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VMT/ORCEM REVISED OPERATIONS ALTERNATIVE AIR QUALITY AND HEALTH RISK ASSESSMENT
VALLEJO, CA

RAMBOLL

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1. EXECUTIVE SUMMARY

This Air Quality Evaluation and Health Risk Assessment for the Revised Operations Alternative (ROA) of the Orcem California (Orcem) and Vallejo Marine Terminal (VMT) Project in Vallejo California has been prepared as supplemental information for inclusion in the Project Final EIR. The original September 2015 Draft EIR published by the City of Vallejo contains quantified estimates of air emissions and health risk assessments for the original Project, but only addresses the ROA qualitatively.

The ROA has been sponsored by Orcem and VMT as a feasible alternative to the Original Project, designed to minimize all environmental effects through use of superior efficiencies in equipment and operations for both Orcem and VMT. The ROA was originally identified in the Draft EIR as the "*Environmentally Superior Alternative*" because of its feasible approach to avoidance and minimization of Project impacts. Since the ROA accomplishes the basic Project objectives for Orcem and VMT with reduced levels of combined impacts, the applicants have requested approval of this alternative by the City of Vallejo, together with the issuance of permits from both the lead agency (City of Vallejo) and all responsible agencies (including the BAAQMD).

The supplemental information contained in this ROA Evaluation addresses both the criteria pollutants and health risk assessment issues originally addressed for the Project in Appendix D-1 of the Draft EIR, focusing on the unique operational attributes of ROA. As requested by City and BAAQMD staff, it includes an overall summary of ROA emissions, and presents a clear statement of assumptions and methodology, as well as clear calculations and references to supporting documentation throughout. The conclusions summarized in this report have been drawn directly from a set of six (6) Interim Work Products delivered in to the City and their EIR consultants for review and comment, and delivered to staff at BAAQMD in final form reflecting City consultant comments, responses and final edits.

All emissions and health risks have been quantified and evaluated for the combined Orcem and VMT components of the ROA under maximum emissions or "worst case" air quality impact conditions. The analysis documents that such maximum ROA emissions occur with respect to all defined criteria pollutants, health risks[1], and GHG emissions under the operating scenario when: (1) The Orcem Mill is operating at maximum Mode 3 / Milestone 5 (producing maximum GBGFS and blended cement products), utilizing 19 large (average 40,000 MT) annual vessel shipments of raw materials; and in addition (2) The VMT Terminal is operating at its remaining maximized capacity with 29 (of the total 48) large annual vessel shipments, where all imported goods are loaded onto rail for distribution. The combined emissions for all other ROA operating scenarios (VMT utilizing a greater percentage of the total 48 large vessels, VMT utilizing a combination of smaller and larger vessels, Orcem operating in maximized Modes 1 or 2, etc.) have all been tested and found to be either equal to or lower than the results presented in this supplemental report.

The components listed below are elements of the ROA description (distinguishing it from the original project), assumptions used in the air quality analysis, and/or required mitigation measures in the EIR. In order to assist the reader, each item is noted as such:

- ROA Component/AQ Assumption: Revised Orcem Truck Loading & Weight Confirmation System which reduces truck counts by 4%. This is incorporated in the analysis by way of the Orcem truck capacity (see Attachment 3).

- ROA Component/AQ Assumption: Enhanced Orcem Truck Scheduling Efficiency which substantially reduces the average daily number of trucks from 189 to 122

[1] As discussed in section 4 of this report, the Health Risk Assessment was evaluated in Moth Modes 2 and 3. Results are presented for Mode 2, as the increased truck volume has slightly greater local impacts.

(including the 4% reduction above) by increasing the average monthly trucking days from 17.5 to 26.

- AQ Assumption: A 17% reduction in maximum output of the Orcem Mill under Mode 3 / Milestone 5 (702, 980 MT/year when GBFS is ground and blended with cement), compared to Mode 2 / Milestone 5 (844,444 MT/year when clinker is ground to produce cement), resulting in a proportionate reduction in the monthly number of truck trips on top of all other reductions (see stack emissions calculation details in Attachment 1). Both modes were considered in this analysis, see Section 3.5

- ROA Component/AQ Assumption: A commitment to use of all 2010 or newer technology truck engines (existing Project mitigation in the DEIR). This is included by statute in EMFAC2017 beginning in 2023, before the analysis year of 2025 (see Attachment 3).

- ROA Component/AQ Assumption: A commitment to use of Tier 4 Equipment for all land-based construction activities (excluding wharf pile drivers), with substantially reduced criteria pollutant emissions. See Attachment 1 for emission factors and calculation details.

- ROA Component: Use of a Fleet and Equipment Management Plan to rely on newer and lower-emission technologies (up and beyond BAAQMD standards) for trucks, front-loaders, and all other powered equipment. This was not incorporated into this analysis.

- ROA Component/AQ Assumption: Reduced train lengths of 50 versus 100 rail cars, to improve air emission efficiencies while dramatically reducing the time required for trains to cross local city streets (the “gate down time”). See Attachment 4 for details.

- ROA Component: A Barge Preference Implementation Strategy (BPIS) through which VMT will prioritize the movement of goods through the Terminal by barge over rail or trucks (Note that this market-based preference program has a 25% usage goal, which would result in further reduced air emissions; however, this has not been relied on for any of the quantified air emissions or HRA analysis).

- ROA Component: Revised Project-Sponsored Technology Upgrades to avoid significant air quality and HRA effects for the ROA. This program is integrated into the Emission Estimate for the ROA, utilizing both clearly defined BAAQMD-approved technologies which will be easily verified and enforced by the City of Vallejo. The specific technologies are presented in Table 6 for the HRA, but have not been quantified for criteria pollutant and GHG emissions.

- AQ Assumption: Updated analysis of the ROA alternative’s time needed to achieve Milestone 5 operating levels (revised to 2025 for the ROA).

- ROA Component: Elimination of All Nighttime Train Activity (Note that this serves to reduce noise impacts but does not affect emissions and has not been utilized in the quantified HRA analysis).

- ROA Component: Elimination of Late Night Orcem Operations within 300 Feet of the Nearest Residential Boundary (Note again that this serves to reduce noise impacts but does not affect emissions and has not been utilized in the quantified HRA analysis).

- ROA Component: Supplemental Landscape Screening for Orcem Mill Operations (Note that this serves to reduce visual impacts but does not affect emissions has not been utilized in the quantified HRA analysis).

~~These design components are part of the ROA description and are not classified as mitigation measures as such.~~

The maximum combined (Orcem and VMT) Project impacts under the ROA are summarized and compared to the relevant BAAQMD CEQA thresholds in Table ES.1 below.

Table ES.1 – Comparison of ROA (Orcem + VMT) Impacts with BAAQMD Adopted May 2017 CEQA Thresholds

	Units	Project	Threshold	Exceed Threshold?
Construction Emissions[1]				
ROG	lb/day	8.2	54	No
NO_X		53.7	54	No
PM_{10} (exhaust)		2.5	82	No
$PM_{2.5}$ (exhaust)		2.5	54	No
GHG	MT	94	--	--
Operational Emissions				
ROG	tons/year	3.6	10	No
NO_X (before statutory offsets)		41.4	10	Yes
NO_X (after statutory offsets)		6.9	10	No
PM_{10} (exhaust)		1.1	15	No
$PM_{2.5}$ (exhaust)		1.0	10	No
ROG	lbs/day	19.7	54	No
NO_X (before statutory offsets)		227	54	Yes
NO_X (after statutory offsets)		38	54	No
PM_{10} (exhaust)		5.9	82	No
$PM_{2.5}$ (exhaust)		5.8	54	No
GHG - stationary source (lifecycle)	MT CO2e/yr	<zero	10,000	No
GHG - stationary source (no lifecycle)	MT CO2e/yr	13,648	10,000	Yes
GHG - other	Compliance with a Climate Action Plan	Yes	Yes	No
Construction Health Impacts on Off-site Receptors				
Excess Lifetime Cancer Risk	in a million	1.14	10	No
Chronic Hazard Index[1]	unitless	0.009	1	No
$PM_{2.5}$ Concentration[1]	$\mu g/m^3$	0.08	0.3	No
Acute Hazard Index[1]	unitless	--	1	No
Operational Health Impacts on Off-site Receptors				
Excess Lifetime Cancer Risk (unmitigated)	in a million	18.25	10	Yes
Maximum Excess Lifetime Cancer Risk (mitigated)	in a million	8.96	10	No
Chronic Hazard Index[1]	unitless	0.1	1	No
$PM_{2.5}$ Concentration[1]	$\mu g/m^3$	0.13	0.3	No
Acute Hazard Index[1]	unitless	0.01	1	No
Combined Health Impacts on Off-Site Maximum Exposed Impacted Receptor (MEISR)				
Excess Lifetime Cancer Risk[2]	in a million	24	100	No
Chronic Hazard Index[1]	unitless	0.1	10	No
$PM_{2.5}$ Concentration[1]	$\mu g/m^3$	0.13	0.8	No
CO Hot Spot Analysis[1]				
Local CO (8-hour average)	ppm	4	9.0	No
Local CO (1-hour average)	ppm	7	20	No

Notes:

1. Denotes values not reevaluated for the ROA (See DEIR table ES.2)
2. 2. Includes maximum unmitigated cancer risk and risk from nearby cumulative sources in the DEIR analysis (4.02) scaled for 2015 OEHHA Guidance

Abbreviations:

ROG - Reactive Organic Gases
PM10 - Particulate Matter up to 10 micrometers in size
PM2.5 - Particulate Matter up to 2.5 micrometers in size
MT CO2e/yr - metric tons of CO2 equivalents
lb/day - pounds per day
MT - Metric Tonnes
Tons/year - tons per year
µg/m3 - microgram per cubic meter
ppm - parts per million

With the exception of cancer risk calculations to account for the use of Tier 4 equipment and revised health risk assessment guidance (see Attachment 6), construction was not reevaluated for the ROA, as it remains similar to that of the original Project. Based on the results of updates to the criteria pollutant emissions and operational cancer risks, non-cancer health impacts and CO and $PM_{2.5}$ concentrations are not expected to increase under the ROA.

The combined unmitigated ROA emissions are greater than the BAAQMD significance threshold for NOx. The BAAQMD requires that emissions from the combination of stationary sources, ocean going vessels and rail be offset if those emissions from any facility are greater than 10 tons per year. Only NOx emissions are greater than 10 tons per year from stationary sources, ocean going vessels and rail activities at both Orcem and VMT.

Permitted emissions of certain criteria pollutants that are greater than 10 tons per year, but less than 35 tons per year are provided offsets by the BAAQMD from its Small Facility (Offset) Banking Account. The only criteria pollutant greater with emissions greater than 10 tons per year from the ROA is NOx. Emissions of NOx from ocean going vessels from Orcem are 9.1 tons per year, Orcem rail emissions are 0.9 tons per year, and stationary sources from Orcem are 5.6 tons per year. Emissions of NOx from ocean going vessels from VMT are 13.8 tons per year and emissions from rail from VMT are 5.1 tons per year. Therefore, the BAAQMD will provide Orcem with 15.5 tons of NOx emissions offsets, and, in the ROA also provide VMT with 18.9 tons of offsets for a total of 34.5 tons of offsets per year (values may differ slightly from rounding). Accordingly, these emissions are shown as “after statutory offsets” emissions in Table ES.2 (emissions which have been reduced by application of an existing BAAQMD program, without need for further project mitigation). These emission offsets are estimates of the total emission offsets that will be provided by the BAAQMD upon permitting. However, the permitting will not be completed until after this Environmental Impact Report (EIR) is certified. Note that application of NOx offsets by the BAAQMD for VMT is only possible through modification of the original Project, as called for in the ROA, to subject the VMT project component to permitting (and associated operational regulation, including the use of Best Available Control Technology [BACT]). Orcem stationary sources are subject to BAAQMD permitting under both the original project and the ROA and are thus eligible for BAAQMD offsets.

Application of NOx offsets for both VMT and Orcem, along with the pollutant reduced and the estimated reduction are contained in Table ES.2, below. The BAAQMD would be permitting Orcem and VMT shipping, and would, under the ROA, individually provide a permit for the both components. In permitting the Orcem and VMT operations, the BAAQMD would provide NOx offsets from its Small Facility (Offset) Banking Account, as each of the operation’s NOx emissions are below 35 tons per year. Table ES.2 outlines the combined annual mean emission totals (tons/yr.) for the Orcem and VMT operations for each aspect of the operations, individually, and combined.

Table ES.2 – Annual Emissions of Criteria Pollutants and Greenhouse Gases from the ROA's Combined Operations of VMT and Orcem

	Emissions (tons/year)								GHG Emissions (MT CO_2e/year)
	CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_X	
VMT Emissions	6.03	19.15	0.48	1.32	0.46	0.20	1.61	1.20	2,873
VMT Offsets	--	18.92	--	--	--	--	--	--	--
VMT After Offsets	6.03	0.22	0.48	1.32	0.46	0.20	1.61	1.20	2,873
Orcem Emissions	18.68	22.24	0.60	2.43	0.59	0.66	1.98	1.00	23,585
Orcem Offsets	--	15.53	--	--	--	--	--	--	--
Orcem After Offsets	18.68	6.72	0.60	2.43	0.59	0.66	1.98	1.00	23585.10
Orcem + VMT Emissions	24.71	41.39	1.08	3.75	1.05	0.86	3.59	2.20	26,459
BAAQMD Thresholds	--	10	15	--	10	--	10	--	--
Unmitigated Emissions Significant?	No	Yes	No	No	No	No	No	No	No
Orcem + VMT After Offsets	24.71	6.94	1.08	3.75	1.05	0.86	3.59	2.20	26,459
BAAQMD Thresholds	--	10	15	--	10	--	10	--	--
Mitigated Emissions Significant?	No	No	No	No	No	No	No	No	No

Notes:
1. Emissions offsets calculated for stationary sources, rail, and shipping, per BAAQMD statute.

2. INTRODUCTION

This report summarizes the assumptions and results of the ROA air quality evaluation and health risk assessment, portions of which were previously provided to the City of Vallejo ("the City") and BAAQMD as a series of six (6) transmittals for review and comment. Each of these transmittals is included in this report as Attachments 1-6. The transmittals detail the assumptions and results of each component of the overall emissions estimation: on-site sources, trucks, rail, and shipping. This report summarizes the combined impacts of these emission components, and explains how the emissions were combined to determine the maximum potential combined impacts of the ROA.

Following the calculation of component emissions for the ROA and the determination of the maximum combined impact scenario, the health risk assessment for operational cancer risk was updated based on the ROA emissions. The health risk assessment was conducted using the same methodology and assumptions described in the February 2016 Ramboll Environ report, "VMT/Orcem Health Risk Assessment 2015 OEHHA Guidance Update".

Based on the component emissions as outlined below and in the detailed calculation attachments, the maximum combined operating scenario was determined to be Orcem Mode 3, Milestone 5 (19 ship calls/year) plus maximum remaining VMT operations of 29 ships per year (for a combined total of 48 large vessels annually). The resulting activity for emissions calculations and health risk assessment are summarized in Tables 1 and 2.

Table 1 – Maximum Combined Impact Scenario Throughputs

Facility	Material Imported by Ship (MT)	Material Imported by Truck (MT)	Material Exported by Truck (MT)	Material Imported by Rail (MT)	Material Exported by Rail (MT)
Orcem	760,000	22,306	557,196	120,000	145,732
VMT	1,160,000	-	-	-	1,160,000

Note: Orcem imports and exports have different volumes to account for drying of GBFS during processing

Table 2 – Maximum Combined Impact Scenario Activity (Annual)

Facility	Ship Calls per Year	Total One-Way Truck Trips	Total Number of Rail Cars
Orcem	19	49,152	1,607
VMT	29	2,496	12,790

Notes:

1. Rail cars are presented rather than unit trains as cars with material from both facilities will be intermingled in 50-car trains, rather than trains being exclusive to Orcem or VMT. Calculations in Attachment 4 assume 33 annual 50-car trains for Orcem and 256 50-car trains for VMT.
2. The four daily VMT trucks are only for material delivery, and not for product transport. In the maximum impact scenario, all VMT product is transloaded to rail (see section 3.2).

3. AIR QUALITY EVALUATION

The following sections describe the emission sources evaluated in the ROA. Emissions were evaluated for maximum operations at each of Orcem (for both Modes 2 and 3) and VMT separately, before being combined to determine the maximum possible combined operating scenario impacts. All emissions were calculated for an operational year of 2025, based on an expected construction period of 2019-2020, Facility operations commencement of 2021, and a five-year "ramp-up" period to reach maximum operations, consistent with the DEIR.

3.1 On-Site Operations

On-site operations consist of all emissions sources contained within the site, i.e., all emissions sources and activities other than ships, trucks, and rail. These sources include exhaust emissions from off-road diesel equipment and the Orcem mill, fugitive dust from material handling, storage piles, and bag filters, and emissions associated with electricity and energy use for Facility operations.

On-site operations were evaluated using the same methodology as the DEIR, with an updated operational year of 2025 and by using the most recent emission factors and input data available. All offroad equipment is assumed to meet CARB/EPA Tier 4 Final engine standards.

The on-site operations assumptions, methods, and emissions are summarized in Attachment 1. Emissions in Attachment 1 represent individual maximum operations for each Facility – Orcem Mode 3, Milestone 5 and VMT at 36 ships per year. When combined with the other emission components, these emissions were scaled to represent the maximum possible combined scenario (i.e. 29 VMT ships when combined with Orcem Milestone 5 production).

3.2 On-Road Truck Trips

Both Orcem and VMT have the potential to rely on heavy-duty diesel trucks for transporting material. Under both Mode 2 and Mode 3 operations, Orcem would import raw material and export finished product via trucks. In Mode 3, a portion of the total truck activity is offset by the use of railcars. Per the original project description, in Mode 3 a portion of finished product will be shipped out by rail rather than by truck, reducing the number of truck trips. Despite the reduction in truck emissions, Mode 3 remains the maximum emissions scenario due to full use of the Mill.

Due to the DEIR limitation of 83 trucks/day for material off-haul[2], VMT would only be able to transport 40,000 MT of material by truck per month, equivalent to 12 fully-loaded HANDYMAX ship calls per year. Once the annual number of ship calls exceeds 12 fully-loaded vessels (or equivalent), VMT will transport material by rail. As a result of the original VMT Phase 2 being removed from the Project, space constraints reduce VMT's ability to load material by truck and rail simultaneously, and it is assumed that all material will be transported by rail.

Rail and truck loading can occur sequentially, but not simultaneously, in the same month. However, when rail loading is interrupted to load trucks, the rail volume decreases substantially, as does the maximum number of ships which can be transloaded per month. Similarly, in order for VMT to reach the maximum number of trucks (83 trucks/day for 26 trucking days/month), no rail cars can be loaded because the terminal transloading area is fully occupied by trucks for the entire month. In order to switch between truck and rail loading, the transloading space must be cleared and reorganized, drastically reducing efficiency. Thus, at full truck capacity, no rail cars

[2] The EIR Project Description includes 87 trucks per day. Four the trucks are for material delivery only. They are not included in emissions for off hauling, but are included in the overall project emissions and HRA impacts.

are loaded and VMT is limited to one ship per month. Therefor the maximum scenario is 29 VMT vessels transloaded to rail.

During the truck transloading process, the terminal is fully occupied for one month as stated above and another ship cannot unload for rail transloading until the terminal is cleared. This was possible under the original Project with VMT Phase 2, but is not possible under the ROA without that additional space.

The only trucks associated with VMT activity in the maximum combined scenario are 4 material delivery trucks per day of terminal operation, for a maximum of 26 days per month and 12 months per year.

The truck trip length used for this ROA analysis was calculated as described in Attachment 2. Maximum truck emissions for each Orcem and VMT are calculated in Attachment 3.

3.3 Rail Activity

As described above, both Orcem and VMT may make use of trains to transport material. In Mode 3, Orcem would both import raw materials and export finished product by rail. In Mode 2, Orcem would not transport any material by rail, even at maximum throughput (19 ships/year). As noted in section 3.2 above, per the original project description a portion of raw materials and finished product will be transported by rail in Mode 3. At more than 12 fully-loaded (or equivalent) ship calls per year, VMT is assumed to transport all material by rail.

In the ROA, train size has been reduced from the DEIR assumption of 100 cars per train to 50 cars per train. Based on information from CalNorthern, the rail line operator, this will require the use of two locomotives per train for line-haul, compared to one locomotive for an empty train and three for a loaded train under the DEIR. The DEIR states that the National Railway Equipment Company (NREC) will provide ultra-low emission equipment for switching activity on the rail ladder adjacent to the Facility. Since the DEIR was published, the most recent NREC equipment will meet Tier 4 engine standards as required by CARB regulations.

Emissions associated with switching, idling, on-site line-haul and off-site line-haul were calculated based on the most recently available rail inventory data and CARB methodology, as described in Attachment 4. Emissions calculations were based on the DEIR limitation of 1,200 rail cars per month, or 14,400 rail cars per year. By assuming all VMT material will be transported by rail, this results in a further limitation from the maximum number of ship calls; under the ROA, VMT would be limited to approximately 32 fully-loaded ships per year. At full Orcem rail capacity, the remaining allowance of rail cars for VMT is equivalent to 29 fully-loaded ships for VMT.

3.4 Ocean Going Vessel (OGV) and Harborcraft (tug) Activity

Emissions from OGV transiting, maneuvering, and hoteling, as well as activity from two tug boats per ship call during maneuvering, were calculated for the ROA using the same methodology as the DEIR, and are presented in Attachment 5. The DEIR calculations were updated to incorporate the most recent low-load adjustment factor data, consistent with the forthcoming CARB emissions inventory.

The DEIR discusses two potential bulk vessels that may be used during operation: 40,000 metric ton “geared” ships and 70,000 metric ton “self-discharge” ships. As noted in the DEIR, both types of ship would have the same material discharge rate, and thus the same total hoteling time for the same amount of material throughput. The air quality analysis of the DEIR, and this this analysis of the ROA, were conducted assuming all 40,000 metric ton ships to maximize the number of ship calls for the same material throughput, and thus maximize the potential air quality impacts from transiting and maneuvering.

The emission factors, load factors, and engine sizes used in the DEIR and ROA analyses are representative of all bulk carriers, regardless of capacity. It is likely that the 40,000 MT bulk vessels are below the averages used to derive default data (and thus the current assessment is conservative), and that engine sizes between the 40,000 MT and 70,000 MT ships would not increase enough to offset the reduction in ship calls.

Shipping emissions and activity are identical for each Orcem and VMT on a per-ship basis, so emissions are presented for the combined maximum operations of 48 ships per year.

3.5 Combined Emissions Summary

All of the emission sources described above were combined to determine the maximum combined operational impact scenario. Activity was limited to 48 total ship calls, and all component emissions were scaled according to Table 3. As shown in Table 3, most Orcem and VMT emissions scale directly with ship calls for the respective facilities. The exceptions are GHGs from electricity use and facility operation, truck and rail activity (under certain circumstances), and the Orcem main stack.

Emissions for the following scenarios were calculated and compared to determine the maximum combined impacts:

- Orcem Mode 2 at 19 ships, VMT 29 ships
- Orcem Mode 2 at 19 ships, VMT 12 ships (truck limited)
- Orcem Mode 2 at 12 ships, VMT 32 ships (rail limited)
- Orcem Mode 3 at 19 ships, VMT 29 ships
- Orcem Mode 3 at 19 ships, VMT 12 ships (truck limited)
- Orcem Mode 3 at 12 ships, VMT 32 ships (rail limited)

Orcem Mode 3 at 19 ships, VMT at 29 ships maximized all emissions categories with applicable BAAQMD CEQA thresholds. Limiting VMT to 12 ships to account for maximum trucks resulted in a *de minimis* increase in total GHG emissions, though the applicable threshold is for stationary sources. That scenario as well as some Orcem Mode 2 scenarios result in greater total fugitive PM emissions from increased truck activity, but there is no applicable threshold for fugitive dust. A summary of total Orcem+VMT emissions for each scenario is presented in Table 4. The total component emissions for Orcem and VMT at the maximum operational scenario are presented in Table 5.

Table 3 – ROA Emissions Scaling Summary

Facility	Source Category	Source Description	Scales with Throughput?	Operation in Mode 2?	Operation in Mode 3?	Notes
Orcem	On-Site	Storage Piles	Yes	1	1	
		Material Handling	Yes	1	1	
		Front End Loader	Yes	1	1	
		Excavator	Yes	1	1	
		Stack	Yes	30%	1	Dryer usage substantially reduced in Mode 2 when no GBFS drying is required; dryer usage is 100% in Mode 3; assume maximum 30% natural gas use for other process heat in Mode 2
		Hopper/conveyor	Yes	1	1	
		Bag Filters	Yes	1	1	
		Industrial Electricity	Yes	1	1	
		Facility Operations	No	1	1	
	Rail	Rail (all)	Yes	0	1	
	Truck	Truck Trips (Mode 2)	Yes	1	0	
		Truck Trips (Mode 3)	Yes	0	1	
		Worker Trips	No	1	1	
	Shipping	Shipping	Yes	1	1	
VMT	On-Site	Storage Piles	Yes	--	--	
		Material Handling	Yes	--	--	
		Front End Loader	Yes	--	--	
		Forklift	Yes	--	--	
		Facility Operations	No	--	--	
	Rail	Rail (all)	Yes	--	--	0 until 12 ships, scales above that
	Truck	Truck Trips	Yes	--	--	Only scales to 12 ships, 0 above that
		Delivery Trucks	No	--	--	
		Worker Trips	No	--	--	
	Shipping	Shipping	Yes	--	--	

Note: A “1” indicates full usage of a source under the designated Mode, and a “0” indicates no usage. VMT Sources are unaffected by Orcem operating Mode.

Table 4 – ROA Emissions Summary by Scenario

Combined Emissions Case	Emissions (tons/year)								GHG Emissions (metric tons/year)			
	CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_X	CO_2	CH_4	N_2O	CO_2e
Orcem Mode 2 at 19 ships, VMT 29 ships	16.9	40.2	0.9	4.4	0.9	1.0	3.1	2.1	18,212	3.3	0.2	18,379
Orcem Mode 2 at 19 ships, VMT 12 ships (truck limited)	13.5	32.8	0.7	4.9	0.6	1.2	2.2	1.4	18,914	3.2	0.2	19,069
Orcem Mode 2 at 12 ships, VMT 32 ships (rail limited)	13.7	34.4	0.8	3.5	0.8	0.8	2.7	1.9	12,916	3.1	0.2	13,056
Orcem Mode 3 at 19 ships, VMT 29 ships	24.7	41.4	1.1	3.7	1.0	0.9	3.6	2.2	26,277	3.5	0.3	26,459
Orcem Mode 3 at 19 ships, VMT 12 ships (truck limited)	21.3	33.9	0.8	4.2	0.8	1.1	2.7	1.5	26,979	3.4	0.2	27,148
Orcem Mode 3 at 12 ships, VMT 32 ships (rail limited)	18.6	35.2	0.9	3.1	0.9	0.7	3.0	2.0	18,010	3.2	0.2	18,159

Notes:

1. Orcem Mode 3, Milestone 5 (19 ships) with 29 VMT ships maximizes criteria pollutants with BAAQMD CEQA thresholds. While fugitive PM emissions increase in scenarios with greater truck activity, there is no applicable BAAQMD threshold for fugitive dust.
2. The slight increase in total GHGs under the 12 VMT ship scenario is considered de minimis, and does not affect the stationary source for which the BAAQMD threshold in Table ES.1 applies. All scenarios total GHG emissions are reduced from the DEIR total of 31,090 MT in DEIR Table 5.31b.

Table 5 – Maximum Combined ROA Emissions Summary, Orcem Mode 3, Milestone 5

Facility	Source Category	Source Description	Emissions (tons/year)								GHG Emissions (metric tons/year)			
			CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_X	CO_2	CH_4	N_2O	CO_2e
Orcem	On-Site	Storage Piles	--	--	--	0.0011	--	0.00017	--	--	--	--	--	--
		Material Handling	--	--	--	0.68	--	0.10	--	--	--	--	--	--
		Front End Loader	1.2	0.13	0.011	0.10	0.011	0.0098	0.22	0.0044	306	0.012	0.0025	307
		Excavator	0.52	0.09	0.0018	0.017	0.0018	0.0017	0.032	0.00068	48	0.0019	0.00039	48
		Stack	11	5.6	0.25	--	0.25	--	0.69	0.18	13,620	0.26	0.073	13,648
		Hopper/conveyor	2.4	0.50	0.0070	--	0.0070	--	0.060	0.0044	311	0.013	0.0025	312
		Bag Filters	--	--	--	0.18	--	0.16	--	--	--	--	--	--
		Industrial Electricity	--	--	--	--	--	--	--	--	5,190	0.51	0.11	5,235
		Facility Operations	--	--	--	--	--	--	--	--	173	1.4	0.014	211
	Rail	Rail (all)	0.41	0.88	0.014	--	0.013	--	0.031	0.0017	170	--	--	171
	Truck	Truck Trips	0.94	6.0	0.057	1.1	0.055	0.3	0.080	0.028	2,706	--	--	2,715
		Worker Trips	0.35	0.025	0.00071	0.38	0.00066	0.094	0.034	0.0012	113	--	--	114
	Shipping	Shipping	1.5	9.1	0.26	--	0.25	--	0.84	0.78	815	0.1	0.02	823
VMT	On-Site	Storage Piles	--	--	--	0.0017	--	0.00026	--	--	--	--	--	--
		Material Handling	--	--	--	1.0	--	0.13	--	--	--	--	--	--
		Front End Loader	1.0	0.12	0.0089	0.058	0.0089	0.0058	0.13	0.0045	314	0.013	0.0025	315
		Forklift	0.089	0.018	0.00026	0.036	0.00026	0.0036	0.0028	0.00016	11	0.00044	0.000089	11
		Facility Operations	--	--	--	--	--	--	--	--	138	1.1	0.0109	168
	Rail	Rail (all)	2.3	5.1	0.079	--	0.073	--	0.18	0.0086	1,021	--	--	1,025
	Truck	Truck	0.03	0.1	0.001	0.02	0.0005	0.005	0.002	0.0003	27	--	--	27
		Worker Trips	0.22	0.016	0.00045	0.235	0.00041	0.059	0.021	0.00077	71	--	--	71
	Shipping	Shipping	2.4	13.8	0.39	--	0.38	--	1.3	1.2	1,244	0.1	0.03	1,257
Orcem Total			18.7	22.2	0.60	2.4	0.59	0.7	2.0	1.00	23,452	2.3	0.2	23,585
VMT Total			6.0	19.1	0.48	1.3	0.46	0.2	1.6	1.20	2,825	1.2	0.0	2,873
Orcem + VMT			24.7	41.4	1.08	3.7	1.05	0.9	3.6	2.20	26,277	3.5	0.3	26,459

Notes:

1. Emissions presented for the maximum combined operational case: Orcem Mode 3, Milestone 5 (19 ships per year), plus an additional 29 VMT ships per year.

2. If methane and nitrous oxide emissions were not originally presented (e.g. for rail activity), CO2e emissions were calculated from CO2 emissions and the ratio of emission factors from the USEPA Mandatory Reporting Rule, Tables C-1 and C-2 of Subpart C to 40 CFR Part 98.

3. CO2e calculated from component GHG emissions via the 100-year Global Warming Potentials for CH_4 and N_2O from Table A-1 to Subpart A of 40 CFR Part 98.

4. HEALTH RISK ASSESSMENT (HRA)

Once the maximum combined scenario for the ROA was determined, the revised diesel particulate matter (DPM) exhaust emissions from off-road equipment, trucks, rail, and shipping activity were incorporated into the HRA following the same methods described in the February 2016 Ramboll Environ report. Cancer risk was calculated for the same mitigation scenarios as that report and the DEIR, using the 2015 OEHHA Guidance and incorporating non-DPM cancer risk from ship boilers and material handling emissions.

The health risk analysis presented here was conducted by combining ROA emissions with the same dispersion modeling results presented in the DEIR, using the same calculations presented in the DEIR and the February 2016 update for the 2015 OEHHA Guidance. Emissions were updated instead of scaling DEIR cancer risk results to account for potentially changing locations of the MEISR between different scenarios. See Attachment 7 for details on HRA-specific emissions and example calculations.

As in the previous reports (for the original Project), cancer risk was estimated for full operations in each mitigation scenario. Emissions were then scaled by ship count to determine the maximum number of ship calls for each scenario in the ROA to achieve less-than-significant cancer risk. Significant impacts have been defined in the DEIR based on BAAQMD threshold standards at 10 in a million. However, this ROA analysis has conservatively identified a "*mitigation implementation threshold*" of 9 in a million cancer risk (well below the adopted "*significant impact threshold*"), to allow for potential construction overlap with operations as described in Attachment 6, and to allow additional time for implementation of the selected mitigation measure.

Emissions for the HRA were scaled the same way as described in section 3.5 above. For each ROA scenario, Orcem ships were prioritized over VMT, as Orcem activity in both Modes 2 and 3 was found to have a higher cancer risk per ship call due to the greater number of trucks and offroad equipment usage. For example, the "base case" scenario presents impacts for the operational maximum of 48 ships, followed by the maximum number of ships before cancer risk for the "base case" exceeds the mitigation implementation threshold - 14 Orcem ships. Any scenario with greater than 19 annual ships assumes 19 for Orcem and the balance for VMT. If a scenario was modeled with 12 or fewer VMT ships, impacts for VMT trucks were included. For more than 12 VMT ships, truck emissions were removed and rail emissions were included. Cancer risk results for each mitigation scenario are presented in Table 6.

The ROA Mitigation Summary in Table 6 below presents a range of measures which the project operators may select to maintain a residential cancer risk which is well below the 10 in one million BAAQMD and DEIR threshold. As noted above, the relative timing of these measures is triggered in advance of their actual need, in order to provide additional time for full implementation.

