Intended for

**VMT / Orcem**

Date

**May 2015**

# VMT / ORCEM HEALTH

# RISK ASSESSMENT VALLEJO, CA

RAMBOLL ENVIRON

# VMT / ORCEM HEALTH RISK ASSESSMENT VALLEJO, CA

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# CONTENTS


| | | |
|---|---|---|
| **1.** | **HEALTH RISK ASSESSMENT ANALYSIS** | **1** |
| **2.** | **PROJECT DESCRIPTION** | **2** |
| 2.1 | Quantification of Project Toxic Air Contaminants | 3 |
| 2.2 | Port Activity | 6 |
| 2.2.1 | Geared Ships | 6 |
| 2.2.2 | Self-Discharge Ships | 6 |
| 2.2.3 | Shipping Emissions | 6 |
| 2.2.4 | Orcem Process Operations and Emissions | 12 |
| 2.3 | Truck Movements on Local Road Network | 13 |
| 2.4 | Rail Movements Accessing the Orcem and VMT Facilities | 16 |
| 2.5 | Diesel Particulate Emissions | 16 |
| 2.6 | Modeling Methodology | 18 |
| **3.** | **HEALTH RISK ASSESSMENT** | **22** |
| 3.1 | Cancer Risks | 22 |
| 3.2 | Non-Cancer Health Effects | 22 |
| 3.3 | Significance Criteria | 22 |
| 3.4 | Chemicals of Concern | 24 |
| 3.5 | Calculation of Risks | 26 |
| 3.5.1 | Characterization of Risks from Toxic Air Pollutants | 28 |
| **4.** | **MITIGATION MEASURES AND MITIGATED HEALTH IMPACTS** | **32** |
| **5.** | **CUMULATIVE IMPACTS** | **34** |
| **6.** | **REFERENCES** | **35** |

# APPENDICES

### Appendix 1

Modelled Source Stack and Location Data

### Appendix 2

Modeling/HRA Compact Disk

# 1. HEALTH RISK ASSESSMENT ANALYSIS

This report presents the methodology and results of a human health risk assessment (HRA) which was performed to assess potential impacts and public exposure associated with the combined airborne emissions of toxic air contaminants (TAC) from the routine operation of both the ORCEM California Inc., Orcem Vallejo GBFS Plant (Orcem) and the Vallejo Marine Terminal (VMT). The combination of the Orcem and VMT is referred to as the "Project" in this document. This analysis is also applicable to the Reduced Operations Alternative (ROA) to the proposed Project, as the effects of the ROA with respect to health risks are substantially the same or slightly less than those of the Project. This report was done in conjunction with AWN Consulting.

Air will be the dominant pathway for public exposure to chemical substances released by the Project. Emissions to the air will consist primarily of combustion by-products produced by the dryer, and from diesel-fired engines. Emissions of toxics from fugitive processes from the various cement processing and handling systems were assessed Potential health risks from facility-wide emissions will occur almost entirely by direct inhalation. To be conservative, additional pathways were included in the health risk modeling, *i.e.,* soil ingestion, dermal exposure, mother's milk exposure. However, direct inhalation is considered the most likely exposure pathway. The HRA was conducted in accordance with guidance established by the California Office of Environmental Health Hazard Assessment (OEHHA), the California Air Resources Board (CARB), and the Bay Area Air Quality Management District (BAAQMD).

TACs are compounds designated by the California's Environmental Protection Agency's (Cal/EPA) OEHHA as known or suspected to cause adverse health effects after short-term (acute) or long-term (chronic) exposure. In addition to naming certain chemicals as TACs, OEHHA also provides information that allows the prediction of health impacts associated with the public's potential exposure to TACs. This information is used in an HRA to estimate the potential public health impacts resulting from TAC emissions from the Project and the ROA. The resulting incremental carcinogenic and non-carcinogenic health risks from the Project are then compared to the BAAQMD California Environmental Quality Act (CEQA) thresholds to assess compliance, and hence, significance.

The HRA process was designed to evaluate the health impacts of the Project and ROA, and to ensure that the Project scenario that resulted in the greatest health impacts was evaluated. The material throughput for both the Orcem and VMT projects would ramp up over time, as shown in Table 1.1 of the Air Quality and GHG Analysis. The greatest air quality impact would result from the activities described in #3 in Table 1.1 of the Air Quality and GHG Analysis, where the maximum material is moved through the facilities via trucks and rail. The maximum mode will not occur until at least 2020. Accordingly, the emissions are analyzed for 2020 fleet year for the shipping scenario where 160,000 metric tonnes of material is shipped to the facility monthly via four vessels, and of that, 91,900 metric tonnes is shipped by truck, and 68,100 metric tons is shipped by rail. This is equivalent to two 100-car trans per week, or eight per month. While there may be up to 12 100-car trains per month, such a scenario would result in lower emissions, as there would be fewer truck trips. Note that the ROA would have the same number of cars, but it would be delivered in 50-car trains rather than 100-car trains. As discussed below, the emissions associated with marine traffic and diesel truck traffic had the greatest impacts on the health impacts. Accordingly, the Project scenarios with the greatest marine and truck traffic was analyzed.

# 2. PROJECT DESCRIPTION

Orcem has filed an application with the City of Vallejo to approve a Major Use Permit and Site Development Plan to construct and operate a processing plant for the manufacture of ground granulated blast furnace slag (GGBFS) and other cement products. Orcem's primary finished product, GGBFS, will be produced on site, via the following major steps:

1. Receive via several alternative transport modes, various raw materials, including, Granulated Blast Furnace Slag (GBFS), clinker, Portland cement, pozzolan, gypsum and limestone.
2. Store the GBFS, clinker, Portland cement, pozzolan, gypsum and limestone on the site.
3. Process, by milling within a closed system, the GBFS granulate and gypsum into GGBFS powder, and all the materials into a variety of hydraulic cements.
4. Store the GGBFS and cement products within enclosed storage facilities on the site.
5. Distribute the GGBFS and cement from the enclosed storage facilities on the site for use in construction projects throughout California and neighboring states.

Orcem will import its raw materials (GBFS, Clinker, portland cement, gypsum, limestone and pozzolan) for production via several methods of transport including ocean going vessels which will berth at the VMT dock. The raw materials will be unloaded and transported to open or covered stockpiles on the site, as appropriate, to fully contain fugitive dust. The raw materials will then be reclaimed from these stockpiles by front end loaders to be transported by conveyors into fully enclosed processing equipment for milling into fine powders (the finished products). The finished products will be transported in fully enclosed conveyance systems into storage silos, for subsequent loading into truck or rail tankers for distribution to customers in the region. GGBFS is manufactured by recycling a by-product, GBFS, from the steel industry. It is used as a partial replacement for traditional (portland) cement.

Given the nature of the operation outlined above, the proposed facility will require review under the BAAQMD Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants. This HRA was prepared consistent with the requirements of Regulation 2, Rule 5 as well as the BAAQMD CEQA Guidelines.

The site is located at the former General Mills facility, Vallejo, California. The site is currently not in operation and it is proposed to redevelop the land for the following uses:

- Orcem is proposing to locate a GGGBS (Ground Granulated Blast Furnace Slag) manufacturing facility on the site as described above, and;
- Vallejo Marine Terminal (VMT) is planning to develop a new dry bulk and break bulk cargo import/export facility at the Project Site. The terminal will act as a dry bulk aggregate receiving, storage and transfer facility, to operate as a distribution hub servicing local and regional markets. It will also facilitate the import of raw materials for the Orcem operation.
- This report covers the cumulative health risks from these proposed developments operating simultaneously.
- The site in question is illustrated in Figure 1 below. The site is located adjacent to the Napa River and is bounded to the east by a steep incline with thick vegetation, to the west by the Napa

River, to the south by undeveloped land and Sandy Beach residential development beyond and to the North by other industrial lands.

- The nearest residential receptor locations to the site are located to the east within the condominium development on Seawitch Lane overlooking the site at a distance of approximately 20 feet from the nearest boundary of the VMT Site.
- As part of the overall development of the site there will be new TAC and $PM_{2.5}$ emission sources introduced. These can broadly be described as follows:
  - Vehicle movements on site;
  - Off-road equipment activity on site;
  - New air emissions from emission point P-1 (Main Stack) and various minor emission points associated with bag filters;
  - Fugitive dust emissions from hoppers & material transfer points;
  - Truck movements on the local road network;
  - Port activity, e.g. ship hotelling, ship unloading, stockpiling etc, and;
  - Rail activity.
- This report discusses the human health impacts of these elements using the following methodology:
  - Identification and quantification of TAC emissions for the two facilities in operation.
  - Identification of the potentially exposed off-site populations (adult and child residents, school child, off-site workers).
  - Quantification of project-related TAC concentrations at locations of the exposed population through the use of air quality dispersion modeling of project TAC emissions.
  - Calculation of health risks (increased cancer risks, chronic and acute non-cancer health effects, and $PM_{2.5}$ concentrations) and comparison to applicable health risk significance thresholds; and
  - Discussion of possible mitigation measures (where required).

