Lake A and Lake B, reclamation treatment for other disturbed areas, including the Lake J excavation (not part of the Chain of Lakes), processing plant sites, and process water ponds will involve backfills and/or grading for a return to open space and/or agriculture. These areas are referred to as the North Areas for purposes of this study.

The Project is a modification of an approved reclamation plan project (i.e., SMP-23) for a vested mining operation. Except as outlined above, CEMEX proposes no change to any fundamental element of the existing operation (e.g., mining methods, processing operations, production levels, truck traffic, or hours of operation). A more complete description of the proposed Project is contained in CEMEX's Project Description, Revised Reclamation Plan, and other application materials provided to the County.

Project Reclamation Schedule

An estimated time schedule for Project reclamation construction activity is provided in Table 1, Anticipated Reclamation Schedule and Duration. This anticipated sequence and schedule is dependent upon many factors such as securing regulatory entitlements, fluctuations in market demands, and need for specific aggregate products. The reclamation finish (end) dates listed represent the anticipated date by which physical reclamation activity will be complete.

TABLE 1
ANTICIPATED RECLAMATION SCHEDULE AND DURATION

Area	Timing[2]	Est. Duration
1. Lake A		
a. Convert berm to island	2022	2 weeks
b. Berm between ADV and Lake A	2022	2 weeks
c. Overflow outlet to ADV	2022	1 week
d. Pipeline from Lake A to Lake C[2]	2022	3 months
e. Diversion structure – ADV**	2023	2 months
f. Fill percolation ponds[5]	2023	1 week
g. Revegetation	2023	1 month
2. Lake B		
a. Realigned Arroyo del Valle**	2022	7 months
b. Berm between ADV and Lake B	2022	2 weeks
c. Pedestrian and bike trail[3]	2028	6 months
d. Conduit from Lake B to C	2031	1 week
e. Overflow outlet to ADV	2056	2 weeks
f. Excavate Shark's fin drainage notch	2056	1 week
g. Revegetation	2056	1 week
3. North Area - Silt Ponds, Plant Site, Lake J[4]		
a. Resoiling cap – main silt pond	2030	2 weeks
b. Revegetation – main silt pond	2030	1 week
a. Plant site removal	2056	3 months
a. Contour grading / resoiling	2056	1 month
b. Retention ponds	2056	2 weeks
c. Revegetation – plant site and Lake J	2056	3 weeks

Notes:

** Timing for these reclamation items contingent on obtaining regulatory agency authorizations (e.g., 404, 401, and 1600 authorizations).

1. Anticipated progression is approximate only. Actual timelines will vary depending on market and geologic conditions. The reclamation schedule assumes anticipated average mine production of 1,000,000 tons per year.
2. Pipeline from Lake A to Lake C includes turn-out into Lake B.
3. Pedestrian and bike trail south of the realigned ADV is assumed to be developed after an estimated five-year revegetation monitoring period for the realigned ADV.
4. The Lake J excavation will be repurposed as a silt pond after mining is complete (anticipated year 2030).
5. The percolation ponds have a clean, gravel substrate to promote water infiltration to ground. No products have been stored in the percolation ponds that would require any remediation or cleanup.

The reclamation activities listed in the table above would generally commence after mining is complete in each area. For the Lake A area, CEMEX is planning no further mining and plans to complete reclamation and dedicate the lake to Zone 7 as early as 2023. For the Lake B area, mining is ongoing and will continue for approximately 35 years pursuant to existing vested mining rights. In the near term, CEMEX plans to realign and restore the Lake B reach of the ADV as an item of concurrent reclamation to promote the southerly progression of mining in Lake B. The large gap in time between the early reclamation activities and final reclamation is because the installation of certain items of work, such as the overflow outlet, excavation of the drainage notch in the Shark's fin area, and revegetation would not occur until mining in the Lake B area is complete. Similarly for the North reclamation areas, final reclamation including plant site removal, contour grading, installation of retention ponds, and revegetation would not occur until mining is complete in both the Lake B and Lake J areas.