The maximum number of ship calls listed in Table 6 serves as the basis for determining when supplemental mitigation is required in order maintain an overall less than significant ROA project risk. Ship calls listed in Table 6 correspond to average 40,000 MT cargoes. The Terminal Operator is required to provide an annual reporting of the number and sizes of ships using the Terminal. The mitigation implementation threshold is reached based on any combination of ships reaching the same total cargo weight (i.e. the first 14-ship mitigation implementation threshold represents an annual cargo of 560,000 MT). Implementation of supplemental mitigation will be required in the calendar year immediately following the year in which the mitigation implementation threshold is reached.

It is important to note that the associated cancer risk in the last column of Table 6 represent lifetime cancer risk assuming 30 years of exposure at that level of activity; e.g. under the “base case”, lifetime cancer risk does not approach 8.96 in a million until there have been 14 ships per year for 30 years. Under the proposed mitigation plan above, once the terminal exceeds 14 ships in a single year per the required report to the City, new mitigations will be required for the following year.

Neither of Measures 7 or 8, for example, would be needed unless ship calls exceeded 34 in a year. Once ship calls exceed 34 in any given year (as documented by annual reporting to the City of Vallejo), either Measure 7 or Measure 8 would need to be fully implemented for the next year and maintained each year thereafter. Alternatively, the project sponsors could submit to the City and BAAQMD for review and approval, an updated study providing documented evidence of proposed alternative technologies capable of maintaining a Risk Factor of less than 10 when operating above 36 ship calls per year.

Detailed HRA calculations are presented for one case in Attachment 7, along with emission rates and mitigation reductions for each case evaluated in Table 6.

Table 6 – ROA Mitigation Measure Summary (Orcem + VMT Combined Operations)

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)
1) 20% Biodiesel in all on-site equipment (Base Case)	18.25	14	8.96
2) 100% Biodiesel in conveyors and hoppers, 20% Biodiesel in all other on-site equipment	16.85	16	8.78
3) 20% Biodiesel in all equipment, with Orcem natural gas-fueled (CNG) front end loaders (FELs)	13.62	29	8.86
4) 20% Biodiesel in all equipment, with Orcem and VMT CNG FELs	12.83	30	8.81
5) 100% Biodiesel in conveyors and hoppers, 20% Biodiesel in forklifts and VMT FEL, Orcem CNG FELs	13.16	31	8.90
6) Orcem and VMT CNG FELs, electrified conveyors and forklifts	11.90	34	8.78
7) Orcem and VMT CNG FELs, Electrified conveyors and forklifts, 76% Hoteling reduction	4.46	-	4.46
8) Orcem and VMT CNG FELs, Electrified conveyors and forklifts, 86% Hoteling reduction	4.14	-	4.14

Notes:

1. All scenarios assume Orcem Mode 2 and 19 Orcem ships per year (except where fewer than 19 ships are required to remain less than significant), as this was found to maximize cancer risk for each case.
2. Cancer risk from VMT operations include impacts from trucks at less than 12 VMT ships/year, and rail at more than 12 ships.
3. Results do not include cancer risks from rail improvement construction activity (see Ramboll memo "Construction Health Risk Impacts Associated with Orcem-VMT Project Revised Operations Alternative", dated June 4, 2018)
4. All calculations consistent with Ramboll Environ report "VMT/Orcem Health Risk Assessment 2015 OEHHA Guidance Update", dated February 22, 2016.

ATTACHMENT 1
ON-SITE EMISSIONS CALCULATIONS

Onsite Emissions Summary

Facility	Total Emissions (tons/year)								GHG Emissions (Metric tonnes/year)		
	Source	CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_2	CO_2	CH_4	N_2O
Orcem	Storage Piles	--	--	--	1.10E-03	--	1.65E-04	--	--	--		
	Material Handling	--	--	--	0.68	--	0.1035	--	--	--		
	Front End Loader	1.17	0.131	0.0108	0.0980	0.0108	0.0098	0.22	0.00	306	0.01	0.002
	Excavator	0.52	0.093	1.79E-03	1.72E-02	1.79E-03	1.72E-03	0.03	6.82E-04	48	1.94E-03	3.89E-04
	Stack	11.31	5.57	0.25	--	0.25	--	0.69	0.18	13,620	0.26	0.07
	Hopper/conveyor	2.43	0.501	0.0070	--	0.01	--	0.06	4.43E-03	311	0.01	0.003
	Bag Filters	--	--	--	0.18	--	0.16	--	--	--	--	--
	Industrial Electricity	--	--	--	--	--	--	--	--	5,190	0.5	0.11
	Facility Operations	--	--	--	--	--	--	--	--	173	1.4	0.014
	Total	15.4	6.3	0.3	1.0	0.3	0.3	1.0	0.2	19,648	2.2	0.2
VMT	Storage Piles	--	--	--	2.17E-03	--	3.25E-04	--	--	--		
	Material Handling	--	--	--	1.23	--	0.17	--	--	--		
	Front End Loader	1.25	0.15	0.01	0.07	0.01	0.01	0.17	0.01	390	0.02	0.003
	Forklift	0.11	0.02	0.0003	0.04	0.0003	0.00	0.00	0.0002	14	5.51E-04	1.10E-04
	Facility Operations	--	--	--	--	--	--	--	--	138	1.09	0.011
	Total	1.36	0.17	0.01	1.35	0.01	0.18	0.17	0.01	541	1.11	0.01

Facility	Daily Emissions (lbs/day)								
	Source	CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_2
Orcem	Storage Piles	--	--	--	0.01	--	0.00	--	--
	Material Handling	--	--	--	3.75	--	0.57	--	--
	Front End Loader	6.41	0.72	0.06	0.54	0.06	0.05	1.18	0.02
	Excavator	2.86	0.51	0.01	0.09	0.01	0.01	0.17	0.00
	Stack	61.98	30.54	1.35	--	1.35	--	3.77	0.98
	Hopper/conveyor	13.31	2.75	0.04	--	0.04	--	0.33	0.02
	Bag Filters	--	--	--	0.99	--	0.90	--	--
	Industrial Electricity	--	--	--	--	--	--	--	--
	Facility Operations	--	--	--	--	--	--	--	--
	Total	84.6	34.5	1.5	5.4	1.5	1.5	5.5	1.0
VMT	Storage Piles	--	--	--	0.01	--	0.00	--	--
	Material Handling	--	--	--	6.76	--	0.92	--	--
	Front End Loader	6.82	0.82	0.06	0.39	0.06	0.04	0.91	0.03
	Forklift	0.60	0.12	0.00	0.25	0.00	0.02	0.02	0.00
	Facility Operations	--	--	--	--	--	--	--	--
	Total	7.43	0.94	0.06	7.41	0.06	0.98	0.93	0.03

Notes:

1. Orcem combustion emissions calculated based on Milestone 5 hours of operation and Mode 3 conditions, which maximize the use of the main stack. Material handling and fugitive dust emissions calculated based on Milestone 5 hours of operation and maximum throughputs, which occur under Mode 2 conditions.
2. VMT emissions calculated at maximum capacity of 36 ships/year. At greater than 12 ships/year under the ROA, all material is assumed to be loaded by rail due to loading times and space limitations as part of the ROA.
3. Emissions represent maximum operations for Orcem and VMT independently. Maximum combined activity is limited to 48 ships/year.
4. Greenhouse Gas emissions for diesel equipment converted from CO2 by the ratio of default emission factors for CO2, CH4, and N2O for Distillate Fuel Oil No. 2 of the USEPA Mandatory Reporting Rule (Tables C-1 and C-2 to Subpart C of 40 CFR Part 98)

Orcem Emissions From Stack

Stack Parameters	
Temperature (K)	381.1
O_2 vol %	11.09
H_2O Vol %	31.55
Reference Oxygen %	3
Natural Gas Consumption (MMSCF/year)	250
Hours of Operation	7600

	Flowrate (m^3/hr)	
	Wet, actual O_2	Dry 3% vol O_2
Stack Exit Temperature (381K)	83,821	-
Normalized Temperature (298K)	65,585	11,784

show AP-42 or ppm to these concentrations

Total Stack Emission Rates normalized to 298 K

Pollutant	CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_2	CO_2	CH_4	N_2O
Emission Factor (lb/10^6 scf natural gas)	-	-	-	-	5.5	1.4	120,000	2.3	0.64
Concentration (ppm)	100	30	-	-	-	-	-	-	-
Molecular Weight (g/mol)	28.01	46.01	-	-	-	-	-	-	-
Molar Volume at 298K (L/mol)	24.45	24.45	-	-	-	-	-	-	-
Concentration (mg/m^3)	114.6	56.5	2.5	2.5	-	-	-	-	-
Stack Flow Rate	11,784	11,784	11,784	11,784	-	-	-	-	-
Emission Rate (lb/hr)	2.98	1.47	0.06	0.06	0.18	0.05	3,951	0.08	0.02
Emission Rate (tpy)	11.3	5.57	0.25	0.25	0.69	0.18	15,013	0.29	0.08

Notes:

1. ROG and GHG emission factors from USEPA AP-42 Chapter 1.4, Natural Gas Combustion (https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf). SO2 emission factor converted from PG&E total Sulfur limit of 1 grain per 100 scf.
2. CO, NOx, and PM concentrations were determined by a BACT analysis for similar operations conducted by Orcem, in conjunction with the equipment supplier.

3. Natural gas consumption calculated for maximum dryer operations, assuming 10.08 Nm3/tonne of GBFS and maximum Mode 3 throughput of 702,958 tonnes. No GBFS is processed under Mode 2 operations, but Mode 2 operations will assume 30% of maximum dryer operations for other process heat requirements. Natural gas consumption per tonne specified by Orcem.

Orcem Hopper and Conveyor Emissions

Parameter	CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_2	CO_2
Load Factor	0.4	0.4	0.4	0.4	0.4	0.4	0.4
HP	201	201	201	201	201	201	201
Zero-Hour Emission Factor (g/hp-hr)	2.7	0.559	0.009158	0.0091577	0.043925	4.87E-03	471
Deterioration Rate g/(hr-hr^2)	7.14E-05	7.37E-06	4.28E-07	4.28E-07	1.17E-05	0.00E+00	0.00E+00
Age (years)	5	5	5	5	5	5	5
Average Activity (hours/year)	570	570	570	570	570	570	570
Activity Factor (Fractional usage per hour)	1	1	1	1	1	1	1
Fuel Correction Factor	1	0.95	0.9	0.9	0.9	1	1
Hours of Operation	1140	1140	1140	1140	1140	1140	1140
Number of Equipment	9	9	9	9	9	9	9
B20 Biodiesel Factor	0.92	1	0.82	0.82	0.944	1	0.8
Annual Emissions (tpy)	2.43	0.50	0.007	0.007	0.06	4.43E-03	343

Notes:

1. Emission factors, deterioration rate, and fuel correction factor were taken from OFFROAD2017 assuming diesel-firing Tier 4 engines (https://www.arb.ca.gov/msei/ordiesel.htm).
2. Equipment count, horsepower, annual hours of operation, and fractional usage per hour specified by Orcem
3. Emissions estimated for operational year 2025
4. All onsite diesel equipment will use 20% biodiesel. Emissions reductions based on Table 5.18 of the DEIR. GHG emissions are only calculated for the conventional diesel portion of the fuel.
5. Average activity calculated from the maximum operational hours per year, consistent with ARB's OFFROAD2017 Emissions Tool guidance, assuming usage increases linearly from 2021-2024: (20% + 40% + 60% + 80%)/4 = 50% of maximum operations per year. Per DEIR section 5.2.1, throughput is expected to increase linearly in years 1-4, so this method slightly overestimates total cumulative hours.

Bag Filter Emissions

Emission Rate Derivation				
Emission Source	PM_{10} Concentration	Volume Flow	Emission Rate	
			PM10	PM2.5
	(mg/Nm^3)	(Nm^3/hr)	(g/hr)	(g/hr)
Silo 1	2.5	2301	5.75	5.18
Silo 2	2.5	495	1.24	1.11
Silo 3	2.5	495	1.24	1.11
Truck 1	2.5	1793	4.48	4.03
Truck 2	2.5	1793	4.48	4.03
Truck 3	2.5	1793	4.48	4.03
Total Bag Filters			21.68	19.51

Bag Filter Emissions	
Hours of Operation (hr)	7600
PM_{10} Emissions (ton/yr)	0.18
$PM_{2.5}$ Emissions (ton/yr)	0.16

Notes:
1. PM_{10} concentration was determined by a BACT analysis for similar operations conducted by Orcem, in conjunction with the equipment supplier. Flow rates from engineering estimates provided by Orcem.
2. $PM_{2.5}$ is conservatively assumed to be 90% of PM_{10} by mass.

Orcem Excavator Emissions

Parameter	CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_2	CO_2
Load Factor	0.3819	0.3819	0.3819	0.3819	0.3819	0.3819	0.3819
HP	175	175	175	175	175	175	175
Zero-Hour Emission Factor (g/hp-hr)	2.7	0.559	0.009158	0.0091577	0.043925	4.87E-03	471
Deterioration Rate g/(hr-hr^2)	7.14E-05	7.37E-06	4.28E-07	4.28E-07	1.17E-05	0.00E+00	0.00E+00
Age (years)	5	5	5	5	5	5	5
Average Activity (hours/year)	3800	3800	3800	3800	3800	3800	3800
Activity Factor (Fractional usage per hour)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Fuel Correction Factor	1	0.95	0.9	0.9	0.9	1	1
Hours of Operation	7600	7600	7600	7600	7600	7600	7600
Number of Equipment	1	1	1	1	1	1	1
B20 Biodiesel Factor	0.92	1	0.82	0.82	0.944	1	0.8
Annual Emissions (tpy)	0.52	0.09	0.002	0.002	0.03	0.00	53

Notes:

1. Emission factors, deterioration rate, and fuel correction factor were taken from OFFROAD2017 assuming diesel-firing Tier 4 engines (https://www.arb.ca.gov/msei/ordiesel.htm).
2. Equipment count, horsepower, annual hours of operation, and fractional usage per hour specified by Orcem
3. Emissions estimated for operational year 2025
4. All onsite diesel equipment will use 20% biodiesel. Emissions reductions based on Table 5.18 of the DEIR. GHG emissions are only calculated for the conventional diesel portion of the fuel.
5. Average activity calculated from the maximum operational hours per year, consistent with ARB's OFFROAD2017 Emissions Tool guidance, assuming usage increases linearly from 2021-2024: (20% + 40% + 60% + 80%)/4 = 50% of maximum operations per year. Per DEIR section 5.2.1, throughput is expected to increase linearly in years 1-4, so this method slightly overestimates total cumulative hours.

Orcem Excavator Fugitive Dust

Parameter	Units	PM10	PM2.5	Reference
Mean Vehicle Weight	tons	22.59	22.59	John Deere 180G LC
Average Days of Precipitation Per Year	Days	56	56	CalEEMod default for BAAQMD
Constant, K	lb/VMT	1.5	0.15	AP42 Table 13.2.2-2
Constant a		0.9	0.9	AP42 Table 13.2.2-2
Constant, b		0.45	0.45	AP42 Table 13.2.2-2
Silt content, s	%	4.8	4.8	AP42 Table 13.2.2-1
UnControlled Emission Factor E	lb/VMT	1.38	0.14	Calculation
Uncontrolled Emission factor, E	g/VKT	389.24	38.92	Calculation
Control Efficiency for Watering	Factor	0.968	0.968	Cumulative efficiency based on dust suppression using MgCl2, frequent watering & 15 mph speed limit
Controlled Emission factor, E	g/VKT	12.46	1.25	Calculation

Milestone 5		
Slag Heap North Distance	0.12	kilometers
Slag Heap South Distance	0.045	kilometers
Trips per hour	1	
Operational Hours	7600.0	Hours/year

	PM10	PM2.5
Slag Heap North Emission Rate (lb/hr)	0.0033	0.0003
Slag Heap South Emission Rate (lb/hr)	0.0012	0.0001
Annual Emissions (tpy)	0.017	0.0017

Notes:

1. Calculated using E =[281.9*k*(s/12)a(W/3)b g/veh km
2. Western Governors' Association (WRAP) Fugitive Dust Handbook indicates 84% control efficiency for MgCl2. The Alaska

References:

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Western Governors' Association (WRAP). 2006. WRAP Fugitive Dust Handbook. Availabe at:
https://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf

Orcem Front End Loaders

Parameter	CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_2	CO_2
Load Factor	0.3618	0.3618	0.3618	0.3618	0.3618	0.3618	0.3618
HP	369	369	369	369	369	369	369
Zero-Hour Emission Factor (g/hp-hr)	0.92	0.1207808	0.009321	0.0093212	0.043925	4.85E-03	469
Deterioration Rate g/(hr-hr^2)	2.43E-05	1.59E-06	3.45E-07	3.45E-07	1.17E-05	0.00E+00	0.00E+00
Age (years)	5	5	5	5	5	5	5
Average Activity (hours/year)	4070	4070	4070	4070	4070	4070	4070
Activity Factor (Fractional usage per hour)	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Fuel Correction Factor	1	0.95	0.9	0.9	0.9	1	1
Hours of Operation	8140	8140	8140	8140	8140	8140	8140
Number of Equipment	1	1	1	1	1	1	1
B20 Biodiesel Factor	0.92	1	0.82	0.82	0.944	1	0.8
Annual Emissions (tpy)	1.17	0.13	0.011	0.011	0.22	0.00	337

Notes:

1. Emission factors, deterioration rate, and fuel correction factor were taken from OFFROAD2017 assuming diesel-firing Tier 4 engines (https://www.arb.ca.gov/msei/ordiesel.htm).
2. Equipment count, horsepower, annual hours of operation, and fractional usage per hour specified by Orcem
3. Emissions estimated for operational year 2025
4. All onsite diesel equipment will use 20% biodiesel. Emissions reductions based on Table 5.18 of the DEIR. GHG emissions are only calculated for the conventional diesel portion of the fuel.
5. Average activity calculated from the maximum operational hours per year, consistent with ARB's OFFROAD2017 Emissions Tool guidance, assuming usage increases linearly from 2021-2024: (20% + 40% + 60% + 80%)/4 = 50% of maximum operations per year. Per DEIR section 5.2.1, throughput is expected to increase linearly in years 1-4, so this method slightly overestimates total cumulative hours.

Orcem Front End Loader (FEL) Fugitive Dust

Parameter	Units	PM10	PM2.5	Reference
Mean Vehicle Weight	tons	42.5	42.5	CAT980 (34.43 empty, 16.14 tons load)
Average Days of Precipitation Per Year	Days	56	56	CalEEMod default for BAAQMD
Constant, K	lb/VMT	1.5	0.15	AP42 Table 13.2.2-2
Constant a		0.9	0.9	AP42 Table 13.2.2-2
Constant, b		0.45	0.45	AP42 Table 13.2.2-2
Silt content, s	%	4.8	4.8	AP42 Table 13.2.2-1
UnControlled Emission Factor E	lb/VMT	1.84	0.18	Calculation
Uncontrolled Emission factor, E	g/VKT	517.34	51.73	Calculation
Control Efficiency for Watering	Factor	0.968	0.968	Cumulative efficiency based on dust suppression using MgCl2, frequent watering & 15 mph speed limit
Controlled Emission factor, E	g/VKT	16.55	1.66	Calculation

Milestone 5		
GBFS/Clinker/Cement	880,000	metric tonnes/annum
Gypsum unloaded	43,084	metric tonnes/annum
Loader Capacity	14.64	tonnes
Slag Heap North Distance	0.12	kilometers
Slag Heap South Distance	0.045	kilometers
Gypsum Storage	0.14	kilometers
Total operating hours	8140.0	Hours/year
Slag Heaps (N/S) Trips per hour	3.7	
Gypsum Storage Trips per hour	0.36	

	PM10	PM2.5
Slag Heap North Emission Rate (lb/hr)	0.016	0.002
Slag Heap South Emission Rate (lb/hr)	0.006	0.001
Gypsum Storage Heap (lb/hr)	0.002	0.0002
Annual Emissions (tpy)	0.098	0.010

Notes:

1. Calculated using E =[281.9*k*(s/12)a(W/3)b g/veh km
2. Western Governors' Association (WRAP) Fugitive Dust Handbook indicates 84% control efficiency for MgCl2. The Alaska Cooperative Transportation and Public Facilities Research Program (Control of Dust Emissions from Unpaved Roads, 1992) reports up to 80% control for 15mph speed limitation. This results in a cumulative control of 96.8%.

References:

Alaska Cooperative Transportation and Public Facilities Research Program. 1992. Control of Dust Emissions from Unpaved Roads. Available at: http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_92_05.pdf

United states Environmental Protection Agency (USEPA). 2006. AP-42 Chapter 13.2.2, Unpaved Roads. Available at: https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf

Western Governors' Association (WRAP). 2006. WRAP Fugitive Dust Handbook. Availabe at: https://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf

VMT Front End Loaders

Parameter	CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_2	CO_2
Load Factor	0.3618	0.3618	0.3618	0.3618	0.3618	0.3618	0.3618
HP	369	369	369	369	369	369	369
Zero-Hour Emission Factor (g/hp-hr)	0.92	0.1207808	0.009321	0.0093212	0.043925	4.85E-03	469
Deterioration Rate g/(hr-hr^2)	2.43E-05	1.59E-06	3.45E-07	3.45E-07	1.17E-05	0.00E+00	0.00E+00
Age (years)	5	5	5	5	5	5	5
Average Activity (hours/year)	2160	2160	2160	2160	2160	2160	2160
Activity Factor (Fractional usage per hour)	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Fuel Correction Factor	1	0.95	0.9	0.9	0.9	1	1
Hours of Operation	4320	4320	4320	4320	4320	4320	4320
Number of Equipment	2	2	2	2	2	2	2
B20 Biodiesel Factor	0.92	1	0.82	0.82	0.944	1	0.8
Annual Emissions (tpy)	1.25	0.15	0.011	0.011	0.17	0.01	430

Notes:

1. Emission factors, deterioration rate, and fuel correction factor were taken from OFFROAD2017 assuming diesel-firing Tier 4 engines (https://www.arb.ca.gov/msei/ordiesel.htm).
2. Equipment count, horsepower, annual hours of operation, and fractional usage per hour specified by VMT
3. Emissions estimated for operational year 2025
4. All onsite diesel equipment will use 20% biodiesel. Emissions reductions based on Table 5.18 of the DEIR. GHG emissions are only calculated for the conventional diesel portion of the fuel.
5. Average activity calculated from the maximum operational hours per year, consistent with ARB's OFFROAD2017 Emissions Tool guidance, assuming usage increases linearly from 2021-2024: (20% + 40% + 60% + 80%)/4 = 50% of maximum operations per year. Per DEIR section 5.2.1, throughput is expected to increase linearly in years 1-4, so this method slightly overestimates total cumulative hours.

VMT Front End Loader (FEL) Fugitive Dust

Parameter	Units	PM10	PM2.5	Reference
Mean Vehicle Weight	tons	42.5	42.5	CAT980 (34.43 empty, 16.14 tons load)
We Days Per Year	Days	56	56	CalEEMod default for BAAQMD
Constant, K	lb/VMT	1.5	0.15	AP42 Table 13.2.2-2
Constant a		0.9	0.9	AP42 Table 13.2.2-2
Constant, b		0.45	0.45	AP42 Table 13.2.2-2
Silt content, s	%	4.8	4.8	AP42 Table 13.2.2-1
UnControlled Emission Factor E	lb/VMT	1.84	0.18	Calculation
Uncontrolled Emission factor, E	g/VKT	517.34	51.73	Calculation
Control Efficiency for Watering	Factor	0.968	0.968	Cumulative efficiency based on dust suppression using MgCl2, frequent watering & 15 mph speed limit
Controlled Emission factor, E	g/VKT	16.55	1.66	Calculation

Rail Loading		
Ton unloaded	1,440,000	metric tonnes/annum
Rail loading distance	0.04	kilometers
Total Operating Hours	8640.0	Hours/year
Loader Capacity	14.64	tonnes
Trips per hour	11.4	

	PM10	PM2.5
Rail Loading Emissions (lb/hr)	0.0166	0.0017
Annual Emissions (tpy)	0.0718	0.0072

Notes:

1. Calculated using E =[281.9*k*(s/12)a(W/3)b g/veh km

2. Western Governors' Association (WRAP) Fugitive Dust Handbook indicates 84% control efficiency for MgCl2. The Alaska Cooperative Transportation and Public Facilities Research Program (Control of Dust Emissions from Unpaved Roads, 1992) reports up to 80% control for 15mph speed limitation. This results in a cumulative control of 96.8%.

References:

Alaska Cooperative Transportation and Public Facilities Research Program. 1992. Control of Dust Emissions from Unpaved Roads. Available at: http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_92_05.pdf

United states Environmental Protection Agency (USEPA). 2006. AP-42 Chapter 13.2.2, Unpaved Roads. Available at: https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf

Western Governors' Association (WRAP). 2006. WRAP Fugitive Dust Handbook. Availabe at: https://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf

VMT Forklifts

Parameter	CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_2	CO_2
Load Factor	0.2	0.2	0.2	0.2	0.2	0.2	0.2
HP	100	100	100	100	100	100	100
Zero-Hour Emission Factor (g/hp-hr)	2.7	0.559	0.009158	0.0091577	0.05	4.87E-03	472
Deterioration Rate g/(hr-hr^2)	7.14E-05	7.37E-06	4.28E-07	4.28E-07	1.17E-05	0.00E+00	0.00E+00
Average Activity (hours/year)	900	900	900	900	900	900	900
Age (years)	5	5	5	5	5	5	5
Activity Factor (Fractional usage per hour)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Fuel Correction Factor	1	0.95	0.9	0.9	0.9	1	1
Hours of Operation	1800	1800	1800	1800	1800	1800	1800
Number of Equipment	2	2	2	2	2	2	2
B20 Biodiesel Factor	0.92	1	0.82	0.82	0.944	1	0.8
Annual Emissions (tpy)	0.11	0.02	0.0003	0.0003	0.00	1.93E-04	15

Notes:

1. Emission factors, deterioration rate, and fuel correction factor were taken from OFFROAD2017 assuming diesel-firing Tier 4 engines (https://www.arb.ca.gov/msei/ordiesel.htm).
2. Equipment count, horsepower, annual hours of operation, and fractional usage per hour specified by VMT
3. Emissions estimated for operational year 2025
4. All onsite diesel equipment will use 20% biodiesel. Emissions reductions based on Table 5.18 of the DEIR. GHG emissions
5. Average activity calculated from the maximum operational hours per year, consistent with ARB's OFFROAD2017 Emissions Tool guidance, assuming usage increases linearly from 2021-2024: (20% + 40% + 60% + 80%)/4 = 50% of maximum operations per year. Per DEIR section 5.2.1, throughput is expected to increase linearly in years 1-4, so this method slightly overestimates total cumulative hours.

VMT Forklift Fugitive Dust

Parameter	Units	PM10	PM2.5	Reference
Mean Vehicle Weight	tons	18.27	18.27	Hyundai 80D-9 (13.86 empty, 8.82 tons load)
We Days Per Year	Days	56	56	CalEEMod default for BAAQMD
Constant, K	lb/VMT	1.5	0.15	AP42 Table 13.2.2-2
Constant a		0.9	0.9	AP42 Table 13.2.2-2
Constant, b		0.45	0.45	AP42 Table 13.2.2-2
Silt content, s	%	4.8	4.8	AP42 Table 13.2.2-1
UnControlled Emission Factor E	lb/VMT	1.26	0.13	Calculation
Uncontrolled Emission factor, E	g/VKT	353.86	35.39	Calculation
Control Efficiency for Watering	Factor	0.968	0.968	Cumulative efficiency based on dust suppression using MgCl2, frequent watering & 15 mph speed limit
Controlled Emission factor, E	g/VKT	11.32	1.13	Calculation

Rail Loading		
Ton unloaded	1,440,000	metric tonnes/annum
Distance Traveled Per Hour	1	kilometers
Trips per hour	1	
Total Operational Hours	3600.0	Hours/year

	PM10	PM2.5
Hourly Emissions (lb/hr)	0.0250	0.0025
Annual Emissions (tpy)	0.0449	0.0045

Notes:

1. Calculated using E =[281.9*k*(s/12)a(W/3)b g/veh km
2. Western Governors' Association (WRAP) Fugitive Dust Handbook indicates 84% control efficiency for MgCl2. The Alaska Cooperative Transportation and Public Facilities Research Program (Control of Dust Emissions from Unpaved Roads, 1992) reports up to 80% control for 15mph speed limitation. This results in a cumulative control of 96.8%.
3. Vehicle weight chosen for the largest available 100 HP forklift for operational flexibility; actual emissions may be lower.

References:

Alaska Cooperative Transportation and Public Facilities Research Program. 1992. Control of Dust Emissions from Unpaved Roads. Available at: http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_92_05.pdf
United states Environmental Protection Agency (USEPA). 2006. AP-42 Chapter 13.2.2, Unpaved Roads. Available at: https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf
Western Governors' Association (WRAP). 2006. WRAP Fugitive Dust Handbook. Availabe at: https://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf

Orcem Material Handling

Parameter	Units	PM10	PM2.5	Reference
Material Moisture Content	%	7	7	Analysis of material
Mean Wind Speed	m/s	3.28	3.28	CPRodeo Average 2007-12
Constant, K		0.35	0.053	AP42 Table 13.2.4-2
Uncontrolled Emission factor, E [a]	kg/Mg	0.000163	0.000025	Calculation
Control Efficiency for Watering[b]		0.62	0.62	SCAQMD (2007)
Controlled Emission Factor E	kg/Mg	6.19E-05	9.37E-06	

Notes: USEPA Ap-42 Chapter 13.2.4 (https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0204.pdf)
a: Calculated using $E = k(0.0016)*(U/2.2)^{1.3}/(M/2)^{1.4}$ kg/Mg
b: The control efficiency for watering was based off of the control efficiency for continuous water spray at conveyor transfer points in Table XI-B of SCAQMD (2007) Mitigation Measures. This is more conservative than the 95% control assumed in the DEIR to provide greater operational flexibility; actual emissions may be lower.

Milestone 5		
Ton unloaded	760,000	metric tonnes/annum
Ship capacity	40000	metric tonnes capacity
Ship calls	19	trips per year
Unloading	303	metric tonnes/hr
Hours per ship	132.0	hours
Annual Operations	7600.0	Hours/year
Unloading Capacity	303	tonnes/hour (average)
Mill Capacity	100	tonnes/hour (maximum)

PM10 Emissions

Drop Points	tonnage /shipment	tonnage per hour	Emission rate (lb/hr)	Hours per shipment	Emission per Day (lb/day)	Emission per shipment (lb)	Annual Emissions (tons/year)
ship upload 1	20000	152	2.07E-02	132.0	4.96E-01	2.73E+00	2.59E-02
ship upload 2	20000	152	2.07E-02	132.0	4.96E-01	2.73E+00	2.59E-02
mobile hopper 1	20000	152	2.07E-02	132.0	4.96E-01	2.73E+00	2.59E-02
mobile hopper 2	20000	152	2.07E-02	132.0	4.96E-01	2.73E+00	2.59E-02
conveyor1	40000	303	4.14E-02	132.0	9.93E-01	5.46E+00	5.19E-02
intake hopper	40000	303	4.14E-02	132.0	9.93E-01	5.46E+00	5.19E-02
front loading upload 1	n/a	50	6.83E-03	--	1.64E-01	--	2.59E-02
front loading upload 2	n/a	50	6.83E-03	--	1.64E-01	--	2.59E-02
excavator upload & drop1	n/a	100	1.37E-02	--	3.28E-01	--	5.19E-02
excavator upload & drop2	n/a	100	1.37E-02	--	3.28E-01	--	5.19E-02
millfeed	n/a	103	1.41E-02	--	3.37E-01	--	5.34E-02
elevator drop	n/a	103	1.41E-02	--	3.37E-01	--	5.34E-02
main silo	n/a	100	1.37E-02	--	3.28E-01	--	5.19E-02
gypsum silo	n/a	3	4.10E-04	--	9.83E-03	--	1.56E-03
main silo conveyor	n/a	100	1.37E-02	--	3.28E-01	--	5.19E-02
gypsum silo conveyor	n/a	3	4.10E-04	--	9.83E-03	--	1.56E-03
mill intake	n/a	103	1.41E-02	--	3.37E-01	--	5.34E-02
conveyor drop 1	n/a	151.5	2.07E-02	132.0	4.96E-01	2.73E+00	2.59E-02
conveyor drop 2	n/a	151.5	2.07E-02	132.0	4.96E-01	2.73E+00	2.59E-02
gypsum handling (drop & upload)	n/a	3	4.10E-04	--	9.83E-03	--	1.56E-03
Total		2333.12	0.318		7.644	27.30	0.68

Orcem Material Handling

PM2.5 Emissions

Drop Points	tonnage /shipment	tonnage per hours	Emission rate (lb/hr)	Hours per shipment	Emission per Day (lb/day)	Emission per shipment (lb)	Annual Emissions (tons/year)
ship upload 1	20000	152	3.13E-03	132.0	7.52E-02	4.13E-01	3.93E-03
ship upload 2	20000	152	3.13E-03	132.0	7.52E-02	4.13E-01	3.93E-03
mobile hopper 1	20000	152	3.13E-03	132.0	7.52E-02	4.13E-01	3.93E-03
mobile hopper 2	20000	152	3.13E-03	132.0	7.52E-02	4.13E-01	3.93E-03
conveyor1	40000	303	6.26E-03	132.0	1.50E-01	8.27E-01	7.86E-03
intake hopper	40000	303	6.26E-03	132.0	1.50E-01	8.27E-01	7.86E-03
front loading upload 1	n/a	50	1.03E-03	--	2.48E-02	--	3.93E-03
front loading upload 2	n/a	50	1.03E-03	--	2.48E-02	--	3.93E-03
excavator upload & drop1	n/a	100	2.07E-03	--	4.96E-02	--	7.86E-03
excavator upload & drop2	n/a	100	2.07E-03	--	4.96E-02	--	7.86E-03
millfeed	n/a	103	2.13E-03	--	5.11E-02	--	8.09E-03
elevator drop	n/a	103	2.13E-03	--	5.11E-02	--	8.09E-03
main silo	n/a	100	2.07E-03	--	4.96E-02	--	7.86E-03
gypsum silo	n/a	3	6.20E-05	--	1.49E-03	--	2.36E-04
main silo conveyor	n/a	100	2.07E-03	--	4.96E-02	--	7.86E-03
gypsum silo conveyor	n/a	3	6.20E-05	--	1.49E-03	--	2.36E-04
mill intake	n/a	103	2.13E-03	--	5.11E-02	--	8.09E-03
conveyor drop 1	n/a	151.5	3.13E-03	132.0	7.52E-02	4.13E-01	3.93E-03
conveyor drop 2	n/a	151.5	3.13E-03	132.0	7.52E-02	4.13E-01	3.93E-03
gypsum handling (drop & upload)	n/a	3	6.20E-05	--	1.49E-03	--	2.36E-04
Total		2333.12	0.048		1.158	4.13	0.1035

VMT Material Handling

Parameter	Units	PM10	PM2.5	Reference
Material Moisture Content	%	5	5	Analysis of material
Mean Wind Speed	m/s	3.28	3.28	CPRodeo Average 2007-12
Constant, K		0.35	0.053	AP42 Table 13.2.4-2
Uncontrolled Emission factor, E [a]	kg/Mg	0.000261	0.000040	Calculation
Control Efficiency for Watering [b]		0.62	0.62	SCAQMD (2007)
Controlled Emission Factor E	kg/Mg	9.92E-05	1.50E-05	

Notes: USEPA Ap-42 Chapter 13.2.4 (https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0204.pdf)

a: Calculated using $E = k(0.0016)*(U/2.2)^{1.3}/(M/2)^{1.4}$ kg/Mg

b: The control efficiency for watering was based off of the control efficiency for continuous water spray at conveyor transfer points in Table XI-B of SCAQMD (2007) Mitigation Measures. This is more conservative than the 95% control assumed in the DEIR to provide greater operational flexibility; actual emissions may be lower.