## 2.1 Quantification of Project Toxic Air Contaminants

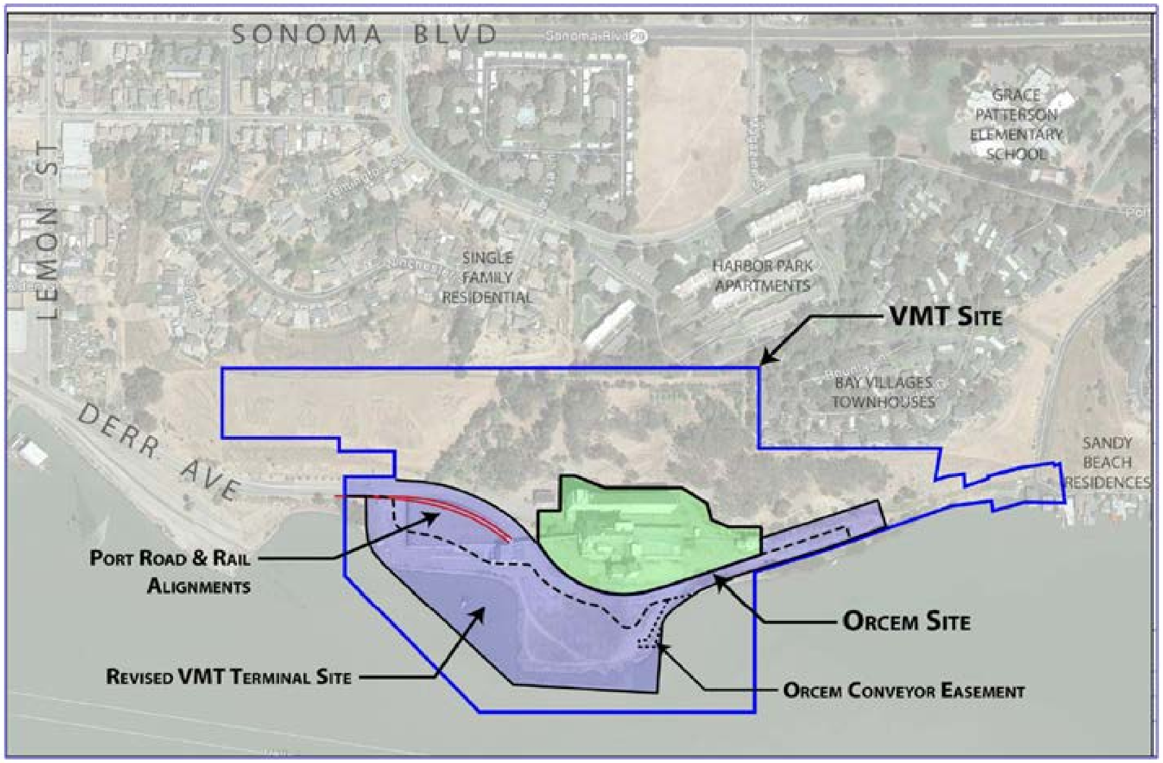
The major sources of emissions of TACs from Project operations are the transportation related combustion air emissions. Transportation-related combustion air emissions sources include vessels associated with marine shipping, locomotives associated with rail transport, and trucks associated with bringing materials into and out of the Project. For purposes of evaluating the health risks from the combustion of diesel fuels in internal combustion engines (ICE), combustion formed $PM_{10}$ was used as the surrogate for diesel particulate matter (DPM), which is used to represent all compounds of diesel combustion related emissions, i.e., particulate and gaseous toxic pollutants. This procedure is consistent with CARB and BAAQMD guidance, as well as its use in numerous other large facility health risk assessments prepared for the BAAMQD. For other diesel fueled sources that do not use an ICE, such as ship boilers, total organic gas (TOG) and $PM_{10}$ emissions were speciated into their individual TAC compounds using CARB PM and organic gas speciation profile data.

The operational phase of the development will see simultaneous operation of both Orcem and VMT in their respective areas. Cumulative emissions associated with the following major activities were quantified in the following sections:

- Port activity, e.g. tug operations, ship exhaust emissions during transit, maneuvering, hotelling and ship unloading;
- Material Unloading and Handling Emissions – stockpiling, uploading of material, material drop points etc;
- Fugitive Dust Emissions and process emissions from the dryer ;
- Off-road equipment activity on site;
- Truck movements both on-site and on the local road network;
- Rail activity.

For the HRA, emissions of DPM (as exhaust $PM_{10}$), TACs from boiler exhaust, TACS from material handling and processing sources, and total $PM_{2.5}$ (combined exhaust $PM_{2.5}$ plus fugitive $PM_{2.5}$ emissions) were based on those identified and quantified in the Air Quality Analysis. The Air Quality Analysis provides detailed discussions of the emission calculations and associated assumptions and are not repeated here. In cases where TAC emissions were calculated specifically for the HRA (e.g., non-DPM speciated emissions), a discussion of the emission calculations is provided.

**Figure 1.1**




| | |
|---|---|
| **Project** | Orcem & VMT Air Modelling Assessment |
| **Reference** | 13/6740AR01 |
| **Figure 1.1** | Site Location |

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## 2.2 Port Activity

The principal raw materials to be processed in the Orcem facility will be GBFS and Clinker. These materials will arrive by ship at the proposed upgraded VMT Phase 1 wharf to be owned and operated by VMT. Two types of ships will be utilized as follows:

### 2.2.1 Geared Ships

Nominally a 40,000 metric tonne bulk carrier with on board cranes (geared ship). This ship will berth at the dock and the raw material on board will be discharged from the ship using clamshell grabs fitted to the on board cranes. The clamshell grabs will lift the raw material from the ship holds and deposit it into mobile hoppers located on the dock.

### 2.2.2 Self-Discharge Ships

Nominally a 70,000 metric tonne bulk carrier with on board reclaim conveyors and a discharge boom with an integral belt conveyor (self-discharge ship). This ship will berth at the dock and the raw material on board will be discharged from the ship via the self-discharge boom which will swing into the required position and transport the raw material from the ship and deposit it into receiving hopper located on the shore. Although these types of vessels may call at the dock, emissions on a per-ton basis will be greater if geared ships were used. Therefore, all vessels were assumed to be geared ships.

### 2.2.3 Shipping Emissions

The principal raw materials to be processed in the Orcem plant will be GBFS and Clinker. Sand and aggregates will be transported by VMT. Both Orcem and VMT will move these materials through the Phase 1 wharf which will be owned and operated by VMT by nominally 40,000 metric tonnes Handymax vessels. The frequency of vessel calls per phase is outlined in Table 1 with Phases 4 and 5 assuming Orcem in operation at Milestone 5. The air emissions associated with the transportation of GBFS within the 24 nautical miles (nm) of the Californian coast (within the low-sulfur fuel zone (0.1% sulfur marine oil) are outlined below.

**Table 1. Number of Vessel Calls Per Milestone**

| Project Mode 1, 2 & 3 For Milestones | Vessel | Annual Orcem Vessel Calls | Annual VMT Vessel Calls |
|---|---|---|---|
| 1 | 40,000 tonne Handymax | 3 | 12 |
| 2 | 40,000 tonne Handymax | 6 | 18 |
| 3 | 40,000 tonne Handymax | 9 | 34 |
| 4 | 40,000 tonne Handymax | 12 | 29 |
| 5 | 40,000 tonne Handymax | 19 | 29 |

TAC emissions associated with ocean going vessels would be DPM, except for the boiler. For the boiler, TOG and $PM_{10}$ emissions were speciated into their individual TAC compounds using PM and organic gas speciation profile data approved by the BAAQMD in a certified EIR. The unspeciated boiler $PM_{10}$ and TOG emissions are in table 2, and the speciation profiles are presented in table 3.

**Table 2. Emissions from Ship Boilers used for TAC Speciation**

| Source Name | Description | Number of Sources | Source Type | Pollutant | $PM_{10}$ Emissions per Source Maximum Hourly (lb/hr/source) | Average Annual (lb/year/source) |
|---|---|---|---|---|---|---|
| SHPHT LB | Ship Hotelling - Boiler | 2 | Point | $PM_{10}$ | 0.02 | 100.12 |
| SHPHT LB | Ship Hotelling - Boiler | 2 | Point | ROG | 0.01 | 93.16 |

**Table 3. Ship Boiler TAC Speciation Profiles for $PM_{10}$ and TOG**

| Toxic Air Contaminant | $PM_{10}$ Weight %[1] | TOG Weight %[2] |
|---|---|---|
| Aluminum | 0.92% | - |
| Ammonium | 6.20% | - |
| Antimony | 0.02% | - |
| Arsenic | 0.00% | - |
| Barium | 0.02% | - |
| Bromine Atom | 0.01% | - |
| Cadmium | 0.00% | - |
| Calcium | 0.04% | - |
| Chlorine atom | 0.06% | - |
| Chromium | 0.00% | - |
| Cobalt | 0.01% | - |
| Copper | 0.01% | - |
| Elemental Carbon | 28.90% | - |
| Gallium | 0.01% | - |
| Indium | 0.01% | - |
| Iron | 0.59% | - |
| Lanthanum | 0.03% | - |
| Lead | 0.03% | - |
| Magnesium | 0.01% | - |
| Molybdenum | 0.01% | - |
| Nickel | 0.72% | - |
| Nitrate | 0.24% | - |
| Organic carbon | 4.80% | - |
| Phosphorus | 0.37% | - |
| Potassium | 0.00% | - |
| Rubidium | 0.00% | - |
| Selenium | 0.00% | - |

**Table 3. Ship Boiler TAC Speciation Profiles for $PM_{10}$ and TOG**

| Toxic Air Contaminant | $PM_{10}$ Weight %[1] | TOG Weight %[2] |
|---|---|---|
| Silicon | 0.89% | - |
| Sodium | 0.25% | - |
| Strontium | 0.00% | - |
| Sulfate | 44.18% | - |
| Tin | 0.01% | - |
| Titanium | 0.00% | - |
| Vanadium | 1.83% | - |
| Zinc | 0.03% | - |
| 1-methyl-2-ethylbenzene | - | 0.08% |
| 2,4,5-trimethylheptane | - | 1.18% |
| 2,4-dimethyl-1-pentene | - | 0.09% |
| 2,4-dimethyloctane | - | 1.30% |
| 2-methyldecane | - | 0.84% |
| 2-methylnonane | - | 0.84% |
| 2-methyloctane | - | 0.30% |
| Acetylene | - | 4.33% |
| a-pinene | - | 0.02% |
| Benzene | - | 2.16% |
| Benzothiazole | - | 0.01% |
| Butylcyclohexane | - | 0.34% |
| C10 alkylphenols | - | 0.08% |
| C10 internal alkenes | - | 0.43% |
| C11 alkylphenols | - | 0.03% |
| C11 dialkyl benzenes | - | 0.02% |
| C11 internal alkenes | - | 0.20% |
| C12 internal alkenes | - | 0.02% |
| Chlorobenzene | - | 0.05% |
| Diethylcyclohexane | - | 0.09% |
| Diethylmethylcyclohexanes | - | 0.11% |
| Dimethylbenzylalcohol | - | 0.03% |
| Dimethylbutylcyclohexane | - | 0.01% |
| Dimethyldecane | - | 0.06% |
| Dimethylethylcyclohexane | - | 0.19% |
| Dimethylheptanes | - | 0.11% |
| Dimethylnonane | - | 0.50% |
| Dimethylundecane | - | 0.05% |
| Dimethyoctyne diol | - | 0.02% |