As part of final reclamation, all processing facilities (including the aggregate, asphaltic-concrete, and ready-mix concrete plants), conveyors, and truck scales will be dismantled and removed. Buildings (such as the office and shop buildings), fences and the road networks servicing the quarry may be left in place to facilitate the planned end uses of water management, open space and agriculture. Any incidental refuse or garbage will be collected, hauled off-site and disposed of in accordance with state and local standards. The Project *Air and Greenhouse Gas Emissions Study* (Compass, December 2019) and this HRA account for these processing plant removal activities.

The detailed locations for Project reclamation activities are included in the Revised Reclamation Plan and its supporting figures and design sheets submitted to Alameda County as part of the application.

Project Activities Associated with Public Health Risks

As described above, reclamation would occur in three areas (see Figure 1):

1. Lake A Area
2. Lake B Area
3. North Reclamation Area

Reclamation would occur in phases and sporadically over a period of approximately 34 years (2022 to 2056) as mining is completed in each area. During the reclamation period various activities such as grading, earthmoving, excavation, construction of pipelines, paving of a public trail, and re-vegetation would take place. Each of these activities has the potential to release fugitive dust as well as exhaust from various construction equipment, but in very limited time-frames and duration. Exposure to equipment exhaust and fugitive dust can lead to various health impacts. Specifically, the following three types of public health impacts are commonly associated with exposure to trace metals in dust and diesel particulate matter:

1. Cancer risk (reported as a probability)
2. Acute non-cancer risk (reported as a hazard index)

3. Chronic non-cancer risk (reported as a hazard index)

These health impacts are more thoroughly described in Section 1.3, below. The objective of this HRA is to determine if the Project is likely to expose nearby residents or workers to significant health risks that exceed applicable thresholds. The criteria used to determine if health risks are significant is discussed in Section 2.0, below.

1.2 Scope of the Risk Assessment

The preparation of health risk assessments is a three-step process. The first step is to identify potential contaminants that may contribute to public health risks. The second step is to assess the amount of contaminants that may reach the public (exposure assessment). The third and last step is to calculate the magnitude of the health risk as a result of exposure to harmful contaminants on the basis of the toxicology of the contaminants.

The Office of Environmental Health Hazard Assessment ("OEHHA") and BAAQMD have provided guidance on the procedures that should be used for health risk assessments, including but not limited to the use of toxicological data for individual contaminants. While this HRA uses certain procedures and data from these Guidelines, this assessment is not intended to satisfy the reporting requirements under AB-2588 "Air Toxics" Hot Spots program. The latter requires a more detailed discussion of cancer burden, health values used in dosage-response and dosage estimates, etc. The Project is not subject to this program.

The procedures and assumptions used in this HRA were discussed ahead of time with staff at BAAQMD. To assist with the scoping of this HRA, Compass prepared an initial protocol for air dispersion modeling and health risk calculations ("Modeling Protocol"). The Modeling Protocol provided details on the emission rate calculations and how public health risks would be calculated. See Appendix A, Original Modeling Protocol. The Modeling Protocol suggested the use of San Joaquin Valley Air Pollution Control District ("SJVAPCD") default emissions factors for metal content in fugitive dust for aggregate crushing operations due to a lack of site-specific information at the time relating to trace metals content in soils. After reviewing the protocol, BAAQMD directed Compass to conduct site-specific soil sampling to inform trace metal concentrations for use in the Project health risk modeling. Compass conducted soil sampling as discussed in Section 3.0 below and used the site-specific information in place of the SJVAPCD default factors. Other methods originally proposed in the modeling protocol (e.g., grid sizing) have also been updated. The modeling parameters used in this study are described in Section 4.0 below and supersede those that are found in the original Modeling Protocol.