Phase 1 Alternative		
Ton unloaded	1,440,000	metric tonnes/annum
Ship capacity	40000	metric tonnes capacity
Ship calls	36	trips per year
Unloading	303	metric tonnes/hr
Hours per ship	132.0	hours
Annual Operations	5760.0	Hours/year
Unloading Capacity	303	tonnes/hour (average)
Truck Loading	0	tonnes/year
Truck Drops	2	Drops per tonne
Rail Loading	1,440,000	tonnes/year
Rail Drops	3	Drops per tonne

PM10 Emissions

Drop Points	tonnage /shipment	tonnage per hour	Emission rate (lb/hr)	Hours per shipment	Emission per Day (lb/day)	Emission per shipment (lb)	Annual Emissions (tons/year)
ship upload 1	20000	152	3.31E-02	132.0	7.95E-01	4.37E+00	7.87E-02
ship upload 2	20000	152	3.31E-02	132.0	7.95E-01	4.37E+00	7.87E-02
mobile hopper 1	40000	303	6.63E-02	132.0	1.59E+00	8.75E+00	1.57E-01
mobile hopper 2	40000	303	6.63E-02	132.0	1.59E+00	8.75E+00	1.57E-01
mobile hopper 3	20000	152	3.31E-02	132.0	7.95E-01	4.37E+00	7.87E-02
mobile hopper 4	13333.33333	101	2.21E-02	132.0	5.30E-01	2.92E+00	5.25E-02
mobile hopper 5	13333.33333	101	2.21E-02	132.0	5.30E-01	2.92E+00	5.25E-02
mobile hopper 6	13333.33333	101	2.21E-02	132.0	5.30E-01	2.92E+00	5.25E-02
mobile hopper 7	13333.33333	101	2.21E-02	132.0	5.30E-01	2.92E+00	5.25E-02
	Tonnage	Drop Points					
Truck Loading	0	2	0.00E+00		0.00E+00		0.00E+00
Rail Loading	1,440,000	3	1.64E-01		3.94E+00		4.72E-01
Total		1469.65	0.484		11.622	42.27	1.23

VMT Material Handling

PM2.5 Emissions

Drop Points	tonnage /shipment	tonnage per hours	Emission rate (lb/hr)	Hours per shipment	Emission per Day (lb/day)	Emission per shipment (lb)	Annual Emissions (tons/year)
ship upload 1	20000	152	5.02E-03	132.0	1.20E-01	6.62E-01	1.19E-02
ship upload 2	20000	152	5.02E-03	132.0	1.20E-01	6.62E-01	1.19E-02
mobile hopper 1	20000	152	5.02E-03	132.0	1.20E-01	6.62E-01	1.19E-02
mobile hopper 2	20000	152	5.02E-03	132.0	1.20E-01	6.62E-01	1.19E-02
mobile hopper 3	40000	303	1.00E-02	132.0	2.41E-01	1.32E+00	2.38E-02
mobile hopper 4	40000	303	1.00E-02	132.0	2.41E-01	1.32E+00	2.38E-02
mobile hopper 5	n/a	1.5	4.97E-05	--	1.19E-03	--	1.43E-04
mobile hopper 6	n/a	1.5	4.97E-05	--	1.19E-03	--	1.43E-04
mobile hopper 7	n/a	3	9.93E-05	--	2.38E-03	--	2.86E-04
	Tonnage	Drop Points					
Truck Loading	0	2	0.00E+00		0.00E+00		0.00E+00
Rail Loading	1,440,000	3	2.48E-02		5.96E-01		7.15E-02
Total		1223.12	0.065		1.564	5.30	0.17

Orcem Facility Operations

Greenhouse Gas Electricity Intensity				
PG&E 2016 Data	N_2O	CH_4	CO_2	Units
Intensity Factor per Total Energy Delivered	0.006	0.029	293.7	lbs/MWh
% of Total Energy From Renewables	33%	33%	33%	-
Intensity Factor For Non-Renewable Energy	0.0092	0.0432	437	lbs/MWh
Estimated Intensity for Total Energy				
Projections Based on RPS	N_2O	CH_4	CO_2	Units
2020 RPS (33%)	0.006	0.029	292.8	lbs/MWh
2030 RPS (50%)	0.005	0.022	218.5	lbs/MWh
2025 RPS (41.5%)	0.005	0.025	255.7	lbs/MWh

Non-Default CalEEMod Inputs	
Land Use	Manufacturing
Size	60.91
Units	1000 sqft
Population	20
Operational Year	2025
CO_2 Intensity	255.7 lb/MWhr
CH_4 Intensity	0.025 lb/MWhr
N_2O Intensity	0.005 lb/MWhr

Category	NBio- CO2	Total CO2	CH4	N2O	CO2e
	MT/yr				
Area	1.1E-03	1.1E-03	0	0	1.2E-03
Energy	144	144	0.0074	0.0027	145
Mobile	0	0	0	0	0
Waste	0	15	0.91	0	38
Water	8.8	13	0.46	0.0110	28
Total	153	173	1.4	0.014	211

Notes:

1. Carbon dioxide electricity intensity was determined based on data on 2016 greenhouse gas intensity from non-renewable energy production reported by Pacific Gas & Electricity (http://www.pgecorp.com/corp_responsibility/reports/2017/assets/PGE_CRSR_2017.pdf).

2. 2016 emission factors for CH_4 and N_2O are the CalEEMod default intensities for PG&E. This is a conservative assumption since the CH_4 and N_2O intensity factors used in CalEEMod 2016.3.2. are based on the 2012 E-Grid for the state of California. This data is from the 2009 inventory, so it is expected that the 2016 intensity factors for CH_4 and N_2O should be lower than reported above.

3. Greenhouse gas intensity was projected to 2025 based on RPS for 2020 and 2030, consistent with SB 32 and SB 350 (http://www.energy.ca.gov/sb350/).

Orcem Facility Operations

Greenhouse Gas Electricity Intensity				
PG&E 2016 Data	N_2O	CH_4	CO_2	Units
Intensity Factor per Total Energy Delivered	0.006	0.029	293.7	lbs/MWh
% of Total Energy From Renewables	33%	33%	33%	-
Intensity Factor For Non-Renewable Energy	0.0092	0.0432	437	lbs/MWh
Estimated Intensity for Total Energy				
Projections Based on RPS	N_2O	CH_4	CO_2	Units
2020 RPS (33%)	0.006	0.029	292.8	lbs/MWh
2030 RPS (50%)	0.005	0.022	218.5	lbs/MWh
2025 RPS (41.5%)	0.005	0.025	255.7	lbs/MWh

Non-Default CalEEMod Inputs	
Land Use	Manufacturing
Size	48.5
Units	1000 sqft
Population	42
Operational Year	2025
CO_2 Intensity	255.7 lb/MWhr
CH_4 Intensity	0.025 lb/MWhr
N_2O Intensity	0.005 lb/MWhr

Category	NBio- CO2	Total CO2	CH4	N2O	CO2e
	MT/yr				
Area	8.7E-04	8.7E-04	0	0	9.2E-04
Energy	115	115	0.0059	0.0022	116
Mobile	0	0	0	0	0
Waste	0	12	0.72	0	30
Water	7.0	11	0.37	0.0088	22
Total	122	138	1.1	0.011	168

Notes:

1. Carbon dioxide electricity intensity was determined based on data on 2016 greenhouse gas intensity from non-renewable energy production reported by Pacific Gas & Electricity (http://www.pgecorp.com/corp_responsibility/reports/2017/assets/PGE_CRSR_2017.pdf).

2. 2016 emission factors for CH_4 and N_2O are the CalEEMod default intensities for PG&E. This is a conservative assumption since the CH_4 and N_2O intensity factors used in CalEEMod 2016.3.2. are based on the 2012 E-Grid for the state of California. This data is from the 2009 inventory, so it is expected that the 2016 intensity factors for CH_4 and N_2O should be lower than reported above.

3. Greenhouse gas intensity was projected to 2025 based on RPS for 2020 and 2030, consistent with SB 32 and SB 350 (http://www.energy.ca.gov/sb350/).

Electricity Consumption for Production

Parameters		Units
GGBS	53	kWh/ton
Electricity Intensity	255.7	lb CO_2/MWhr
	0.025	lb CH_4/MWhr
	0.005	lb N_2O/MWhr

Emisisons from Electricity		Mode 1	Mode 2	Mode 3
Production (MT/yr)	GGBS	582,928	0	582,928
	Cement	0	844,444	120,000
Electricity (kWh)	GGBS	30,895,184	0	30,895,184
	Cement	0	44,755,532	6,360,000
	Total Electricity	30,895,184	44,755,532	37,255,184
CO_2 Emissions (lb/yr)		7,898,361	11,441,762	9,524,296
CO_2 Emissions (MT/yr)		3,583	5,190	4,320
CH_4 Emissions (MT/yr)		0.4	0.5	0.4
N_2O Emissions (MT/yr)		0.1	0.1	0.1

Notes:
1. The electricity consumption per metric ton of GGBS produced was provided by Orcem based on existing plant data. See DEIR Table 5.5 for product volumes.
2. Electricity intensity was determined based on data on 2016 greenhouse gas intensity from non-renewable energy production reported by Pacific Gas & Electricity (http://www.pgecorp.com/corp_responsibility/reports/2017/assets/PGE_CRSR_2017.pdf). It was then projected to 2025 based on RPS for 2020 and 2030, consistent with SB 32 and SB 350 (http://www.energy.ca.gov/sb350/).

Conversion Factors

2204.6	lb/MT
1.10231	ton/MT
0.001	kWh/MWh

Orcem Annual Wind Erosion of Stockpiles

Inputs		Units	Reference
Maximum windspeed (u^{+}_{10})	13.41	m/s	Maximum windspeed for Concord Airport in 2012. (NCDC 2015)
Threshold Friction Velocity (u_t)	1.12	m/s	Uncrusted coal pile. AP-42 Table 13.2.5-2.
$P = 58\,(u^* - u_t^*)^2 + 25\,(u^* - u_t^*)$ $P = 0$ for $u^* \leq u_t^*$			AP-42 Chapter 13.2.5, equation 3.
Total Erosion Potential (P)	7.42	g/m^2	Calculated on a daily basis from max daily windspeeds
Slag Heap South Area	1440	m^2	Area of stockpile controlled by watering
Slag Heap North and Gypsum Area	5019	m^2	Area of stockpile controlled by watering and 3-sided enclosures
PM_{10} Particle size multiplier (k)	0.5	unitless	AP-42 Chapter 13.2.5.
$PM_{2.5}$ Particle size multiplier (k)	0.075	unitless	AP-42 Chapter 13.2.5.
Control from watering	90%		SCAQMD 2007, Table XI-B
Control from watering and 3-sided enclosures	75.0%		SCAQMD 2007, Table XI-E

Annual PM_{10} Emissions	0.0011 tons/year
Annual $PM_{2.5}$ Emissions	0.0002 tons/year

Notes:
1. Surface wind sped distribution, Friction velocity, and erosion potential are presented for the maximum daily windspeed. Erosion potentials were calculated on a daily basis for one year of daily maximum windspeeds. The Total Erosion Potential shown here represents the total annual emissions divided by the total stockpile area.
2. All stockpiles will be watered to control emissions. The Slag Heap North and Gypsum Area will have three-sided enclosures in addition.

References:
1. National Climatic Data Center (NCDC). 2015. WFO Monthly/Daily Climate Data. Available at: http://w2.weather.gov/climate/getclimate.php?wfo=mtr&pil=CF6&sid=CCR
2. South Coast Aqir Quality Management District (SCAQMD). 2007. Fugitive Dust Mitigation Measures. Available at: http://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/fugitive-dust
3. United States Environmental Protection Agency (USEPA). 2006. AP-42, Chapter 13.2.5: Industrial Wind Erosion. November. Available at: http://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0205.pdf

VMT Annual Wind Erosion of Stockpiles

Inputs		Units	Reference
Maximum windspeed (u^{+}_{10})	13.41	m/s	Maximum windspeed for Concord Airport in 2012. (NCDC 2015)
Threshold Friction Velocity (u_t)	1.12	m/s	Uncrusted coal pile. AP-42 Table 13.2.5-2.
$P = 58 (u^* - u_t^*)^2 + 25 (u^* - u_t^*)$ $P = 0$ for $u^* \leq u_t^*$			AP-42 Chapter 13.2.5, equation 3.
Total Erosion Potential (P)	7.43	g/m^2	Calculated on a daily basis from max daily windspeeds
Stockpile Area	5288	m^2	Total stockpile area
PM_{10} Particle size multiplier (k)	0.5	unitless	AP-42 Chapter 13.2.5.
$PM_{2.5}$ Particle size multiplier (k)	0.075	unitless	AP-42 Chapter 13.2.5.
Control from watering	90%		SCAQMD 2007, Table XI-B

Annual PM_{10} Emissions	0.0022 tons/year
Annual $PM_{2.5}$ Emissions	0.0003 tons/year

Notes:

1. Surface wind sped distribution, Friction velocity, and erosion potential are presented for the maximum daily windspeed. Erosion potentials were calculated on a daily basis for one year of daily maximum windspeeds. The Total Erosion Potential shown here represents the total annual emissions divided by the total stockpile area.

References:

1. National Climatic Data Center (NCDC). 2015. WFO Monthly/Daily Climate Data. Available at: http://w2.weather.gov/climate/getclimate.php?wfo=mtr&pil=CF6&sid=CCR
2. South Coast Aqir Quality Management District (SCAQMD). 2007. Fugitive Dust Mitigation Measures. Available at: http://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/fugitive-dust
3. United States Environmental Protection Agency (USEPA). 2006. AP-42, Chapter 13.2.5: Industrial Wind Erosion. November. Available at: http://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0205.pdf

ATTACHMENT 2
TRUCK TRIP DISTANCE

RAMBOLL

ENVIRONMENT
& HEALTH

MEMO

Client	Orcem / VMT
Date	May 14, 2018
To	David Vintze (Bay Area Air Quality Management District) and Lora Granovsky (Ilanco Consultants)
From	Shari Beth Libicki, Ph.D. and Michael Howley
Copy to	Darcy Rosenblatt, Dudek Consulting; Lisa Plowman, City of Vallejo; Dick Loewke, Loewke Planning Assoc.; Steve Bryant, Orcem; and Matt Fettig

SUBJECT: One-Way Distance Estimation for Truck Movements Associated with Orcem-VMT Project Revised Operations Alternative

Date May 14, 2018

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Introduction: This one-way distance-weighted truck movement estimate has been developed following our meeting with City and BAAQMD staff on 5/08/18 for use as part of a supplemental air quality and health risk assessment focusing on the unique operational attributes of the Revised Operations Alternative ("ROA") for the combined Orcem California ("Orcem") and Vallejo Marine Terminal ("VMT") Project in Vallejo, California. As requested by BAAQMD staff, this memorandum is intended to present a clear statement of assumptions, methodology, and calculations.

The ROA is sponsored by Orcem and VMT as a feasible alternative to the Original Project, intended to minimize environmental effects through use of superior efficiencies in equipment and operations for both Orcem and VMT. Because it accomplishes the basic project objectives for Orcem and VMT, the ROA is the alternative for which the applicants are seeking approval and permits from both the lead agency (Vallejo) and all responsible agencies (including the BAAQMD).

Methodology and Assumptions: Trucks that serve Orcem/VMT are primarily delivering materials from Orcem and VMT to populations in and around the Bay Area Air Quality Management District (BAAQMD). For the 60% of the material that the proponent anticipates will be delivered to populations within the BAAQMD jurisdiction, we estimated delivery routes based on a population weighted average distance (PWAD). For the 40% of the deliveries that the proponent believes will be delivered outside the BAAQMD jurisdiction, we estimated distance within the BAAQMD based on predicted pathways out of the BAAQMD, and the distances to those boundaries. The results of this calculation is 41.9 miles for each one-way trip, presented in Table 1, below, and described in more detail in this memorandum.

We determined an average truck-trip weighted hauling distance from Vallejo within the boundaries of the BAAQMD, as shown in Table 1. This average comprises two main components: (1) a composite PWAD from Vallejo to the 20 most populous cities within the BAAQMD, all together weighted by a truck-trip factor of 60%; and (2) a delivery weighted average to the three exits from the BAAQMD the trucks are most likely to use, based on the populations they are serving. Those exits from the BAAQMD, the percentage of deliveries, and the distances are:

- 10% of the deliveries from Vallejo to the northern BAAQMD boundary near Healdsburg on US-101 (55 miles);
- 20% of the deliveries from Vallejo to the north eastern BAAQMD boundary near Vacaville on I-80 (23 miles); and
- 10% of the deliveries from Vallejo to the eastern BAAQMD boundary near Tracy on I-580 (60 miles),

To determine the PWAD to cities within the Bay Area, we downloaded 2010 census population data from the US Census website [1] and filtered them to obtain Bay Area city populations ($Population_i$). We then identified the cities that exist within the BAAQMD jurisdictional boundaries [2] and ranked them to obtain the top 20 most populous cities. We used the 20 most populous cities, as we believe that the balance of the population is distributed roughly evenly around those populous cities. We used Google Maps to determine the distance ($Distance_i$) from Vallejo to each of these

20 cities (in terms of driving routes, not straight-line distances). We calculated PWAD, as shown in Table 2, between these cities and Vallejo. The following formula was used to calculate PWAD:

$$PWAD = \frac{\sum_{i=1}^{20} Distance_i * Population_i}{\sum_{i=1}^{20} Population_i}$$

Table 1: Truck-trip weighted average distance from Vallejo within BAAQMD boundary.

Trip Component	Distance (Miles)	Trips (%)	Distance x Trips
20-City PWAD within BAAQMD	43 (Table 2)	60	25.8
Northern BAAQMD boundary	55	10	5.5
Northeastern BAAQMD boundary	23	20	4.6
Eastern BAAQMD boundary	60	10	6
Truck-trip weighted distance (miles)			**41.9**

Table 2: Population-weighted average distance (PWAD) from Vallejo to top 20 most populous cities within the BAAQMD jurisdictional boundaries.

City Name	Population (2010 Census)	Distance from Vallejo (miles)	Distance x Population
San Jose	945,942	69.6	65823941.6
San Francisco	805,235	31.2	25114683.8
Oakland	390,724	26.2	10220062.2
Fremont	214,089	54.5	11665283.6
Santa Rosa	167,815	42.4	7121194.3
Hayward	144,186	47.4	6835164.7
Sunnyvale	140,081	68.3	9573555.8
Concord	122,067	18.0	2199366.6
Santa Clara	116,468	68.3	7959772.5
Vallejo	115,942	0.0	0.0
Berkeley	112,580	21.7	2448108.4
Fairfield	105,321	18.0	1897642.2
Richmond	103,701	16.8	1739594.6
Antioch	102,372	29.5	3021176.9
Daly City	101,123	39.1	3958146.4
San Mateo	97,207	56.3	5471760.6
San Leandro	84,950	36.2	3071763.1
Livermore	80,968	46.5	3762845.3
Napa	76,915	16.1	1237690.8
Redwood	76,815	55.5	4261856.7
PWAD (miles): Sum (Distance x Population)/Sum(Population)			**43.2**

References:

1) 2010 US Census population data retrieved from: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.ST10
2) Bay Area Air Quality Management District Boundaries: http://www.baaqmd.gov/~/media/files/legal/baaqmd-boundaries-17-ccr-sec-60101.pdf

ATTACHMENT 3
TRUCK EMISSIONS CALCULATIONS

Onroad Annual Emissions

Diesel Heavy Duty Truck Emissions							CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_X	CO_2	CO_2e
						Running EF (g/mi)	0.23	2.48	0.03	0.386	0.02	0.105	0.02	0.01	1284.00	--
						Per trip EF (g/trip)	7.87	6.39	0.003	4	0.002	1	0.53	0.01	1252.55	--
Facility	Scenario	Volume Imported by Truck (tonnes/year)	Volume Exported by Truck (tonnes/year)	Truck Capacity (tonnes/truck)	Total One-Way Trips	One-Way Trip Distance (mi/trip)	Emissions (tons/year)								Emissions (tonnes/year)	
Orcem	Mode 2, Milestone 5	86,168	844,444	23.58	78,932	41.9	1.5	9.6	0.1	1.8	0.1	0.5	0.1	0.045	4,345	4,360
Orcem	Mode 3, Milestone 5	22,306	557,196	23.58	49,152	41.9	0.9	6.0	0.1	1.1	0.1	0.3	0.1	0.028	2,706	2,715
VMT	Revised VMT Project without Phase 2	--	480,000	20	48,000	41.9	0.9	5.8	0.1	1.1	0.1	0.3	0.1	0.028	2,643	2,652
VMT	Delivery Trucks	--	--	--	2,496	7.3	0.03	0.1	0.001	0.02	0.0005	0.005	0.002	0.0003	27	27

Notes:

1. Material volumes and truck capacity specified by Orcem-VMT for the Revised Operations Alternative (ROA). Orcem volumes calculated from a maximum of 19 ship calls per year (See DEIR tables 5.20 and 5.21). The total volume of material exported in Mode 3 is reduced by 145,732 tonnes, which will be exported by rail. VMT volumes calculated from 12 ship calls per year. For more than 12 VMT ships per year, all material will be loaded by rail due to loading times and space limitations as part of the ROA.
2. One-way trip distance calculated as described in Ramboll memo dated May 14, 2018, "One-Way Distance Estimation for Truck Movements Associated with Orcem-VMT Project Revised Operations Alternative"

3. Emission factors taken from EMFAC2017 for diesel heavy-duty trucks in Solano County for operational year 2025. Running emission factors calculated using specific speed emssion factors within the HRA modeling domain, and the EMFAC2017 aggregate speed emission factor for the remainder of the one-way trip distance. Calculation details are presented in a subsequent table. Idling EFs converted to g/trip by multiplying EMFAC2017 outputs in g/vehicle/day by EMFAC reported population count and dividing by EMFAC reported trips.
4. Greenhouse Gas emissions converted from CO_2 to CO_2e by the ratio of default emission factors for CO2, CH4, and N2O for Distillate Fuel Oil No. 2 of the USEPA Mandatory Reporting Rule (Tables C-1 and C-2 to Subpart C of 40 CFR Part 98), scaled by Global Warming Potential (Table A-1 to Subpart A of 40 CFR Part 98).
5. Fugitive PM emission factors include tire and brake wear from EMFAC2017 as running EFs, plus off-site roadway dust calculated for public roads from AP-42 methods in the following table. Per trip fugitive dust emission factors represent on and near-site roadway dust calculated by the same method, conservatively assuming all traffic is heavy-duty trucks.
6. VMT Delivery trucks assume 4 trucks/day during terminal operations, consistent with the DEIR, for a maximum of 26 days/month, 12 months/year. Delivery truck trip distance is the CalEEMod default for construction vendor trips.

Light Duty Vehicle (worker trip) Emissions							CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_X	CO_2	CO_2e
						Running EF (g/mi)	0.53	0.04	0.001	0.333	0.001	0.088	0.01	0.003	257.39	
						Per trip EF (g/trip)	2.21	0.19	0.002	4	0.002	1	0.70	0.001	53.32	--
Facility	Scenario	Number of workers	Days/Week	Weeks/Year	Total One-Way Trips	One-Way Trip Distance (mi/trip)	Emissions (tons/year)								Emissions (tonnes/year)	
Orcem	Mode 2, Milestone 5	64	6	52	39,936	10.8	0.3	0.03	0.001	0.3	0.001	0.09	0.03	0.001	113.1	114
Orcem	Mode 3, Milestone 5	64	6	52	39,936	10.8	0.3	0.03	0.001	0.3	0.001	0.09	0.03	0.001	113.1	114
VMT	Revised VMT Project without Phase 2	40	6	52	24,960	10.8	0.2	0.02	0.0004	0.2	0.000	0.05	0.02	0.001	70.7	71

Notes:

1. Worker counts provided by Orcem-VMT. Assumes 6 operating days/week.
2. One-way trip length taken from CAlEEMod default for BAAQMD worker trips.
3. Emission factors taken from EMFAC2017 for light duty vehicles (EMFAC2007 categories LDA, LDT1, and LDT2) in Solano County for aggregate speeds. Running emission factors calculated as weighted average by VMT. Per trip EFs include starting emissions for all pollutants, as well as hotsoak, evaporative, and diurnal emissions for ROGs.
4. Greenhouse Gas emissions converted from CO_2 to CO_2e by the ratio of default emission factors for CO2, CH4, and N2O for motor gasoline of the USEPA Mandatory Reporting Rule (Tables C-1 and C-2 to Subpart C of 40 CFR Part 98), scaled by Global Warming Potential (Table A-1 to Subpart A of 40 CFR Part 98).
5. Fugitive PM emission factors include tire and brake wear from EMFAC2017 as running EFs, plus off-site roadway dust calculated for public roads from AP-42 methods in the following table. Per trip fugitive dust emission factors represent on and near-site roadway dust calculated by the same method, conservatively assuming all traffic is heavy-duty trucks.

Onroad Daily Emissions

Diesel Heavy Duty Truck Emissions				CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_X
			Running EF (g/mi)	0.23	2.48	0.03	0.39	0.02	0.11	0.02	0.01
			Idling EF (g/hr)	7.87	6.39	0.003	4	0.002	1	0.53	0.01
Facility	Scenario	Average One-Way Trips	One-Way Trip Distance (mi/trip)	Emissions (lbs/day)							
Orcem	Mode 2, Milestone 5	216	41.9	8.3	52.5	0.5	9.7	0.5	2.6	0.7	0.2
Orcem	Mode 3, Milestone 5	135	41.9	5.2	32.7	0.3	6.0	0.3	1.6	0.4	0.2
VMT	Revised VMT Project without Phase 2	132	41.9	5.0	31.9	0.3	5.9	0.3	1.6	0.4	0.2
VMT	Delivery Trucks	7	7.3	0.1	0.4	0.003	0.1	0.003	0.03	0.01	0.002

Notes:
1. Daily truck counts calculated as annual counts/365
2. One-way trip distance calculated as described in Ramboll memo dated May 14, 2018, "One-Way Distance Estimation for Truck Movements Associated with Orcem-VMT Project Revised Operations Alternative"

3. Emission factors taken from EMFAC2017 for diesel heavy-duty trucks in Solano County for operational year 2025. Running emission factors calculated using specific speed emssion factors within the HRA modeling domain, and the EMFAC2017 aggregate speed emission factor for the remainder of the one-way trip distance. Calculation details are presented in a subsequent table. Idling EFs converted to g/trip by multiplying EMFAC2017 outputs in g/vehicle/day by EMFAC reported population count and dividing by EMFAC reported trips.

Light Duty Vehicle (worker trip) Emissions				CO	NO_X	PM_{10} (Exhaust)	PM_{10} (Fugitive)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ (Fugitive)	ROG	SO_X
			Running EF (g/mi)	0.53	0.04	0.001	0.33	0.001	0.09	0.01	0.003
			Per trip EF (g/trip)	2.21	0.19	0.002	4	0.002	1	0.70	0.001
Facility	Scenario	Number of workers	One-Way Trip Distance (mi/trip)	Emissions (lbs/day)							
Orcem	Mode 2, Milestone 5	64	10.8	1.1	0.1	0.002	1.1	0.002	0.3	0.1	0.004
Orcem	Mode 3, Milestone 5	64	10.8	1.1	0.1	0.002	1.1	0.002	0.3	0.1	0.004
VMT	Revised VMT Project without Phase 2	40	10.8	0.7	0.1	0.001	0.7	0.001	0.2	0.1	0.002

Notes:
1. Worker counts provided by Orcem-VMT.
2. One-way trip length taken from CAlEEMod default for BAAQMD worker trips.
3. Emission factors taken from EMFAC2017 for light duty vehicles (EMFAC2007 categories LDA, LDT1, and LDT2) in Solano County for aggregate speeds. Running emission factors calculated as weighted average by VMT. Per trip EFs include starting emissions for all pollutants, as well as hotsoak, evaporative, and diurnal emissions for ROGs.

Maximum On-Road Emissions for HRA Modeling

			LEFUG	LMFUG	ORFUG	VMTFUG	SMFUG	SNFUG	SSFUG
		Distance (mi)	0.51	0.45	0.23	0.23	0.43	0.33	0.46
		PM10 EF (g/mi)	0.0068	0.0068	0.0124	0.0124	0.0119	0.0119	0.0119
Facility	Case	Max Annual On-Way Trips	Emissions (tons/year)						
Orcem	Mode 2	78,932	3.02E-04	2.65E-04	4.72E-04	0E+00	4.48E-04	3.37E-04	4.72E-04
Orcem	Mode 3	49,152	1.88E-04	1.65E-04	2.94E-04	0E+00	2.79E-04	2.10E-04	2.94E-04
VMT	All	48,000	1.84E-04	1.61E-04	0E+00	2.82E-04	2.73E-04	2.05E-04	2.87E-04
VMT	Delivery	2,496	9.55E-06	8.38E-06	0E+00	1.46E-05	1.42E-05	1.07E-05	1.49E-05

Notes:

1. Distances and speeds consistent with DEIR. Onsite source groups include idling emissions for each one-way trip, using the same idling emission factor as the ROA truck emissions in Attachment 3.
2. Emission factors taken from EMFAC2017 for diesel HHDT trucks in Solano county, operational year 2025.

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: SOLANO
Calendar Year: 2025, 2050
Season: Annual
Vehicle Classification: EMFAC2007 Categories
Units: miles/day for VMT, g/mile for RUNEX, PMBW and PMTW

Region	Calendar Y	Vehicle Category	Model Year	Speed	Fuel	VMT	PM10_RUNEX
SOLANO	2025	HHDT	Aggregated	10	DSL	19907.68	0.01243
SOLANO	2025	HHDT	Aggregated	20	DSL	22873.4	0.00681
SOLANO	2025	HHDT	Aggregated	40	DSL	21826.7	0.011878

Idle EF (g/trip): 0.002511428

HHDT Running Emission Factors

Segment	Speed (mph)	Length (mi)	% of Trucks	EMFAC2017 EFs (g/mi)						
				ROG_RUNEX	CO_RUNEX	NOx_RUNEX	SOx_RUNEX	CO2_RUNEX	PM10_RUNEX	PM2_5_RUNEX
Onsite	10	0.23	100%	0.090	1.308	10.291	0.026	2744.403	0.012	0.012
Lemon St	20	0.45	100%	0.030	0.461	5.530	0.017	1825.060	0.007	0.007
Lemon St (cont)	20	0.51	56%	0.030	0.461	5.530	0.017	1825.060	0.007	0.007
South Sonoma Blvd	40	0.89	39%	0.015	0.162	2.004	0.011	1174.575	0.012	0.011
North Sonoma Blvd	40	0.33	5%	0.015	0.162	2.004	0.011	1174.575	0.012	0.011
Freeway	Aggregate	39.49	100%	0.023	0.223	2.444	0.012	1301.320	0.026	0.025
Weighted Average (g/mi)				0.023	0.227	2.475	0.012	1284.000	0.025	0.024

Notes:

1. Roadway segment lengths and percent of trucks taken from the DEIR HRA modeling. Beyond the modeling domain, assume aggregate speed emission factors for the balance of the one-way trip length.
2. Emission factors from EMFAC2017 for Solano County, diesel Heavy Heavy Duty Trucks (HHDT), operational year 2025.