**Table 3. Ship Boiler TAC Speciation Profiles for $PM_{10}$ and TOG**

| Toxic Air Contaminant | $PM_{10}$ Weight %[1] | TOG Weight %[2] |
|---|---|---|
| Ethane | - | 0.46% |
| Ethene | - | 12.19% |
| Ethyl propylcyclohexanes | - | 0.10% |
| Ethylbenzene | - | 0.07% |
| Ethylcyclohexane | - | 0.12% |
| Ethylhexane | - | 0.07% |
| Ethylmethylcyclohexanes | - | 0.86% |
| Ethylmethylhexane | - | 0.02% |
| Ethyloctane | - | 0.04% |
| Formaldehyde | - | 0.10% |
| Indene | - | 0.07% |
| Isomers of butylbenzene | - | 0.75% |
| Isomers of decane | - | 2.41% |
| Isomers of decyne | - | 0.01% |
| Isomers of dodecane | - | 0.22% |
| Isomers of tridecane | - | 0.01% |
| Isomers of undecane | - | 1.59% |
| Isomers of undecyne | - | 0.04% |
| Isomers of xylene | - | 0.34% |
| Isopropylcyclohexane | - | 0.42% |
| Isopropylmethylcyclohexane | - | 0.09% |
| Methane | - | 5.01% |
| Methyl propylcyclohexanes | - | 1.20% |
| Methyldecalins | - | 0.11% |
| Methyldecene | - | 0.13% |
| Methylundecane | - | 0.18% |
| m-xylene | - | 0.45% |
| Naphthalene | - | 0.07% |
| n-butane | - | 3.64% |
| n-heptane | - | 0.46% |
| n-hexane | - | 1.59% |
| n-nonane | - | 1.86% |
| n-octane | - | 0.46% |
| Nonadiene | - | 0.03% |
| n-pentadecane | - | 39.98% |
| n-pentane | - | 2.05% |
| n-propylbenzene | - | 0.20% |

**Table 3. Ship Boiler TAC Speciation Profiles for $PM_{10}$ and TOG**

| Toxic Air Contaminant | $PM_{10}$ Weight %[1] | TOG Weight %[2] |
|---|---|---|
| Octahydroindenes | - | 0.03% |
| Octahydropentalene | - | 0.02% |
| Octanol | - | 0.02% |
| o-xylene | - | 0.31% |
| Pentylindenecyclohexane | - | 0.03% |
| Propene | - | 4.56% |
| Propenylcyclohexane | - | 0.15% |
| Propyl heptene | - | 0.11% |
| t-butylbenzene | - | 0.06% |
| t-decahydronaphthalene | - | 0.12% |
| Tetramethylcyclopentane | - | 0.11% |
| Tetramethylpentanone | - | 0.13% |
| Tetramethylthiourea | - | 0.01% |
| Toluene | - | 2.15% |
| Trans-1,3-dimethylcyclohexane | - | 0.09% |
| Tethylbenzenes (mixed) | - | 0.68% |
| Trimethylcyclohexane | - | 0.40% |
| Trimethylcyclohexanol | - | 0.03% |
| Trimethylcyclopentanone | - | 0.03% |
| Trimethylhexene | - | 0.07% |
| Trimethyloctanes | - | 0.07% |

Notes:
[1] PM10 speciated by conservatively combining EPA emissions profiles #5676 and #127102.5 (i.e., taking the greater fraction for each overlapping compound).
[2] OG speciated according to California Air Resources Board (CARB) emissions profile #504

Fugitive TAC emissions would be associated with the storage, handling, and processing of GBFS and gypsum. Fugitive GBFS and gypsum $PM_{10}$ emissions, presented in table 4, were speciated into their individual TAC compounds using the speciation data shown in Table 5.

**Table 4. $PM_{10}$ Emissions from Material Handling Sources used for TAC Speciation**

| Source Name | Description | No. of Sources | Source Type | Area Source Size ($m^2$) | GBFS PM Emissions (lb/hr) | GBFS PM Emissions (lb/year) | Gypsum PM Emissions (lb/hr) | Gypsum PM Emissions (lb/year) |
|---|---|---|---|---|---|---|---|---|
| RMSP_S | Raw material storage south | 1 | Area | 1440 | 6.21E-04 | 1.18E+00 | 0 | 0 |
| RWSP_N | Raw material storage north | 1 | Area Poly | 3879.4 | 1.55E-04 | 7.93E-01 | 0 | 0 |
| RMSA_GYP | Gypsum RMSA | 1 | Area Poly | 113.7 | 0 | 0 | 2.03E-05 | 0.233 |
| STACK | Main Stack | 1 | Point | – | 5.17E-01 | 3927.02 | 1.55E-02 | 117.81 |
| SILO1 | Silo 1 | 1 | Point | – | 1.23E-04 | 0.936 | 3.69E-06 | 0.028 |
| SILO2 | Silo 2 | 1 | Point | – | 2.65E-05 | 0.201 | 7.95E-07 | 6.04E-03 |
| SILO3 | Silo 3 | 1 | Point | – | 2.65E-05 | 0.201 | 7.95E-07 | 6.04E-03 |
| LOAD1 | Truck loading 1 | 1 | Point | – | 9.60E-05 | 0.729 | 2.88E-06 | 2.19E-02 |
| LOAD2 | Truck loading 2 | 1 | Point | – | 9.60E-05 | 0.729 | 2.88E-06 | 2.19E-02 |
| LOAD3 | Truck loading 3 | 1 | Point | – | 9.60E-05 | 0.729 | 2.88E-06 | 2.19E-02 |
| FLS1F1- FLS1F26 | RMSP1 to mobile hopper fugitives | 26 | Volume | - | 6.95E-04 | 5.29E+00 | 0 | 0 |
| FLS2F1 - FLS1F13 | RMSP2 to mobile hopper fugitives | 13 | Volume | - | 6.65E-04 | 5.06E+00 | 0 | 0 |
| GYPSFUG1 - GYPSFUG12 | gypsum to mobile hopper fugitives | 12 | Volume | - | 0 | 0 | 1.71E-04 | 1.298 |
| SHP_UPLD | ship upload 1 | 1 | Volume | – | 2.72E-03 | 6.826 | 0 | 0 |
| SHPUPLD2 | ship upload 2 | 1 | Volume | – | 2.72E-03 | 6.826 | 0 | 0 |
| MOB_HOP1 | mobile hopper 1 | 1 | Volume | – | 2.72E-03 | 6.826 | 0 | 0 |
| MOB_HOP2 | mobile hopper 2 | 1 | Volume | – | 2.72E-03 | 6.826 | 0 | 0 |
| INTAKEH | intake hopper | 1 | Volume | – | 5.44E-03 | 13.651 | 0 | 0 |
| MILLFEED | mill feed hopper | 1 | Volume | – | 1.80E-03 | 13.651 | 5.39E-05 | 4.10E-01 |
| MAINSILO | mill silo | 1 | Volume | – | 1.80E-03 | 13.651 | 0 | 0 |
| MILLIN | mill intake | 1 | Volume | – | 1.80E-03 | 13.651 | 5.39E-05 | 4.10E-01 |
| FL_S1 | front loader S1 material handling | 1 | Volume | – | 9.00E-04 | 6.826 | 0 | 0 |
| FL_S2 | front loader S2 material handling | 1 | Volume | – | 9.00E-04 | 6.826 | 0 | 0 |
| EC_HAND1 | excavator material loading and unloading 1 | 1 | Volume | – | 1.80E-03 | 13.651 | 0 | 0 |
| EC_HAND2 | excavator material loading and unloading 2 | 1 | Volume | – | 1.80E-03 | 13.651 | 0 | 0 |
| GYP_MH | gypsum material handling | 1 | Volume | – | 0 | 0 | 1.08E-04 | 8.19E-01 |
| GYPSILO | gypsum silo | 1 | Volume | – | 0 | 0 | 5.39E-05 | 4.10E-01 |
| ELEVAT | elevator drop | 1 | Volume | – | 1.80E-03 | 13.651 | 5.39E-05 | 0.41 |
| GYPCONV | gypsum to conveyor | 1 | Volume | – | 0 | 0 | 5.39E-05 | 0.41 |
| MAINCON | main silo to conveyor | 1 | Volume | – | 1.80E-03 | 13.651 | 0 | 0 |
| CONVY1 | mobile conveyor drop | 1 | Volume | – | 5.44E-03 | 13.651 | 0 | 0 |
| RMSPD1 | conveyor drop 1 | 1 | Area Poly | 230.4 | 3.00E-03 | 6.825 | 0 | 0 |
| RMSPD2 | conveyor drop 2 | 1 | Area Poly | 90.4 | 3.00E-03 | 6.825 | 0 | 0 |

**Table 5 GBFS and Gypsum TAC Speciation Profiles for $PM_{10}$**

| Toxic Air Contaminant | GBFS $PM_{10}$ Weight % | Gypsum $PM_{10}$ Weight % |
|---|---|---|
| Beryllium | 0.00069 | 0 |
| Manganese | 0.12 | 0.001 |
| Selenium | 0.00026 | 0.00013 |
| Vanadium | 0.0029 | 0 |

2.2.4 Orcem Process Operations and Emissions

TAC emissions would be produced from the combustion of pipeline quality natural gas in the drier, as well as TAC emissions associated with the $PM_{10}$ emitted from the stack and bag filtration systems due to GBFS and gypsum use in the production process. TAC emissions from combustion of natural gas in the dryer were calculated based on fuel use and emission factors from CARB's California Air Toxics Emission Factor (CATEF) database shown in Table 6.