1.3 Toxic Air Contaminants and Fine Particulate Matter

The following discussion of toxic air contaminants and fine particulate matter is sourced from the May 2017 *California Environmental Quality Act Air Quality Guidelines* issued by BAAQMD ("BAAQMD CEQA Guidelines") to provide information and background on the primary constituents contributing to the Project health risks that are evaluated in this report.

1.3.1 Toxic Air Contaminants

Toxic air contaminants ("TACs") are a defined set of airborne pollutants that may pose a present or potential hazard to human health. A wide range of sources, from industrial plants to motor vehicles, emit TACs. TAC can be emitted directly and can also be formed in the atmosphere through reactions among different pollutants. This report will focus on direct TAC emissions that would be associated with Project reclamation activities, not those formed in the atmosphere.

The health effects associated with TACs are quite diverse and generally are assessed locally, rather than regionally. TACs can cause long-term health effects such as cancer, birth defects, neurological damage, asthma, bronchitis or genetic damage; or short-term acute affects such as eye watering, respiratory irritation (a cough), running nose, throat pain, and headaches. For evaluation purposes, TACs are separated into carcinogens and non-carcinogens based on the nature of the physiological effects associated with exposure to the pollutant. Carcinogens are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per one million exposed individuals, typically over a lifetime of exposure. Non-carcinogenic substances differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis. Acute and chronic exposure to non-carcinogens is expressed as a hazard index (HI), which is the ratio of expected exposure levels to an acceptable reference exposure level.

TACs are primarily regulated through State and local risk management programs. These programs are designed to eliminate, avoid, or minimize the risk of adverse health effects from exposures to TACs. A chemical becomes a regulated TAC in California based on designation by OEHHA. As part of its jurisdiction under Air Toxics Hot Spots Program (Health and Safety Code Section 44360(b)(2)), OEHHA derives cancer potencies and reference exposure levels (RELs) for individual air contaminants based on the current scientific knowledge that includes consideration of possible differential effects on the health of infants, children and other sensitive subpopulations, in accordance with the mandate of the Children's Environmental Health Protection Act (Senate Bill 25, Escutia, Chapter 731, Statutes of 1999, Health and Safety Code Sections 39669.5 et seq.).

1.3.2 Fine Particulate Matter

$PM_{2.5}$ is a fine particulate matter with a diameter equal to or less than 2.5 micrometers. $PM_{2.5}$ is a complex mixture of substances that includes elements such as carbon and metals; compounds such as nitrates, organics, and sulfates; and complex mixtures such as diesel exhaust and wood smoke. $PM_{2.5}$ can be emitted directly and can also be formed in the atmosphere through reactions among different pollutants. This report will focus on direct $PM_{2.5}$ emissions that would be associated with Project reclamation activities, not those formed in the atmosphere.

Compelling evidence suggests that $PM_{2.5}$ is by far the most harmful air pollutant in the San Francisco Bay Area Air Basin ("SFBAAB") in terms of the associated impact on public health (BAAQMD 2017). A large body of scientific evidence indicates that both long-term and short-term exposure to $PM_{2.5}$ can cause a wide range of health effects (e.g., aggravating asthma and bronchitis, causing visits to the hospital for respiratory and cardio-vascular symptoms, and contributing to heart attacks and deaths). BAAQMD recommends characterizing potential health effects from exposure to direct $PM_{2.5}$ emissions through comparison to the applicable thresholds of significance. These thresholds are presented in Section 2.0, below.

1.3.3 Impacted Communities – Project Site Not Included

In the Bay Area, there are a number of urban or industrialized communities where the exposure to TACs is relatively high in comparison to others. These same communities are often faced with other environmental and socio-economic hardships that further stress their residents and result in poor health outcomes. To address community risk from air toxics, BAAQMD initiated the Community Air Risk Evaluation ("CARE") program in 2004 to identify locations with high levels of risk from TACs co-located with sensitive populations and use the information to help focus mitigation measures. Through the CARE program, BAAQMD developed an inventory of TAC emissions for 2005 and compiled demographic and heath indicator data. According to the findings of the CARE Program, diesel particulate matter, mostly from on and off-road mobile sources, accounts for over 80 percent of the inhalation cancer risk from TACs in the Bay Area. Impacted communities as of November 2009 include the urban core areas of Concord, eastern San Francisco, western Alameda County, Redwood City/East Palo Alto, Richmond/San Pablo, and San Jose. The Project site is not located in one of these impacted communities.