Paved Road Fugitive Dust Emission Factors

On- and Near-Site Travel

Parameter	Units	PM10	PM2.5	Reference
Mean Vehicle Weight	tons	25	25	Average loaded and unloaded
Wet Days Per Year	Days	56	56	CalEEMod default for BAAQMD
Constant, k	g/VKT	0.62	0.15	AP42 Table 13.2.1-1
Constant, a		0.91	0.91	AP42 Equation 13.2.1-1
Constant, b		1.02	1.02	AP42 Equation 13.2.1-2
Silt Loading, Sl	g/m2	0.1	0.1	CalEEMod default
Emission factor, E	g/VKT	1.96	0.47	
Near-Site Trip Length	km	2.14	2.14	Combined length of modeled roadways
Emission factor, E	g/trip	4.19	1.01	

Off-Site Travel

Parameter	Units	PM10	PM2.5	Reference
Mean Vehicle Weight	tons	2.4	2.4	CalEEMod default
Wet Days Per Year	Days	56	56	CalEEMod default for BAAQMD
Constant, k	g/VKT	0.62	0.15	AP42 Table 13.2.1-1
Constant, a		0.91	0.91	AP42 Equation 13.2.1-1
Constant, b		1.02	1.02	AP42 Equation 13.2.1-2
Silt Loading, Sl	g/m2	0.1	0.1	CalEEMod default
Emission factor, E	g/VKT	0.18	0.04	
Emission factor, E	g/VMT	0.29	0.07	

Notes:

1. Emission factors calcualted per USEPA AP-42 as $E = [k*(sL)^a(W)^b*(365 - [\text{Wet Days}])/365$
2. Per AP-42, the mean vehicle weight in this equation represents the mean wieght of all vehicles on the road. The mean weight of the haul trucks was conservatively applied for on and near-site travel for all vehicles, and the CalEEMod default value is used for the total trip length.
3. On and near-site trip length calculated from DEIR HRA model lengths, assuming an on-site length of 0.3875 km, 0.72 km on Lemon St, the a 56/39/5% split continuing on Lemon St (0.82 km), south on Sonoma Blvd (1.433 km), or North on Sonoma Blvd (0.525 km)

References:

California Air Pollution Control Officers Association (CAPCOA). 2017. California Emissions Estimator Model (CalEEMod). Available at: http://www.aqmd.gov/docs/default-source/caleemod/02_appendix-a2016-3-2.pdf?sfvrsn=6

United States Environmental Protection Agency (USEPA). 2011. AP-42 Chapter 13.2.1 Paved Roads. Available at: https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s0201.pdf

ATTACHMENT 4
RAIL EMISSIONS CALCULATIONS

Rail Emissions Input Assumptions

Parameter	Value	Notes
Switching time (minutes/train)	160	Per section 5.2.7 of the DEIR, switching time is estimated based on 20 mintes each way for 16 railcar segments, the maximum that can fit in the rail transloading area. 50/16 = 4 segments per train, x 40 minutes of switching per segment
Idling time (minutes/train)	60	15 minutes idling shutoff/locomotive/one-way trip
Line-haul on-site time (minutes/round trip)	29	Travel at 10-15 km/hr within 1 mile of site
Line-haul distance (miles/one-way)	29	Rail distance to BAAQMD boundary
Locomotives/train	2	ROA description, based on information from CalNorthern Rail
Weight of locomotive (tons)	208	General Electric ET44C4
Rail cars/train	50	ROA description
Weight of empty rail car (tons)	38	Union Pacific small open-top hopper
Total weight of empty train	2316	
Rail car capacity (short tons)	100	
Orcem Mode 3, Milestone 5 material imported by rail (tonnes/year)	120,000	See DEIR Table 5.26
Orcem Mode 3, Milestone 5 material exported by rail (tonnes/year)	145,732	See DEIR Table 5.26
VMT material exported by rail (tonnes/year)	1,280,000	Maximum product volume from 32 ships/year (see note below)
Orcem maximum trains/year	33	Assumes imports/exports use same trains
VMT maximum trains/year	283	

Notes:
Per the DEIR, the combined operations of Orcem and VMT are limited to 1,200 rail cars/month, or 14,400 rail cars/year. This is equivalent to approximately 32.7 VMT ships/year, if no Orcem material were exported by rail (i.e., operates in Mode 2). If Orcem operated in Mode 3, total material shipments from the combined facilities would be limited to 288 trains/year at 50 cars/train. At the full Orcem capacity above, this would be equivalent to 29 VMT ships/year.

References:
GE Transportation. 2016. "Full Locomotive Product Portfolio". Available at: https://issuu.com/getransportation/docs/ge-locomotive-product-catalog-2016
Union Pacific. 2018. "Open-Top Hoppers". Available at: https://www.up.com/customers/all/equipment/descriptions/open-top_hoppers/index.htm

Rail Emissions Summary

Facility	Mode	Annual Emissions (tons/year)						CO_2 (tonnes/year)
		CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_X	
Orcem	Switching	0.001	0.03	6.2E-05	5.7E-05	2.3E-04	2.4E-04	23
	Idling	0.001	0.006	6.5E-05	6.0E-05	3.2E-04	9.9E-06	1
	Line-Haul (onsite)	0.003	0.020	4.3E-04	3.9E-04	6.1E-04	4.6E-05	4
	Line-Haul (offsite)	0.41	0.83	0.01	0.01	0.03	0.001	142
	Total	0.41	0.88	0.01	0.01	0.03	0.002	170
VMT	Switching	0.004	0.244	0.001	0.000	0.002	4.5E-06	198
	Idling	0.010	0.048	0.001	0.001	0.003	8.5E-05	8
	Line-Haul (onsite)	0.03	0.17	3.7E-03	3.4E-03	5.3E-03	4.0E-04	38
	Line-Haul (offsite)	2.54	5.14	0.08	0.08	0.18	0.009	883
	Total	2.58	5.60	0.09	0.08	0.19	0.01	1,127

Facility	Mode	Average Emissions (lbs/day)					
		CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_X
Orcem	Switching	0.00	0.16	0.00	0.00	0.00	1.31E-03
	Idling	0.01	0.03	3.56E-04	3.27E-04	1.73E-03	5.41E-05
	Line-Haul (onsite)	0.02	0.11	2.34E-03	2.15E-03	3.37E-03	2.53E-04
	Line-Haul (offsite)	2.24	4.53	0.07	0.07	0.16	0.01
	Total	2.27	4.82	0.08	0.07	0.17	0.010
VMT	Switching	0.02	1.34	0.00	0.00	0.01	0.00
	Idling	0.05	0.26	3.05E-03	2.81E-03	0.01	4.64E-04
	Line-Haul (onsite)	0.16	0.94	0.02	0.02	0.03	2.17E-03
	Line-Haul (offsite)	13.91	28.15	0.45	0.41	1.01	0.05
	Total	14.15	30.69	0.48	0.44	1.06	0.052

Notes:

1. Orcem emissions calculated for Mode 3, Milestone 5. VMT Emissions calculated for 32 ships/year (See note 1 under the Assumptions Table).
2. Emissions calculated based on ARB inventory inventory data and projected locomotive fleet mix for operational year 2025.
3. ROG Emissions converted from hydrocarbons by a factor of 1.21 (ARB 2017).
4. PM2.5 converted from PM10 by a factor of 0.92 (ARB 2017).
5. SO2 emissions calculated from fuel use assuming a sulfur content of 15 ppm
6. CO2 emissions calculated from fuel use by a factor of 10,206 g/gal of fuel, and a fuel density of 3,200 g/gal (ARB 2017).

References:

California Air Resources Board (ARB). 2017. "2016 Line Haul Locomotive Model & Update". October. Available at: https://www.arb.ca.gov/msei/ordiesel.htm

Switching Emission Factors

Notch Position	Idle	DB	1	2	3	4	5	6	7	8	Average
Time in Notch	44.2%	0.0%	5.0%	25.0%	2.3%	21.5%	1.5%	0.6%	0.0%	0.0%	
HC (g/hr)	1.24	0	0.86	0.6	0.87	0.91	1.11	1.33	2.02	3.87	1.96
CO (g/hr)	0.16	0	40.34	0.85	1.13	1.42	1.74	2.04	2.9	4.25	5.34
NOx (g/hr)	59.8	0	124.3	168.5	256.2	270.4	348.5	472	759	2013.6	293.72
PM (g/hr)	0.030095	0	0.081264	0.208228	0.321303	1.083889	0.434	0.818318	1.558957	2.144631	0.64
Fuel Use (lb/hr)	10.45	0	71.67601	110.95	156.738	211.108	252.269	298.592	341.502	417.339	181.02

Notes:
1. DEIR Section 5.2.7 states "the National Railway Equipment Company will supply ultra-low emissions road-switcher locomotives for both switching and line-haul." Accordingly, emission factors are based on the most recent NREC switchers (Tacoma Green 2016). As the 2016 model is a lower horsepower than the 2006 model assumed in the DEIR (1300 hp vs 2100 hp), the total emission factors are doubled to account for two switchers in operation.

2. Time in notch based on Davis Yard trim operations (Sierra Research 2007), consistent with the DEIR (Table 5.28). Percentages rescaled to assume no activity in notches 7 and 8 onsite. "Trim" operations refer to splitting and building trains from rail car segments, which most closely resembles the activity at the rail ladder adjacent to the Facility as 50 car trains are split into 16 car segments and rebuilt.
3. Emissions calculated as [number of trains]*[switching time per train]*[emission factor]

References:
Sierra Research. 2007. "Toxic Air Contaminant Emissions Inventory and Dispersion Modeling Report for the Los Angeles Transportation Center." January. Available at: https://www.arb.ca.gov/railyard/hra/sr_latc_rpt.pdf
Tacoma Green Transportation Summit & Expo. 2016. "NRE Tier 4 ARB Verified Switcher Locomotive". April. Available at: http://www.gtsummitexpo.socialenterprises.net/assets/docs/past-events/GTSE-tacoma-2016/april-6/gtse-tacoma-2016-WCC-Session-7A-All-Presentations-Advances-In-Locomotive-Marine-Sector-April-6th.pdf

On-Site Line-Haul Emission Factors

Throttle Position (Percent Time in Notch)

Duty Cycle	Idle	DB	1	2	3	4	5	6	7	8
EPA Line-Haul	47.0%	15.5%	8.0%	8.0%	6.4%	5.4%	4.7%	4.8%	0.0%	0.0%

HC Emission Rates (g/hr)

Tier	Fleet Fraction	Idle	DB	1	2	3	4	5	6	7	8	Total
1+	0%	34	191	130	184	374	440	487	574	604	675	
2+	8%	12	32	31	60	110	112	156	204	244	310	
3	31%	12	32	31	60	110	112	156	204	244	310	
4	60%	4	10	10	18	34	35	48	63	75	95	
Average	1	7	20	19	36	66	67	93	121	144	183	29

CO Emission Rates (g/hr)

Tier	Fleet Fraction	Idle	DB	1	2	3	4	5	6	7	8	Total
1+	0%	49	461	244	368	896	1505	1788	2014	2714	3356	
2+	8%	30	120	142	239	607	806	479	537	790	1034	
3	31%	30	120	142	239	607	806	479	537	790	1034	
4	60%	30	120	142	239	607	806	479	537	790	1034	
Average	1	30	122	142	240	609	809	485	544	799	1045	196

NOx Emission Rates (g/hr)

Tier	Fleet Fraction	Idle	DB	1	2	3	4	5	6	7	8	Total
1+	0%	376	2036	1538	4672	14369	16071	13855	18020	20886	23913	
2+	8%	296	591	1021	2457	4779	6521	8651	12109	14405	16709	
3	31%	296	591	1021	2457	4779	6521	8651	12109	14405	16709	
4	60%	60	120	207	497	966	1319	1749	2449	2913	3379	
Average	1	155	315	535	1292	2538	3447	4536	6344	7543	8749	1139

PM Emission Rates (g/hr)

Tier	Fleet Fraction	Idle	DB	1	2	3	4	5	6	7	8	Total
1+	0%	11	55	39	88	190	240	265	325	340	486	
2+	8%	3	19	31	65	135	162	180	186	228	270	
3	31%	3	19	31	65	135	162	180	186	228	270	
4	60%	1	3	6	12	25	30	34	35	43	50	
Average	1	2	10	16	33	69	83	93	96	117	139	24

Fuel Emission Rates (lb/hr)

Tier	Fleet Fraction	Idle	DB	1	2	3	4	5	6	7	8	Total
1+	0%	20	54	86	184	371	510	720	938	1161	1461	
2+	8%	20	44	102	209	447	612	825	1060	1310	1598	
3	31%	20	44	102	209	447	612	825	1060	1310	1598	
4	60%	20	44	102	209	447	612	825	1060	1310	1598	
Average	1	20	44	102	209	447	612	824	1059	1309	1597	193

Notes:

1. Line haul emission factors based on Tier 1 "Dash 9" type locomotives and Tier 2 "ES44" type locomotives, as these are the most common engines in the most recent Port of Oakland inventory (Oakland 2016). Raw emission factors by duty cycle and tier correction factors are provided in the next table.

2. Duty cycle time in mode values were taken from EPA line-haul duty cycle, consistent with DEIR Table 5.29, assuming no time in notches 7 and 8 (Sierra Research 2007).

3. Fuel consumption for higher engine tiers assumed to be the same as Tier 2

4. Fleet fractions taken for operational year 2025 based on ARB inventory (ARB 2017).

References:

California Air Resources Board (ARB). 2017. "2017 Emissions Inventory Aggregated at County/Air Basin/State". Available at: https://www.arb.ca.gov/msei/ordiesel.htm
Port of Oakland. 2016. "2015 Seaport Air Emissions Inventory." Available at:
https://www.portofoakland.com/files/PDF/Port%20of%20Oakland%202015%20Seaport%20Emissions%20Inventory%20Final-11Oct2016.pdf
Sierra Research. 2007. "Toxic Air Contaminant Emissions Inventory and Dispersion Modeling Report for the Los Angeles Transportation Center." January. Available at:
https://www.arb.ca.gov/railyard/hra/sr_latc_rpt.pdf

Raw Switching and On-Site Emission Factors

Correction Factors for New Tiers			
Tier	THC	NOx	PM
0+ / 0	0.625	0.837	0.625
1+ / 1	0.617	1	0.625
2+ / 2	0.5	0.9	0.444
3 / 2	0.5	0.9	0.444
4 / 2	0.154	0.182	0.083

Locomotive Class		Tier	Idle	DB	1	2	3	4	5	6	7	8
HC EF (g/hr)	Dash 9	1	54.8	309.1	210.4	297.8	606.1	713.7	789.0	931.1	978.2	1094.0
	ES44	2	24.2	64.6	62.2	120.0	220.4	224.2	311.2	407.6	487.6	619.4
CO EF (g/hr)	Dash 9	1	49.4	461.4	243.5	368.0	895.5	1505.0	1788.4	2014.4	2713.7	3356.1
	ES44	2	30.4	120.3	141.8	239.4	607.3	805.9	479.2	537.4	790.1	1033.9
NOx EF (g/hr)	Dash 9	1	375.9	2035.5	1538.4	4671.8	14368.6	16071.1	13854.8	18020.0	20886.3	23912.8
	ES44	2	329.1	656.7	1134.9	2730.2	5310.1	7246.1	9611.9	13454.9	16005.1	18565.9
PM EF (g/hr)	Dash 9	1	16.9	88.4	62.1	140.2	304.0	383.5	423.9	520.2	544.6	778.1
	ES44	2	7.7	42.0	69.3	145.8	304.3	365.0	405.2	418.4	513.5	607.5
Fuel Consumption (lb/hr)	Dash 9	1	19.7	54.3	85.9	183.9	371.2	509.5	719.9	938.1	1161.4	1461.0
	ES44	2	19.9	43.9	101.7	209.3	447.3	612.3	824.7	1060.0	1310.0	1598.1

Notes:
1. Engine tier correction factors taken from most recent Port of Oakland inventory (Oakland 2016).
2. Dash 9 and ES44 emission factors from 2005 Port of Oakland inventory (Oakland 2008).

References:
Port of Oakland. 2008. "Port of Oakland 2005 Seaport Air Emissions Inventory". March. Available at:
https://www.portofoakland.com/files/pdf/environment/airEmissions_Inventory.pdf
Port of Oakland. 2016. "2015 Seaport Air Emissions Inventory." Available at:
https://www.portofoakland.com/files/PDF/Port%20of%20Oakland%202015%20Seaport%20Emissions%20Inventory%20Final-11Oct2016.pdf

Off-Site Line-Haul Emission Factors

EPA Emission Factors (g/gal)

	PM_{10}	HC	NO_x	CO	DPM	PM2.5	CO2	SOx	ROG	2025 Tier Distribution Activity
Pre-Tier	6.66	9.98	270.4	26.62	6.66	6.13	10206	0.094	12.08	0%
Tier 0	6.66	9.98	178.88	26.62	6.66	6.13	10206	0.094	12.08	0%
Tier 0+	4.16	6.24	149.76	26.62	4.16	3.83	10206	0.094	7.55	0%
Tier 1	6.66	9.78	139.36	26.62	6.66	6.13	10206	0.094	11.83	0%
Tier 1+	4.16	6.03	139.36	26.62	4.16	3.83	10206	0.094	7.30	0%
Tier 2	3.74	5.41	102.96	26.62	3.74	3.44	10206	0.094	6.55	0%
Tier 2+	1.66	2.7	102.96	26.62	1.66	1.53	10206	0.094	3.27	8%
Tier 3	1.66	2.7	102.96	26.62	1.66	1.53	10206	0.094	3.27	31%
Tier 4	0.31	0.83	20.8	26.62	0.31	0.29	10206	0.094	1.00	60%
Average (g/gallon)	0.86	1.59	53.86	26.62	0.862	0.793	10206	0.094	1.929	

Conversion Factor		Notes
0.02247	SO3	Fraction of sulfur converted to PM
15	ppm	Assumed sulfur fule content
1.21	ROG/HC	

Notes:
1. Emission Factors for PM10, HC, Nox, CO and CO2 were taken from ARB documentation (ARB 2017a).
2. 2025 Tier Distribution activity were taken from ARB inventory (ARB 2017b).

3. SO2 and CO2 emission factors calculated from fuel use, and ROG emission factor converted from HC, based on ARB documentation (ARB 2017a).

References:
California Air Resources Board (ARB). 2017a. "2016 Line Haul Locomotive Model & Update". October. Available at: https://www.arb.ca.gov/msei/ordiesel.htm
California Air Resources Board (ARB). 2017b. "2017 Emissions Inventory Aggregated at County/Air Basin/State". Available at: https://www.arb.ca.gov/msei/ordiesel.htm

Line-Haul Fuel Consumption

Inbound from Sacramento

Parameter	Value	Notes
Negative Grade	-0.0047	Roseville to Oakland (ARB 2017)
Positive Grade	0.0038	Roseville to Oakland (ARB 2017)
1/(GTM/gal)	0.00103074	
GTM/gal	970	

Outbound to Sacramento

Parameter	Value	Notes
Negative Grade	-0.0038	Oakland to Roseville (ARB 2017)
Positive Grade	0.0047	Oakland to Roseville (ARB 2017)
1/(GTM/gal)	0.00111696	
GTM/gal	895	

Facility	Train Empty weight (tons)	Annual Freight (tons)		Annual Trains	One-Way Distance (mi)	Gross Ton-Miles		Fuel (gallons)		
		Inbound	Outbound			Inbound	Outbound	Inbound	Outbound	Total
Orcem	2316	132,277	160,642	33	29	6,052,455	6,875,031	6,239	7,679	13,918
VMT	2316	0	1,410,958	283	29	19,007,412	59,925,208	19,592	66,934	86,526

Notes:
gross ton-mile per gallon (GTM/gal) calculated per ARB Guidance as 1/(GTM/gal) = 0.00075 + 0.086*(Positive Grade) + 0.0098*(Negative Grade)

References:
California Air Resources Board (ARB). 2017. "2016 Line Haul Locomotive Model & Update". October. Available at: https://www.arb.ca.gov/msei/ordiesel.htm

ATTACHMENT 5
SHIPPING EMISSIONS CALCULATIONS

Assumptions	
Maneuvering	Maneuvering prior to hotelling covers a distance of 1300 m (POAK 2013)
Transit	Transiting activity begins at the Sea Buoy 10.4 nautical miles from the Golden Gate (City of Richmond 2014) plus the 23.13 nm from the Golden Gate to the Facility, plus 1,700 meters for low-speed transiting (POAK 2013, POSF 2010).
Ship Type	Bulk Cargo
Transit Engine Speed	12 knots (6.17 m/s) until 3km from port when it reduces to 7 knots (POSF 2010)
Maneuvering Engine Speed	5 knots inwards, 8 knots outwards (CARB 2011)
Fuel Type	Marine Distillate (0.1% S) (CARB 2011)

Assumption	Orcem+VMT
Maximum Vessels per Year	48
Maximum Vessels per Month	4
Maxmum Vessels per Week	1

References:

1. California Air Resource Board (CARB) 2011 Appendix D, Emissions Estimation Metodology for Ocean-Going Vessels can be found at https://www.arb.ca.gov/regact/2011/ogv11/ogv11appd.pdf
2. City of Richmond. 2014. Chevron Modernization Project Final EIR, Appendix 4.3-SHP. July. Available at: https://s3.amazonaws.com/chevron/Final+EIR/Volume+3_Final+EIR.pdf
3. Port of Oakland (POAK). 2013. Port of Oakland 2012 Seaport Air Emissions Inventory. November. Available at: https://www.portofoakland.com/files/PDF/environment/maqip_emissions_inventory.pdf
4. Port of San Francisco (POSF). 2010. Port of San Francisco 2005 Emissions Inventory. June. Available at: http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Emission%20Inventory/Port%20of%20San%20Francisco%202005%20Emissions%20Inventory%20June%202010.ashx

Vessel Activity and Engine Characteristics

Ship Capacity	40000	metric tonne
Hotelling Time	132	hrs
Transit distance assessed (>3km)	59098	metres
Transit Distance (within 3km)	1700	metres
Maneurvering Distance	1300	metres

Bulk Emission Details (see notes)		*1.1508*	*0.5144*
	knots	miles/hr	m/s
Main Engine Speed (> 3km)	12	13.81	6.17
Main Engine (3km from port)	7	8.06	3.60
Maneuving Inbound Speed	5	5.75	2.57
Maneuvering Outbound Speed	8	9.21	4.12
Main Power	7803	kilowatts	
Auxiliary power	2459	kilowatts	
Boiler Power	109	kilowatts	
Tug Power	1620	kilowatts	(2172 hp - Average)
Tug (auiliary)	95	kilowatts	
Load Factor			
Main Engine	82.5%	at cruise speed	
Maximum Handymax speed	15	knots	
Main Engine Speed (> 3km)	51.2%	RSZ (12 knots)	(average speed)
Main Engine (3km from port)	10.2%	Slow-down approaching port	
Main Engine	3.7%	Maneuvering (5 knots)	inwards
Main Engine	15.2%	Maneuvering (7 knots)	outwards
Load Factor			
Tug Main Engine	0.31	POLA (2013)	
Tug Auxillary Engine	0.43	POLA (2013)	
Auxilliary Engine Default Loads			
Hoteling	6.1%	POLA (2013)	
Maneuvering	27.5%	POLA (2013)	
Transit	10.4%	POLA (2013)	

Notes:

1. Transiting speed from the Sea Buoy to within 3km of the Facility based on the 2005 Port of San Francisco (POSF) Emissions Inventory, reported for general cargo carriers within the Reduced Speed Zone east of the Sea Bouy an in the Bay.
2. Transiting speed within 3km based on approach speed in 2005 POSF inventory.
3. Maneuvering speed taken from CARB Appendix D.
4. Maneuvering distance based on Port of Oakland 2012 Emissions Inventory definition of maneuvering mode between berth and the Bay Bridge, which has a minimum distance of 1.3 km.

References:

1. California Air Resource Board (CARB) 2011 Appendix D, Emissions Estimation Metodology for Ocean-Going Vessels can be found at https://www.arb.ca.gov/regact/2011/ogv11/ogv11appd.pdf
2. POLA. 2013. "Port of Los Angeles 2012 Air Emission Inventory". Available at: https://www.portoflosangeles.org/pdf/2012_Air_Emissions_Inventory.pdf
3. Port of Oakland (POAK). 2013. Port of Oakland 2012 Seaport Air Emissions Inventory. November. Available at: https://www.portofoakland.com/files/PDF/environment/maqip_emissions_inventory.pdf
4. Port of San Francisco (POSF). 2010. Port of San Francisco 2005 Emissions Inventory. June. Available at: http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Emission%20Inventory/Port%20of%20San%20Francisco%202005%20Emissions%20Inventory%20June%202010.ashx

Shipping Emissions Summary

Annual Emissions

Activity	Engine	Total Annual Emissions, 48 Vessels (tons/year)						GHG Emissions (metric tons/year)		
		ROG	CO	NOX	PM10	PM25	SOx	CH4	CO2	N20
Transit (> 3km from port)	main engine	1.1	1.7	12.4	0.2	0.2	0.4	0.10	622	0.02
	auxiliary engine	0.03	0.1	0.4	0.02	0.02	0.03	0.01	45	0.00
Transit (within 3km of port)	main engine	0.08	0.05	0.2	0.004	0.003	0.004	0.0031	6	0.0003
	auxiliary engine	0.002	0.004	0.02	0.001	0.001	0.001	0.0003	2	0.0001
Maneuvering	main engine	0.23	0.12	0.7	0.011	0.007	0.01	0.009	16	0.001
	auxiliary engine	0.01	0.03	0.2	0.01	0.01	0.01	0.002	16	0.000
	boiler	0.0005	0.00	0.01	0.001	0.001	0.01	1.12E-04	4	4.92E-05
Hoteling	auxiliary engine	0.5	1.2	6.8	0.3	0.3	0.4	0.1	652	0.0
	boiler	0.1	0.2	1.5	0.1	0.1	1.1	0	636	0
Tug	main engine	0.1	0.6	0.6	0.02	0.02	0.001	0	55	0
	auxiliary engine	0.01	0.04	0.05	0.002	0.002	0.0001	0	5	0
Total		2.1	3.9	22.9	0.7	0.6	2.0	0.2	2,058	0.1

Average Daily Emissions

Activity	Engine	Total Annual Emissions, 48 Vessels (lbs/day)					
		ROG	CO	NOX	PM10	PM25	SOx
Transit (> 3km from port)	main engine	6.1	9.4	68.1	1.2	1.2	2.2
	auxiliary engine	0.18	0.4	2.5	0.10	0.10	0.14
Transit (within 3km of port)	main engine	0.42	0.26	1.3	0.024	0.016	0.022
	auxiliary engine	0.009	0.021	0.12	0.005	0.005	0.007
Maneuvering	main engine	1.25	0.68	3.8	0.061	0.040	0.05
	auxiliary engine	0.07	0.16	0.9	0.04	0.03	0.05
	boiler	0.0025	0.00	0.05	0.003	0.003	0.03
Hoteling	auxiliary engine	2.6	6.3	37.0	1.4	1.4	2.0
	boiler	0.5	0.8	8.3	0.6	0.5	6.3
Tug	main engine	0.4	3.0	3.2	0.12	0.12	0.003
	auxiliary engine	0.05	0.22	0.27	0.012	0.012	0.0003
Total		11.6	21.3	125.6	3.6	3.5	10.8

Notes:

1. Emissions calculated for combined Orcem + VMT maximum annual vessel calls, as emissions do not vary between the two facilities.
2. Emissions calculated using DEIR methodologies for operational year 2025. Low-load adjustment factors updated to the most recent publsihed data (POLA 2016). See backup tables for details.

Emission Rates by Activity

Operating Time

Activity	Engine	inward speed	outward speed	one-way distance	inward hours	outward hours
		m/s	m/s	m	hours/one-way trip	hours/one-way trip
Transit (> 3km from port)	main engine	6.17	6.17	59098	2.66	2.66
	auxiliary engine	6.17	6.17	59098	2.66	2.66
Transit (within 3km of port)	main engine	3.60	3.60	1700	0.13	0.13
	auxiliary engine	3.60	3.60	1700	0.13	0.13
Maneuvering	main engine	2.57	4.12	1300	0.39	0.34
	auxiliary engine	2.57	4.12	1300	0.39	0.34
	boiler	2.57	4.12	1300	0.39	0.34
Hoteling	auxiliary engine	0	0	0	132	
	boiler	0	0	0	132	
Tug	main engine	2.57	4.12	1300	0.39	0.34
	auxiliary engine	2.57	4.12	1300	0.39	0.34

Inbound Emission Rates

Activity	Engine	emission rate - inward								
		ROG	CO	NOX	PM10	PM25	SOx	CH4	CO2	N20
		g/hr	g/hr	g/hr	g/hr	g/hr	g/hr	g/hr	g/hr	g/hr
Transit (> 3km from port)	main engine	2633	5358	33518	799	780	1342	271	2340881	66
	auxiliary engine	117	280	1589	64	62	91	21	174903	5
Transit (within 3km of port)	main engine	5546	3401	17617	316	207	288	244	504555	26
	auxiliary engine	117	280	1589	64	62	91	21	174903	5
Maneuvering	main engine	2434	1329	7476	119	78	107	107	187281	11
	auxiliary engine	310	742	4352	169	165	240	57	462978	13
	boiler	12	22	217	15	14	164	3	100442	1
Hoteling	auxiliary engine	69	165	967	38	37	53	13	102884	3
	boiler	12	22	217	15	14	164	3	100442	1
Tug	main engine	1064	7194	7547	286	286	8	0	790709	0
	auxiliary engine	118	527	635	28	28	1	0	64636	0

Outbound Emission Rates

Activity	Engine	emission rate - outward								
		ROG	CO	NOX	PM10	PM25	SOx	CH4	CO2	N20
		g/hr	g/hr	g/hr	g/hr	g/hr	g/hr	g/hr	g/hr	g/hr
Transit (> 3km from port)	main engine	5239	6780	54782	789	770	1450	539	2528151	109
	auxiliary engine	117	280	1589	64	62	91	21	174903	5
Transit (within 3km of port)	main engine	5546	3401	17617	316	207	288	244	504555	26
	auxiliary engine	117	280	1589	64	62	91	21	174903	5
Maneuvering	main engine	9969	5444	30622	489	321	438	439	767103	45
	auxiliary engine	310	742	4352	169	165	240	57	462978	13
	boiler	12	22	217	15	14	164	3	100442	1
Hoteling	auxiliary engine	69	165	967	38	37	53	13	102884	3
	boiler	12	22	217	15	14	164	3	100442	1
Tug	main engine	1064	7194	7547	286	286	8	0	790709	0
	auxiliary engine	118	527	635	28	28	1	0	64636	0

Combined Emission Factors

Activity	Engine	per-trip emissions (inward + outward)								
		ROG	CO	NOX	PM10	PM25	SOx	CH4	CO2	N20
		lb/round trip	lb/round trip	lb/round trip	lb/round trip	lb/round trip	lb/round trip	lb/round trip	lb/round trip	lb/round trip
Transit (> 3km from port)	main engine	46	71	518	9	9	16	5	28547	1
	auxiliary engine	1	3	19	1	1	1	0	2051	0
Transit (within 3km of port)	main engine	3	2	10.187	0	0	0	0	292	0
	auxiliary engine	0	0	0.919	0	0	0	0	101	0
Maneuvering	main engine	10	5	29	0	0	0	0	732	0
	auxiliary engine	0	1	7	0	0	0	0	743	0
	boiler	0	0	0	0	0	0	0	161	0
Hoteling	auxiliary engine	20	48	281	11	11	16	4	29940	1
	boiler	3	6	63	4	4	48	1	29230	0
Tug	main engine	3	23	24	1	1	0	0	2539	0
	auxiliary engine	0	2	2	0	0	0	0	208	0

Notes:

1. Operating times based on speed and sitance modeled. Maneuvering and tug operating timesinclude an additional 15 minutes for docking/undocking (see DEIR section 6.2.2)
2. Emission rates calculated as [Emission Factor]*[Engine Power]*[Load Factor]*[Low-Load Adjustment Factor]

OGV Load Adjustment Factors

	Speed	Load	ROG	CO	NOX	PM10	PM25	SOx	CH4	CO2	N20
Main - Transit	12	51%	0.96	0.98	0.93	0.8	0.8	1	0.96	1	0.93
Main - Transit	7	10%	1.91	1.24	1.52	0.79	0.79	1.08	1.91	1.08	1.52
Main - Maneuvering	5	4%	2.3	1.33	1.77	0.82	0.82	1.1	2.3	1.1	1.77

Notes:

1. Consistent with the forthcoming 2018 CARB Inventory, Load Adjustment Factors for MAN 2-Stroke Propulsion Engines with Conventional Valves were used because many of the bulk carriers are older and may not have the updated technology or do not have MAN engines

References:

1. CARB. 2018. Email Communication between Cory Pamer, Manager, Off-Road Diesel Analysis Section, and Ramboll. April. Attached.
2. Port of Los Angeles Inventory of Air Emissions - 2016 (POLA 2016) available at: https://www.portoflosangeles.org/pdf/2016_Air_Emissions_Inventory.pdf

OGV and Tug Emission Factors

	Fuel	Unit	ROG	CO	NOX	PM10	PM25	SOx	CH4	CO2	N20
Main - Transit	Marine Distillate (0.1% S)	g/kW-hr	0.69	1.37	9.02	0.25	0.24	0.34	0.07	585.93	0.02
Main - Maneuvering	Marine Distillate (0.1% S)	g/kW-hr	3.66	3.46	14.62	0.50	0.33	0.34	0.16	589.12	0.02
Auxiliary - Transit	Marine Distillate (0.1% S)	g/kW-hr	0.46	1.10	6.23	0.25	0.24	0.36	0.08	685.89	0.02
Auxiliary - Maneuveri	Marine Distillate (0.1% S)	g/kW-hr	0.46	1.10	6.45	0.25	0.24	0.36	0.08	685.89	0.02
Auxiliary - Hoteling	Marine Distillate (0.1% S)	g/kW-hr	0.46	1.10	6.45	0.25	0.24	0.36	0.08	685.89	0.02
Boiler	Marine Distillate (0.1% S)	g/kW-hr	0.11	0.20	1.99	0.13	0.13	1.50	0.03	921.49	0.01
Tug - Main		g/s	0.30	2.00	2.10	0.08	0.08	0.002	0.00	219.64	0.00
Tug - Auxiliary		g/s	0.03	0.15	0.18	0.01	0.01	0.0002	0.00	17.95	0.00

Notes:

1. For the Auxillary and main engine a 0.1% S marine distillate was assumed as required by the California and Emission Control Area
2. OGV emission factors selected for HANDYMAX ships in 2025 (ARB 2014). Tug emission factors calculated in the next table, following the methodology in DEIR section 5.2.2

The OGV model input has four screens: Base Year, Forecast Years, Controls, and Reports

Base Year – no change from the defaults

Forecast Years – 2025

A question of Forecast Data must be checked (otherwise Do Not Forecast is the default).