**Table 6 Cement Dryer Emission Values**

| Pollutant | Emission Factor lb / MMscf [(1)] | Lbs / Hour | Lbs / Year |
|---|---|---|---|
| Acetaldehyde | 4.61E-03 | 1.53E-04 | 1.16E+00 |
| Acrolein | 4.51E-03 | 1.49E-04 | 1.14E+00 |
| Ammonia | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Benzene | 2.34E-03 | 7.75E-05 | 5.89E-01 |
| 1,3-Butadiene | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Ethylbenzene | 2.25E-03 | 7.46E-05 | 5.67E-01 |
| Formaldehyde | 4.75E-03 | 1.57E-04 | 1.20E+00 |
| Hexane | 6.30E-03 | 2.09E-04 | 1.59E+00 |
| Naphthalene | 2.37E-04 | 7.85E-06 | 5.97E-02 |
| PAH | 7.93E-05 | 2.63E-06 | 2.00E-02 |
| Propylene | 4.63E-01 | 1.53E-02 | 1.17E+02 |
| Propylene oxide | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Toluene | 3.23E-02 | 1.07E-03 | 8.13E+00 |
| Xylene | 1.87E-02 | 6.20E-04 | 4.71E+00 |
| Chrysene | 1.39E-06 | 4.61E-08 | 3.50E-04 |
| Lead | 4.08E-04 | 1.35E-05 | 1.03E-01 |
| Beryllium | [(2)] | 3.57E-06 | 2.71E-02 |
| Manganese | [(2)] | 6.20E-04 | 4.71E+00 |
| Selenium | [(2)] | 1.36E-06 | 1.04E-02 |
| Vanadium | [(2)] | 1.50E-05 | 1.14E-01 |

Notes:

1.Emission factors for natural gas external combustion CARB CATEF Database (34.3 MMBtu/hr)

2 Speciated emission factors based on percent weight from dryer stack PM10 (see Table 3)

## 2.3 Truck Movements on Local Road Network

DPM emissions from truck exhaust were calculated based on a 70-year weighted average. Emission factors from EMFAC2011 for the 70-year operational exposure period were weighted based on the age sensitivity factor (ASF) from BAAQMD guidance (BAAQMD 2010[1]). Each year's emission factor was calculated as the average of the preceding 13 truck model year emission factors, based on the CARB Truck and Bus regulations that mandate 2010 or later engines in all vehicles by 2023 (CARB 2014[2]). Running and idling emission factors, as well as the ASF weighting for each, are presented in Table 7.

[1] http://www.baaqmd.gov/~/media/Files/Engineering/Air%20Toxics%20Programs/hrsa_guidelines.ashx

[2] http://www.arb.ca.gov/msprog/onrdiesel/documents/faqModelyr.pdf

**Table 7 70-Year Weighted Truck Emission Factors**

| Operating Year | 10 mph Running EF[1] (g/mile) | 20 mph Running EF[1] (g/mile) | 40 mph Running EF[1] (g/mile) | Idling EF[1] (g/mile) | Age Sensitivity Factor[2] | 10 mph Weighted Running EF (g/mile) | 20 mph Weighted Running EF (g/mile) | 40 mph Weighted Running EF (g/mile) | Weighted Idling EF (g/mile) |
|---|---|---|---|---|---|---|---|---|---|
| 2020 | 0.0297 | 0.0228 | 0.0166 | 0.0037 | 10 | 0.2967 | 0.2276 | 0.1658 | 0.0366 |
| 2021 | 0.0256 | 0.0196 | 0.0143 | 0.0015 | 10 | 0.2559 | 0.1963 | 0.1430 | 0.0150 |
| 2022 | 0.0215 | 0.0165 | 0.0120 | 0.0015 | 4.75 | 0.1021 | 0.0783 | 0.0571 | 0.0071 |
| 2023 | 0.0174 | 0.0134 | 0.0097 | 0.0015 | 3 | 0.0523 | 0.0401 | 0.0292 | 0.0045 |
| 2024 | 0.0133 | 0.0102 | 0.0074 | 0.0015 | 3 | 0.0400 | 0.0307 | 0.0223 | 0.0045 |
| 2025 | 0.0093 | 0.0071 | 0.0052 | 0.0015 | 3 | 0.0278 | 0.0213 | 0.0155 | 0.0045 |
| 2026 | 0.0117 | 0.0089 | 0.0065 | 0.0015 | 3 | 0.0350 | 0.0268 | 0.0195 | 0.0045 |
| 2027 | 0.0116 | 0.0089 | 0.0065 | 0.0015 | 3 | 0.0349 | 0.0268 | 0.0194 | 0.0045 |
| 2028 | 0.0116 | 0.0089 | 0.0065 | 0.0015 | 3 | 0.0348 | 0.0267 | 0.0194 | 0.0045 |
| 2029 | 0.0116 | 0.0089 | 0.0064 | 0.0015 | 3 | 0.0347 | 0.0266 | 0.0193 | 0.0045 |
| 2030 | 0.0116 | 0.0089 | 0.0064 | 0.0015 | 3 | 0.0347 | 0.0266 | 0.0193 | 0.0045 |
| 2031 | 0.0115 | 0.0088 | 0.0064 | 0.0015 | 3 | 0.0346 | 0.0265 | 0.0193 | 0.0045 |
| 2032 | 0.0115 | 0.0088 | 0.0064 | 0.0015 | 3 | 0.0346 | 0.0265 | 0.0193 | 0.0045 |
| 2033 | 0.0115 | 0.0088 | 0.0064 | 0.0015 | 3 | 0.0346 | 0.0265 | 0.0192 | 0.0045 |
| 2034 | 0.0115 | 0.0088 | 0.0064 | 0.0015 | 3 | 0.0345 | 0.0265 | 0.0192 | 0.0045 |
| 2035 | 0.0115 | 0.0088 | 0.0064 | 0.0015 | 1.5 | 0.0173 | 0.0132 | 0.0096 | 0.0022 |
| 2036 | 0.0115 | 0.0088 | 0.0064 | 0.0015 | 1 | 0.0115 | 0.0088 | 0.0064 | 0.0015 |
| 2037 | 0.0115 | 0.0089 | 0.0064 | 0.0015 | 1 | 0.0115 | 0.0089 | 0.0064 | 0.0015 |
| 2038 | 0.0116 | 0.0089 | 0.0064 | 0.0015 | 1 | 0.0116 | 0.0089 | 0.0064 | 0.0015 |
| 2039 | 0.0116 | 0.0089 | 0.0064 | 0.0015 | 1 | 0.0116 | 0.0089 | 0.0064 | 0.0015 |
| 2040 | 0.0116 | 0.0089 | 0.0065 | 0.0015 | 1 | 0.0116 | 0.0089 | 0.0065 | 0.0015 |
| 2041 | 0.0116 | 0.0089 | 0.0065 | 0.0015 | 1 | 0.0116 | 0.0089 | 0.0065 | 0.0015 |
| 2042 | 0.0116 | 0.0089 | 0.0064 | 0.0015 | 1 | 0.0116 | 0.0089 | 0.0064 | 0.0015 |
| 2043 | 0.0115 | 0.0088 | 0.0064 | 0.0015 | 1 | 0.0115 | 0.0088 | 0.0064 | 0.0015 |
| 2044 | 0.0114 | 0.0087 | 0.0063 | 0.0015 | 1 | 0.0114 | 0.0087 | 0.0063 | 0.0015 |
| 2045 | 0.0112 | 0.0086 | 0.0062 | 0.0015 | 1 | 0.0112 | 0.0086 | 0.0062 | 0.0015 |
| 2046 | 0.0109 | 0.0084 | 0.0061 | 0.0015 | 1 | 0.0109 | 0.0084 | 0.0061 | 0.0015 |
| 2047 | 0.0106 | 0.0081 | 0.0059 | 0.0015 | 1 | 0.0106 | 0.0081 | 0.0059 | 0.0015 |
| 2048 | 0.0102 | 0.0078 | 0.0057 | 0.0015 | 1 | 0.0102 | 0.0078 | 0.0057 | 0.0015 |
| 2049 | 0.0098 | 0.0075 | 0.0054 | 0.0015 | 1 | 0.0098 | 0.0075 | 0.0054 | 0.0015 |
| 2050 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2051 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2052 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2053 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2054 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2055 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2056 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2057 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2058 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2059 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2060 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2061 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2062 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2063 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2064 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2065 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2066 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2067 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2068 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2069 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2070 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2071 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2072 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2073 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2074 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2075 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2076 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2077 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2078 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2079 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2080 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |

**Table 7 70-Year Weighted Truck Emission Factors**

| Operating Year | 10 mph Running EF[1] (g/mile) | 20 mph Running EF[1] (g/mile) | 40 mph Running EF[1] (g/mile) | Idling EF[1] (g/mile) | Age Sensitivity Factor[2] | 10 mph Weighted Running EF (g/mile) | 20 mph Weighted Running EF (g/mile) | 40 mph Weighted Running EF (g/mile) | Weighted Idling EF (g/mile) |
|---|---|---|---|---|---|---|---|---|---|
| 2081 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2082 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2083 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2084 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2085 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2086 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2087 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2088 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 2089 | 0.0092 | 0.0071 | 0.0051 | 0.0015 | 1 | 0.0092 | 0.0071 | 0.0051 | 0.0015 |
| 70-Year Weighted EF: | | | | | | 0.0137 | 0.0105 | 0.0076 | 0.0016 |

Notes:
1. Calculated from EMFAC2011 emission factors, assuming 13 model years of truck active in each year.
2. From BAAQMD guidance.
Sources:
EMFAC2011

## 2.4 Rail Movements Accessing the Orcem and VMT Facilities

The existing California Northern Railroad short line currently extends into the VMT Site, running parallel to Orcem's westerly boundary which serves Vallejo and the North Bay, and connects to the Union Pacific Railroad. It is proposed that as part of this development the line be upgraded with capacity for the storage of rail cars and loading/unloading of materials. Rail tanker cars will be loaded at a location immediately north of the Orcem Site within the VMT site, along the westerly side of the main access road. Trucks will transfer materials to the rail cars from the Loading Silos and Outload Building; materials arriving via rail will be transferred by enclosed pipeline to the material storage areas.