1.4 Report Organization

This report is divided into seven sections along with supporting figures and appendices. Following this introduction, Section 2.0 describes the applicable significance criteria that the lead agency may use for the evaluation of Project health risks pursuant to CEQA. Section 3.0 discusses the peak hourly and annual averaged emissions and site-specific soil constituents associated with the Project. Section 4.0 describes the methods used for the exposure assessment, including the data and tools used to determine the dispersion pattern of emissions from the Project. This analysis considers the location of nearby homes, local wind patterns and topography. Section 5.0 describes the results of the Project risk assessment. Section 6.0 summarizes the results and the risk assessment findings relative to applicable thresholds of significance. Section 7.0 provides technical references. Technical data and calculations are provided in figures and appendices.

2.0 SIGNIFICANCE CRITERIA

This section describes the criteria that are used in this report to assess the significance of public health risks. These criteria are based on the May 2017 *California Environmental Quality Act Air Quality Guidelines* issued by BAAQMD ("BAAQMD CEQA Guidelines"). The BAAQMD CEQA Guidelines inform the public and lead agencies of the extent of airborne emissions from stationary sources and the potential public health impacts associated with such emissions.

To assist lead agencies in evaluating air quality impacts at the neighborhood scale, BAAQMD recommends thresholds of significance for local community risks and hazards associated with

TACs and $PM_{2.5}$ with respect to siting a new source and/or receptor; as well as for assessing both individual source and cumulative multiple source impacts. Local community risk and hazard impacts are associated with TACs and $PM_{2.5}$ because emissions of these pollutants can have significant health impacts at the local level. If emissions of TACs or $PM_{2.5}$ exceed any of the thresholds of significance listed below, a proposed project would result in a significant impact:

1. Non-compliance with a qualified risk reduction plan; or
2. An excess cancer risk level of more than 10 in one million, or a non-cancer (i.e., chronic or acute) hazard index greater than 1.0 would be a cumulatively considerable contribution; or
3. An incremental increase of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$) annual average $PM_{2.5}$ would be a cumulatively considerable contribution.

A project would have a cumulatively considerable impact if the aggregate total of all past, present, and foreseeable future sources within a 1,000 foot radius from the fence line of a source plus the contribution from the project, exceeds the following:

1. Non-compliance with a qualified risk reduction plan; or
2. An excess cancer risk levels of more than 100 in one million or a chronic non-cancer hazard index (from all local sources) greater than 10.0; or
3. 0.8 $\mu g/m^3$ annual average $PM_{2.5}$.

These thresholds for local risks and hazards associated with TACs and $PM_{2.5}$ are intended to apply to both permitted stationary sources and on- and off-road mobile sources, such as sources related to construction, busy roadways, or freight movement. While the Project does not introduce a new stationary source, the modeled Project health risks involve on- and off-road mobile sources that can be compared to the BAAQMD thresholds for purposes of CEQA analysis.

3.0 EMISSIONS SUMMARY

Project reclamation activities would release a variety of TACs, such as diesel particulate matter ("DPM") and fugitive dust containing trace metals and respirable silica for brief periods of construction-related work. These are not prolonged exposures lasting many years.

A summary of emissions is presented in Appendix B, Modeling Emissions Inputs. DPM emissions are based on the number, type and duration of usage of construction equipment. Table 1 in Appendix B presents a breakdown of DPM by year and annual average DPM emissions. These emissions were sourced from the Project *Air and Greenhouse Gas Emissions Study* (Compass, December 2019), which relied primarily on the CalEEMod model to quantify emissions associated with reclamation activities. Project reclamation activities were modeled as independent phases in CalEEMod for each of the Lake A, Lake B, and North Areas. The phases were then combined to calculate total Project emissions.