Average Recession Recovery is the default and was left unchanged.

Controls – Default except for North American Emission Control Area w/Tier III was chosen because it was instituted.

Report – Either the District Bay Area AQMD or Air Basin San Francisco Bay Area result in the same emission rates.

Emission factors calculated as average across all ports for each engine and operating mode as [emissions in tons/day]*[365 days]/[power load in MW-hr] for criteria pollutants, and [emissions in MMT CO2e]/[power load]/[global warming potential] for GHGs

References:

California Air Resources Board (ARB). 2014. "Marine Emissions Model v2.3L". Available at: https://www.arb.ca.gov/msei/ordiesel.htm

TUGS - Main Engines

In relation to the main engines likely to be used for the tugs escorting the Handymax bulk carrier (40,000 mtonnes) into port, the following assumptions were made:

- 2172 hp was assumed as the rated horsepower of each of the two main engines.
- The emission factor for a 4344 hp tug is assumed to be as follows in Table 1:

Table 1 Main Engine & Auxiliary Engine Emission Factors (ARB 2010) – Tug Boat (g/hp-hr)

HP Range	Model Year	ME NOx	ME PM	ME ROG	ME CO	ME SOx	ME CH4	ME CO2	ME N2O
1901 – 3300 hp	2007 - 2012	4.87	0.14	0.60	4.53	0.01	0.00	587.17	0.00

- The useful life of the tug boat main engine has been assumed to be 21 years.
- The age of the tug boat is assumed to be 15 years (model year 2010 in calendar year 2025).
- Hours of operation per annum for milestone 5 is 19 trips x 2 hours per trip = 38 hours/annum.
- The engine load of the tug boat is assumed to be 0.31 for the propulsion engine. (POLA 2013)
- The engine deterioration factor for > 251 hp is as follows:

Table 2 Engine Deterioration Factor (ARB 2012)

HP Range	NOx	PM	HC	CO	SOx	CH4	CO2	N2O
> 251 hp	0.21	0.67	0.44	0.25	0	0	0	0

Thus:

Main Engine Emissions	=	EF_0 x F x (1 + D x A/DL) x HP x LF x Hr
HP (2172 hp x 2)	=	4344
Fuel Correction Factor	=	1.000
Emissions (g/s)	=	(EF g/hp-hr) x (1) x (1 + (D) x (15)/(21)) x 4344hp x 0.31

	NOx	PM	HC	CO	SOx	CH4	CO2	N2O
Main Engine Emissions =	2.096	0.079	0.295	1.998	0.002	0.000	219.641	0.000

Auxiliary Engine

In relation to the auxiliary engine likely to be used for the tugs escorting the Handymax bulk carrier (40,000 mtonnes) into port, the following assumptions were made:

- 128 hp was assumed as the rated horsepower of the 2 auxiliary engines.
- The emission actor for a 256hp tug is assumed to be as follows in Table 3:

Table 3 Auxiliary Engine Emission Factors (ARB 2010) – Tug Boat (g/hp-hr)

HP Range	Model Year	AE NOX	AE PM	AE ROG	AE CO	AE SOx	AE CH4	AE CO2	AE N2O
121 - 175 hp	2004 - 2012	5.28	0.20	0.91	4.34	0.01	0.00	587.17	0.00

- The useful life of the tug boat auxiliary engine has been assumed to be 23 years.
- The age of the tug boat is assumed to be 15 years (model year 2010 in calendar year 2025).
- Hours of operation per annum for milestone 5 is 19 trips x 2 hours per trip = 38 hours/annum.
- The engine load of the tug boat is assumed to be 0.43 for the auxiliary engine. (POLA 2013)
- The engine deterioration factor for > 251 hp is as follows:

Table 4 Engine Deterioration Factor (ARB 2012)

HP Range	NOx	PM	HC	CO	CH4	CH4	CO2	N2O
51 – 250 hp	0.14	0.44	0.28	0.16	0	0	0	0

Thus:

Auxiliary Engine Emissi	=	EF_0 x F x (1 + D x A/DL) x HP x LF x Hr							
HP (128 hp x 2)	=	256							
Fuel Correction Factor	=	1.000							
Emissions (g/s)	=	(EF g/hp-hr) x (1) x (1 + (D) x (15)/(23)) x256hp x 0.43							
		NOx	PM	HC	CO	SOx	CH4	CO2	N2O
Auxiliary Engine Emissi	=	0.1763	0.0078	0.0327	0.1465	0.0002	0.0000	17.9544	0.0000

Notes:

1. Tug main and auxilliary engine load factors taken from the POLA 2012 Emissions Inventory, consistent with the Chevron Modernization Project EIR.
2. Zero-hour emission factors derived from CARB database from the following inputs:
   i. Emission Estimation Tab, choose ARB Regulated Emissions Inventory
   ii. Output of 2025 SF Bay Tug Boats Emissions (ROG, CO, NOx, PM, SOx, CO2) in tons
   iii. Zero-hour Fuel EF for all vessels is 184.1585 g/hp-hr in input files; estimate CO2 EF multiplying fuel EF by 44/13.8 (MW CO2 / MW fuel per carbon atom; 1.8 Hydrogen per carbon atom, CFR 89.424 - Dilute emission sampling calculations; https://www.law.cornell.edu/cfr/text/40/89.424)
   iv. Divide CO2 emissions by CO2 EF to estimate total Hp-hr
   v. Divide Criteria emission by Hp-hr to estimate average EF

References:

1. California Air Resources Board (ARB). 2010. "Commercial Harborcraft Database". Available at: https://www.arb.ca.gov/msei/ordiesel.htm
2. California Air Resources Board (ARB). 2012. "Appendix B Emissions Estimation Methodology for Comercial Harbor Craft Operating in California". February. Available at: https://www.arb.ca.gov/msei/chc-appendix-b-emission-estimates-ver02-27-
3. City of Richmond. 2014. Chevron Modernization Project Final EIR, Appendix 4.3-SHP. July. Available at: https://s3.amazonaws.com/chevron/Final+EIR/Volume+3_Final+EIR.pdf
4. POLA. 2013. "Port of Los Angeles 2012 Air Emission Inventory". Available at: https://www.portoflosangeles.org/pdf/2012_Air_Emissions_Inventory.pdf

From: Parmer, Cory@ARB <Cory.Parmer@arb.ca.gov>
Sent: Wednesday, April 04, 2018 13:38
To: Christian Lindhjem; Furey, Russell@ARB
Subject: RE: OGV and Harbor Craft

Hi Christian,
CARB plans to use the Starcrest MAN low load adjustment factors in our next OGV inventory. We plan on using the slide valve adjustments for MAN engines, and the MAN engines without slide valves for everything else.

We have reviewed the literature on previous studies and the sources of the low load adjustment factor and find the MAN study to be more applicable to the OGV inventory.

This obviously won't be released in the immediate future, but likely close to the end of 2018. I would not say using the previous ARB models is incorrect, but we are moving over to the MAN engine study. As you suggest, it almost makes sense to have both, but I wanted to get back to you so you know the sensitivity analysis (using the Starcrest numbers) will match up with the factors used in the next ARB OGV inventory.

Feel free to shoot us any questions.

Thanks,
Cory

Cory Parmer
Manager, Off-Road Diesel Analysis Section
Air Quality Planning and Science Division
California Air Resources Board
cory.parmer@arb.ca.gov (916) 323-8525

From: Christian Lindhjem <clindhjem@ramboll.com>
Sent: Monday, April 02, 2018 4:16 PM
To: Furey, Russell@ARB <Russell.Furey@arb.ca.gov>; Parmer, Cory@ARB <Cory.Parmer@arb.ca.gov>
Subject: RE: OGV and Harbor Craft

Hi, I was wondering what you had in mind about the load adjustment factors?

1. What should we use for OGV low load adjustment factors?
    a. Let us know your recommendations
    b. Important for evaluating the BAAQMD VSR program as well as other modes

In the absence of ARB guidance we will retain those load adjustment factors as originally included in the ARB Staff Reports concerning emission inventory documentation. We may also present results using the POLA (Starcrest adjustment factors) as a sensitivity result.

Yours sincerely
Christian Lindhjem

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From: Christian Lindhjem
Sent: Tuesday, March 13, 2018 9:16 AM
To: Russell.Furey@arb.ca.gov; Parmer, Cory@ARB (Cory.Parmer@arb.ca.gov) <Cory.Parmer@arb.ca.gov>
Subject: RE: OGV and Harbor Craft

We had tentatively scheduled a call at 1 PM today, but now I have a conflict. Should be available at 2 or later if you still want to have a talk.

Otherwise, I only had two things to discuss that you can answer at your convenience:

1. What should we use for OGV low load adjustment factors?
    a. Let us know your recommendations
    b. Important for evaluating the BAAQMD VSR program as well as other modes
2. New Offroad EF emission factors for CHE emissions estimates
    a. We plan to use these unless you tell us otherwise.

Yours sincerely
Christian Lindhjem

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From: Christian Lindhjem
Sent: Tuesday, March 06, 2018 2:24 PM
To: Russell.Furey@arb.ca.gov; Parmer, Cory@ARB (Cory.Parmer@arb.ca.gov) <Cory.Parmer@arb.ca.gov>
Cc: Till Stoeckenius (tstoeckenius@ramboll.com) <tstoeckenius@ramboll.com>; Timothy M. Sturtz <tsturtz@ramboll.com>
Subject: OGV and Harbor Craft

Elizabeth Yura wrote that you are now available to discuss OGV emission inventory estimates and had some questions about harbor craft.

We were interested in exploring the use of low load adjustment factors that date back to a CY2000 EPA report (attached) that heavily relied on Great Lakes Coast Guard cutters emission testing conducted in 1995. And now with the POLA emission inventory largely eliminating low load adjustment factors. This issue has an impact on the expected benefits of VSR and near shore emissions.

Let me know what works good for you, or just give me a call when you are available and perhaps I can ask and answer questions directly.

Yours sincerely
Christian Lindhjem

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From: Yura, Elizabeth@ARB [mailto:eyura@arb.ca.gov]
Sent: Tuesday, March 06, 2018 1:26 PM
To: Catherine Mukai <cmukai@portoakland.com>
Cc: Diane Heinze <dheinze@portoakland.com>
Subject: RE: Follow-up items for POAK waterfront inventory: ships, trucks, example modeling inputs

Hi Catherine,

I spoke with our inventory folks about the low load factors Ramboll had questions on, and they said although they have used these factors in the past, but they are looking at potentially changing that, and would like to engage with you and Ramboll. They are also interested in talking with you all about your harbor craft numbers as well.

It sounded like the Ramboll folks already knew our OGV/marine inventory team, but for your reference, I've include their contact info below. Feel free to reach out to reach out to them (or have Ramboll reach out) with questions.

Cory Parmer, Manager of the Off-Road Diesel Analysis Section
Cory.Parmer@arb.ca.gov
(916) 323-8525

Russel Furey, Lead staff on OGV inventory
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(916) 327-8399

Elizabeth Yura
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California Air Resources Board
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Branch Line: (916) 323-4327
Elizabeth.Yura@arb.ca.gov

ATTACHMENT 6
CONSTRUCTION HRA

RAMBOLL

ENVIRONMENT
& HEALTH

MEMO

Client	Orcem / VMT
Date	June 7, 2018
To	David Vintze (Bay Area Air Quality Management District) and Lora Granovsky (Ilanco Consultants)
From	Shari Beth Libicki, Ph.D. and Michael Howley
Copy to	Darcy Rosenblatt, Dudek Consulting; Lisa Plowman, City of Vallejo; Dick Loewke, Loewke Planning Assoc.; Steve Bryant, Orcem; and Matt Fettig

SUBJECT: Construction Health Risk Impacts Associated with Orcem-VMT Project Revised Operations Alternative

Date June 7, 2018

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Introduction: This health risk assessment has been developed following our meeting with City and BAAQMD staff on 5/08/18 to estimate the impacts of changes in planned construction of the combined Orcem California ("Orcem") and Vallejo Marine Terminal ("VMT") Project in Vallejo, California, as well as the effects of implementing the most recent California Office of Environmental Health Hazard Assessment ("OEHHA") Guidance. As requested by BAAQMD staff, this memorandum is intended to present a clear statement of assumptions, methodology, and calculations.

Methodology and Assumptions: The DEIR for the Project included an air quality and health risk assessment in Appendix CONST. That assessment calculated diesel particulate matter (DPM) emissions for each phase of construction, modeled those emissions on an annual basis from a combined source group for all emissions (Appendix CONST Figure 2), then calculated cancer risk for the maximally exposed

individual receptor ("MEIR") from the resulting concentrations via the methods described in the 2010 BAAQMD CEQA Guidelines. As a result, the cancer risk value scales directly with total DPM emissions, and we can calculate updated maximum cancer risk from construction based on changes to total DPM emissions and updated health risk calculation methodology.

Under the ROA, there are two changes to the planned construction that will reduce emissions: the removal of VMT Phase 2 from the Project Description, and the commitment by Orcem and VMT to use Tier 4 Final offroad equipment where available. Orcem and VMT report from the contractors that all equipment will be available as Tier 4 Final with the exception of pile drivers and diesel impact hammers.

The construction assessment in the DEIR estimated offroad equipment emissions assuming fleet average equipment for construction years 2015 and 2016 using the CalEEMod®[1] emissions estimation software. To calculate the emissions reduction from the use of Tier 4 equipment, Ramboll reproduced the DEIR construction CalEEMod® outputs. The equipment inputs into CalEEMod® are included as attachment 1. The emissions were calculated for the same construction schedule and equipment as the DEIR, with Tier 4 Final mitigation applied to all equipment except pieces designated as pile drivers or impact hammers.

Since the DEIR designated pile drivers and impact hammers as cranes, the number of cranes mitigated in each CalEEMod® run was reduced by the number of impact hammers/pile drivers. For example, the Orcem equipment list includes one offroad crane, one piling drill rig, and one crane, therefore only two cranes were designated as Tier 4 Final in CalEEMod®. CalEEMod® mitigation reports for all equipment are included as attachment 2. The results are presented in Table 1.

[1] CAPCOA. 2016. California Emissions Estimator Model. Available online at: www.caleemod.com

Table 1. ROA Construction DPM Emission Reductions

Construction Phase	Unmitigated DPM Offroad Emissions (tons)	Mitigated DPM Offroad Emissions (tons)	DPM Emissions Reduction (tons)
Orcem	0.16333	0.01579	0.14754
VMT	0.05017	0.01481	0.03536
Emissions Reduced from Removal of VMT Phase 2			0.086
Total DPM Reduction for the ROA			*0.2689*
Total DEIR DPM Emissions			0.301
Total ROA DPM Emissions			0.032
DPM Emissions Reduction (%)			89.34%

VMT Phase 2 and total DEIR emissions taken from DEIR Appendix CONST Table 4

Since the DEIR was published, the California Office of Environmental Health Hazard Assessment ("OEHHA") published updated revised HRA guidance[2], which has since been adopted by the BAAQMD[3]. Under the new guidance, the breathing rates used to calculate inhalation cancer risk for different years of exposure have changed.

Since the construction exposure duration is less than two years, the risk can be evaluated conservatively for a population between zero to two years old. In both the OEHHA guidelines used in the DEIR and 2015 updates, a single breathing rate is used for exposure from zero to two years (the most conservative exposure period). All other exposure parameters for this age group were conserved in the 2015 guidance, so the net revised cancer risk under the ROA can be calculated from the ratio of breathing rates as follows:

$$CR_{ROA} = CR_{DEIR} * (1 - ER\%) * \frac{BR_{OEHHA}}{BR_{DEIR}}$$

Where:

CR_{ROA} is the revised cancer risk at the MEIR (risk in a million)
CR_{DEIR} is the original MEIR cancer risk from the DEIR
ER% is the emissions reduction percent, calculated in Table 1

[2] Cal/EPA. 2015. The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. Office of Environmental Health Hazard Assessment. August. Available online at: http://oehha.ca.gov/air/hot_spots/hotspots2015.html

[3] BAAQMD. 2017. California Environmental Quality Act Air Quality Guidelines. May. Available online at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en.

BR_{OEHHA} is the breathing rate from the 2015 OEHHA guidance (L/kg-day)
BR_{DEIR} is the breathing rate used in the DEIR

This results in an ROA maximum cancer risk from construction of:

$$CR_{ROA} = 5.7 * (1 - 0.89.3) * \frac{1090}{581} = 1.14 \; in \; a \; million$$

This scaling technique assumes the entire cancer risk value scales by the calculated emission reduction percent, which does not apply to truck emissions. According to the DEIR construction assessment, "A trip length of 0.65 miles was used to represent vehicle travel while at or near the construction site. It was assumed that these emissions from on-road vehicles traveling at or near the site would occur at the construction site or along Lemon Street."

However, based on the CalEEMod output files of the DEIR assessment, 9,912 of the total 12,575 haul truck trips would have occurred in VMT Phase 2, or 78.8% of the total. Of the construction phases with haul trucks in the remaining construction (e.g. Orcem grading phase), emissions are one to two orders of magnitude less than offroad equipment emissions even when the default trip length of 20 miles is preserved. In addition, the MEIR identified in Figure 2 of the DEIR construction appendix is located much closer to the Facility than Lemon Street. Based on the relatively small emissions and distance from the MEIR, truck contributions to the total construction cancer risk are likely to be insignificant.

As part of the construction evaluated in the DEIR, full implementation of the Project will require rail improvements as described in the ROA. This construction activity, which will occur during Project operations after the construction impacts analyzed in the DEIR, includes: (a) Demolition of the old 42,500 square foot Warehouse Building; (b) Fine grading within the approximately 1.5 acre area where the rail ladder area is proposed and the Warehouse is removed, as shown on the attached current VMT Plans; and (c) Laying track (gravel, timber, rails, and spikes). This construction activity will also use of Tier 4 Final equipment where available. Full production of the Project cannot occur until this construction is finished. As a result, this construction will occur before the

combined Orcem and VMT operations reach 75% of capacity (36 ships/year).

The construction activity analyzed in the DEIR includes demolition, grading, construction, and paving activities for the entire 12.93 acre area of construction. As show in Table 2 below, conservatively assuming that all modeled demolition, site preparation, and grading activities are related to the rail improvements results in approximately 21% of the mitigated DEIR construction impacts estimated above, based on the by-phase emissions in the CalEEMod® files in Attachment 3. This estimate is likely overly conservative, as it includes the piling drill rig in the Orcem grading phase, which would not be used for rail construction activity. The total mitigated cancer risk is 1.14 in a million, therefore risks from this portion of construction would be no greater than 0.24 in a million. Since the ROA cancer risks do not exceed the 9 in a million mitigation threshold, adding rail improvement construction-related cancer risk to the ROA would result in impacts less than significant.

Table 2 – By-Phase Mitigated ROA Offroad Construction Emissions

Phase	Exhaust PM2.5 Emissions (tons)		
	Orcem	VMT	Total
Demolition	0.00305	0.00004	0.00309
Site Preparation	0.0001	--	0.0001
Grading	0.0037	--	0.0037
Conservative Rail Improvement Total			*0.00689*
Total ROA Construction Emissions from Table 1			0.032
Conservative Percent Rail Improvement			21%

ATTACHMENT 1 – CALEEMOD OFF-ROAD EQUIPMENT INPUTS

Phase	Equipment Name		Equipment Inputs				Notes
	DEIR Equipment Description	DEIR Input into CalEEMod	Quantity	HP	Load Factor	Mitigation	
Demolition	Excavators	Excavators	1	162	0.38	Tier 4	
Demolition	Rubber-Tired Dozers	Rubber Tired Dozers	1	255	0.40	Tier 4	
Demolition	Gipo Truck Crusher	Crushing/Proc. Equipment	1	350	0.78	Tier 4	
Demolition	Off-road Crane	Cranes	1	226	0.29	Tier 4	
Site Preparation	Rubber-Tired Dozers	Rubber-Tired Dozers	1	255	0.40	Tier 4	
Site Preparation	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes	1	97	0.37	Tier 4	
Grading/Excavation	Excavators	Excavators	2	162	0.38	Tier 4	
Grading/Excavation	Graders	Graders	1	174	0.41	Tier 4	
Grading/Excavation	Rubber-Tired Dozers	Rubber Tired Dozers	1	255	0.40	Tier 4	
Grading/Excavation	Trucks	--	2	--	--	--	Included as hauling trips
Grading/Excavation	Piling Drill Rig	Cranes	1	205	0.50	None	Not included in Attachment 2 mitigation report
Trenching	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes	1	97	0.37	Tier 4	
Building Construction	Cranes	Cranes	1	226	0.29	Tier 4	
Building Construction	Forklifts	Forklifts	1	89	0.20	Tier 4	
Building Construction	Welders	Welders	1	46	0.45	Tier 4	
Building Construction	MEWPs	--	4	--	--	--	Fully Electric
Interior Construction	Air Compressors	Air Compressors	1	78	0.48	Tier 4	
Interior Construction	Aerial Lift	Aerial Lifts	1	62	0.31	Tier 4	
Paving	Cement and Mortar Mixers	Cement and Mortar Mixers	1	9	0.56	Tier 4	
Paving	Pavers	Pavers	1	125	0.42	Tier 4	
Paving	Paving Equipment	Paving Equipment	1	130	0.36	Tier 4	
Paving	Rollers	Rollers	1	80	0.38	Tier 4	
Paving	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes	1	97	0.37	Tier 4	

Equipment	Total Number	Number Mitigated
Aerial Lifts	1	1
Air Compressors	1	1
Cement and Mortar Mixers	1	1
Cranes	3	2
Crushing/Proc. Equipment	1	1
Excavators	3	3
Forklifts	1	1
Graders	1	1
Pavers	1	1
Paving Equipment	1	1
Rollers	1	1
Rubber Tired Dozers	2	2
Rubber-Tired Dozers	1	1
Tractors/Loaders/Backhoes	3	3
Welders	1	1

Phase	Equipment Name		Equipment Inputs				Notes
	DEIR Equipment Description	DEIR Input into CalEEMod	Quantity	HP	Load Factor	Mitigation	
Demolition	Concrete/Industrial Saws	--	0	81	0.73	Tier 4	
Demolition	Excavators	Excavators	2	162	0.38	Tier 4	
Demolition	Skif for Containment Boom	--	1	--	--	Tier 4	Included as tug boat emissions in DEIR Appendix
Dredging	Dredge	Cranes	1	850	0.29	Tier 4	
Dredging	Tug	--	1	1200	--	--	Included as tug boat emissions in DEIR Appendix
Dredging	Generator	Generator Sets	1	150	0.74	Tier 4	
Building Construction	Cranes - Manitowoc 4100	Cranes	1	226	0.29	Tier 4	
Building Construction	Cranes - 60 ton hydraulic	Cranes	1	226	0.29	Tier 4	
Building Construction	Forklifts	Forklifts	1	89	0.20	Tier 4	
Building Construction	Diesel Impact Hammer	Cranes	2	226	0.29	None	Not included in Attachment 2 mitigation report
Building Construction	Derrick Barge	Other Construction Equipment	1	750	0.31	Tier 4	
Building Construction	Deck Barge	--	--	--	--	--	Not self-powered so no emissions
Concrete Placement	Cement Truck	--	84	9	0.56	Tier 4	Included as hauling trips
Concrete Placement	Concrete Pump	Pumps	1	84	0.74	Tier 4	

Equipment	Total Number	Number Mitigated
Excavators	2	2
Cranes	5	3
Generator Sets	1	1
Forklifts	1	1
Other Construction Equipment	1	1
Pumps	1	1

ATTACHMENT 2 – CALEEMOD MITIGATION REPORTS

Orcem California GGBFS Plant

Solano-San Francisco County, Mitigation Report

Construction Mitigation Summary

Phase	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction												
Building Construction	0.51	0.52	0.06	0.00	0.74	0.75	0.00	0.00	0.00	0.00	0.00	0.00
Demolition	0.74	0.87	0.07	0.00	0.89	0.89	0.00	0.00	0.00	0.00	0.00	0.00
Grading	0.73	0.80	0.05	0.00	0.90	0.90	0.00	0.00	0.00	0.00	0.00	0.00
Interior Construction	0.03	0.82	0.00	0.00	0.97	0.97	0.00	0.00	0.00	0.00	0.00	0.00
Paving	0.73	0.92	-0.06	0.00	0.97	0.96	0.00	0.00	0.00	0.00	0.00	0.00
Site Preparation	0.84	0.95	0.47	0.00	0.98	0.98	0.00	0.00	0.00	0.00	0.00	0.00
Trenching	0.81	0.94	0.03	0.00	0.98	0.98	0.00	0.00	0.00	0.00	0.00	0.00

OFFROAD Equipment Mitigation

Equipment Type	Fuel Type	Tier	Number Mitigated	Total Number of Equipment	DPF	Oxidation Catalyst
Aerial Lifts	Diesel	Tier 4 Final	1	1	No Change	0.00
Air Compressors	Diesel	Tier 4 Final	1	1	No Change	0.00
Cement and Mortar Mixers	Diesel	Tier 4 Final	1	1	No Change	0.00
Concrete/Industrial Saws	Diesel	Tier 4 Final	0	0	No Change	0.00
Cranes	Diesel	Tier 4 Final	2	3	No Change	0.00
Crushing/Proc. Equipment	Diesel	Tier 4 Final	1	1	No Change	0.00
Excavators	Diesel	Tier 4 Final	3	3	No Change	0.00
Forklifts	Diesel	Tier 4 Final	1	1	No Change	0.00
Generator Sets	Diesel	Tier 4 Final	0	0	No Change	0.00
Graders	Diesel	Tier 4 Final	1	1	No Change	0.00
Off-Highway Trucks	Diesel	Tier 4 Final	0	0	No Change	0.00
Pavers	Diesel	Tier 4 Final	1	1	No Change	0.00
Paving Equipment	Diesel	Tier 4 Final	1	1	No Change	0.00
Rollers	Diesel	Tier 4 Final	1	1	No Change	0.00
Rubber Tired Dozers	Diesel	Tier 4 Final	3	3	No Change	0.00
Tractors/Loaders/Backhoes	Diesel	Tier 4 Final	3	3	No Change	0.00
Welders	Diesel	Tier 4 Final	1	1	No Change	0.00

Equipment Type	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	Unmitigated tons/yr						Unmitigated mt/yr					
Aerial Lifts	1.78000E-003	2.91800E-002	3.14400E-002	5.00000E-005	1.30000E-003	1.19000E-003	0.00000E+000	4.52583E+000	4.52583E+000	1.36000E-003	0.00000E+000	4.55430E+000
Air Compressors	3.15800E-002	2.00800E-001	1.52050E-001	2.40000E-004	1.70600E-002	1.70600E-002	0.00000E+000	2.04792E+001	2.04792E+001	2.58000E-003	0.00000E+000	2.05334E+001
Cement and Mortar Mixers	5.80000E-004	3.67000E-003	3.06000E-003	1.00000E-005	1.50000E-004	1.50000E-004	0.00000E+000	4.55410E-001	4.55410E-001	5.00000E-005	0.00000E+000	4.56410E-001
Concrete/Industrial Saws	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Cranes	6.80800E-002	8.07840E-001	2.81410E-001	5.20000E-004	3.68500E-002	3.39000E-002	0.00000E+000	4.94123E+001	4.94123E+001	1.47700E-002	0.00000E+000	4.97225E+001
Crushing/Proc. Equipment	2.71500E-002	2.50560E-001	8.97900E-002	3.80000E-004	8.27000E-003	8.27000E-003	0.00000E+000	3.90967E+001	3.90967E+001	2.20000E-003	0.00000E+000	3.91429E+001
Excavators	5.68200E-002	6.63560E-001	4.69100E-001	7.20000E-004	3.27500E-002	3.01300E-002	0.00000E+000	6.87444E+001	6.87444E+001	2.05200E-002	0.00000E+000	6.91754E+001
Forklifts	1.91300E-002	1.64400E-001	1.02170E-001	1.20000E-004	1.38000E-002	1.26900E-002	0.00000E+000	1.16511E+001	1.16511E+001	3.49000E-003	0.00000E+000	1.17243E+001
Generator Sets	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Graders	3.20300E-002	3.27800E-001	1.50230E-001	1.90000E-004	1.84300E-002	1.69600E-002	0.00000E+000	1.79793E+001	1.79793E+001	5.37000E-003	0.00000E+000	1.80920E+001
Off-Highway Trucks	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pavers	3.99000E-003	4.48500E-002	2.83400E-002	4.00000E-005	2.23000E-003	2.05000E-003	0.00000E+000	4.22834E+000	4.22834E+000	1.28000E-003	0.00000E+000	4.25513E+000
Paving Equipment	3.05000E-003	3.54500E-002	2.52700E-002	4.00000E-005	1.76000E-003	1.62000E-003	0.00000E+000	3.75647E+000	3.75647E+000	1.13000E-003	0.00000E+000	3.78026E+000
Rollers	2.45000E-003	2.26800E-002	1.46700E-002	2.00000E-005	1.67000E-003	1.54000E-003	0.00000E+000	1.80138E+000	1.80138E+000	5.40000E-004	0.00000E+000	1.81279E+000
Rubber Tired Dozers	4.57700E-002	5.17210E-001	3.94600E-001	3.20000E-004	2.41300E-002	2.22000E-002	0.00000E+000	3.04586E+001	3.04586E+001	9.09000E-003	0.00000E+000	3.06495E+001
Tractors/Loaders/Backhoes	1.14800E-002	1.09400E-001	7.81300E-002	1.00000E-004	8.53000E-003	7.85000E-003	0.00000E+000	9.55602E+000	9.55602E+000	2.86000E-003	0.00000E+000	9.61607E+000
Welders	3.07700E-002	9.29800E-002	1.01240E-001	1.30000E-004	7.72000E-003	7.72000E-003	0.00000E+000	9.44045E+000	9.44045E+000	2.51000E-003	0.00000E+000	9.49306E+000

Equipment Type	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	Mitigated tons/yr						Mitigated mt/yr					
Aerial Lifts	1.17000E-003	2.68200E-002	3.62200E-002	5.00000E-005	8.00000E-005	8.00000E-005	0.00000E+000	4.52582E+000	4.52582E+000	1.36000E-003	0.00000E+000	4.55429E+000
Air Compressors	2.38000E-003	1.03300E-002	1.46970E-001	2.40000E-004	3.20000E-004	3.20000E-004	0.00000E+000	2.04792E+001	2.04792E+001	2.58000E-003	0.00000E+000	2.05334E+001
Cement and Mortar Mixers	0.00000E+000	0.00000E+000	0.00000E+000	1.00000E-005	0.00000E+000	0.00000E+000	0.00000E+000	4.55410E-001	4.55410E-001	5.00000E-005	0.00000E+000	4.56410E-001
Concrete/Industrial Saws	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Cranes	2.73600E-002	2.92930E-001	2.50220E-001	5.20000E-004	1.30900E-002	1.20900E-002	0.00000E+000	4.94122E+001	4.94122E+001	1.47700E-002	0.00000E+000	4.97224E+001
Crushing/Proc. Equipment	4.55000E-003	1.97200E-002	1.66840E-001	3.80000E-004	6.10000E-004	6.10000E-004	0.00000E+000	3.90967E+001	3.90967E+001	2.20000E-003	0.00000E+000	3.91429E+001
Excavators	8.89000E-003	3.85000E-002	5.47950E-001	7.20000E-004	1.18000E-003	1.18000E-003	0.00000E+000	6.87443E+001	6.87443E+001	2.05200E-002	0.00000E+000	6.91753E+001
Forklifts	1.51000E-003	6.55000E-003	9.32200E-002	1.20000E-004	2.00000E-004	2.00000E-004	0.00000E+000	1.16511E+001	1.16511E+001	3.49000E-003	0.00000E+000	1.17243E+001
Generator Sets	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Graders	2.28000E-003	9.87000E-003	1.40420E-001	1.90000E-004	3.00000E-004	3.00000E-004	0.00000E+000	1.79793E+001	1.79793E+001	5.37000E-003	0.00000E+000	1.80920E+001
Off-Highway Trucks	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pavers	5.50000E-004	2.39000E-003	3.40500E-002	4.00000E-005	7.00000E-005	7.00000E-005	0.00000E+000	4.22834E+000	4.22834E+000	1.28000E-003	0.00000E+000	4.25512E+000
Paving Equipment	4.90000E-004	2.13000E-003	3.03500E-002	4.00000E-005	7.00000E-005	7.00000E-005	0.00000E+000	3.75646E+000	3.75646E+000	1.13000E-003	0.00000E+000	3.78026E+000
Rollers	2.30000E-004	1.02000E-003	1.44600E-002	2.00000E-005	3.00000E-005	3.00000E-005	0.00000E+000	1.80138E+000	1.80138E+000	5.40000E-004	0.00000E+000	1.81279E+000
Rubber Tired Dozers	3.88000E-003	1.68100E-002	1.42280E-001	3.20000E-004	5.20000E-004	5.20000E-004	0.00000E+000	3.04585E+001	3.04585E+001	9.09000E-003	0.00000E+000	3.06495E+001
Tractors/Loaders/Backhoes	1.22000E-003	5.31000E-003	7.55300E-002	1.00000E-004	1.60000E-004	1.60000E-004	0.00000E+000	9.55601E+000	9.55601E+000	2.86000E-003	0.00000E+000	9.61606E+000
Welders	2.20000E-003	5.03600E-002	7.50800E-002	1.30000E-004	1.50000E-004	1.50000E-004	0.00000E+000	9.44044E+000	9.44044E+000	2.51000E-003	0.00000E+000	9.49305E+000