An area for transferring goods and materials between rail cars and trucks ("Rail Transloading" area) will be established. A wheel loader reclaim hopper will be positioned opposite the Orcem Plant (between VMT the Phase 1 and 2 boundaries), and connected to a rail car loading station via an enclosed transfer conveyor. This common mobile system makes it possible for both VMT and Orcem to load and unload rail cars, while maximizing the efficiency of lay-down areas for VMT vessel cargos.

Processing and movement of bulk cargo, under the worst case scenario described earlier in this report, through the use of rail transportation serving the combined VMT Terminal Phases 1 and 2 may require up to 8 monthly unit trains of up to 100 cars per episode (800 total monthly cars). The VMT Project anticipates the use of 2 switch-mobiles or a small locomotive to handle rail car movements on the VMT Site and to and from the California Northern Railroad track spurs adjacent to the Site.

The project rail movements for Orcem are outlined in the Air Quality Analysis (Section 5.2.7 for Orcem and Section 5.4.6 for VMT) and are broken down into raw material imports (cement only under Mode 3) and finished product exports (GGBFS under both Mode 1 and 3). Also discussed in those sections, there is a reduction in truck movements associated with the use of rail to export GGBFS finished product. Thus, should GGBFS be exported by rail, the number of trucks required would be reduced by an equivalent number. However, the risk assessment analyzes full truck movements for VMT of 83 trucks per day, six out of seven days of the week, plus an additional four trucks used for other purposes. The ROA reduces the length of these trains to 50 cars each, along with a doubling of the number of trains. This change in the ROA was designed to reduce traffic and safety effects of the original Project, and will not have a meaningful effect on the analysis or conclusions of this report.

## 2.5 Diesel Particulate Emissions

Diesel particulate (DPM) emissions from ships, trucks, rail, and onsite diesel equipment were included in this HRA. All $PM_{10}$ from these sources was assumed to be DPM. The DPM emissions by source are provided in Table 8.

**Table 8 DPM Emission Sources and Annual Emissions from the Orcem and VMT Sites**

| Source Name(s) | Source Description | Source Type | Number of Sources | DPM Emissions (lb/year/source) |
|---|---|---|---|---|
| CONVY1-7 | Mobile conveyors (exhaust) | Point | 7 | 2.14 |
| MOB_HOP1 - MOB_HOP2 | Mobile hoppers (exhaust) | Point | 2 | 2.14 |
| RAIL_ID - RAILID3 | Rail idling #1 | Point | 1 | 0.04 |
| SHPHTAX | Ship Hotelling - Auxiliary Engine | Point | 2 | 261.92 |
| TRANS1 - TRANS34 | Ship Transit within 3 km | Volume | 34 | 0.27 |
| TRANS35 - TRANS99 | Ship Transit beyond 3 km | Volume | 65 | 0.51 |
| BARGE | Barge hoteling emission point | Volume | 1 | 0 |
| BARGE1 - BARGE29 | Barge emissions | Volume | 29 | 0 |
| BARGE30 - BARG126 | Barge in transit area | Volume | 97 | 0 |
| MANV1 - MANV26 | Ship Maneuvering | Volume | 26 | 1.29 |
| TUG1 - TUG26 | Tug boat - ship assist inbound emissions | Volume | 26 | 0.79 |
| TUGB1 - TUGB26 | Tug boat - ship assist inbound emissions | Volume | 26 | 0.79 |
| NTUG1 - NTUG26 | Tug boat - ship assist inbound emissions (night) | Volume | 26 | 0.79 |
| NTUGB1 - NTUGB26 | Tug boat - ship assist inbound emissions (night) | Volume | 26 | 0.79 |
| RAILST1 - RAILST75 | Rail switching | Volume | 75 | 0.14 |
| RAILLN1 - RAILLN41 | Rail line emissions @ 10 kph | Volume | 41 | 0.01 |
| RAILLN42 - RAILLN65 | Rail line emissions @ 15 kph | Volume | 24 | 0.02 |
| NRAILST1 - NRAILST75 | Rail switching (night) | Volume | 75 | 0.14 |
| NRAILLN1 - NRAILLN41 | Rail line emissions @ 10 kph (night) | Volume | 41 | 0.01 |
| NRAILN42 - NRAILN65 | Rail line emissions @ 15 kph (night) | Volume | 24 | 0.02 |
| ONFUG1 - ONFUG41 | On-site exhaust emissions (Orcem & VMT) | Volume | 41 | 0.02 |
| ONFUG64 - ONFUG83 | On-site exhaust emissions (Orcem & VMT) | Volume | 20 | 0.02 |
| ORFUG42 - ORFUG63 | Orcem Only - on-site exhaust emissions | Volume | 22 | 0.01 |
| LMFUG1 - LMFUG51 | Lemon St exhaust | Volume | 51 | 0.04 |
| SNFUG1 - SNFUG22 | Sonoma Blvd North exhaust | Volume | 22 | 0.003 |

| | | | | |
|---|---|---|---|---|
| SSFUG1 - SSFUG31 | Sonoma Blvd South exhaust | Volume | 31 | 0.003 |
| SMFUG1 - SMFUG29 | Sonoma Blvd South of Magazine exhaust | Volume | 29 | 0.02 |
| LEFUG1 - LEFUG51 | Lemon St exhaust | Volume | 51 | 0.03 |
| VMTFUG1 - VMTFUG19 | VMT Only - on-site exhaust emissions | Volume | 19 | 0.01 |
| FLS1F1 - FLS1F5 | Orcem Only - front-end loader exhaust | Volume | 5 | 0.77 |
| FLS2F1 - FLS1F16 | Orcem Only - front-end loader exhaust | Volume | 16 | 0.77 |
| FLS3F1 - FLS3F7 | Orcem Only - front-end loader exhaust | Volume | 7 | 0.77 |
| FL_PH1 | Front loader Phase 1 | Volume | 1 | 35.99 |
| FL_PH2 | Front loader Phase 2 | Volume | 1 | 0 |
| FORK1 | Forklift operation exhaust | Volume | 1 | 1.79 |

## 2.6 Modeling Methodology

Two primary methods were used to assess the potential for TAC impacts in the surrounding areas. Both methods relied on the USEPA AERMOD dispersion model to calculate initial concentrations of TACs.

The air dispersion modeling, including the model used, the sources and receptors, the meteorological data that was used, and the methods used to process that data are described in Appendix MODEL of the Air Quality and GHG Analysis, which contains a description of the modeling used to evaluate CO and $PM_{2.5}$ concentrations resulting from the Project. The sources and locations of emissions can be found in Appendix1 of this document.

Consistent with the BAAQMD's recommendations (BAAQMD, 2012), this analysis estimated TAC concentrations at potential sensitive receptor locations including people—children, adults, and seniors—occupying or residing in:

- Residential dwellings, including apartments, houses, condominiums;
- Schools, colleges, and universities;
- Daycare;
- Hospitals; and
- Senior-care facilities.

BAAQMD CEQA Guidance (BAAQMD, 2012) requires sensitive receptors within a "radius of impact," which is typically 1,000 feet surrounding the Facility boundary. Moreover, the Guidance indicates that locations where "people reside for long periods should [also] be considered sensitive, residential receptors", and should be included in the CEQA analysis. Because of the size and nature of the Project, the receptors included in this analysis extended beyond the radius of impact in areas along Lemon Avenue and Sonoma Road. Figure 2 displays the locations of the receptors used in the HRA. The 20 meter resolution receptor grid also included areas zoned for both residential and industrial.

Two different approaches were used to model the risks from the TACs, depending on the TACs being modelled:

1. For the calculation of risk impacts associated with DPM, AERMOD was run with the emissions of DPM unit emissions of 1 gram/second to calculate concentrations of DPM dispersion factors in units of µg/m3/g/s. DPM concentrations were then calculated via the "unit emission rate" method, by multiplying these dispersion factors by the actual emission rates. These concentrations were then multiplied by the DPM unit risk factors and adjusted to reflect the age sensitivity weighting factors (discussed below) in order to calculate total DPM risk. DPM risk is only based on the inhalation pathway, therefore, there is no multipathway risk evaluation.
2. For the remaining TACs, both AERMOD and the CARB HARP On-Ramp models were used to assess acute, cancer, and chronic impacts for all receptors. As some of the TACs have exposure pathways that include non-inhalation pathways, HARP is the approved method to assess these impacts. TAC emissions from ship hotelling boilers were evaluated using HARP methodology in an external database to efficiently accommodate changes in input parameters.

The results of the DPM risks were then added to the additional TAC risks from HARP and HARP methodology (for boilers, as noted above) in order to calculate a total cancer risk at each receptor. Both models are discussed below. These calculations are contained in Appendix 2.


U:\Orcem - VMT\GIS\Updated Risk Results.mxd

RAMBOLL ENVIRON

**Modeled Receptor Grid**
**Orcem-VMT**
Vallejo, California

FIGURE **2**

DRAFTED BY: MJH | DATE: | 0336906A

Sensitive receptors are defined as groups of individuals that may be more susceptible to health risks due to chemical exposure. As mentioned above, schools, both public and private, day care facilities, convalescent homes, and hospitals are of particular concern. There were a number of sensitive receptors identified within an approximate 2.5 mile radius of the site. These receptors are noted in Table 9.