Site-specific soil samples were collected at each of the three reclamation areas (i.e., Lake A, Lake B, and North reclamation areas) to inform emission rates for respirable silica and trace metals. No heavy metals or toxic compounds have been stored at Lakes A or B. The same is true for the North reclamation areas, except for fuels, oils and lubricants that are used for heavy equipment fueling and maintenance and aggregate processing operations. To identify trace concentrations of metals and respirable silica in soils, three soil samples were collected for each of the three reclamation areas, for a total of nine samples. Soil samples were conducted in accordance with the EPA operating procedures for soil sampling (i.e., SESDPROC-300-R3, adopted August 21, 2014) and field equipment cleaning and decontamination (i.e., SESDPROC-205-R3, adopted December 18, 2015). Samples were delivered with chain of custody to McCampbell Analytical, Inc. for analysis. Samples were analyzed by McCampbell to determine the respirable fraction of silica and trace metals concentrations. McCampbell's laboratory reports are included in Appendix C, Soils Analysis Laboratory Results.

Laboratory results were averaged for each of the three reclamation areas to determine annual and daily emission rates. This data along with annual and daily emission rates of PM_{10} were used to quantify annual and hourly emission rates of respirable silica and trace metals. Calculations are provided in Tables 2 through 5 of Appendix B.

The emission rate for respirable silica used in this study is calculated by multiplying the respirable silica percentage (based on the site-specific soil samples) by the PM_{10} emissions rate. The respirable silica percentage is calculated by multiplying the laboratory reported percentage weight of silica quartz in a bulk sample by a factor of 0.44 (44%) to account for the estimated respirable fraction. The respirable factor of 0.44 is based on an aggregate industry study titled, *PM4 Crystalline Silica Emission Factors and Ambient Concentrations at Aggregate-Producing Sources in California* (Richards et al., November 2009), published in the Journal of the Air & Waste Management Association, Vol. 59, which found that the concentration of crystalline silica in respirable PM averaged 44% of the crystalline silica content of the bulk mineral.

The annual emission rate of metals in pounds is calculated by multiplying the laboratory reported average concentration for each metal (in mg/Kg, aka parts per million by weight) by the annual PM_{10} emission rate (in tons) by 2,000 (to convert from tons to pounds) and then dividing by 1,000,000 (see Table 3 of Appendix B). The hourly emission rate of metals in pounds is calculated by multiplying the laboratory reported average concentration for each metal (in mg/Kg or ppm) by the maximum daily PM_{10} emission rate (in pounds per day) and then dividing by 1,000,000, and then dividing again by 8 to convert from pounds per day to pounds per hour.

To address a request by the County's peer reviewer, hexavalent chromium ("Cr-VI") is accounted for in this revised risk analysis. However, based on the site-specific soil sampling the fraction of hexavalent chromium ("Cr-VI") in soils that would be disturbed during reclamation is essentially de minimis. Of the nine site-specific (9) samples that were analyzed, only one sample detected Cr-VI at a level that is above the laboratory detection limit of 0.2 mg/Kg (ppm). The reported value for the single sample for the Lake B Arroyo del Valle berm area is 0.24 mg/Kg, which is just above the detection limit of 0.2 mg/Kg. Please refer to Appendix C at pp. 13-15 for the analytical results for Cr-VI (non-detect for all but the one noted sample), which was then compared to the analytical results for total chromium at pp. 16-24. based on the site-specific sampling, the computed emission rate for Cr-VI in the Lake B area is only 4.99x10^{-5} pounds per year, which corresponds to a 0.193% fraction of the total chromium found in the Lake B area soils. Compass' calculation for the annual emission rate of Cr-VI at Lake B (the only location where Cr-VI was detected) is presented below. For Lake B, the Cr-VI emission rate used for purposes of modeling is based on the average concentration of the three Lake B samples assuming one-half the detection limit (or 0.10 mg/Kg) for the two non-detect samples in the mining and TopCon areas. While Cr-VI is accounted for in the modeling, it does not meaningfully change the results of the risk assessment due to the very low level found in only one sample on the site.