Equipment Type	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction												
Aerial Lifts	3.42697E-001	8.08773E-002	-1.52036E-001	0.00000E+000	9.38462E-001	9.32773E-001	0.00000E+000	2.20954E-006	2.20954E-006	0.00000E+000	0.00000E+000	2.19573E-006
Air Compressors	9.24636E-001	9.48556E-001	3.34101E-002	0.00000E+000	9.81243E-001	9.81243E-001	0.00000E+000	9.76600E-007	9.76600E-007	0.00000E+000	0.00000E+000	9.74021E-007
Cement and Mortar Mixers	1.00000E+000	1.00000E+000	1.00000E+000	0.00000E+000	1.00000E+000	1.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Concrete/Industrial Saws	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Cranes	5.98120E-001	6.37391E-001	1.10835E-001	0.00000E+000	6.44776E-001	6.43363E-001	0.00000E+000	1.21427E-006	1.21427E-006	0.00000E+000	0.00000E+000	1.20670E-006
Crushing/Proc. Equipment	8.32413E-001	9.21296E-001	-8.58113E-001	0.00000E+000	9.26239E-001	9.26239E-001	0.00000E+000	1.27888E-006	1.27888E-006	0.00000E+000	0.00000E+000	1.27737E-006
Excavators	8.43541E-001	9.41980E-001	-1.68088E-001	0.00000E+000	9.63969E-001	9.60836E-001	0.00000E+000	1.16373E-006	1.16373E-006	0.00000E+000	0.00000E+000	1.15648E-006
Forklifts	9.21066E-001	9.60158E-001	8.75991E-002	0.00000E+000	9.85507E-001	9.84240E-001	0.00000E+000	1.71658E-006	1.71658E-006	0.00000E+000	0.00000E+000	8.52932E-007
Generator Sets	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Graders	9.28817E-001	9.69890E-001	6.52999E-002	0.00000E+000	9.83722E-001	9.82311E-001	0.00000E+000	1.11239E-006	1.11239E-006	0.00000E+000	0.00000E+000	1.10546E-006
Off-Highway Trucks	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pavers	8.62155E-001	9.46711E-001	-2.01482E-001	0.00000E+000	9.68610E-001	9.65854E-001	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	2.35010E-006
Paving Equipment	8.39344E-001	9.39915E-001	-2.01029E-001	0.00000E+000	9.60227E-001	9.56790E-001	0.00000E+000	2.66207E-006	2.66207E-006	0.00000E+000	0.00000E+000	0.00000E+000
Rollers	9.06122E-001	9.55026E-001	1.43149E-002	0.00000E+000	9.82036E-001	9.80519E-001	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Rubber Tired Dozers	9.15228E-001	9.67499E-001	6.39432E-001	0.00000E+000	9.78450E-001	9.76577E-001	0.00000E+000	9.84944E-007	9.84944E-007	0.00000E+000	0.00000E+000	1.30508E-006
Tractors/Loaders/Backhoes	8.93728E-001	9.51463E-001	3.32779E-002	0.00000E+000	9.81243E-001	9.79618E-001	0.00000E+000	1.04646E-006	1.04646E-006	0.00000E+000	0.00000E+000	1.03993E-006
Welders	9.28502E-001	4.58378E-001	2.58396E-001	0.00000E+000	9.80570E-001	9.80570E-001	0.00000E+000	1.05927E-006	1.05927E-006	0.00000E+000	0.00000E+000	1.05340E-006

Fugitive Dust Mitigation

Yes/No	Mitigation Measure	Mitigation Input		Mitigation Input		Mitigation Input	
No	Soil Stabilizer for unpaved Roads	PM10 Reduction	0.00	PM2.5 Reduction	0.00		

No	Replace Ground Cover of Area Disturbed	PM10 Reduction	0.00	PM2.5 Reduction	0.00		
No	Water Exposed Area	PM10 Reduction	0.00	PM2.5 Reduction	0.00	Frequency (per day)	
No	Unpaved Road Mitigation	Moisture Content %	0.00	Vehicle Speed (mph)	0.00		
Yes	Clean Paved Road	% PM Reduction	0.00				

		Unmitigated		Mitigated		Percent Reduction	
Phase	Source	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Building Construction	Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00
Building Construction	Roads	0.06	0.02	0.06	0.02	0.00	0.00
Demolition	Fugitive Dust	0.08	0.01	0.08	0.01	0.00	0.00
Demolition	Roads	0.00	0.00	0.00	0.00	0.00	0.00
Grading	Fugitive Dust	0.09	0.05	0.09	0.05	0.00	0.00
Grading	Roads	0.02	0.00	0.02	0.00	0.00	0.00
Interior Construction	Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00
Interior Construction	Roads	0.01	0.00	0.01	0.00	0.00	0.00
Paving	Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00
Paving	Roads	0.01	0.00	0.01	0.00	0.00	0.00
Site Preparation	Fugitive Dust	0.03	0.02	0.03	0.02	0.00	0.00
Site Preparation	Roads	0.00	0.00	0.00	0.00	0.00	0.00
Trenching	Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00
Trenching	Roads	0.00	0.00	0.00	0.00	0.00	0.00

Operational Percent Reduction Summary

Category	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction												
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Indoor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15	0.02
Water Outdoor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Operational Mobile Mitigation

Project Setting:

Mitigation	Category	Measure	% Reduction	Input Value 1	Input Value 2	Input Value
No	Land Use	Increase Density	0.00			
No	Land Use	Increase Diversity	-0.01	0.13		
No	Land Use	Improve Walkability Design	0.00			
No	Land Use	Improve Destination Accessibility	0.00			
No	Land Use	Increase Transit Accessibility	0.25			
No	Land Use	Integrate Below Market Rate Housing	0.00			
	Land Use	Land Use SubTotal	0.00			

No	Neighborhood Enhancements	Improve Pedestrian Network				
No	Neighborhood Enhancements	Provide Traffic Calming Measures				
No	Neighborhood Enhancements	Implement NEV Network	0.00			
	Neighborhood Enhancements	Neighborhood Enhancements Subtotal	0.00			
No	Parking Policy Pricing	Limit Parking Supply	0.00			
No	Parking Policy Pricing	Unbundle Parking Costs	0.00			
No	Parking Policy Pricing	On-street Market Pricing	0.00			
	Parking Policy Pricing	Parking Policy Pricing Subtotal	0.00			
No	Transit Improvements	Provide BRT System	0.00			
No	Transit Improvements	Expand Transit Network	0.00			
No	Transit Improvements	Increase Transit Frequency	0.00			
	Transit Improvements	Transit Improvements Subtotal	0.00			
		Land Use and Site Enhancement Subtotal	0.00			
No	Commute	Implement Trip Reduction Program				
No	Commute	Transit Subsidy				
No	Commute	Implement Employee Parking "Cash Out"				
No	Commute	Workplace Parking Charge				
No	Commute	Encourage Telecommuting and Alternative Work Schedules	0.00			
No	Commute	Market Commute Trip Reduction Option	0.00			
No	Commute	Employee Vanpool/Shuttle	0.00		2.00	
No	Commute	Provide Ride Sharing Program				
	Commute	Commute Subtotal	0.00			

No	School Trip	Implement School Bus Program	0.00			
		Total VMT Reduction	0.00			

Area Mitigation

Measure Implemented	Mitigation Measure	Input Value
No	Only Natural Gas Hearth	
No	No Hearth	
No	Use Low VOC Cleaning Supplies	
No	Use Low VOC Paint (Residential Interior)	100.00
No	Use Low VOC Paint (Residential Exterior)	150.00
No	Use Low VOC Paint (Non-residential Interior)	100.00
No	Use Low VOC Paint (Non-residential Exterior)	150.00
No	% Electric Lawnmower	
No	% Electric Leafblower	
No	% Electric Chainsaw	

Energy Mitigation Measures

Measure Implemented	Mitigation Measure	Input Value 1	Input Value 2
No	Exceed Title 24		
No	Install High Efficiency Lighting		
No	On-site Renewable		

Appliance Type	Land Use Subtype	% Improvement
ClothWasher		30.00

DishWasher		15.00
Fan		50.00
Refrigerator		15.00

Water Mitigation Measures

Measure Implemented	Mitigation Measure	Input Value 1	Input Value 2
No	Apply Water Conservation on Strategy		
No	Use Reclaimed Water		
No	Use Grey Water		
No	Install low-flow bathroom faucet	32.00	
No	Install low-flow Kitchen faucet	18.00	
No	Install low-flow Toilet	20.00	
No	Install low-flow Shower	20.00	
No	Turf Reduction		
No	Use Water Efficient Irrigation Systems	6.10	
No	Water Efficient Landscape		

Solid Waste Mitigation

Mitigation Measures	Input Value
Institute Recycling and Composting Services Percent Reduction in Waste Disposed	

VMT Phase 1 Construction

Solano-San Francisco County, Mitigation Report

Construction Mitigation Summary

Phase	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction												
Building Construction	0.57	0.60	0.10	0.00	0.64	0.63	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Placement	0.84	0.78	-0.05	0.00	0.96	0.96	0.00	0.00	0.00	0.00	0.00	0.00
Demolition	0.60	0.52	-0.13	0.00	0.83	0.83	0.00	0.00	0.00	0.00	0.00	0.00
Dredging	0.85	0.94	-0.26	0.00	0.96	0.96	0.00	0.00	0.00	0.00	0.00	0.00

OFFROAD Equipment Mitigation

Equipment Type	Fuel Type	Tier	Number Mitigated	Total Number of Equipment	DPF	Oxidation Catalyst
Concrete/Industrial Saws	Diesel	Tier 4 Final	0	0	No Change	0.00
Cranes	Diesel	Tier 4 Final	3	5	No Change	0.00
Excavators	Diesel	Tier 4 Final	2	2	No Change	0.00
Forklifts	Diesel	Tier 4 Final	1	1	No Change	0.00
Generator Sets	Diesel	Tier 4 Final	1	1	No Change	0.00
Graders	Diesel	Tier 4 Final	0	0	No Change	0.00
Other Construction Equipment	Diesel	Tier 4 Final	1	1	No Change	0.00
Pavers	Diesel	Tier 4 Final	0	0	No Change	0.00
Paving Equipment	Diesel	Tier 4 Final	0	0	No Change	0.00
Pumps	Diesel	Tier 4 Final	1	1	No Change	0.00
Rollers	Diesel	Tier 4 Final	0	0	No Change	0.00
Rubber Tired Dozers	Diesel	Tier 4 Final	0	0	No Change	0.00
Scrapers	Diesel	Tier 4 Final	0	0	No Change	0.00
Tractors/Loaders/Backhoes	Diesel	Tier 4 Final	0	0	No Change	0.00
Welders	Diesel	Tier 4 Final	0	0	No Change	0.00

Equipment Type	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	Unmitigated tons/yr						Unmitigated mt/yr					
Concrete/Industrial Saws	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Cranes	6.96000E-002	8.25990E-001	2.87560E-001	5.30000E-004	3.77100E-002	3.46900E-002	0.00000E+000	5.03822E+001	5.03822E+001	1.50400E-002	0.00000E+000	5.07582E+001
Excavators	2.08000E-003	2.43200E-002	1.72000E-002	3.00000E-005	1.20000E-003	1.10000E-003	0.00000E+000	2.51996E+000	2.51996E+000	7.50000E-004	0.00000E+000	2.53876E+000
Forklifts	7.48000E-003	6.42400E-002	3.95500E-002	5.00000E-005	5.40000E-003	4.96000E-003	0.00000E+000	4.50995E+000	4.50995E+000	1.35000E-003	0.00000E+000	4.54361E+000
Generator Sets	5.17000E-003	4.86100E-002	3.45100E-002	7.00000E-005	2.24000E-003	2.24000E-003	0.00000E+000	6.05579E+000	6.05579E+000	4.20000E-004	0.00000E+000	6.06618E+000
Graders	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pavers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Paving Equipment	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pumps	1.33800E-002	9.81900E-002	7.72500E-002	1.30000E-004	7.13000E-003	7.13000E-003	0.00000E+000	1.13042E+001	1.13042E+001	1.09000E-003	0.00000E+000	1.13315E+001
Rollers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Rubber Tired Dozers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Scrapers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Tractors/Loaders/ Backhoes	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Welders	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000

Equipment Type	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	Mitigated tons/yr						Mitigated mt/yr					
Concrete/Industrial Saws	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Cranes	3.17400E-002	3.47300E-001	2.58080E-001	5.30000E-004	1.56000E-002	1.44000E-002	0.00000E+000	5.03821E+001	5.03821E+001	1.50400E-002	0.00000E+000	5.07582E+001
Excavators	3.30000E-004	1.41000E-003	2.00900E-002	3.00000E-005	4.00000E-005	4.00000E-005	0.00000E+000	2.51995E+000	2.51995E+000	7.50000E-004	0.00000E+000	2.53876E+000
Forklifts	5.80000E-004	2.53000E-003	3.60100E-002	5.00000E-005	8.00000E-005	8.00000E-005	0.00000E+000	4.50994E+000	4.50994E+000	1.35000E-003	0.00000E+000	4.54360E+000
Generator Sets	7.00000E-004	3.05000E-003	4.34600E-002	7.00000E-005	9.00000E-005	9.00000E-005	0.00000E+000	6.05579E+000	6.05579E+000	4.20000E-004	0.00000E+000	6.06618E+000
Graders	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pavers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Paving Equipment	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pumps	1.32000E-003	5.70000E-003	8.11300E-002	1.30000E-004	1.80000E-004	1.80000E-004	0.00000E+000	1.13041E+001	1.13041E+001	1.09000E-003	0.00000E+000	1.13315E+001
Rollers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Rubber Tired Dozers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Scrapers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Tractors/Loaders/Backhoes	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Welders	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000

Equipment Type	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction												
Concrete/Industrial Saws	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Cranes	5.43966E-001	5.79535E-001	1.02518E-001	0.00000E+000	5.86317E-001	5.84895E-001	0.00000E+000	1.19090E-006	1.19090E-006	0.00000E+000	0.00000E+000	1.18207E-006
Excavators	8.41346E-001	9.42023E-001	-1.68023E-001	0.00000E+000	9.66667E-001	9.63636E-001	0.00000E+000	3.96832E-006	3.96832E-006	0.00000E+000	0.00000E+000	0.00000E+000
Forklifts	9.22460E-001	9.60616E-001	8.95070E-002	0.00000E+000	9.85185E-001	9.83871E-001	0.00000E+000	2.21732E-006	2.21732E-006	0.00000E+000	0.00000E+000	2.20089E-006
Generator Sets	8.64603E-001	9.37256E-001	-2.59345E-001	0.00000E+000	9.59821E-001	9.59821E-001	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Graders	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pavers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Paving Equipment	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Pumps	9.01345E-001	9.41949E-001	-5.02265E-002	0.00000E+000	9.74755E-001	9.74755E-001	0.00000E+000	8.84631E-007	8.84631E-007	0.00000E+000	0.00000E+000	8.82496E-007
Rollers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Rubber Tired Dozers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Scrapers	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Tractors/Loaders/Backhoes	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
Welders	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000

Fugitive Dust Mitigation

Yes/No	Mitigation Measure	Mitigation Input		Mitigation Input		Mitigation Input	
No	Soil Stabilizer for unpaved Roads	PM10 Reduction	0.00	PM2.5 Reduction	0.00		
No	Replace Ground Cover of Area Disturbed	PM10 Reduction	0.00	PM2.5 Reduction	0.00		
No	Water Exposed Area	PM10 Reduction	0.00	PM2.5 Reduction	0.00	Frequency (per day)	

No	Unpaved Road Mitigation	Moisture Content %	0.00	Vehicle Speed (mph)	0.00		
No	Clean Paved Road	% PM Reduction	0.00				

		Unmitigated		Mitigated		Percent Reduction	
Phase	Source	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Building Construction	Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00
Building Construction	Roads	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Placement	Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Placement	Roads	0.00	0.00	0.00	0.00	0.00	0.00
Demolition	Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00
Demolition	Roads	0.00	0.00	0.00	0.00	0.00	0.00
Dredging	Fugitive Dust	0.01	0.00	0.01	0.00	0.00	0.00
Dredging	Roads	0.00	0.00	0.00	0.00	0.00	0.00

Operational Percent Reduction Summary

Category	ROG	NOx	CO	SO2	Exhaust PM10	Exhaust PM2.5	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction												
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Indoor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Outdoor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Operational Mobile Mitigation

Project Setting:

Mitigation	Category	Measure	% Reduction	Input Value 1	Input Value 2	Input Value
No	Land Use	Increase Density	0.00			
No	Land Use	Increase Diversity	-0.01	0.13		
No	Land Use	Improve Walkability Design	0.00			
No	Land Use	Improve Destination Accessibility	0.00			
No	Land Use	Increase Transit Accessibility	0.25			
No	Land Use	Integrate Below Market Rate Housing	0.00			
	Land Use	Land Use SubTotal	0.00			

No	Neighborhood Enhancements	Improve Pedestrian Network				
No	Neighborhood Enhancements	Provide Traffic Calming Measures				
No	Neighborhood Enhancements	Implement NEV Network	0.00			
	Neighborhood Enhancements	Neighborhood Enhancements Subtotal	0.00			
No	Parking Policy Pricing	Limit Parking Supply	0.00			
No	Parking Policy Pricing	Unbundle Parking Costs	0.00			
No	Parking Policy Pricing	On-street Market Pricing	0.00			
	Parking Policy Pricing	Parking Policy Pricing Subtotal	0.00			
No	Transit Improvements	Provide BRT System	0.00			
No	Transit Improvements	Expand Transit Network	0.00			
No	Transit Improvements	Increase Transit Frequency	0.00			
	Transit Improvements	Transit Improvements Subtotal	0.00			
		Land Use and Site Enhancement Subtotal	0.00			
No	Commute	Implement Trip Reduction Program				
No	Commute	Transit Subsidy				
No	Commute	Implement Employee Parking "Cash Out"				
No	Commute	Workplace Parking Charge				
No	Commute	Encourage Telecommuting and Alternative Work Schedules	0.00			
No	Commute	Market Commute Trip Reduction Option	0.00			
No	Commute	Employee Vanpool/Shuttle	0.00		2.00	
No	Commute	Provide Ride Sharing Program				
	Commute	Commute Subtotal	0.00			

No	School Trip	Implement School Bus Program	0.00			
		Total VMT Reduction	0.00			

Area Mitigation

Measure Implemented	Mitigation Measure	Input Value
No	Only Natural Gas Hearth	
No	No Hearth	
No	Use Low VOC Cleaning Supplies	
No	Use Low VOC Paint (Residential Interior)	100.00
No	Use Low VOC Paint (Residential Exterior)	150.00
No	Use Low VOC Paint (Non-residential Interior)	100.00
No	Use Low VOC Paint (Non-residential Exterior)	150.00
No	Use Low VOC Paint (Parking)	150.00
No	% Electric Lawnmower	
No	% Electric Leafblower	
No	% Electric Chainsaw	

Energy Mitigation Measures

Measure Implemented	Mitigation Measure	Input Value 1	Input Value 2
No	Exceed Title 24		
No	Install High Efficiency Lighting		
No	On-site Renewable		

Appliance Type	Land Use Subtype	% Improvement
ClothWasher		30.00
DishWasher		15.00
Fan		50.00
Refrigerator		15.00

Water Mitigation Measures

Measure Implemented	Mitigation Measure	Input Value 1	Input Value 2
No	Apply Water Conservation on Strategy		
No	Use Reclaimed Water		
No	Use Grey Water		
No	Install low-flow bathroom faucet	32.00	
No	Install low-flow Kitchen faucet	18.00	
No	Install low-flow Toilet	20.00	
No	Install low-flow Shower	20.00	
No	Turf Reduction		
No	Use Water Efficient Irrigation Systems	6.10	
No	Water Efficient Landscape		

Solid Waste Mitigation

Mitigation Measures	Input Value

Institute Recycling and Composting Services Percent Reduction in Waste Disposed	

ATTACHMENT 3 – CALEEMOD OUTPUT FILES

Orcem California GGBFS Plant

Solano-San Francisco County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Heavy Industry	72.50	1000sqft	4.83	72,500.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	56
Climate Zone	4			**Operational Year**	2017
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Based on Construction data provided

Construction Phase - Constrution schedule provided by client

Off-road Equipment -

Off-road Equipment - Provided by client

Off-road Equipment - Costruction equipment provided by client

Off-road Equipment - Provided by Client

Off-road Equipment - Provided by client

Off-road Equipment - Provided by Client

Off-road Equipment - Construction Schedule Provided by client

Off-road Equipment - Provided by Client

Trips and VMT - Provided by client

Demolition -

Grading - Facility info

Vehicle Trips - Provided by client

Consumer Products - Not looking at operations

Area Coating -

Landscape Equipment - Not looking at operations

Construction Off-road Equipment Mitigation - Tier 4 engines for all equipment except for pile driver and diesel impact hammer

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	EF_Nonresidential_Exterior	150.00	250.00
tblArchitecturalCoating	EF_Nonresidential_Interior	100.00	250.00
tblArchitecturalCoating	EF_Residential_Exterior	150.00	250.00
tblArchitecturalCoating	EF_Residential_Interior	100.00	250.00
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
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tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final

tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	18.00	385.00
tblConstructionPhase	NumDays	230.00	321.00
tblConstructionPhase	NumDays	20.00	63.00
tblConstructionPhase	NumDays	8.00	127.00
tblConstructionPhase	NumDays	18.00	106.00
tblConstructionPhase	NumDays	5.00	63.00
tblConstructionPhase	PhaseEndDate	9/20/2017	6/30/2016
tblConstructionPhase	PhaseEndDate	9/21/2016	3/30/2016
tblConstructionPhase	PhaseEndDate	9/23/2015	6/30/2015
tblConstructionPhase	PhaseEndDate	11/25/2016	5/30/2016
tblConstructionPhase	PhaseEndDate	6/25/2015	3/30/2015
tblConstructionPhase	PhaseEndDate	12/24/2015	6/30/2015
tblConstructionPhase	PhaseStartDate	3/31/2016	1/9/2015
tblConstructionPhase	PhaseStartDate	7/1/2015	1/7/2015
tblConstructionPhase	PhaseStartDate	3/31/2015	1/4/2015
tblConstructionPhase	PhaseStartDate	7/1/2016	1/2/2016
tblConstructionPhase	PhaseStartDate	3/31/2015	1/1/2015
tblConstructionPhase	PhaseStartDate	7/1/2015	1/4/2015
tblGrading	AcresOfGrading	30.16	4.00
tblGrading	MaterialExported	0.00	2,509.00
tblGrading	MaterialImported	0.00	6,290.00
tblLandUse	LotAcreage	1.66	4.83
tblOffRoadEquipment	HorsePower	226.00	205.00
tblOffRoadEquipment	HorsePower	85.00	350.00
tblOffRoadEquipment	HorsePower	226.00	205.00
tblOffRoadEquipment	LoadFactor	0.29	0.50
tblOffRoadEquipment	LoadFactor	0.29	0.50

tblOffRoadEquipment	OffRoadEquipmentType		Cranes
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	6.00	2.50
tblOffRoadEquipment	UsageHours	6.00	1.50
tblOffRoadEquipment	UsageHours	7.00	3.00
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	7.60
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	3.80
tblOffRoadEquipment	UsageHours	8.00	1.50
tblOffRoadEquipment	UsageHours	6.00	1.50
tblOffRoadEquipment	UsageHours	6.00	1.10
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	1.90
tblOffRoadEquipment	UsageHours	8.00	1.30
tblOffRoadEquipment	UsageHours	8.00	1.10

tblOffRoadEquipment	UsageHours	8.00	1.30
tblOffRoadEquipment	UsageHours	8.00	2.50
tblProjectCharacteristics	OperationalYear	2014	2017
tblTripsAndVMT	HaulingTripLength	20.00	0.20
tblTripsAndVMT	HaulingTripLength	20.00	7.30
tblTripsAndVMT	HaulingTripLength	20.00	7.30
tblVehicleTrips	ST_TR	1.50	0.00
tblVehicleTrips	SU_TR	1.50	0.00
tblVehicleTrips	WD_TR	1.50	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.9193	3.3318	2.5079	3.9900e-003	0.2760	0.1588	0.4349	0.0990	0.1482	0.2473	0.0000	365.2225	365.2225	0.0633	0.0000	366.5514
2016	0.3373	0.4046	0.3858	6.6000e-004	0.0211	0.0227	0.0438	5.6500e-003	0.0214	0.0271	0.0000	56.4778	56.4778	8.9400e-003	0.0000	56.6655
Total	**1.2566**	**3.7365**	**2.8936**	**4.6500e-003**	**0.2971**	**0.1816**	**0.4787**	**0.1047**	**0.1697**	**0.2743**	**0.0000**	**421.7004**	**421.7004**	**0.0722**	**0.0000**	**423.2170**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.6753	0.8317	2.3425	3.9900e-003	0.2760	0.0209	0.2970	0.0990	0.0195	0.1186	0.0000	365.2223	365.2223	0.0633	0.0000	366.5512
2016	0.3034	0.1172	0.3831	6.6000e-004	0.0211	2.7700e-003	0.0238	5.6500e-003	2.5800e-003	8.2300e-003	0.0000	56.4778	56.4778	8.9400e-003	0.0000	56.6655
Total	**0.9787**	**0.9488**	**2.7257**	**4.6500e-003**	**0.2971**	**0.0237**	**0.3208**	**0.1047**	**0.0221**	**0.1268**	**0.0000**	**421.7000**	**421.7000**	**0.0722**	**0.0000**	**423.2166**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**22.12**	**74.61**	**5.80**	**0.00**	**0.00**	**86.96**	**32.98**	**0.00**	**86.96**	**53.78**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.2832	1.0000e-005	6.8000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.3000e-003	1.3000e-003	0.0000	0.0000	1.3700e-003
Energy	0.0107	0.0974	0.0818	5.8000e-004		7.4000e-003	7.4000e-003		7.4000e-003	7.4000e-003	0.0000	296.4984	296.4984	0.0106	3.7300e-003	297.8769
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	18.2489	0.0000	18.2489	1.0785	0.0000	40.8969
Water						0.0000	0.0000		0.0000	0.0000	5.3190	26.3911	31.7101	0.5475	0.0132	47.2830
Total	**0.2939**	**0.0974**	**0.0825**	**5.8000e-004**	**0.0000**	**7.4000e-003**	**7.4000e-003**	**0.0000**	**7.4000e-003**	**7.4000e-003**	**23.5679**	**322.8908**	**346.4587**	**1.6366**	**0.0169**	**386.0582**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.2832	1.0000e-005	6.8000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.3000e-003	1.3000e-003	0.0000	0.0000	1.3700e-003
Energy	0.0107	0.0974	0.0818	5.8000e-004		7.4000e-003	7.4000e-003		7.4000e-003	7.4000e-003	0.0000	296.4984	296.4984	0.0106	3.7300e-003	297.8769
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	18.2489	0.0000	18.2489	1.0785	0.0000	40.8969
Water						0.0000	0.0000		0.0000	0.0000	5.3190	26.3911	31.7101	0.5474	0.0131	47.2745
Total	**0.2939**	**0.0974**	**0.0825**	**5.8000e-004**	**0.0000**	**7.4000e-003**	**7.4000e-003**	**0.0000**	**7.4000e-003**	**7.4000e-003**	**23.5679**	**322.8908**	**346.4587**	**1.6365**	**0.0169**	**386.0498**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.12**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2015	3/30/2015	5	63	
2	Site Preparation	Site Preparation	1/1/2015	3/30/2015	5	63	
3	Grading	Grading	1/4/2015	6/30/2015	5	127	
4	Trenching	Trenching	1/4/2015	6/30/2015	5	127	
5	Building Construction	Building Construction	1/7/2015	3/30/2016	5	321	
6	Interior Construction	Architectural Coating	1/9/2015	6/30/2016	5	385	
7	Paving	Paving	1/2/2016	5/30/2016	5	106	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 4

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 108,750; Non-Residential Outdoor: 36,250 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	0	8.00	81	0.73
Demolition	Cranes	1	4.00	226	0.29
Demolition	Crushing/Proc. Equipment	1	4.00	350	0.78
Demolition	Excavators	1	4.00	162	0.38
Demolition	Rubber Tired Dozers	1	4.00	255	0.40
Site Preparation	Rubber Tired Dozers	1	1.30	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	1	1.30	97	0.37
Grading	Cranes	0	1.30	205	0.50
Grading	Excavators	2	7.60	162	0.38
Grading	Graders	1	3.80	174	0.41
Grading	Off-Highway Trucks	0	5.00	400	0.38
Grading	Rubber Tired Dozers	1	1.90	255	0.40
Grading	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Trenching	Tractors/Loaders/Backhoes	1	2.50	97	0.37
Building Construction	Cranes	1	3.00	226	0.29
Building Construction	Forklifts	1	4.00	89	0.20
Building Construction	Generator Sets	0	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Building Construction	Welders	1	2.50	46	0.45
Interior Construction	Aerial Lifts	1	1.20	62	0.31
Interior Construction	Air Compressors	1	2.50	78	0.48
Paving	Cement and Mortar Mixers	1	1.50	9	0.56
Paving	Pavers	1	1.50	125	0.42
Paving	Paving Equipment	1	1.50	130	0.36
Paving	Rollers	1	1.10	80	0.38
Paving	Tractors/Loaders/Backhoes	1	1.10	97	0.37
Grading	Cranes	1	1.30	205	0.50

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	710.00	12.40	7.30	0.20	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	5	13.00	0.00	1,100.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Trenching	1	3.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	3	30.00	12.00	0.00	12.40	7.30	7.30	LD_Mix	HDT_Mix	HHDT
Interior Construction	2	6.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	5	13.00	0.00	0.00	12.40	7.30	7.30	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Clean Paved Roads

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0768	0.0000	0.0768	0.0116	0.0000	0.0116	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0655	0.6925	0.3651	6.9000e-004		0.0290	0.0290		0.0273	0.0273	0.0000	68.8424	68.8424	0.0111	0.0000	69.0751
Total	**0.0655**	**0.6925**	**0.3651**	**6.9000e-004**	**0.0768**	**0.0290**	**0.1057**	**0.0116**	**0.0273**	**0.0389**	**0.0000**	**68.8424**	**68.8424**	**0.0111**	**0.0000**	**69.0751**

3.2 Demolition - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.4200e-003	0.0103	0.0732	1.0000e-005	7.0000e-005	5.0000e-005	1.2000e-004	2.0000e-005	5.0000e-005	7.0000e-005	0.0000	0.8190	0.8190	2.0000e-005	0.0000	0.8195
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.8700e-003	0.0177	3.0000e-005	2.8700e-003	2.0000e-005	2.8900e-003	7.6000e-004	2.0000e-005	7.8000e-004	0.0000	2.6922	2.6922	1.5000e-004	0.0000	2.6954
Total	**6.7200e-003**	**0.0122**	**0.0909**	**4.0000e-005**	**2.9400e-003**	**7.0000e-005**	**3.0100e-003**	**7.8000e-004**	**7.0000e-005**	**8.5000e-004**	**0.0000**	**3.5113**	**3.5113**	**1.7000e-004**	**0.0000**	**3.5148**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0768	0.0000	0.0768	0.0116	0.0000	0.0116	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0120	0.0818	0.3353	6.9000e-004		3.2200e-003	3.2200e-003		3.0500e-003	3.0500e-003	0.0000	68.8423	68.8423	0.0111	0.0000	69.0750
Total	**0.0120**	**0.0818**	**0.3353**	**6.9000e-004**	**0.0768**	**3.2200e-003**	**0.0800**	**0.0116**	**3.0500e-003**	**0.0147**	**0.0000**	**68.8423**	**68.8423**	**0.0111**	**0.0000**	**69.0750**

3.2 Demolition - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.4200e-003	0.0103	0.0732	1.0000e-005	7.0000e-005	5.0000e-005	1.2000e-004	2.0000e-005	5.0000e-005	7.0000e-005	0.0000	0.8190	0.8190	2.0000e-005	0.0000	0.8195
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.8700e-003	0.0177	3.0000e-005	2.8700e-003	2.0000e-005	2.8900e-003	7.6000e-004	2.0000e-005	7.8000e-004	0.0000	2.6922	2.6922	1.5000e-004	0.0000	2.6954
Total	**6.7200e-003**	**0.0122**	**0.0909**	**4.0000e-005**	**2.9400e-003**	**7.0000e-005**	**3.0100e-003**	**7.8000e-004**	**7.0000e-005**	**8.5000e-004**	**0.0000**	**3.5113**	**3.5113**	**1.7000e-004**	**0.0000**	**3.5148**

3.3 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0308	0.0000	0.0308	0.0169	0.0000	0.0169	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.3600e-003	0.0912	0.0686	6.0000e-005		4.8100e-003	4.8100e-003		4.4300e-003	4.4300e-003	0.0000	5.8576	5.8576	1.7500e-003	0.0000	5.8943
Total	**8.3600e-003**	**0.0912**	**0.0686**	**6.0000e-005**	**0.0308**	**4.8100e-003**	**0.0356**	**0.0169**	**4.4300e-003**	**0.0214**	**0.0000**	**5.8576**	**5.8576**	**1.7500e-003**	**0.0000**	**5.8943**

3.3 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.5000e-004	9.4000e-004	8.8400e-003	2.0000e-005	1.4400e-003	1.0000e-005	1.4500e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.3461	1.3461	7.0000e-005	0.0000	1.3477
Total	**6.5000e-004**	**9.4000e-004**	**8.8400e-003**	**2.0000e-005**	**1.4400e-003**	**1.0000e-005**	**1.4500e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.3461**	**1.3461**	**7.0000e-005**	**0.0000**	**1.3477**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0308	0.0000	0.0308	0.0169	0.0000	0.0169	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	7.5000e-004	3.2400e-003	0.0323	6.0000e-005		1.0000e-004	1.0000e-004		1.0000e-004	1.0000e-004	0.0000	5.8576	5.8576	1.7500e-003	0.0000	5.8943
Total	**7.5000e-004**	**3.2400e-003**	**0.0323**	**6.0000e-005**	**0.0308**	**1.0000e-004**	**0.0309**	**0.0169**	**1.0000e-004**	**0.0170**	**0.0000**	**5.8576**	**5.8576**	**1.7500e-003**	**0.0000**	**5.8943**