**Table 9 Sensitive Receptors Within the Regional Area of the Project**

| Receptor ID | Receptor Type | Receptor ID | UTM Coordinates (E/N), m | Distance (mile) |
|---|---|---|---|---|
| 15 | medical facility | Mare Island VA Hosp | 562359, 4217056 | 2.78 |
| 8 | school | Mare Island Academy | 563474, 4215422 | 1.8 |
| 2 | school | Touro Univ. | 564493, 4215574 | 1.1 |
| 11 | school | Reignierd School | 566142, 4218726 | 2.3 |
| 1 | school | Grace Patterson ES | 566878, 4214937 | 0.36 |
| 13 | school | St. Basils School | 566881, 4218709 | 2.3 |
| 10 | school | Cal Maritime Academy | 567463, 4213715 | 1.3 |
| 12 | school | Cave ES | 567736, 4218848 | 2.5 |
| 4 | school | Beverly Hills ES | 568008, 4215793 | 1.24 |
| 9 | school | John Swett HS | 568280, 4211942 | 2.3 |
| 14 | convalescent home | Genesis Home Care | 568897, 4215861 | 1.59 |
| 7 | daycare facility | Village Childcare | 569207, 4216011 | 2.3 |
| 6 | school | Annie Pennycook ES | 569251, 4216011 | 1.4 |
| 3 | school | Glen Cove ES | 569365, 4214485 | 2 |
| 5 | school | St. Patrick HS | 569974, 4215797 | 2.3 |
| 16 | daycare facility | Benecia Kinder Care | 570897, 4215220 | 2.8 |

In accordance with BAAQMD CEQA Guidance, receptors were also placed in areas zoned as industrial in order to calculate worker impacts. The same 20 meter grid was used in all worker zoned areas.

In general, receptors were not placed directly on roadways, overwater, or at other locations where long-term exposure would not occur. For 1-hour acute impact analyses, fence line receptors were assessed. The receptor grid is shown in Figure 2.

Meteorology

Associated with each point, volume and area source, are unique source and stack release parameters. These parameters include release height, exit velocity, exit temperature, stack diameter, base elevation, area source size, and sigma y/sigma z. These parameters as well as the UTM locations in NAD83 for each source and source type are summarized in Appendix A. Health Risk Methodology and Assessment.

# 3. HEALTH RISK ASSESSMENT

A health risk assessment includes the evaluation of cancer risks and non-cancer chronic and acute health impacts.

## 3.1 Cancer Risks

Cancer risk is the probability or chance of contracting cancer over a human life span (assumed to be 70 years). Carcinogens are not assumed to have a threshold below which there would be no human health impact. In other words, any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure, the lower the cancer risk (i.e., a linear, no threshold model). Under various state and local regulations, an incremental cancer risk greater than 10 in a million due to a project is considered to be a significant impact on public health. For example, the 10 in a million risk level is used by the Air Toxics Hot Spots (California Health and Safety Code [CHSC] 44300 et seq.) program and California's Proposition 65 as the public notification level for air toxic emissions from existing sources.

## 3.2 Non-Cancer Health Effects

Non-cancer health effects can be classified as either chronic or acute. In determining the potential health risks of non-cancerous air toxics, it is assumed there is a dose of the chemical of concern below which there would be no impact on human health. The air concentration corresponding to this dose is called the Reference Exposure Level (REL). Non cancer health risks are measured in terms of a hazard quotient, which is the calculated exposure of each contaminant divided by its REL. Hazard quotients for pollutants affecting the same target organ are typically summed with the resulting totals expressed as hazard indices for each organ system. A hazard index of less than 1.0 is considered to be an insignificant health risk. For this HRA, all hazard quotients were summed regardless of target organ. This method leads to a conservative, upper-bound assessment. RELs used in the hazard index calculations were those published in the CARB/OEHHA listings dated June 2014.

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure, caused by chemicals accumulating in the body, i.e. typically over a lifetime of seventy years. Because chemical accumulation to toxic levels typically occurs slowly, symptoms of chronic effects usually do not appear until long after exposure commences. The lowest no effect chronic exposure level for a non carcinogenic air toxic is the chronic REL. Below this threshold, the body is capable of eliminating or detoxifying the chemical rapidly enough to prevent its accumulation. The chronic hazard index was calculated using the hazard quotients calculated with annual concentrations.

Acute toxicity is defined as adverse health effects caused by a brief chemical exposure over periods ranging from 1 to 8 hours. For most chemicals, the air concentration required to produce acute effects is higher than the level required to produce chronic effects because the exposure duration is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all hazard quotients are typically summed to calculate the acute hazard index. Average short-term modelled concentrations are divided by acute RELs to obtain a hazard index for health effects caused by relatively high, short term exposure to air toxics.

## 3.3 Significance Criteria

In June 2010, BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA. These thresholds were designed to establish the level at which BAAQMD identified air pollution emissions would cause significant environmental impacts under CEQA and were posted on BAAQMD's website and included in the Air District's updated CEQA Guidelines (updated May 2011). The significance thresholds identified by BAAQMD and used in this analysis are summarized in Table 10.

BAAQMD's adoption of significance thresholds contained in the 2011 CEQA Air Quality Guidelines was called into question by an order issued March 5, 2012, in California Building Industry Association (CBIA) v. BAAQMD (Alameda Superior Court Case No. RGI0548693). The order requires BAAQMD to set aside its approval of the thresholds until it has conducted environmental review under CEQA. The ruling made in the case concerned the environmental impacts of adopting the thresholds and how the thresholds would indirectly affect land use development patterns. In August 2013, the Appellate Court struck down the lower court's order to set aside the thresholds. However, this litigation remains pending as the California Supreme Court recently accepted a portion of CBIA's petition to review the appellate court's decision to uphold BAAQMD's adoption of the thresholds. The specific portion of the argument to be considered is in regard to whether CEQA requires consideration of the effects of the environment on a project (as contrasted to the effects of a proposed project on the environment). Therefore, the health risk significance thresholds contained in the 2011 CEQA Air Quality Guidelines have been used for evaluation of this Project and the ROA.

**Table 10. BAAQMD Health Risks and Hazards Thresholds of Significance**

| Category | Operational Threshold |
|---|---|
| Health Risks and Hazards for New Sources | |
| Excess Cancer Risk | 10 in a million |
| Chronic or Acute Hazard Index | 1 |
| Incremental annual average $PM_{2.5}$ | 0.3 $\mu g/m^3$ |
| Cumulative Health Risks and Hazards for New Sources | |
| Excess Cancer Risk | 100 per one million |
| Chronic Hazard Index | 10 |
| Annual Average $PM_{2.5}$ | 0.8 $\mu g/m^3$ |

Cancer risks less than 10 in a million are unlikely to represent significant public health impacts that require additional controls of facility emissions. Risks higher than 10 in a million may or may not be of concern, depending upon several factors. These include the conservatism of assumptions used in risk estimation, size of the potentially exposed population, and toxicity of the risk-driving chemicals.

Increased cancer risks and non-carcinogenic health effects were evaluated for the following exposure types and receptor locations.

- 70 year residential exposure – residential receptors were assumed to be at locations of existing and potential future residential structures.
- 9 year school child exposure – school child receptors were assumed to be at the location of school(s) where children under the age of 16 are present.
- Worker exposure – non-residential receptors where workers are likely to be present.

Human health risks associated with emissions from the proposed Project and the ROA were calculated for each modeling receptor for each applicable exposure type and the location of the receptor with the maximum health risk, or maximum impact receptor (MIR), identified. Health risks from the Project and the ROA are unlikely to be higher at any other location in the Project area than at the location of the MIRs. If there is no significant impact associated with the health risks at the

MIR locations, it is unlikely there would be significant impacts in any other location in the vicinity of the Project for the exposure scenario evaluated.

## 3.4 Chemicals of Concern

The human health risks associated with Toxic Air Contaminants (TACs) were evaluated in this HRA. The chemical substances emitted to the air from the proposed Project stationary and mobile sources, including fugitives from other miscellaneous support and handling systems are listed in Table 11.

**Table 11. Toxicity Values Used To Characterize Health Risks (Inhalation)**

| Compound | Unit Risk Factor $(mg/m^3)^{-1}$ | Chronic Reference Exposure Level $(mg/m^3)$ | Acute Reference Exposure Level $(mg/m^3)$ |
|---|---|---|---|
| Acetaldehyde | 0.0000027 | 140 | 470 |
| Acrolein | - | 0.35 | 2.5 |
| Benzene | 0.000029 | 60 | 1,300 |
| 1-3 Butadiene | 0.00017 | 20 | - |
| Ethylbenzene | 0.0000025 | 2,000 | - |
| Formaldehyde | 0.000006 | 9 | 55 |
| Hexane | - | 7,000 | - |
| Naphthalene | 0.000034 | 9 | - |
| PAHs (as BaP) | 0.0011 | - | - |
| Chrysene | 0.000011 | - | - |
| Propylene | - | 3,000 | - |
| Propylene Oxide | 0.0000037 | 30 | 3,100 |
| Toluene | - | 300 | 37,000 |
| Xylene | - | 700 | 22,000 |
| Chlorine | - | 0.2 | 210 |
| Chlorobenzene | - | 1000 | - |
| MEK | - | - | 13000 |
| Antimony | - | - | - |
| Barium | - | - | - |
| Chromium[6] | - | - | - |
| Beryllium | 0.0024 | 0.007 | - |
| Manganese | - | 0.09 | - |
| Selenium | - | 20 | - |
| Vanadium | - | - | 30 |
| Arsenic | 0.0033 | 0.015 | 0.2 |
| Cadmium | 0.0042 | 0.02 | - |
| Copper | - | - | 100 |
| Lead | 0.000012 | - | - |
| Mercury | - | 0.03 | 0.6 |
| Nickel | 0.00026 | 0.014 | 0.2 |
| Diesel PM | 0.0003 | 5 | - |

Sources:

BAAQMD. 2010. Regulation 2, Rule 5. January. Available at: http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2002/rg0205.ashx?la=en. Accessed 9 May, 2015.

OEHHA. 2009. Revised Air Toxics Hot Spots Program Technical Support Document for Cancer Potency Factors. June. Available at: http://www.oehha.org/air/hot_spots/tsd052909.html. Accessed 9 May, 2015.