		Assume 0 Concentration if Not Detected		Assume 1/2 of detection limit if Not Detected	
Lake B Lab Analysis	Pit	0	mg/Kg	0.10	1/2 Det Limit
	TopCon	0	mg/Kg	0.10	1/2 Det Limit
	Adv Berm	0.24	mg/Kg	0.24	
Aver Concentration of Cr+6		0.08	mg/Kg	0.147	
Annual PM-10 Emission Rate (From Table 3)		0.17		0.17	tons/yr
		340		340	lbs/yr
Cr+6 Emission Rate (e.g., 0.08 x 340 / 1,000,000)		2.72E-05		4.99E-05	lbs/yr
Total Cr Emission Rate		2.58E-02		2.58E-02	lbs/yr
Ratio Cr+6/Cr		1.05E-03		1.93E-03	
% Cr+6 as fraction ot total Cr		0.105%		0.193%	

4.0 METHODS FOR EVALUATING EXPOSURE

Exposure assessment involves translating the emission rate (e.g., lbs/hr) of individual TACs (presented in Tables 1 to 5 of Appendix B) into a concentration (e.g., grams/cubic meter or parts per million) of each TAC. The key step in performing an exposure assessment is the application of an air dispersion model. The dispersion model incorporates the local meteorological data (wind speed, wind direction, local temperature, inversion heights, etc.), stack height, and exhaust flow characteristics into the concentration of individual air contaminant.

Dispersion modeling was performed using the latest version of the AERMOD Modeling System version 19121. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. AERMOD, like most dispersion models, uses mathematical formulations to characterize the atmospheric processes that disperse pollutants emitted by a source. Using source emission rates, exhaust parameters, terrain characteristics, and meteorological inputs, AERMOD calculates down-wind pollutant concentrations at specified receptor locations. AERMOD is recommended by both the EPA and BAAQMD for stationary source air dispersion modeling.

4.1 Model Setup and Options

The EPA and BAAQMD recommended AERMOD dispersion model was employed in the current exposure assessment. Model selection parameters are listed in Table 2, below.

4.2 Modeling Grid

Two modeling grids were used. Grid 1 provides an overall distribution of risk. A second, smaller grid provides a more detailed calculation of risk. The first grid covers an area 5,880 meters x 4,620 meters and uses a 140-meter spacing. This grid consists of 1,764 individual locations. The second grid covers an area 3,750 meters x 3,250 meters. The second grid is divided into 50-meter cells for a total of 4,875 individual receptors in the vicinity of the Project. In addition, discrete receptors were located at nearby homes, school and hospital. The maximum risk at discrete receptors does not depend on the choice of grid. See Figure 2, Modeling Grid. The final grid employed was larger than what had been proposed in the original Modeling Protocol (Appendix A). The expanded grid was selected to provide additional coverage to the east of the site.

4.3 Meteorological Data

Five years of meteorological data was used in the exposure assessment. The surface data (wind speed, wind direction, temperature, etc.) were recorded at Livermore airport for the period January 1, 2009 to December 31, 2013. This is the most recent data available from the California Air Resources Board ("CARB"). Figure 3, Distribution of Winds, shows the overall wind patterns based on the five years of hourly wind data. This figure shows that the winds are predominantly from the northwest with an average annual speed of 5.5 knots. Calm winds occur approximately 31% of the time.

In addition to surface meteorological data, hourly inversion height data were also required. Five years of data from the nearest upper air station (Oakland Airport, CA) were used to develop hourly inversion heights.