3.3 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.5000e-004	9.4000e-004	8.8400e-003	2.0000e-005	1.4400e-003	1.0000e-005	1.4500e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.3461	1.3461	7.0000e-005	0.0000	1.3477
Total	**6.5000e-004**	**9.4000e-004**	**8.8400e-003**	**2.0000e-005**	**1.4400e-003**	**1.0000e-005**	**1.4500e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.3461**	**1.3461**	**7.0000e-005**	**0.0000**	**1.3477**

3.4 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0934	0.0000	0.0934	0.0502	0.0000	0.0502	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1135	1.2739	0.7802	1.0500e-003		0.0640	0.0640		0.0589	0.0589	0.0000	100.2354	100.2354	0.0299	0.0000	100.8638
Total	**0.1135**	**1.2739**	**0.7802**	**1.0500e-003**	**0.0934**	**0.0640**	**0.1575**	**0.0502**	**0.0589**	**0.1091**	**0.0000**	**100.2354**	**100.2354**	**0.0299**	**0.0000**	**100.8638**

3.4 Grading - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0156	0.1924	0.1511	4.2000e-004	9.3100e-003	2.8600e-003	0.0122	2.5600e-003	2.6300e-003	5.1900e-003	0.0000	38.3336	38.3336	3.2000e-004	0.0000	38.3404
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3900e-003	4.9000e-003	0.0464	9.0000e-005	7.5300e-003	6.0000e-005	7.5800e-003	2.0000e-003	5.0000e-005	2.0500e-003	0.0000	7.0554	7.0554	3.9000e-004	0.0000	7.0636
Total	**0.0189**	**0.1973**	**0.1974**	**5.1000e-004**	**0.0168**	**2.9200e-003**	**0.0198**	**4.5600e-003**	**2.6800e-003**	**7.2400e-003**	**0.0000**	**45.3889**	**45.3889**	**7.1000e-004**	**0.0000**	**45.4039**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0934	0.0000	0.0934	0.0502	0.0000	0.0502	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0166	0.1025	0.7287	1.0500e-003		3.8700e-003	3.8700e-003		3.7000e-003	3.7000e-003	0.0000	100.2353	100.2353	0.0299	0.0000	100.8637
Total	**0.0166**	**0.1025**	**0.7287**	**1.0500e-003**	**0.0934**	**3.8700e-003**	**0.0973**	**0.0502**	**3.7000e-003**	**0.0539**	**0.0000**	**100.2353**	**100.2353**	**0.0299**	**0.0000**	**100.8637**

3.4 Grading - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0156	0.1924	0.1511	4.2000e-004	9.3100e-003	2.8600e-003	0.0122	2.5600e-003	2.6300e-003	5.1900e-003	0.0000	38.3336	38.3336	3.2000e-004	0.0000	38.3404
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3900e-003	4.9000e-003	0.0464	9.0000e-005	7.5300e-003	6.0000e-005	7.5800e-003	2.0000e-003	5.0000e-005	2.0500e-003	0.0000	7.0554	7.0554	3.9000e-004	0.0000	7.0636
Total	**0.0189**	**0.1973**	**0.1974**	**5.1000e-004**	**0.0168**	**2.9200e-003**	**0.0198**	**4.5600e-003**	**2.6800e-003**	**7.2400e-003**	**0.0000**	**45.3889**	**45.3889**	**7.1000e-004**	**0.0000**	**45.4039**

3.5 Trenching - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	7.1500e-003	0.0681	0.0481	6.0000e-005		5.3300e-003	5.3300e-003		4.9000e-003	4.9000e-003	0.0000	5.8954	5.8954	1.7600e-003	0.0000	5.9324
Total	**7.1500e-003**	**0.0681**	**0.0481**	**6.0000e-005**		**5.3300e-003**	**5.3300e-003**		**4.9000e-003**	**4.9000e-003**	**0.0000**	**5.8954**	**5.8954**	**1.7600e-003**	**0.0000**	**5.9324**

3.5 Trenching - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.8000e-004	1.1300e-003	0.0107	2.0000e-005	1.7400e-003	1.0000e-005	1.7500e-003	4.6000e-004	1.0000e-005	4.7000e-004	0.0000	1.6282	1.6282	9.0000e-005	0.0000	1.6301
Total	**7.8000e-004**	**1.1300e-003**	**0.0107**	**2.0000e-005**	**1.7400e-003**	**1.0000e-005**	**1.7500e-003**	**4.6000e-004**	**1.0000e-005**	**4.7000e-004**	**0.0000**	**1.6282**	**1.6282**	**9.0000e-005**	**0.0000**	**1.6301**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	7.5000e-004	3.2700e-003	0.0465	6.0000e-005		1.0000e-004	1.0000e-004		1.0000e-004	1.0000e-004	0.0000	5.8954	5.8954	1.7600e-003	0.0000	5.9324
Total	**7.5000e-004**	**3.2700e-003**	**0.0465**	**6.0000e-005**		**1.0000e-004**	**1.0000e-004**		**1.0000e-004**	**1.0000e-004**	**0.0000**	**5.8954**	**5.8954**	**1.7600e-003**	**0.0000**	**5.9324**

3.5 Trenching - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.8000e-004	1.1300e-003	0.0107	2.0000e-005	1.7400e-003	1.0000e-005	1.7500e-003	4.6000e-004	1.0000e-005	4.7000e-004	0.0000	1.6282	1.6282	9.0000e-005	0.0000	1.6301
Total	**7.8000e-004**	**1.1300e-003**	**0.0107**	**2.0000e-005**	**1.7400e-003**	**1.0000e-005**	**1.7500e-003**	**4.6000e-004**	**1.0000e-005**	**4.7000e-004**	**0.0000**	**1.6282**	**1.6282**	**9.0000e-005**	**0.0000**	**1.6301**

3.6 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0764	0.6326	0.3113	4.7000e-004		0.0369	0.0369		0.0344	0.0344	0.0000	42.8002	42.8002	0.0126	0.0000	43.0642
Total	**0.0764**	**0.6326**	**0.3113**	**4.7000e-004**		**0.0369**	**0.0369**		**0.0344**	**0.0344**	**0.0000**	**42.8002**	**42.8002**	**0.0126**	**0.0000**	**43.0642**

3.6 Building Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0231	0.1777	0.2454	3.7000e-004	9.9300e-003	2.8500e-003	0.0128	2.8400e-003	2.6200e-003	5.4600e-003	0.0000	33.6589	33.6589	3.0000e-004	0.0000	33.6652
Worker	0.0159	0.0229	0.2165	4.2000e-004	0.0351	2.7000e-004	0.0354	9.3400e-003	2.5000e-004	9.5900e-003	0.0000	32.9478	32.9478	1.8200e-003	0.0000	32.9861
Total	**0.0389**	**0.2006**	**0.4619**	**7.9000e-004**	**0.0451**	**3.1200e-003**	**0.0482**	**0.0122**	**2.8700e-003**	**0.0151**	**0.0000**	**66.6066**	**66.6066**	**2.1200e-003**	**0.0000**	**66.6512**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0173	0.1995	0.2659	4.7000e-004		7.1600e-003	7.1600e-003		6.6400e-003	6.6400e-003	0.0000	42.8001	42.8001	0.0126	0.0000	43.0641
Total	**0.0173**	**0.1995**	**0.2659**	**4.7000e-004**		**7.1600e-003**	**7.1600e-003**		**6.6400e-003**	**6.6400e-003**	**0.0000**	**42.8001**	**42.8001**	**0.0126**	**0.0000**	**43.0641**

3.6 Building Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0231	0.1777	0.2454	3.7000e-004	9.9300e-003	2.8500e-003	0.0128	2.8400e-003	2.6200e-003	5.4600e-003	0.0000	33.6589	33.6589	3.0000e-004	0.0000	33.6652
Worker	0.0159	0.0229	0.2165	4.2000e-004	0.0351	2.7000e-004	0.0354	9.3400e-003	2.5000e-004	9.5900e-003	0.0000	32.9478	32.9478	1.8200e-003	0.0000	32.9861
Total	**0.0389**	**0.2006**	**0.4619**	**7.9000e-004**	**0.0451**	**3.1200e-003**	**0.0482**	**0.0122**	**2.8700e-003**	**0.0151**	**0.0000**	**66.6066**	**66.6066**	**2.1200e-003**	**0.0000**	**66.6512**

3.6 Building Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0179	0.1517	0.0757	1.2000e-004		8.6800e-003	8.6800e-003		8.1000e-003	8.1000e-003	0.0000	10.5679	10.5679	3.0800e-003	0.0000	10.6325
Total	**0.0179**	**0.1517**	**0.0757**	**1.2000e-004**		**8.6800e-003**	**8.6800e-003**		**8.1000e-003**	**8.1000e-003**	**0.0000**	**10.5679**	**10.5679**	**3.0800e-003**	**0.0000**	**10.6325**

3.6 Building Construction - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.2200e-003	0.0385	0.0578	9.0000e-005	2.4700e-003	5.7000e-004	3.0400e-003	7.1000e-004	5.2000e-004	1.2300e-003	0.0000	8.2864	8.2864	7.0000e-005	0.0000	8.2878
Worker	3.5200e-003	5.1000e-003	0.0479	1.0000e-004	8.7500e-003	6.0000e-005	8.8200e-003	2.3300e-003	6.0000e-005	2.3900e-003	0.0000	7.9141	7.9141	4.1000e-004	0.0000	7.9228
Total	**8.7400e-003**	**0.0436**	**0.1057**	**1.9000e-004**	**0.0112**	**6.3000e-004**	**0.0119**	**3.0400e-003**	**5.8000e-004**	**3.6200e-003**	**0.0000**	**16.2005**	**16.2005**	**4.8000e-004**	**0.0000**	**16.2105**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.2300e-003	0.0485	0.0659	1.2000e-004		1.7200e-003	1.7200e-003		1.6000e-003	1.6000e-003	0.0000	10.5679	10.5679	3.0800e-003	0.0000	10.6325
Total	**4.2300e-003**	**0.0485**	**0.0659**	**1.2000e-004**		**1.7200e-003**	**1.7200e-003**		**1.6000e-003**	**1.6000e-003**	**0.0000**	**10.5679**	**10.5679**	**3.0800e-003**	**0.0000**	**10.6325**

3.6 Building Construction - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.2200e-003	0.0385	0.0578	9.0000e-005	2.4700e-003	5.7000e-004	3.0400e-003	7.1000e-004	5.2000e-004	1.2300e-003	0.0000	8.2864	8.2864	7.0000e-005	0.0000	8.2878
Worker	3.5200e-003	5.1000e-003	0.0479	1.0000e-004	8.7500e-003	6.0000e-005	8.8200e-003	2.3300e-003	6.0000e-005	2.3900e-003	0.0000	7.9141	7.9141	4.1000e-004	0.0000	7.9228
Total	**8.7400e-003**	**0.0436**	**0.1057**	**1.9000e-004**	**0.0112**	**6.3000e-004**	**0.0119**	**3.0400e-003**	**5.8000e-004**	**3.6200e-003**	**0.0000**	**16.2005**	**16.2005**	**4.8000e-004**	**0.0000**	**16.2105**

3.7 Interior Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5564					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0228	0.1567	0.1219	1.9000e-004		0.0127	0.0127		0.0126	0.0126	0.0000	16.5722	16.5722	2.6600e-003	0.0000	16.6282
Total	**0.5793**	**0.1567**	**0.1219**	**1.9000e-004**		**0.0127**	**0.0127**		**0.0126**	**0.0126**	**0.0000**	**16.5722**	**16.5722**	**2.6600e-003**	**0.0000**	**16.6282**

3.7 Interior Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.1500e-003	4.5400e-003	0.0430	8.0000e-005	6.9700e-003	5.0000e-005	7.0300e-003	1.8500e-003	5.0000e-005	1.9000e-003	0.0000	6.5383	6.5383	3.6000e-004	0.0000	6.5459
Total	**3.1500e-003**	**4.5400e-003**	**0.0430**	**8.0000e-005**	**6.9700e-003**	**5.0000e-005**	**7.0300e-003**	**1.8500e-003**	**5.0000e-005**	**1.9000e-003**	**0.0000**	**6.5383**	**6.5383**	**3.6000e-004**	**0.0000**	**6.5459**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5564					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3600e-003	0.0246	0.1213	1.9000e-004		2.6000e-004	2.6000e-004		2.6000e-004	2.6000e-004	0.0000	16.5722	16.5722	2.6600e-003	0.0000	16.6281
Total	**0.5588**	**0.0246**	**0.1213**	**1.9000e-004**		**2.6000e-004**	**2.6000e-004**		**2.6000e-004**	**2.6000e-004**	**0.0000**	**16.5722**	**16.5722**	**2.6600e-003**	**0.0000**	**16.6281**

3.7 Interior Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.1500e-003	4.5400e-003	0.0430	8.0000e-005	6.9700e-003	5.0000e-005	7.0300e-003	1.8500e-003	5.0000e-005	1.9000e-003	0.0000	6.5383	6.5383	3.6000e-004	0.0000	6.5459
Total	**3.1500e-003**	**4.5400e-003**	**0.0430**	**8.0000e-005**	**6.9700e-003**	**5.0000e-005**	**7.0300e-003**	**1.8500e-003**	**5.0000e-005**	**1.9000e-003**	**0.0000**	**6.5383**	**6.5383**	**3.6000e-004**	**0.0000**	**6.5459**

3.7 Interior Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.2837					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0105	0.0732	0.0616	1.0000e-004		5.6900e-003	5.6900e-003		5.6700e-003	5.6700e-003	0.0000	8.4329	8.4329	1.2700e-003	0.0000	8.4596
Total	**0.2942**	**0.0732**	**0.0616**	**1.0000e-004**		**5.6900e-003**	**5.6900e-003**		**5.6700e-003**	**5.6700e-003**	**0.0000**	**8.4329**	**8.4329**	**1.2700e-003**	**0.0000**	**8.4596**

3.7 Interior Construction - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4300e-003	2.0700e-003	0.0195	4.0000e-005	3.5600e-003	3.0000e-005	3.5800e-003	9.5000e-004	2.0000e-005	9.7000e-004	0.0000	3.2151	3.2151	1.7000e-004	0.0000	3.2186
Total	**1.4300e-003**	**2.0700e-003**	**0.0195**	**4.0000e-005**	**3.5600e-003**	**3.0000e-005**	**3.5800e-003**	**9.5000e-004**	**2.0000e-005**	**9.7000e-004**	**0.0000**	**3.2151**	**3.2151**	**1.7000e-004**	**0.0000**	**3.2186**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.2837					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.2000e-003	0.0125	0.0619	1.0000e-004		1.3000e-004	1.3000e-004		1.3000e-004	1.3000e-004	0.0000	8.4328	8.4328	1.2700e-003	0.0000	8.4596
Total	**0.2849**	**0.0125**	**0.0619**	**1.0000e-004**		**1.3000e-004**	**1.3000e-004**		**1.3000e-004**	**1.3000e-004**	**0.0000**	**8.4328**	**8.4328**	**1.2700e-003**	**0.0000**	**8.4596**

3.7 Interior Construction - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4300e-003	2.0700e-003	0.0195	4.0000e-005	3.5600e-003	3.0000e-005	3.5800e-003	9.5000e-004	2.0000e-005	9.7000e-004	0.0000	3.2151	3.2151	1.7000e-004	0.0000	3.2186
Total	**1.4300e-003**	**2.0700e-003**	**0.0195**	**4.0000e-005**	**3.5600e-003**	**3.0000e-005**	**3.5800e-003**	**9.5000e-004**	**2.0000e-005**	**9.7000e-004**	**0.0000**	**3.2151**	**3.2151**	**1.7000e-004**	**0.0000**	**3.2186**

3.8 Paving - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0126	0.1304	0.0889	1.3000e-004		7.6300e-003	7.6300e-003		7.0300e-003	7.0300e-003	0.0000	12.3815	12.3815	3.6400e-003	0.0000	12.4580
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0126**	**0.1304**	**0.0889**	**1.3000e-004**		**7.6300e-003**	**7.6300e-003**		**7.0300e-003**	**7.0300e-003**	**0.0000**	**12.3815**	**12.3815**	**3.6400e-003**	**0.0000**	**12.4580**

3.8 Paving - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.5300e-003	3.6600e-003	0.0344	8.0000e-005	6.2800e-003	5.0000e-005	6.3300e-003	1.6700e-003	4.0000e-005	1.7100e-003	0.0000	5.6800	5.6800	3.0000e-004	0.0000	5.6862
Total	**2.5300e-003**	**3.6600e-003**	**0.0344**	**8.0000e-005**	**6.2800e-003**	**5.0000e-005**	**6.3300e-003**	**1.6700e-003**	**4.0000e-005**	**1.7100e-003**	**0.0000**	**5.6800**	**5.6800**	**3.0000e-004**	**0.0000**	**5.6862**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.5600e-003	6.7400e-003	0.0959	1.3000e-004		2.1000e-004	2.1000e-004		2.1000e-004	2.1000e-004	0.0000	12.3815	12.3815	3.6400e-003	0.0000	12.4580
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**1.5600e-003**	**6.7400e-003**	**0.0959**	**1.3000e-004**		**2.1000e-004**	**2.1000e-004**		**2.1000e-004**	**2.1000e-004**	**0.0000**	**12.3815**	**12.3815**	**3.6400e-003**	**0.0000**	**12.4580**

3.8 Paving - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.5300e-003	3.6600e-003	0.0344	8.0000e-005	6.2800e-003	5.0000e-005	6.3300e-003	1.6700e-003	4.0000e-005	1.7100e-003	0.0000	5.6800	5.6800	3.0000e-004	0.0000	5.6862
Total	**2.5300e-003**	**3.6600e-003**	**0.0344**	**8.0000e-005**	**6.2800e-003**	**5.0000e-005**	**6.3300e-003**	**1.6700e-003**	**4.0000e-005**	**1.7100e-003**	**0.0000**	**5.6800**	**5.6800**	**3.0000e-004**	**0.0000**	**5.6862**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Heavy Industry	9.50	7.30	7.30	59.00	28.00	13.00	92	5	3

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.521474	0.064786	0.165902	0.135956	0.038163	0.005416	0.012558	0.038675	0.004522	0.002630	0.006738	0.000681	0.002498

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	190.4525	190.4525	8.6100e-003	1.7800e-003	191.1857
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	190.4525	190.4525	8.6100e-003	1.7800e-003	191.1857
NaturalGas Mitigated	0.0107	0.0974	0.0818	5.8000e-004		7.4000e-003	7.4000e-003		7.4000e-003	7.4000e-003	0.0000	106.0459	106.0459	2.0300e-003	1.9400e-003	106.6913
NaturalGas Unmitigated	0.0107	0.0974	0.0818	5.8000e-004		7.4000e-003	7.4000e-003		7.4000e-003	7.4000e-003	0.0000	106.0459	106.0459	2.0300e-003	1.9400e-003	106.6913

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Heavy Industry	1.98722e+006	0.0107	0.0974	0.0818	5.8000e-004		7.4000e-003	7.4000e-003		7.4000e-003	7.4000e-003	0.0000	106.0459	106.0459	2.0300e-003	1.9400e-003	106.6913
Total		**0.0107**	**0.0974**	**0.0818**	**5.8000e-004**		**7.4000e-003**	**7.4000e-003**		**7.4000e-003**	**7.4000e-003**	**0.0000**	**106.0459**	**106.0459**	**2.0300e-003**	**1.9400e-003**	**106.6913**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Heavy Industry	1.98722e+006	0.0107	0.0974	0.0818	5.8000e-004		7.4000e-003	7.4000e-003		7.4000e-003	7.4000e-003	0.0000	106.0459	106.0459	2.0300e-003	1.9400e-003	106.6913
Total		**0.0107**	**0.0974**	**0.0818**	**5.8000e-004**		**7.4000e-003**	**7.4000e-003**		**7.4000e-003**	**7.4000e-003**	**0.0000**	**106.0459**	**106.0459**	**2.0300e-003**	**1.9400e-003**	**106.6913**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Heavy Industry	654675	190.4525	8.6100e-003	1.7800e-003	191.1857
Total		**190.4525**	**8.6100e-003**	**1.7800e-003**	**191.1857**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Heavy Industry	654675	190.4525	8.6100e-003	1.7800e-003	191.1857
Total		**190.4525**	**8.6100e-003**	**1.7800e-003**	**191.1857**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.2832	1.0000e-005	6.8000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.3000e-003	1.3000e-003	0.0000	0.0000	1.3700e-003
Unmitigated	0.2832	1.0000e-005	6.8000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.3000e-003	1.3000e-003	0.0000	0.0000	1.3700e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.2832					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.0000e-005	1.0000e-005	6.8000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.3000e-003	1.3000e-003	0.0000	0.0000	1.3700e-003
Total	**0.2832**	**1.0000e-005**	**6.8000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.3000e-003**	**1.3000e-003**	**0.0000**	**0.0000**	**1.3700e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.2832					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.0000e-005	1.0000e-005	6.8000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.3000e-003	1.3000e-003	0.0000	0.0000	1.3700e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.2832**	**1.0000e-005**	**6.8000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.3000e-003**	**1.3000e-003**	**0.0000**	**0.0000**	**1.3700e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	31.7101	0.5474	0.0131	47.2745
Unmitigated	31.7101	0.5475	0.0132	47.2830

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Heavy Industry	16.7656 / 0	31.7101	0.5475	0.0132	47.2830
Total		**31.7101**	**0.5475**	**0.0132**	**47.2830**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Heavy Industry	16.7656 / 0	31.7101	0.5474	0.0131	47.2745
Total		**31.7101**	**0.5474**	**0.0131**	**47.2745**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	18.2489	1.0785	0.0000	40.8969
Unmitigated	18.2489	1.0785	0.0000	40.8969

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Heavy Industry	89.9	18.2489	1.0785	0.0000	40.8969
Total		**18.2489**	**1.0785**	**0.0000**	**40.8969**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Heavy Industry	89.9	18.2489	1.0785	0.0000	40.8969
Total		**18.2489**	**1.0785**	**0.0000**	**40.8969**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

VMT Phase 1 Construction

Solano-San Francisco County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Heavy Industry	6.00	1000sqft	11.00	6,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	56
Climate Zone	4			**Operational Year**	2017
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

VMT Phase 1 Construction - Solano-San Francisco County, Annual

Project Characteristics -

Land Use - From project description

Construction Phase - DEIR

Off-road Equipment - Equipment List from Project Sponsor

Off-road Equipment - Updated to reflect equipment information from Project Sponsor

Off-road Equipment - Equipment List from Project Sponsor

Off-road Equipment - Equipment List from Project Sponsor

Off-road Equipment - Equipment List from Project Sponsor

Trips and VMT - Updated from client information

Construction Off-road Equipment Mitigation - Equipment mitigation from Project Sponsor

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final

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tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	300.00	62.00
tblConstructionPhase	NumDays	20.00	5.00
tblConstructionPhase	NumDays	30.00	4.00
tblConstructionPhase	NumDays	20.00	40.00
tblGrading	AcresOfGrading	0.00	12.50
tblLandUse	LotAcreage	0.14	11.00
tblOffRoadEquipment	HorsePower	231.00	226.00
tblOffRoadEquipment	HorsePower	231.00	226.00
tblOffRoadEquipment	HorsePower	158.00	162.00
tblOffRoadEquipment	HorsePower	158.00	162.00
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tblOffRoadEquipment	HorsePower	130.00	125.00
tblOffRoadEquipment	HorsePower	132.00	130.00
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tblOffRoadEquipment	HorsePower	247.00	255.00
tblOffRoadEquipment	HorsePower	367.00	361.00
tblOffRoadEquipment	HorsePower	231.00	850.00
tblOffRoadEquipment	HorsePower	84.00	150.00
tblOffRoadEquipment	HorsePower	172.00	750.00
tblOffRoadEquipment	HorsePower	231.00	226.00
tblOffRoadEquipment	LoadFactor	0.42	0.31

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tblOffRoadEquipment	LoadFactor	0.29	0.29
tblOffRoadEquipment	OffRoadEquipmentType		Cranes
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
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tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	0.30
tblOffRoadEquipment	UsageHours	7.00	8.00
tblTripsAndVMT	HaulingTripLength	20.00	7.30
tblTripsAndVMT	HaulingTripNumber	0.00	99.00
tblTripsAndVMT	HaulingTripNumber	0.00	186.00
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40

tblTripsAndVMT	WorkerTripLength	10.80	12.40

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.0862	0.9889	0.3907	7.4000e-004	8.7300e-003	0.0468	0.0555	1.2900e-003	0.0433	0.0446	0.0000	69.3563	69.3563	0.0179	0.0000	69.8025
2016	0.0144	0.1178	0.0836	1.7000e-004	1.1300e-003	7.2500e-003	8.3700e-003	3.0000e-004	7.2400e-003	7.5500e-003	0.0000	15.2597	15.2597	1.4000e-003	0.0000	15.2948
Maximum	**0.0862**	**0.9889**	**0.3907**	**7.4000e-004**	**8.7300e-003**	**0.0468**	**0.0555**	**1.2900e-003**	**0.0433**	**0.0446**	**0.0000**	**69.3563**	**69.3563**	**0.0179**	**0.0000**	**69.8025**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.0352	0.3801	0.3695	7.4000e-004	8.7300e-003	0.0161	0.0248	1.2900e-003	0.0149	0.0162	0.0000	69.3562	69.3562	0.0179	0.0000	69.8024
2016	2.3600e-003	0.0254	0.0875	1.7000e-004	1.1300e-003	3.0000e-004	1.4200e-003	3.0000e-004	2.9000e-004	6.0000e-004	0.0000	15.2597	15.2597	1.4000e-003	0.0000	15.2947
Maximum	**0.0352**	**0.3801**	**0.3695**	**7.4000e-004**	**8.7300e-003**	**0.0161**	**0.0248**	**1.2900e-003**	**0.0149**	**0.0162**	**0.0000**	**69.3562**	**69.3562**	**0.0179**	**0.0000**	**69.8024**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**62.65**	**63.37**	**3.65**	**0.00**	**0.00**	**69.70**	**58.96**	**0.00**	**69.98**	**67.85**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**3-2-2015**	**6-1-2015**	0.2038	0.0652
2	**6-2-2015**	**9-1-2015**	0.8750	0.3492
6	**6-2-2016**	**9-1-2016**	0.1131	0.0235
7	**9-2-2016**	**9-30-2016**	0.0189	0.0039
		Highest	0.8750	0.3492

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0266	0.0000	6.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1000e-004	1.1000e-004	0.0000	0.0000	1.1000e-004
Energy	8.5000e-004	7.7600e-003	6.5200e-003	5.0000e-005		5.9000e-004	5.9000e-004		5.9000e-004	5.9000e-004	0.0000	22.8640	22.8640	8.1000e-004	2.9000e-004	22.9707
Mobile	4.3300e-003	0.0229	0.0499	1.4000e-004	9.8300e-003	1.9000e-004	0.0100	2.6400e-003	1.8000e-004	2.8200e-003	0.0000	12.8847	12.8847	6.6000e-004	0.0000	12.9012
Waste						0.0000	0.0000		0.0000	0.0000	1.5103	0.0000	1.5103	0.0893	0.0000	3.7416
Water						0.0000	0.0000		0.0000	0.0000	0.4402	2.1841	2.6243	0.0453	1.0900e-003	4.0813
Total	**0.0318**	**0.0307**	**0.0565**	**1.9000e-004**	**9.8300e-003**	**7.8000e-004**	**0.0106**	**2.6400e-003**	**7.7000e-004**	**3.4100e-003**	**1.9504**	**37.9329**	**39.8833**	**0.1360**	**1.3800e-003**	**43.6949**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0266	0.0000	6.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1000e-004	1.1000e-004	0.0000	0.0000	1.1000e-004
Energy	8.5000e-004	7.7600e-003	6.5200e-003	5.0000e-005		5.9000e-004	5.9000e-004		5.9000e-004	5.9000e-004	0.0000	22.8640	22.8640	8.1000e-004	2.9000e-004	22.9707
Mobile	4.3300e-003	0.0229	0.0499	1.4000e-004	9.8300e-003	1.9000e-004	0.0100	2.6400e-003	1.8000e-004	2.8200e-003	0.0000	12.8847	12.8847	6.6000e-004	0.0000	12.9012
Waste						0.0000	0.0000		0.0000	0.0000	1.5103	0.0000	1.5103	0.0893	0.0000	3.7416
Water						0.0000	0.0000		0.0000	0.0000	0.4402	2.1841	2.6243	0.0453	1.0900e-003	4.0813
Total	**0.0318**	**0.0307**	**0.0565**	**1.9000e-004**	**9.8300e-003**	**7.8000e-004**	**0.0106**	**2.6400e-003**	**7.7000e-004**	**3.4100e-003**	**1.9504**	**37.9329**	**39.8833**	**0.1360**	**1.3800e-003**	**43.6949**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

VMT Phase 1 Construction - Solano-San Francisco County, Annual

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	3/2/2015	3/6/2015	5	5	
2	Dredging	Grading	4/11/2015	4/16/2015	5	4	
3	Building Construction	Building Construction	5/23/2015	8/18/2015	5	62	
4	Concrete Placement	Paving	7/16/2016	9/9/2016	5	40	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

VMT Phase 1 Construction - Solano-San Francisco County, Annual

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Building Construction	Cranes	1	8.00	226	0.29
Building Construction	Cranes	1	0.30	226	0.29
Building Construction	Forklifts	1	8.00	89	0.20
Building Construction	Generator Sets	0	8.00	84	0.74
Building Construction	Other Construction Equipment	1	8.00	750	0.31
Building Construction	Tractors/Loaders/Backhoes	0	7.00	97	0.37
Building Construction	Welders	0	8.00	46	0.45
Concrete Placement	Pavers	0	8.00	125	0.42
Concrete Placement	Paving Equipment	0	8.00	130	0.36
Concrete Placement	Pumps	1	8.00	84	0.74
Concrete Placement	Rollers	0	8.00	80	0.38
Demolition	Concrete/Industrial Saws	0	8.00	81	0.73
Demolition	Excavators	2	8.00	162	0.38
Demolition	Rubber Tired Dozers	0	8.00	255	0.40
Dredging	Cranes	1	24.00	850	0.29
Dredging	Excavators	0	8.00	162	0.38
Dredging	Generator Sets	1	24.00	150	0.74
Dredging	Graders	0	8.00	174	0.41
Dredging	Rubber Tired Dozers	0	8.00	255	0.40
Dredging	Scrapers	0	8.00	361	0.48
Dredging	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Building Construction	Cranes	2	8.00	226	0.29

Trips and VMT

VMT Phase 1 Construction - Solano-San Francisco County, Annual

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Building Construction	6	3.00	1.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Concrete Placement	1	3.00	0.00	186.00	12.40	7.30	7.30	LD_Mix	HDT_Mix	HHDT
Demolition	2	5.00	0.00	99.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Dredging	2	5.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.0800e-003	0.0243	0.0172	3.0000e-005		1.2000e-003	1.2000e-003		1.1000e-003	1.1000e-003	0.0000	2.5200	2.5200	7.5000e-004	0.0000	2.5388
Total	**2.0800e-003**	**0.0243**	**0.0172**	**3.0000e-005**		**1.2000e-003**	**1.2000e-003**		**1.1000e-003**	**1.1000e-003**	**0.0000**	**2.5200**	**2.5200**	**7.5000e-004**	**0.0000**	**2.5388**

3.2 Demolition - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.7000e-004	0.0200	3.8200e-003	4.0000e-005	8.4000e-004	1.9000e-004	1.0300e-003	2.3000e-004	1.8000e-004	4.2000e-004	0.0000	3.9453	3.9453	1.9000e-004	0.0000	3.9500
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.0000e-005	7.0000e-005	6.7000e-004	0.0000	1.1000e-004	0.0000	1.1000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1179	0.1179	0.0000	0.0000	0.1181
Total	**8.6000e-004**	**0.0201**	**4.4900e-003**	**4.0000e-005**	**9.5000e-004**	**1.9000e-004**	**1.1400e-003**	**2.6000e-004**	**1.8000e-004**	**4.5000e-004**	**0.0000**	**4.0632**	**4.0632**	**1.9000e-004**	**0.0000**	**4.0681**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.3000e-004	1.4100e-003	0.0201	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5200	2.5200	7.5000e-004	0.0000	2.5388
Total	**3.3000e-004**	**1.4100e-003**	**0.0201**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5200**	**2.5200**	**7.5000e-004**	**0.0000**	**2.5388**

3.2 Demolition - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.7000e-004	0.0200	3.8200e-003	4.0000e-005	8.4000e-004	1.9000e-004	1.0300e-003	2.3000e-004	1.8000e-004	4.2000e-004	0.0000	3.9453	3.9453	1.9000e-004	0.0000	3.9500
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.0000e-005	7.0000e-005	6.7000e-004	0.0000	1.1000e-004	0.0000	1.1000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1179	0.1179	0.0000	0.0000	0.1181
Total	**8.6000e-004**	**0.0201**	**4.4900e-003**	**4.0000e-005**	**9.5000e-004**	**1.9000e-004**	**1.1400e-003**	**2.6000e-004**	**1.8000e-004**	**4.5000e-004**	**0.0000**	**4.0632**	**4.0632**	**1.9000e-004**	**0.0000**	**4.0681**

3.3 Dredging - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.6300e-003	0.0000	6.6300e-003	7.2000e-004	0.0000	7.2000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.1700e-003	0.0486	0.0345	7.0000e-005		2.2400e-003	2.2400e-003		2.2400e-003	2.2400e-003	0.0000	6.0558	6.0558	4.2000e-004	0.0000	6.0662
Total	**5.1700e-003**	**0.0486**	**0.0345**	**7.0000e-005**	**6.6300e-003**	**2.2400e-003**	**8.8700e-003**	**7.2000e-004**	**2.2400e-003**	**2.9600e-003**	**0.0000**	**6.0558**	**6.0558**	**4.2000e-004**	**0.0000**	**6.0662**