### 3.5 Calculation of Risks

Emissions of toxic pollutants potentially associated with the Project and ROA were estimated using emission factors approved by CARB and the U.S. Environmental Protection Agency (EPA). Concentrations of these pollutants in air potentially associated with Project emissions were estimated using approved dispersion modeling techniques. Modeling allows the estimation of both short-term and long-term average concentrations in air for use in a HRA, accounting for site-specific terrain and meteorological conditions. Health risks potentially associated with the estimated concentrations of pollutants in air were characterized in terms of excess lifetime cancer risks (for carcinogenic substances), or comparison with reference exposure levels for non-cancer health effects (for non carcinogenic substances).

Calculation of TAC concentrations for use in HRA analysis requires the selection of appropriate concentration averaging times. In accordance with OEHHA guidance (OEHHA, 2003), annual average concentrations were estimated and used to evaluate cancer risk, chronic non-cancer impacts. Acute non-cancer impacts were estimated using the maximum 1-hr concentration from each activity, irrespective of hour of occurrence. This results in a conservative estimate of acute impacts. For acute non-cancer hazard analyses, the calculated 1-hour maximum concentrations for each emission source group were used. Note that because the maximum emissions for each group are not expected to occur during the same hour of the year, summing the maximum 1-hour concentrations across all source groups yields conservative (i.e., overestimates of) total air concentrations.

Health risks potentially associated with concentrations of carcinogenic air pollutants were calculated as estimated excess lifetime cancer risks. The excess lifetime cancer risk for a pollutant is estimated as the product of the concentration in air and a unit risk value. The unit risk value is defined as the estimated probability of a person contracting cancer as a result of constant exposure to an ambient concentration of 1 microgram per cubic meter (μg/m3) over a 70-year lifetime. In other words, it represents the increased cancer risk associated with continuous exposure to a concentration in air over a 70-year lifetime.

The BAAQMD’s adopted thresholds are based on estimation of cancer risk using methods from OEHHA’s Technical Support Document for Cancer Potency Factors: Methodologies for Derivation, Listing of Available Values, and Adjustment to Allow for Early Life Stage Exposures (Cal/EPA, 2009). The OEHHA Technical Support Document proposes the use of age-specific sensitivity factors to account for an "anticipated sensitivity to carcinogens" of infants and children. Under this approach, cancer risk estimates are weighted by a factor of 10 for exposures that occur from the third trimester of pregnancy to 2 years of age and by a factor of 3 for exposures that occur from 2 years to 16 years of age. The cancer risk adjustment factor (CRAF) is the weighted factor over the entire exposure duration. The BAAQMD recommended CRAF for a 70-year residential exposure is 1.7 (BAAQMD, 2010) and was applied to the cancer risk estimation for a residential exposure. Worker exposures were assumed to occur for adults over 16 years old; therefore, no adjustment factor was applied in the cancer risks estimations for these populations. School children were assumed to be 16 years of age or younger and a CRAF) of 3 was applied in estimating cancer risks over an assumed 9 year exposure period. The BAAQMD adoptedexposure factors are summarized in Table 12.

**Table 12 Cancer Risk Adjustment Factors**

| Receptor | Cancer Risk Adjustment Factor[1] (CRAF) |
|---|---|
| Resident[2] | 1.7[a,b] |
| Worker[3] | 1[a,c] |
| School Child[4] | 3[a,d] |
| Day Care Child[5] | 5.2[a,e] |

**Notes:**

[1] All values based on BAAQMD Health Risk Screening Analysis guidelines (BAAQMD 2010).

[2] A resident was assumed to be exposed for the whole lifetime (70 years).

3. A worker was assumed to represent age 16 to age 70.

4. A school child was assumed to be from 7 years old to 16 years old.

5. Daycare centers were assumed to accept children from 6 weeks to 6 years old.

**Sources:**

AAQMD. 2010. Air Toxic NSR Program Health Risk Screening Analysis Guidelines. January. Available at: http://www.baaqmd.gov/~/media/Files/Engineering/Air%20Toxics%20Programs/hrsa_guidelines.ashx. Accessed 9 May 2015.

Evaluation of potential non-cancer health effects from exposure to short-term and long-term concentrations in air was performed by comparing modelled concentrations in air with the RELs. A REL is a concentration in air at or below which no adverse health effects are anticipated. RELs are based on the most sensitive adverse effects reported in the medical and toxicological literature. Potential non-cancer effects were evaluated by calculating a ratio of the modelled concentration in air and the REL. This ratio is referred to as a hazard quotient. The unit risk values and RELs used to characterize health risks associated with modelled concentrations in air were obtained from the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (CARB, 2014), and the BAAQMD (Table 2.5-1 of Regulation 2 Rule 5).

DPM was used as the surrogate compound for all diesel combustion related emissions, i.e., particulate and gaseous toxic pollutants, consistent with BAAQMD guidance.

The DPM surrogate was applied to the following diesel fuel combustion sources related to or part of this facility:

- Off-road mobile diesel-fueled equipment, i.e., onsite excavator, loaders, etc.
- Railroad engine related emissions, i.e., haul and switching engines, etc.
- Ship, barge, and tug boat emissions, i.e., primary and auxiliary engines.
- Mobile source diesel engines, i.e., diesel truck engines, and offroad equipment engines

For purposes of the CEQA risk assessment the following sources were included in the analysis:

- All on-site stationary point, area, and fugitive sources.
- All on-site mobile source emissions.
- All off-site mobile source emissions.

### 3.5.1 Characterization of Risks from Toxic Air Pollutants

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk is expressed as a unit less probability. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF).The equation used to calculate the potential excess lifetime cancer risk for the inhalation pathway is as follows:

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk is expressed as a unit less probability. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF).The equation used to calculate the potential excess lifetime cancer risk for the inhalation pathway is as follows:

$$Risk_{inh} = \Sigma\ C_i x\ CF\ x\ IF_{inh}\ x\ CPF_i\ x\ CRAF\ x\ 10^6$$

Where:

$Risk_{inh}$ = Cancer Risk; the incremental probability of an individual developing cancer as a result of inhalation exposure to a particular potential carcinogen (risk per million)
$C_i$= Annual Average Air Concentration for $Chemical_i$ (μg/$m_3$)
CF = Conversion Factor (mg/μg)
$IF_{inh}$ = Intake Factor for Inhalation ($m^3$/kg-day)
$CPF_i$= Cancer Potency Factor for $Chemical_i$ (mg chemical/kg body weight-day)$^{-1}$
CRAF = Cancer Risk Adjustment Factor (unitless)

and

$$IF_{inh} = DBR\ x\ ET\ x\ EF\ x\ ED\ x\ CF/AT$$

Where:

DBR = Daily Breathing Rate (L/kg-day)
ET = Exposure Time (hours/24 hours)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
AT = Averaging Time (days)
CF = Conversion Factor, 0.001 ($m^3$/L)

The potential for exposure to result in chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) to the chemical-specific non-cancer chronic RELs. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed, yielding an HI.

The equations used to calculate the chemical-specific HQs and the overall HI are:

$$Chronic\ HQ_i = C_i\ /\ cREL_i$$

$$\text{Chronic HI} = \Sigma HQ_i$$

Where:

Chronic $HQ_i$ = Chronic Hazard Quotient for $\text{Chemical}_i$ (unitless)
Chronic HI = Hazard Index (unitless)
$C_i$ = Annual Average Air Concentration for $\text{Chemical}_i$ (µg/ $m^3$)
$cREL_i$ = Chronic Non-cancer Reference Exposure Level for $\text{Chemical}_i$ (µg/ $m^3$)

The potential for exposure to result in acute non-cancer effects is evaluated by comparing the estimated 1-hour maximum air concentration to the chemical specific non-cancer acute RELs. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse acute non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed, yielding an HI.

The equations used to calculate the chemical-specific HQs and the overall HI are:

$$\text{Acute } HQ_i = C_i / aREL_i$$
$$\text{Acute HI} = \Sigma HQ_i$$

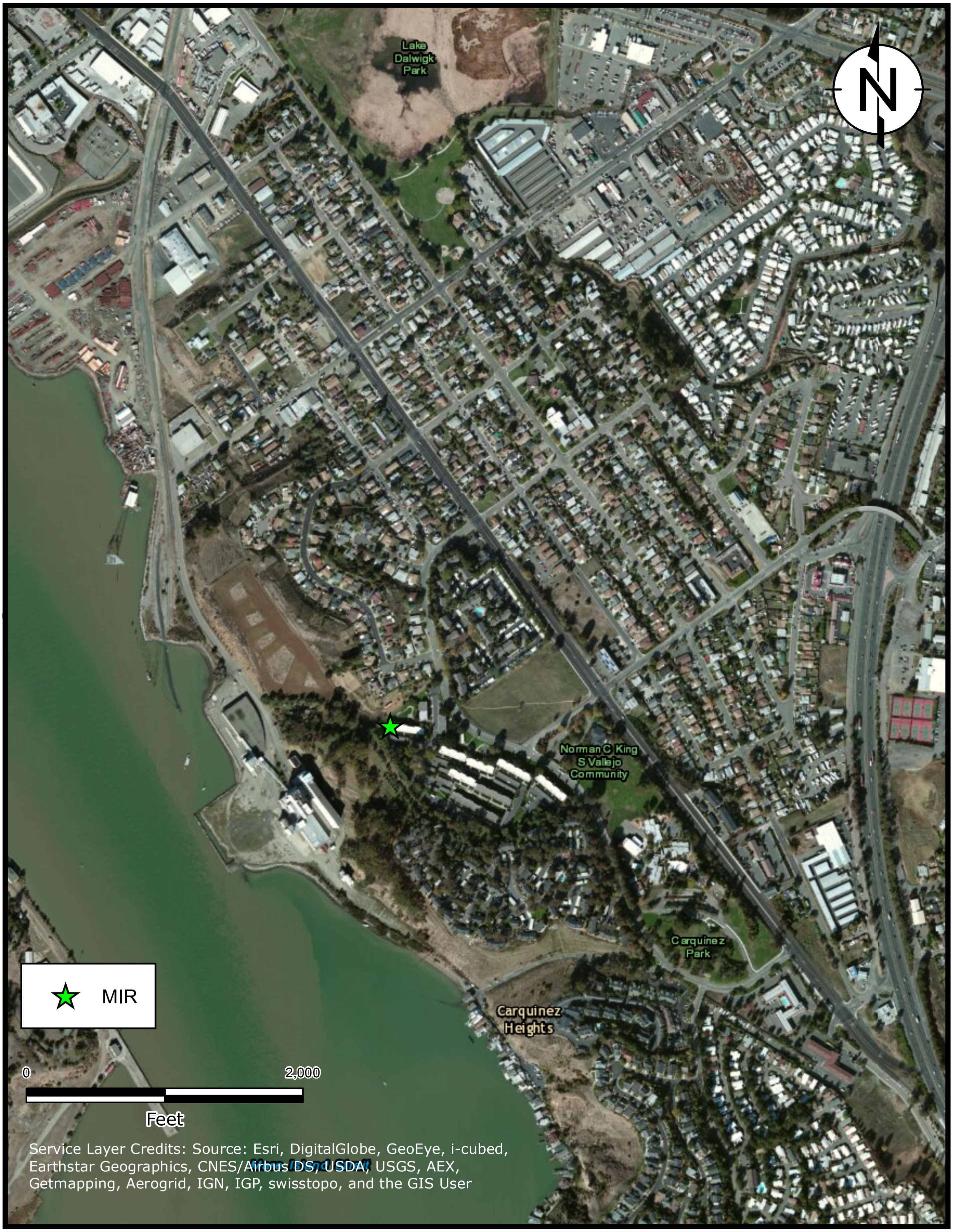
Where:
Acute $HQ_i$ = Acute Hazard Quotient for $\text{Chemical}_i$ (unitless)
Acute HI = Hazard Index (unitless)
$C_i$ = 1-hour Maximum Air Concentration for $\text{Chemical}_i$ (µg/$m^3$)
$aREL_i$ = Acute Non-cancer Reference Exposure Level for $\text{Chemical}_i$ (µg/ $m^3$)