TABLE 2
MODEL SELECTION AND PARAMETERS

Category	Selection / Parameter	Notes
Pollutants Modeled	1. Toxic Metals in fugitive dust 2. Diesel Particulate Matter (DPM)	Annual, 1-Hour concentrations were calculated at each receptor.
Model Selection	AERMOD Version 19121	Industry standard.
Emission Sources and Source Geometry	Various diesel fueled construction equipment and fugitive dust emissions from material handling, excavation, site work, etc. Emissions are modeled as single, elevated (5-meter height) area sources for each of the three reclamation areas. For TACs, a unit emission rate (1 gram/sec) is assigned to each of the three area sources. For $PM_{2.5}$, the annual emission rates of PM_{10} for Lake A and Lake B are divided by the area and results are input in terms of grams/square meter per second. See detailed calculation in Appendix F.	Emission rates of DPM and fugitive dust were determined using the CalEEMod model. The emission rates of metals were calculated from metal composition of fugitive dust based on site specific soil samples. Three samples were collected from each of the three sites, for a total of nine samples.
Modeling Grid(s)	Grid 1: 5,880 meters x 4,620 meters with a 140-meter spacing Grid 2: 3,750 meters x 3,250 meters with a 50-meter spacing	See Figure 2.
Sensitive Receptors	1. Nearest Residences 2. Schools and hospitals	See Figure 2 showing location of nearby residences.
Meteorological Data	1. 5 years of data 2009 to 2013 from Livermore Airport2. Upper Air Data from Oakland Airport 3. Base elevation of 110.58 meters	The meteorological data was obtained from CARB.
Model Options	The following options were used - Non-Regulatory Option to Allow use of U-Star adjusted met data - Terrain option (option used)	

5.0 RISK ANALYSIS

Health risks from public exposure to various TACs is discussed in this section. The emission rates of various TACs referenced in Section 3.0 are used as a basis to quantify various health risks. The HARP2 risk model developed by the CARB and OEHHA[1] was used to calculate the health risks. As described in Section 1.0, three types of health risks were calculated (cancer, chronic non-cancer and acute non-cancer).

5.1 Project Risk Analysis

The project's risks were evaluated using the HARP2 risk model using the OEHHA Derived calculation method. Residential cancer risk is based on a 30-year exposure and worker cancer risk is based on a 25-year exposure consistent with BAAQMD and OEHHA guidelines. For cancer and chronic risks, the minimum mandatory exposure pathways were selected. For acute risks, inhalation pathway was selected.

Since the project is surrounded by an urban residential area, exposure pathways such as home grown produce, raising of animals (cows, pigs, chickens, etc.) for food were not considered. In addition, the area is served by municipal water supply via underground utilities. Therefore, drinking water would not be impacted from any emissions from the project.

The Project's incremental maximum cancer risk at nearby homes is estimated to be 0.8 cancers per million. The risk varies from approximately 0.8 to less than 0.1 excess cancers per million depending on the exposure scenario (residential or sensitive receptor) and location. Cancer risk at nearby businesses is estimated to be 0.03 cancers per million. These results are presented in terms of a probability (cancers risk per million). The spatial distribution of residential and worker cancer risk is shown on Figures 4 and 7, respectively.

The highest residential risk levels are along Vetta Drive, east of Isabel Avenue and north of Lake A in the vicinity of the future construction of the Lake A to C water conveyance pipeline. See Figure 5, Location of Maximum Residential Cancer Risk. Risk at nearby schools and hospitals are estimated to be below 0.04 cancers per million. The highest worker risk occurs southwest of the intersection of Isabel Avenue and East Vineyard Avenue.

The maximum non-cancer risks at nearby homes and businesses are calculated in terms of a hazard index ("HI"). The spatial distribution of acute hazard index is shown on Figure 6. Chronic hazard index was below 0.002 at all locations and as a result a contour map could not be created. The risks for both residential and worker locations are summarized in Table 3.

Excerpts of the HARP2 model inputs are included in Appendix D. HARP model risk tables showing the calculated health risks (including cancer risk and hazard indices) are provided in Appendix E.