3.3 Dredging - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.0000e-005	6.0000e-005	5.4000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0944	0.0944	0.0000	0.0000	0.0945
Total	**7.0000e-005**	**6.0000e-005**	**5.4000e-004**	**0.0000**	**9.0000e-005**	**0.0000**	**9.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0944**	**0.0944**	**0.0000**	**0.0000**	**0.0945**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.6300e-003	0.0000	6.6300e-003	7.2000e-004	0.0000	7.2000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	7.0000e-004	3.0500e-003	0.0435	7.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	6.0558	6.0558	4.2000e-004	0.0000	6.0662
Total	**7.0000e-004**	**3.0500e-003**	**0.0435**	**7.0000e-005**	**6.6300e-003**	**9.0000e-005**	**6.7200e-003**	**7.2000e-004**	**9.0000e-005**	**8.1000e-004**	**0.0000**	**6.0558**	**6.0558**	**4.2000e-004**	**0.0000**	**6.0662**

3.3 Dredging - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.0000e-005	6.0000e-005	5.4000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0944	0.0944	0.0000	0.0000	0.0945
Total	**7.0000e-005**	**6.0000e-005**	**5.4000e-004**	**0.0000**	**9.0000e-005**	**0.0000**	**9.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0944**	**0.0944**	**0.0000**	**0.0000**	**0.0945**

3.4 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0771	0.8902	0.3271	5.8000e-004		0.0431	0.0431		0.0397	0.0397	0.0000	54.8921	54.8921	0.0164	0.0000	55.3018
Total	**0.0771**	**0.8902**	**0.3271**	**5.8000e-004**		**0.0431**	**0.0431**		**0.0397**	**0.0397**	**0.0000**	**54.8921**	**54.8921**	**0.0164**	**0.0000**	**55.3018**

3.4 Building Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.9000e-004	5.1200e-003	1.8200e-003	1.0000e-005	2.0000e-004	7.0000e-005	2.7000e-004	6.0000e-005	6.0000e-005	1.2000e-004	0.0000	0.8533	0.8533	6.0000e-005	0.0000	0.8548
Worker	6.5000e-004	5.3000e-004	5.0100e-003	1.0000e-005	8.5000e-004	1.0000e-005	8.5000e-004	2.3000e-004	1.0000e-005	2.3000e-004	0.0000	0.8775	0.8775	4.0000e-005	0.0000	0.8784
Total	**9.4000e-004**	**5.6500e-003**	**6.8300e-003**	**2.0000e-005**	**1.0500e-003**	**8.0000e-005**	**1.1200e-003**	**2.9000e-004**	**7.0000e-005**	**3.5000e-004**	**0.0000**	**1.7308**	**1.7308**	**1.0000e-004**	**0.0000**	**1.7332**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0323	0.3498	0.2941	5.8000e-004		0.0157	0.0157		0.0145	0.0145	0.0000	54.8921	54.8921	0.0164	0.0000	55.3018
Total	**0.0323**	**0.3498**	**0.2941**	**5.8000e-004**		**0.0157**	**0.0157**		**0.0145**	**0.0145**	**0.0000**	**54.8921**	**54.8921**	**0.0164**	**0.0000**	**55.3018**

3.4 Building Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.9000e-004	5.1200e-003	1.8200e-003	1.0000e-005	2.0000e-004	7.0000e-005	2.7000e-004	6.0000e-005	6.0000e-005	1.2000e-004	0.0000	0.8533	0.8533	6.0000e-005	0.0000	0.8548
Worker	6.5000e-004	5.3000e-004	5.0100e-003	1.0000e-005	8.5000e-004	1.0000e-005	8.5000e-004	2.3000e-004	1.0000e-005	2.3000e-004	0.0000	0.8775	0.8775	4.0000e-005	0.0000	0.8784
Total	**9.4000e-004**	**5.6500e-003**	**6.8300e-003**	**2.0000e-005**	**1.0500e-003**	**8.0000e-005**	**1.1200e-003**	**2.9000e-004**	**7.0000e-005**	**3.5000e-004**	**0.0000**	**1.7308**	**1.7308**	**1.0000e-004**	**0.0000**	**1.7332**

3.5 Concrete Placement - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0134	0.0982	0.0773	1.3000e-004		7.1300e-003	7.1300e-003		7.1300e-003	7.1300e-003	0.0000	11.3042	11.3042	1.0900e-003	0.0000	11.3315
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0134**	**0.0982**	**0.0773**	**1.3000e-004**		**7.1300e-003**	**7.1300e-003**		**7.1300e-003**	**7.1300e-003**	**0.0000**	**11.3042**	**11.3042**	**1.0900e-003**	**0.0000**	**11.3315**

3.5 Concrete Placement - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	6.7000e-004	0.0194	3.5500e-003	4.0000e-005	5.8000e-004	1.2000e-004	7.0000e-004	1.6000e-004	1.1000e-004	2.7000e-004	0.0000	3.3980	3.3980	2.9000e-004	0.0000	3.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8000e-004	3.0000e-004	2.8500e-003	1.0000e-005	5.5000e-004	0.0000	5.5000e-004	1.5000e-004	0.0000	1.5000e-004	0.0000	0.5576	0.5576	2.0000e-005	0.0000	0.5581
Total	**1.0500e-003**	**0.0197**	**6.4000e-003**	**5.0000e-005**	**1.1300e-003**	**1.2000e-004**	**1.2500e-003**	**3.1000e-004**	**1.1000e-004**	**4.2000e-004**	**0.0000**	**3.9556**	**3.9556**	**3.1000e-004**	**0.0000**	**3.9633**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.3200e-003	5.7000e-003	0.0811	1.3000e-004		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	11.3041	11.3041	1.0900e-003	0.0000	11.3315
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**1.3200e-003**	**5.7000e-003**	**0.0811**	**1.3000e-004**		**1.8000e-004**	**1.8000e-004**		**1.8000e-004**	**1.8000e-004**	**0.0000**	**11.3041**	**11.3041**	**1.0900e-003**	**0.0000**	**11.3315**

3.5 Concrete Placement - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	6.7000e-004	0.0194	3.5500e-003	4.0000e-005	5.8000e-004	1.2000e-004	7.0000e-004	1.6000e-004	1.1000e-004	2.7000e-004	0.0000	3.3980	3.3980	2.9000e-004	0.0000	3.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8000e-004	3.0000e-004	2.8500e-003	1.0000e-005	5.5000e-004	0.0000	5.5000e-004	1.5000e-004	0.0000	1.5000e-004	0.0000	0.5576	0.5576	2.0000e-005	0.0000	0.5581
Total	**1.0500e-003**	**0.0197**	**6.4000e-003**	**5.0000e-005**	**1.1300e-003**	**1.2000e-004**	**1.2500e-003**	**3.1000e-004**	**1.1000e-004**	**4.2000e-004**	**0.0000**	**3.9556**	**3.9556**	**3.1000e-004**	**0.0000**	**3.9633**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	4.3300e-003	0.0229	0.0499	1.4000e-004	9.8300e-003	1.9000e-004	0.0100	2.6400e-003	1.8000e-004	2.8200e-003	0.0000	12.8847	12.8847	6.6000e-004	0.0000	12.9012
Unmitigated	4.3300e-003	0.0229	0.0499	1.4000e-004	9.8300e-003	1.9000e-004	0.0100	2.6400e-003	1.8000e-004	2.8200e-003	0.0000	12.8847	12.8847	6.6000e-004	0.0000	12.9012

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	9.00	9.00	9.00	26,276	26,276
Total	9.00	9.00	9.00	26,276	26,276

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Heavy Industry	9.50	7.30	7.30	59.00	28.00	13.00	92	5	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
General Heavy Industry	0.559351	0.041573	0.176231	0.127384	0.024860	0.006030	0.009897	0.039567	0.003119	0.002638	0.007391	0.000604	0.001355

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	14.4176	14.4176	6.5000e-004	1.3000e-004	14.4741
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	14.4176	14.4176	6.5000e-004	1.3000e-004	14.4741
NaturalGas Mitigated	8.5000e-004	7.7600e-003	6.5200e-003	5.0000e-005		5.9000e-004	5.9000e-004		5.9000e-004	5.9000e-004	0.0000	8.4464	8.4464	1.6000e-004	1.5000e-004	8.4966
NaturalGas Unmitigated	8.5000e-004	7.7600e-003	6.5200e-003	5.0000e-005		5.9000e-004	5.9000e-004		5.9000e-004	5.9000e-004	0.0000	8.4464	8.4464	1.6000e-004	1.5000e-004	8.4966

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Heavy Industry	158280	8.5000e-004	7.7600e-003	6.5200e-003	5.0000e-005		5.9000e-004	5.9000e-004		5.9000e-004	5.9000e-004	0.0000	8.4464	8.4464	1.6000e-004	1.5000e-004	8.4966
Total		**8.5000e-004**	**7.7600e-003**	**6.5200e-003**	**5.0000e-005**		**5.9000e-004**	**5.9000e-004**		**5.9000e-004**	**5.9000e-004**	**0.0000**	**8.4464**	**8.4464**	**1.6000e-004**	**1.5000e-004**	**8.4966**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Heavy Industry	158280	8.5000e-004	7.7600e-003	6.5200e-003	5.0000e-005		5.9000e-004	5.9000e-004		5.9000e-004	5.9000e-004	0.0000	8.4464	8.4464	1.6000e-004	1.5000e-004	8.4966
Total		**8.5000e-004**	**7.7600e-003**	**6.5200e-003**	**5.0000e-005**		**5.9000e-004**	**5.9000e-004**		**5.9000e-004**	**5.9000e-004**	**0.0000**	**8.4464**	**8.4464**	**1.6000e-004**	**1.5000e-004**	**8.4966**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Heavy Industry	49560	14.4176	6.5000e-004	1.3000e-004	14.4741
Total		**14.4176**	**6.5000e-004**	**1.3000e-004**	**14.4741**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Heavy Industry	49560	14.4176	6.5000e-004	1.3000e-004	14.4741
Total		**14.4176**	**6.5000e-004**	**1.3000e-004**	**14.4741**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0266	0.0000	6.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1000e-004	1.1000e-004	0.0000	0.0000	1.1000e-004
Unmitigated	0.0266	0.0000	6.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1000e-004	1.1000e-004	0.0000	0.0000	1.1000e-004

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	3.1300e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0234					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.0000e-005	0.0000	6.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1000e-004	1.1000e-004	0.0000	0.0000	1.1000e-004
Total	**0.0266**	**0.0000**	**6.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0000**	**1.1000e-004**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	3.1300e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0234					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.0000e-005	0.0000	6.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1000e-004	1.1000e-004	0.0000	0.0000	1.1000e-004
Total	**0.0266**	**0.0000**	**6.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0000**	**1.1000e-004**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	2.6243	0.0453	1.0900e-003	4.0813
Unmitigated	2.6243	0.0453	1.0900e-003	4.0813

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Heavy Industry	1.3875 / 0	2.6243	0.0453	1.0900e-003	4.0813
Total		**2.6243**	**0.0453**	**1.0900e-003**	**4.0813**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Heavy Industry	1.3875 / 0	2.6243	0.0453	1.0900e-003	4.0813
Total		**2.6243**	**0.0453**	**1.0900e-003**	**4.0813**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	1.5103	0.0893	0.0000	3.7416
Unmitigated	1.5103	0.0893	0.0000	3.7416

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Heavy Industry	7.44	1.5103	0.0893	0.0000	3.7416
Total		**1.5103**	**0.0893**	**0.0000**	**3.7416**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Heavy Industry	7.44	1.5103	0.0893	0.0000	3.7416
Total		**1.5103**	**0.0893**	**0.0000**	**3.7416**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

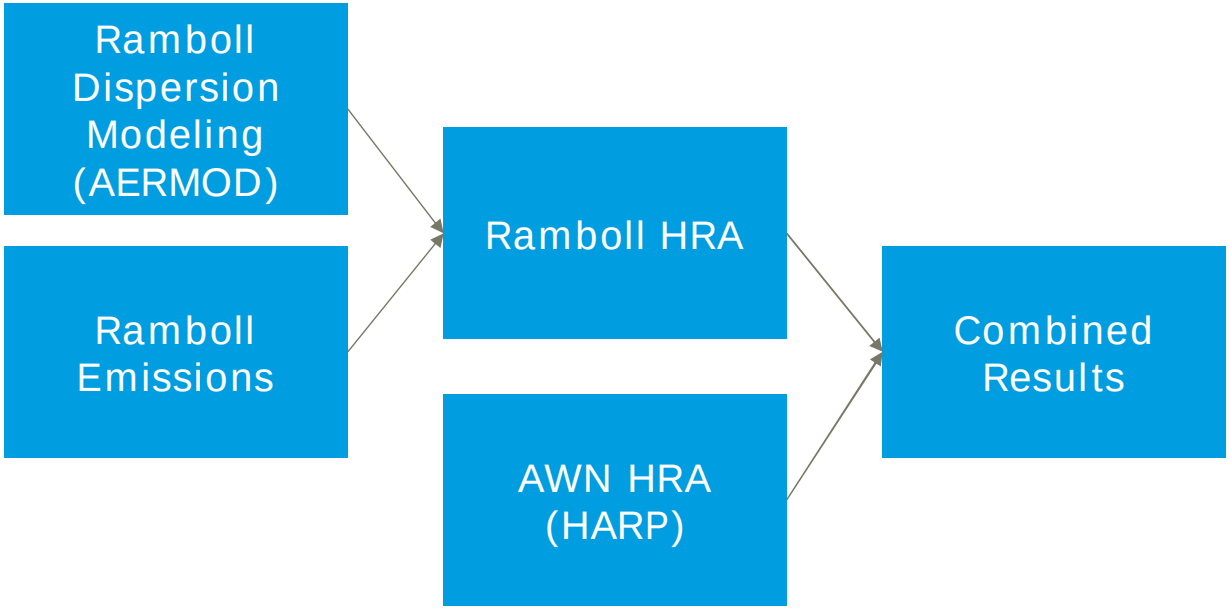
11.0 Vegetation

ATTACHMENT 7
OPERATIONAL HRA

ORCEM-VMT
HRA REVIEW AND EXAMPLE CALCULATIONS

RAMBOLL

PROCESS OVERVIEW



SOURCES INCLUDED IN HRA

- Sources re-modelled by Ramboll
  - Ocean-going vessels
    - Includes ship transiting, manoeuvring, and hoteling
    - Includes tug boats
    - Includes DPM and speciated boiler emissions
  - Trucks
  - Rail
  - Offroad equipment
- Results preserved from AWN
  - Material handling
  - Ship transiting (originally believed to be non-diesel transportation)

CALCULATION OVERVIEW

- $Cancer\ Risk = \sum Concentration \times Cancer\ Potency\ Factor \times \sum Inhalation\ Factor \times 1000$
  - Inhalation factor
    - Varies by age and receptor type
    - Includes age sensitivity factor, breathing rate, and exposure time
    - Parameter values changed with 2015 OEHHA Guidance, use BAAQMD-approved factor of 1.3744
  - Cancer potency factor
    - Chemical-specific
    - Inhalation only for diesel PM, multi-pathway scaling factors included for ship boiler emissions
  - Concentration
    - Calculated for each source-chemical-receptor combination
    - Product of emission rate by source and dispersion factor from modelling

DPM EMISSIONS MITIGATIONS

Mitigation Method	Sources Affected	Calculation Method
Number of Orcem ship calls*	Conveyors, Orcem FELs, Ship emissions (tugs, hotelling, etc), hoppers	Scaled linearly by fraction of max 19 ships/year
Number of VMT ship calls*	VMT FELs, forklifts, ship emissions	Scaled linearly by fraction of max 29 ships/year
Biodiesel*	Orcem and VMT FELs, conveyors, hoppers	Linear interpolation from B20 reduction of 18% to B100 reduction of 60%
CNG FELs	Orcem and VMT FELs	100% reduction, assume CNG TACs are de minimis
Electrification	Conveyors, forklifts	100% reduction
Ship hoods	Ship hotelling auxiliary engines	76%-86% reduction as stated

*Ship call scaling is included in the pre-mitigation emissions. B20 usage already included in “Base Case” emissions, so an additional reduction factor is only included for B100 mitigation scenarios

EXAMPLE HRA CALCULATIONS

- Base emissions case: Orcem Mode 2 Milestone 5, VMT at 29 ships and 100% rail
- Mitigation case: Orcem and VMT CNG FELs, electrified conveyors and forklifts
  - 34 annual average ships
  - Shipping emissions (transiting, maneuvering, tugs, hoteling, boilers) reduced by (1-36/48) = 25%
  - Front-end loaders, conveyors, and forklift DPM emissions reduced by 100%

EXAMPLE MODEL EMISSION RATES FOR HRA

Source Group	DPM Emissions (tons/year)	Number of AERMOD Sources	Scaling Factor	Model Emissions (g/s/source)	Notes
CONVY	6.97E-03	1	0.111111111	2.23E-05	Single-equipment emission rate for all conveyor and hopper sources
FL_PH1	4.59E-03	1	1	1.32E-04	
FEL1F	1.26E-02	28	1	1.30E-05	Combination of Orcem FEL and excavator, 28 sources includes groups FLS2F and FLS3F
FEL2F	1.26E-02	28	1	1.30E-05	
FEL3F	1.26E-02	28	1	1.30E-05	
FORK	1.35E-04	1	1	3.89E-06	
LEFUG	3.11E-04	51	0.56	9.84E-08	0.82 km, 20 mph, 56% of total trucks
LMFUG	2.73E-04	51	1	1.54E-07	.72 km, 20 mph
MANV	1.77E-02	26	1	1.96E-05	
MOB_HOP	6.97E-03	1	0.111111111	2.23E-05	Single-equipment emission rate for all conveyor and hopper sources
NRAIL5LN	1.72E-03	24	0.338842975	6.97E-07	Split on-site line-haul by time/distance in each speed (10 kph and 15 kph)
NRAILLN	1.72E-03	41	0.661157025	7.96E-07	Split on-site line-haul by time/distance in each speed (10 kph and 15 kph)
NRAILST	2.51E-04	75	1	9.61E-08	
NTUG	1.71E-02	26	0.5	9.48E-06	Split total tug emissions between two tugs per ship call
NTUGB	1.71E-02	26	0.5	9.48E-06	Split total tug emissions between two tugs per ship call
ONFUG		83	1	1.69E-07	Sum of ORFUG and VMTFUG
ORFUG	4.72E-04	83	1	1.64E-07	.755 km, 10 mph
RAIL15LN	1.72E-03	24	0.338842975	6.97E-07	Split on-site line-haul by time/distance in each speed (10 kph and 15 kph)
RAILID	2.61E-04	3	1	2.50E-06	
RAILLN	1.72E-03	41	0.661157025	7.96E-07	Split on-site line-haul by time/distance in each speed (10 kph and 15 kph)
RAILST	2.51E-04	75	1	9.61E-08	
SHPHTAX	1.86E-01	2	1	2.67E-03	
SMFUG	4.62E-04	29	0.39	1.79E-07	.698 km, 40 mph, 39% of total trucks
SNFUG	3.48E-04	22	0.05	2.27E-08	.525 km, 40 mph, 5% of total trucks
SSFUG	4.87E-04	31	0.39	1.76E-07	.735 km, 40 mph, 39% or total trucks
TRANS34	3.73E-03	34	1	3.16E-06	
TRANS99	1.71E-01	65	0.0549879	4.16E-06	Scale to modeled segment length of 3,250 meters
TUG	1.71E-02	26	0.5	9.48E-06	Split total tug emissions between two tugs per ship call
TUGB	1.71E-02	26	0.5	9.48E-06	Split total tug emissions between two tugs per ship call
VMTFUG	1.46E-05	80	1	5.27E-09	.728 km, 10 mph

Notes:
1. Model Emissions calculated as [DPM Emissions]/[Number of AERMOD Sources]*[Scaling Factor]
2. DPM Emissions scaled by Orcem and VMT throughput, as shown in Summary Report Table 3. VMT onroad truck emissions only included for scenarios with 12 or fewer VMT ships.
3. See the following table for onroad truck emission calculation details.

MAXIMUM ONROAD EMISSIONS FOR HRA MODELING

			LEFUG	LMFUG	ORFUG	VMTFUG	SMFUG	SNFUG	SSFUG
		Distance (mi)	0.51	0.45	0.23	0.23	0.43	0.33	0.46
		PM10 EF (g/mi)	0.0068	0.0068	0.0124	0.0124	0.0119	0.0119	0.0119
Facility	Case	Max Annual One-Way Trips	Emissions (tons/year)						
Orcem	Mode 2	78,932	3.02E-04	2.65E-04	4.72E-04	0E+00	4.48E-04	3.37E-04	4.72E-04
Orcem	Mode 3	49,152	1.88E-04	1.65E-04	2.94E-04	0E+00	2.79E-04	2.10E-04	2.94E-04
VMT	All	48,000	1.84E-04	1.61E-04	0E+00	2.82E-04	2.73E-04	2.05E-04	2.87E-04
VMT	Delivery	2,496	9.55E-06	8.38E-06	0E+00	1.46E-05	1.42E-05	1.07E-05	1.49E-05

Notes:

1. Distances and speeds consistent with DEIR. Onsite source groups include idling emissions for each one-way trip, using the same idling emission factor as the ROA truck emissions in Attachment 3.
2. Emission factors taken from EMFAC2017 for diesel HHDT trucks in Solano county, operational year 2025.

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: SOLANO
Calendar Year: 2025, 2050
Season: Annual
Vehicle Classification: EMFAC2007 Categories
Units: miles/day for VMT, g/mile for RUNEX, PMBW and PMTW

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	VMT	PM10_RUNEX
SOLANO	2025	HHDT	Aggregated	10	DSL	19907.7	0.01243
SOLANO	2025	HHDT	Aggregated	20	DSL	22873.4	0.00681
SOLANO	2025	HHDT	Aggregated	40	DSL	21826.7	0.01188

Idle EF (g/trip): 0.002511428 (see Attachment 3)

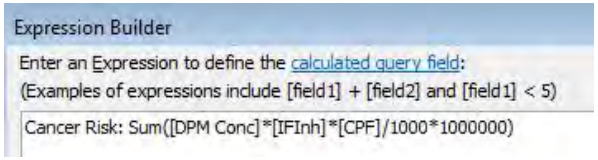
EXAMPLE HRA CALCULATIONS

RID	Receptor Typ	Population	UTM_X	UTM_Y	SrcGrp	Disp_Fact	DPM Emissions	Reduction
R0577	Resident Child	Resident	566447.89	4214958.32	RAILID	0.57939	2.50411174269821E-06	0
R0577	Resident Child	Resident	566447.89	4214958.32	SHPHTAX	3.49171	2.6688851088593E-03	0
R0577	Resident Child	Resident	566447.89	4214958.32	MOB_HOP	10.0624	2.226273296956E-05	1
R0577	Resident Child	Resident	566447.89	4214958.32	CONVY	44.20397	2.226273296956E-05	1
R0577	Resident Child	Resident	566447.89	4214958.32	ONFUG	140.35082	1.68928077449208E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	ORFUG	123.91778	1.63661845584541E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	LMFUG	13.13445	1.54249705480264E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	SNFUG	3.25927	2.27394373415537E-08	0
R0577	Resident Child	Resident	566447.89	4214958.32	SSFUG	13.8224	1.76223304094673E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	SMFUG	26.5937	1.78893729955455E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	LEFUG	5.21309	9.83770343840797E-08	0
R0577	Resident Child	Resident	566447.89	4214958.32	VMTFUG	84.06396	5.26623186466697E-09	0
R0577	Resident Child	Resident	566447.89	4214958.32	FORK	4.24881	3.89135460635537E-06	1
R0577	Resident Child	Resident	566447.89	4214958.32	TUG	14.48238	9.48259772086422E-06	0
R0577	Resident Child	Resident	566447.89	4214958.32	RAILST	35.81386	9.61006481122104E-08	0
R0577	Resident Child	Resident	566447.89	4214958.32	RAILLN	8.88874	7.96292561081922E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	RAIL15LN	1.11943	6.97170726655579E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	TUGB	14.8465	9.48259772086422E-06	0
R0577	Resident Child	Resident	566447.89	4214958.32	NRAILST	8.58364	9.61006481122104E-08	0
R0577	Resident Child	Resident	566447.89	4214958.32	NRAILLN	2.83607	7.96292561081922E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	NRAIL5LN	0.8218	6.97170726655579E-07	0
R0577	Resident Child	Resident	566447.89	4214958.32	NTUG	21.64972	9.48259772086422E-06	0
R0577	Resident Child	Resident	566447.89	4214958.32	NTUGB	21.89058	9.48259772086422E-06	0
R0577	Resident Child	Resident	566447.89	4214958.32	TRANS34	21.25764	3.15655805421951E-06	0
R0577	Resident Child	Resident	566447.89	4214958.32	TRANS99	18.79072	4.16198844940019E-06	0
R0577	Resident Child	Resident	566447.89	4214958.32	MANV	60.34639	1.95980047182993E-05	0
R0577	Resident Child	Resident	566447.89	4214958.32	FL_PH1	4.19147	1.32093958678374E-04	1
R0577	Resident Child	Resident	566447.89	4214958.32	FEL1F	102.04078	1.29692653836551E-05	1
R0577	Resident Child	Resident	566447.89	4214958.32	FEL2F	184.41354	1.29692653836551E-05	1
R0577	Resident Child	Resident	566447.89	4214958.32	FEL3F	29.98275	1.29692653836551E-05	1

$$DPM\ Conc = \sum Disp_{Fact} \times DPMEmissions \times (1 - Reduction)$$

UTM_X	UTM_Y	DPM Conc
566447.89	4214958.32	1.14085844770887E-02

EXAMPLE HRA CALCULATIONS



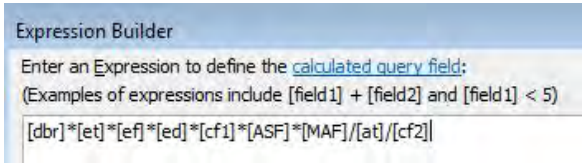
$$Cancer\ Risk = \sum Concentration \times Cancer\ Potency\ Factor \times \sum Inhalation\ Factor \times 1000$$

DPM
6.17810794289557

DPM Conc
1.140858447708887E-02

Chemical	CAS	CPF
Diesel PM	9901	1.10E+00

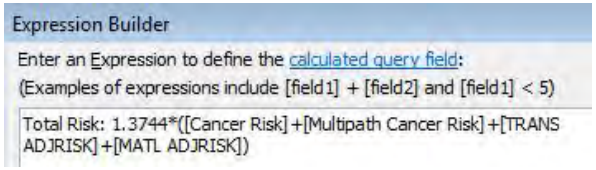
ReceptorType	IFInh
Resident Child	0.492301369863014



$$Inhalation\ Factor = Breathing\ Rate \times Exposure \times Age\ Sensitivity\ Factor / (70 - Year\ Averaging\ Time)$$

ReceptorType	IFInh	DBR	ET	EF	ED	CF1	CF2	ASF	MAF	AT
Resident Child	0.492301369863014	302	24	350	70	0.001	24	1.7	1	25550

EXAMPLE HRA CALCULATIONS



$$Total\ Risk = (DPM + Ship\ Boilers + AWN\ HARP\ Risks) \times OEHHA\ Scaling\ Factor$$

Total Risk	DPM	SHPBLR ADJRISK	TRANS ADJRI	MATL ADJRIS
8.78091808631405	6.17810794289557	6.50951897543537E-02	0.129948	0.015759

1.3744

Note: The OEHHA Scaling Factor is specifically for changes in the inhalation pathway calculations. Because multipathway risks for ship boilers were originally calculated by Ramboll as scaled from inhalation, this factor was conservatively applied to all cancer risks.

MITIGATION SUMMARY BY CASE

Mitigation Measure Scenario:	Base Case		100% Biodiesel in conveyors and hoppers, 20% Biodiesel in all other on-site equipment		20% Biodiesel in all equipment, with Orcem natural gas-fueled (CNG) front end loaders (FELs)		20% Biodiesel in all equipment, with Orcem and VMT CNG FELs		100% Biodiesel in conveyors and hoppers, 20% Biodiesel in forklifts and VMT FEL, Orcem CNG FELs		Orcem and VMT CNG FELs, electrified conveyors and forklifts		Orcem and VMT CNG FELs, Electrified conveyors and forklifts, 76% Hoteling reduction		Orcem and VMT CNG FELs, Electrified conveyors and forklifts, 86% Hoteling reduction	
Scenario Summary Parameter	Value		Value		Value		Value		Value		Value		Value		Value	
Maximum Residential Cancer Risk (In Millions):	18.25	8.96	16.85	8.78	13.62	8.86	12.83	8.81	13.16	8.90	11.90	8.78	4.46	4.46	4.18	4.18
MEI Receptor ID	R0234	R0234	R0589	R0234	R0577	R0577	R0577	R0577	R0577	R0577	R0577	R0577	R0577	R0577	R2415	R2415
Maximum Number of Ship Calls for Less than Significant Impact:	48	14	48	6	48	29	48	30	48	31	48	34	48	48	48	48
Mitigation Measures Factors	Value		Value		Value		Value		Value		Value		Value		Value	
Biodeisel Percent (FELs)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Biodiesel Reduction (FELs)	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biodeisel Percent (conveyors+hoppers)	0.2	0.2	1	1	0.2	0.2	0.2	0.2	1	1	0.2	0.2	0.2	0.2	0.2	0.2
Biodiesel Reduction (conveyors+hoppers)	0%	0	0.5122	0.5122	0	0	0	0	0.5122	0.5122	0	0	0	0	0	0
VMT Hours Reduction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orcem Ships	19	14	19	16	19	19	19	19	19	19	19	19	19	19	19	19
VMT Ships	29	0	29	0	29	10	29	11	29	12	29	15	29	29	29	29
CNG FELs (Orcem)	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CNG FELs (VMT)	No	No	No	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Electric conveyors	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Electric forklift	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Ship Hoteling Reduction	0	0	0	0	0	0	0	0	0	0	0	0	0.76	0.76	0.86	0.86
SrcGrp	Reduction		Reduction		Reduction		Reduction		Reduction		Reduction		Reduction		Reduction	
CONVY	0	0	0.5122	0.5122	0	0	0	0	0.5122	0.5122	1	1	1	1	1	1
FEL1F	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
FEL2F	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
FEL3F	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
FL_PH1	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1
FORK	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
MOB_HOP	0	0	0.5122	0.5122	0	0	0	0	0.5122	0.5122	1	1	1	1	1	1
SHPHTAX	0	0	0	0	0	0	0	0	0	0	0	0	0.76	0.76	0.86	0.86

Yellow highlighting indicates changes from the Base Case.

B100 is assumed to reduce DPM emissions by 60%, consistent with the DEIR. The 0.5122 scaling factor is calculated to account for the 18% reduction already included in the Base Case for B20: 1-(1-0.6)/0.82

MODEL EMISSION RATES BY CASE

Source Group	Ship Calls per Year						
	19 Orcem, 29 VMT	14 Orcem, 0 VMT	16 Orcem, 0 VMT	19 Orcem, 10 VMT	19 Orcem, 11 VMT	19 Orcem, 12 VMT	19 Orcem, 15 VMT
CONVY	2.23E-05	1.64E-05	1.87E-05	2.23E-05	2.23E-05	2.23E-05	2.23E-05
FL_PH1	2.55E-04	0.00E+00	0.00E+00	8.81E-05	9.69E-05	1.06E-04	1.32E-04
FEL1F	1.30E-05	9.56E-06	1.09E-05	1.30E-05	1.30E-05	1.30E-05	1.30E-05
FEL2F	1.30E-05	9.56E-06	1.09E-05	1.30E-05	1.30E-05	1.30E-05	1.30E-05
FEL3F	1.30E-05	9.56E-06	1.09E-05	1.30E-05	1.30E-05	1.30E-05	1.30E-05
FORK	7.52E-06	0.00E+00	0.00E+00	2.59E-06	2.85E-06	3.11E-06	3.89E-06
LEFUG	9.84E-08	7.33E-08	8.33E-08	1.47E-07	1.52E-07	1.56E-07	9.84E-08
LMFUG	1.54E-07	1.15E-07	1.31E-07	2.30E-07	2.38E-07	2.45E-07	1.54E-07
MANV	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05
MOB_HOP	2.23E-05	1.64E-05	1.87E-05	2.23E-05	2.23E-05	2.23E-05	2.23E-05
NRAILSLN	1.35E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E-07
NRAILLN	1.54E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.96E-07
NRAILST	1.86E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.61E-08
NTUG	1.34E-05	3.90E-06	4.46E-06	8.09E-06	8.37E-06	8.65E-06	9.48E-06
NTUGB	1.34E-05	3.90E-06	4.46E-06	8.09E-06	8.37E-06	8.65E-06	9.48E-06
ONFUG	1.69E-07	1.26E-07	1.43E-07	2.53E-07	2.62E-07	2.70E-07	1.69E-07
ORFUG	1.64E-07	1.21E-07	1.38E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
RAIL15LN	1.35E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E-07
RAILID	4.84E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-06
RAILLN	1.54E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.96E-07
RAILST	1.86E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.61E-08
SHPHTAX	3.77E-03	1.10E-03	1.26E-03	2.28E-03	2.35E-03	2.43E-03	2.67E-03
SMFUG	1.79E-07	1.33E-07	1.52E-07	2.67E-07	2.76E-07	2.84E-07	1.79E-07
SNFUG	2.27E-08	1.69E-08	1.93E-08	3.39E-08	3.50E-08	3.61E-08	2.27E-08
SSFUG	1.76E-07	1.31E-07	1.49E-07	2.63E-07	2.71E-07	2.80E-07	1.76E-07
TRANS34	4.46E-06	1.30E-06	1.49E-06	2.69E-06	2.79E-06	2.88E-06	3.16E-06
TRANS99	5.88E-06	1.71E-06	1.96E-06	3.55E-06	3.67E-06	3.79E-06	4.16E-06
TUG	1.34E-05	3.90E-06	4.46E-06	8.09E-06	8.37E-06	8.65E-06	9.48E-06
TUGB	1.34E-05	3.90E-06	4.46E-06	8.09E-06	8.37E-06	8.65E-06	9.48E-06
VMTFUG	5.27E-09	5.27E-09	5.27E-09	8.97E-08	9.81E-08	1.07E-07	5.27E-09