The excess lifetime cancer risks associated with the multi-pathway analyses were calculated for residential, school (child), and worker exposures. The maximum excess cancer risks for each of these exposure types are summarized in Table 13. The maximum residential MIR location, with respect to the Project site is in Figure 3. Excess lifetime cancer risks less than 10 in a million are unlikely to represent significant public health impacts that require additional controls of facility emissions. Risks higher than 10 in a million may or may not be of concern, depending upon several factors. These include the conservatism of assumptions used in risk estimation, size of the potentially exposed population, and toxicity of the risk-driving chemicals. Health effects risk thresholds are listed in Table 10.

The excess cancer risks resulting from Project operation presented in Table 13 would be above the BAAQMD Threshold of significance of an excess cancer risk greater 10.0 in a million with no additional mitigation at maximum activity (as defined by the number of ship calls). Mitigation measures to achieve compliance with the BAAQMD adopted Thresholds are discussed in section 3.5.2 below.

**Table 13. Unmitigated Project Health Risks Summary**

| | Project Impacts | |
|---|---|---|
| **Risk Category** | **Project Values at MIR** | **Applicable Significance Threshold** |
| 70-Year Residential Exposure | | |
| Cancer Risk | 13.34 | Greater than10.0 in a million |
| Chronic Hazard Index (HI) | 0.1 | Chronic HI greater than 1.0 |
| Acute Hazard Index (HI) | 0.0097 | Acute HI greater than 1.0 |
| MIR Location: 566410.58 meters easting, 4215178.79 meters northing | | |
| Sensitive Receptor Exposure (School Child) | | |
| Cancer Risk | 0.86 | Greater than10.0 in a million |
| Chronic Hazard Index | 0.019 | Chronic HI greater than 1.0 |
| Acute Hazard Index (HI) | 0.0097 | Acute HI greater than 1.0 |
| MIR Location: 566878.0 meters easting, 4214937.0 meters northing | | |
| Offsite Worker Exposure | | |
| Cancer Risk | 1.68 | Greater than 10.0 in a million |
| MIR Location: 566059.60 meters easting, 4215591.11 meters northing | | |




RAMBOLL ENVIRON

**MIR Location**
**Orcem-VMT**
Vallejo, California

FIGURE
**3**

DRAFTED BY: MJH | DATE:

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# 4. MITIGATION MEASURES AND MITIGATED HEALTH IMPACTS

In order to determine the annual average number of ship calls that results in no significant impact before additional mitigation is applied, specific emission sources were scaled with shipping activity. Transiting, maneuvering, barges, tugs, and ship hotelling emissions (auxiliary engines and boilers) were all scaled directly with the total number of ship calls. Onsite equipment was similarly scaled, but based on the operator. In other words, Orcem's conveyors, hoppers, and front-end loaders were scaled based on Orcem ship calls (from a maximum of 19 ships), and VMT's forklift and front-end loader were scaled based on VMT ship calls (from a maximum of 29 ships).

Potential mitigation measures include the following:

- Use of biodiesel in all diesel equipment – the unmitigated case assumes the use of 20% biodiesel, consistent with the City of Vallejo Climate Action Plan (2012). Mitigation may include the use of higher fractions of biodiesel in various equipment, up to 100%. 20% biodiesel results in an 18% reduction in DPM (See Section 5 of the Air Quality and GHG Analysis), and 100% biodiesel would result in a maximum reduction of 60% (CalEPA 2012) of DPM;
- Compressed Natural Gas (CNG) front-end loaders – This measure can be applied to either Orcem's front-end loaders, VMT's front-end loader, or all equipment. Implementation would eliminate DPM from these sources entirely;
- Electric-powered Orcem mobile conveyors and hoppers which would eliminate DPM from these sources;
- Electric-powered VMT forklift which would eliminate DPM from that source

Table 14 shows the MEIR cancer risks for various mitigation scenarios, as well as the maximum annual average number of ships under each scenario that would result in less than significant impact. If, during the operation of the Project or ROA, the annual average number of ships exceeded the level of the existing mitigation, additional mitigation would need to be applied to maintain less than significant impact.

**Table 14. Mitigation Measure Summary**

| Mitigation Measures | Maximum Residential Cancer Risk (in a million) | Maximum Number of Ship Calls for Less than Significant Impact | Maximum Residential Cancer Risk at Maximum Ship Calls (in a million) |
|---|---|---|---|
| 20% Biodiesel in all on-site equipment (Base Case) | 13.34 | 28 | 9.92 |
| 100% Biodiesel in conveyors and hoppers, 20% Biodiesel in all other on-site equipment | 11.96 | 36 | 9.91 |
| 20% Biodiesel in all equipment, with Orcem natural gas-fueled (CNG) front end loaders (FELs) | 10.17 | 47 | 9.995 |
| 20% Biodiesel in all equipment, with Orcem and VMT CNG FELs | 9.39 | -- | 9.39 |
| 100% Biodiesel in conveyors and hoppers, 20% Biodiesel in forklift and VMT FEL, Orcem CNG FELs | 9.74 | -- | 9.74 |

Results from the air toxics HRA based on emissions modeling indicate that, after mitigation, there will be no significant incremental public health risks from operation of the Project. All modelled impacts are less than the BAAQMD health risk based CEQA significance levels with the proper adoption of mitigation measures.

# 5. CUMULATIVE IMPACTS

The maximum mitigated excess cancer risk from the Project and the ROA (Orcem and VMT operation) was calculated to be 9.4 in a million, which is below the BAAQMD significance threshold of an increased cancer risk of greater than 10.0 in one million. Additionally, acute and chronic non-cancer health effects would be well below the BAAQMD significance threshold of a hazard index greater than 1.0.

As recommended by the BAAQMD (BAAQMD, 2012), to assist in evaluating cumulative risks, permitted stationary sources of TACs near the Project Site were identified using BAAQMD's *Stationary Source Risk and Hazard Analysis Tool* for sources in Napa-Solano counties.

This mapping tool uses Google Earth to identify the location of stationary sources and their estimated screening level cancer risk and hazard impacts. Three stationary sources within a 0.5 mile radius of the Project site were identified:

- Plant G10729 is the Discount Gas Grocery & Liquor located at 605 Magazine Street, approximately 1,300 feet northeast of the Project boundary. This gas station has a cancer risk value of 4.02, a hazard value of 0.004, and no $PM_{2.5}$ value associated with it.
- Plant 16677 is Original Display Fixtures located at 206 Lemon Street, about 600 feet northwest of the Project boundary. There are no cancer risk, hazard or $PM_{2.5}$ values associated with this source.
- Plant 17907 is the Sousa Solano Auto Body & Paint shop located at 407 Lemon Street, about 970 feet north of the Project boundary. There are no cancer risk, hazard or $PM_{2.5}$ values associated with this source.

It is assumed that both Plants 16677 and 17907 would not contribute to cumulative risks or hazards. For Plant G10729 it is highly unlikely that the gas station will significantly contribute to any significant cumulative cancer risk or hazard when combined with the Project's cancer risks and hazards since the BAAQMD Thresholds for significant cumulative risk are a cancer risk of greater than 100 in a million and a hazard index of greater than 10.0 for all local sources combined.

Based on the above, the project would not exceed the adopted BAAQMD Thresholds with respect to cumulative community risk caused during project operation since single-source and cumulative and cancer risk and hazard index would all be less than the BAAQMD Thresholds. Therefore, the Project and ROA impacts are found to be less-than-significant.

# 6. REFERENCES

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/21/ Risk Management Guidance for the Permitting of New Stationary Diesel-fueled Engines, CARB, SSD-EAB, 10/2000.

/22/ Rail Yard HRA Studies by CARB, i.e., Roseville, Mira Loma, West Oakland, BNSF San Diego, SD-Imperial Rail Yard, Stockton, Colton Yard, Barstow, etc.

/23/ Port HRA Studies, i.e., POLA/POLB HRA, CARB, SSD-EIB, 4/2006.

# APPENDIX 1

# MODELLED SOURCE STACK AND LOCATIONAL DATA

# APPENDIX 2
# MODELING / HRA