[1] OEHHA Hotspots Analysis and Reporting Program (HARP) available at: https://ww3.arb.ca.gov/toxics/harp/harp.htm

5.2 Project Annual Average PM2.5 Concentrations

AERMOD is used to model the Project's incremental annual average $PM_{2.5}$ concentration. The emission rate input into AERMOD is in terms of grams per second per square meter. The highest annual emissions occur during year 2022. During that year, 0.09 tons and 0.28 tons of $PM_{2.5}$ are released from Lake A and B areas, respectively. No reclamation-related emissions from the North Area are expected in 2022.

The Project's incremental annual average $PM_{2.5}$ concentration is 0.26 micrograms per cubic meter (µg/m^3), which is less than the applicable threshold of greater than 0.3 µg/m^3. Inputs and excerpts of the $PM_{2.5}$ modeling are provided in Appendix F. In addition, impacts associated with $PM_{2.5}$ emissions were previously evaluated in the Project *Air and Greenhouse Gas Emissions Study* (Compass, December 2019). Compass' study demonstrated that impacts from $PM_{2.5}$ were less than significant.

5.3 Cumulative Impacts Resulting from TAC and PM2.5 Emissions

The BAAQMD establishes CEQA thresholds of significance for local community and risk hazard impacts for new sources that result in an increase in daily or annual emission levels of any TAC. Current cumulative conditions at the site include on-going mining operations, an approved reclamation plan (SMP-23), and associated TAC and $PM_{2.5}$ emissions. Mining activities, and emissions associated with mining, will generally cease in each area when the majority of reclamation activities begin. As a result, the cumulative TAC and $PM_{2.5}$ emissions in the Project area will be significantly reduced when mining ends and reclamation begins in each area. In addition, State and local law mandate the reclamation of surface mining operations, so reclamation must occur under the approved reclamation plan if the reclamation plan amendments are not approved. Therefore, reclamation emissions from the proposed Project are not considered new. The Project will not have a cumulatively considerable contribution to TAC and $PM_{2.5}$ emissions, as the Project involves amendments to an existing reclamation plan, and these proposed amendments do not implicate an increase in TACs or $PM_{2.5}$ above baseline conditions. Thus, the cumulative impacts related to TAC and $PM_{2.5}$ emissions are less-than-significant.

6.0 RESULTS AND CONCLUSIONS

Table 3 below summarizes the Project health risks in comparison to BAAQMD significance thresholds. The Project's potential health risk impact in terms of excess cancer risk, non-cancer hazards, and maximum incremental annual average $PM_{2.5}$ concentrations is **less than significant**.

The risk assessment process contains numerous, conservative assumptions to ensure that public health risks are not underestimated. These assumptions are related to the exposure duration, toxicity data and use of Gaussian type statistical atmospheric dispersion models. For example, it is unlikely that any individual would remain in the same location for 30 years. As a result, these modeling assumptions may overstate the Project's contribution and the public's exposure to health risks.

TABLE 3
SUMMARY OF MAXIMUM LONG-TERM HEALTH RISKS AT THE PROJECT AREA

Risk Metric	Maximum Off-Site Value	Significance Threshold	Significant?
Residential Cancer Risk per Million (30-year exposure)	0.769	10	No
Worker Cancer Risk (25-year exposure)	0.027	10	No
Cancer Risk per Million at Sensitive Receptors (schools, hospitals)	0.039 at Granada High School 0.029 at Stanford Valley Health Center	10	No
Chronic Hazard Index	Residential 0.0019 Worker 0.0012	1.0	No
Acute Hazard Index	Residential 0.065 Worker 0.028	1.0	No
Annual $PM_{2.5}$	0.26 ug/m3	> 0.3 ug/m3	No

Recommendations for air quality related best management practices for Project construction activities were included in the Air Quality and Greenhouse Gas Emissions Study (Compass, December 2019).

7.0 REFERENCES

BAAQMD (2017). California Environmental Quality Act Air Quality Guidelines. May 2017.

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