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Memo to: Brad Estes, Granite Construction Company

From: Allan Daly AD

Subject: Emission Calculations - Aerojet Project

In an effort to assist Granite Construction Company (Granite) in complying with Sacramento Metropolitan Air Quality Management District (SMAQMD) permit requirements and the California Environmental Quality Act (CEQA), Sierra Research is pleased to present the following emission calculations for your Aerojet Mining Project. The attached tables summarize criteria pollutant emissions (NOx, VOC, CO, SOx, PM_{10}, and $PM_{2.5}$) from the sources listed below.

- Exhaust Emissions from Portable Aggregate Processing Plant
- Exhaust Emissions from Mobile Mining Equipment
- Exhaust Emissions from Material Haul Trucks Occurring within Property Boundaries
- Exhaust Emissions from Support Vehicles
- Fugitive Emissions from Portable Aggregate Processing Plant
- Fugitive Emissions from Vehicle Travel on Unpaved Surfaces

Exhaust Emissions from Portable Aggregate Processing Plant

The portable aggregate processing plant will require a Permit to Operate issued by the SMAQMD. Therefore, emissions were calculated using the procedures specified in the SMAQMD's *Internal Combustion Engine Policy Manual*, December 2005 Update. Emissions were calculated for a current scenario using newly purchased Tier II screening engines and for a future scenario using Tier III engines which will become available in 2007. Additionally, maximum operation was limited by the use of a specified quantity of NOx emission reduction credits (ERCs) recently obtained by Granite. These ERCs, which are expected to be applied to the project, are in the amounts of zero lb/Qtr_1, 5,039 lb/Qtr_2, 8,663 lb/Qtr_3, and 4,000 lb/Qtr_4, for a total of 8.85 tons/year. From the allowable/requested quarterly emission limits, the maximum quantity of fuel was calculated. By applying an estimated load factor, the corresponding hours of operation per quarter were also estimated.

It should be noted that the attached tables report the total project NOx emissions calculated two ways. First, the total project NOx emissions are reported (37.7 tons/year). Then, as specified in the SMAQMD's *Guide to Air Quality Assessment*, July 2004 (CEQA Guide), ERCs applied to the project were subtracted from the total project NOx emissions for comparison to the CEQA NOx operational significance threshold. The SMAQMD considers ERCs required by stationary source permitting to mitigate "surplus" project emissions (those emissions above the SMAQMD NOx offset trigger level of 5,000 lb/quarter). Therefore, for CEQA purposes, the project emissions were reduced by the amount of ERCs to be provided, resulting in total project NOx emissions of 28.8 tons/year.

Exhaust Emissions from Mobile Mining Equipment

Mobile mining equipment does not require SMAQMD permits. Exhaust emissions from this equipment were estimated using maximum daily and quarterly expected operation, as provided by Granite. It should be noted that maximum operation of the mobile mining equipment exceeds the maximum operation of the portable aggregate processing plant, and that these two operational limits are independent. Equipment quantity, make, model, and model year were provided by Granite. From this information, emission factors and load factors were taken from the California Air Resources Board's Carl Moyer Program Guidelines, Appendix B, and from AP-42.

Exhaust Emissions from Material Haul Trucks Occurring within Property Boundaries

Exhaust emissions from haul trucks were calculated using the California Air Resources Board's (CARB's) URBEMIS-2002 computation software. The 2006 fleet average emission rate for heavy-heavy duty Diesel trucks operating within Sacramento County was selected. The total number of daily, quarterly, and annual material haul trucks was determined by dividing the anticipated maximum production rates by the capacity of a haul truck. Each truck trip was assumed to have a round-trip length of two miles within the project boundaries. Truck speeds were assumed to be limited to 15 miles per hour while traveling this distance.

Exhaust Emissions from Support Vehicles

Exhaust emissions from support vehicles were calculated in the same manner as material haul trucks, except that vehicle-specific emission rates were substituted. Support vehicles include pickup trucks, water truck, mechanic/service truck, and fuel/lube truck. For this equipment, the quantity, fuel, model year, and maximum operation were provided by Granite.

Fugitive Emissions from Portable Aggregate Processing Plant

Fugitive particulate matter emissions were calculated using AP-42 emission factors from Chapter 11.19 pertaining to construction and aggregate processing, which are accepted emission factors used by the SMAQMD Stationary Source Permitting Section.

Fugitive Emissions from Vehicle Travel on Unpaved Surfaces

Fugitive particulate matter emissions resulting from vehicle travel on unpaved surfaces were calculated using AP-42, Chapter 13.2.2. Emission sources include mobile mining equipment, haul trucks, and support vehicles. Vehicle weights were provided by Granite. A control efficiency was assumed for improving on-site haul roads with aggregate, watering, and limiting vehicle speed to 15 miles per hour.

We hope that the emission estimates and calculations presented in this memo will assist Granite in its planning, review, and permitting decisions. Feel free to contact me at (916) 444-6666 with any questions or concerns about this project.

Table 1. Operation Limits Based on Tier II Screening Engines				
Estimated Maximum Hours of Operation				
hr/Qtr_1	hr/Qtr_2	hr/Qtr_3	hr/Qtr_4	hr/year
490	983	1,338	881	3,692
Requested Maximum Fuel Usage				
gal/Qtr_1	gal/Qtr_2	gal/Qtr_3	gal/Qtr_4	gal/year
32,667	65,602	89,284	58,812	246,365

Table 2. Aerojet Mining Project - Emissions Summary (With Tier II Screening Engines)							
		Plant Engines	Plant Fugitive	Offroad Vehicles	Unpaved Roads	Onroad Vehicles	Totals
VOC	Total (lb/hr)	2.91	-	0.31	-	0.37	3.59
	Total (lb/day)	58.29	-	4.89	-	6.50	69.7
	Total Qtr_1 (lb/qtr)	1,427	-	143	-	215	1,785
	Total Qtr_2 (lb/qtr)	2,865	-	287	-	258	3,410
	Total Qtr_3 (lb/qtr)	3,900	-	390	-	264	4,555
	Total Qtr_4 (lb/qtr)	2,569	-	257	-	258	3,084
	Total (tons/year)	5.38	-	0.54	-	0.42	6.3
NOx	Total (lb/hr)	10.21	-	8.57	-	4.71	23.49
	Total (lb/day)	204.23	-	123.78	-	78.79	406.8
	Total Qtr_1 (lb/qtr)	4,999	-	3,614	-	2,640	11,253
	Total Qtr_2 (lb/qtr)	10,039	-	7,258	-	3,168	20,465
	Total Qtr_3 (lb/qtr)	13,663	-	9,878	-	3,249	26,790
	Total Qtr_4 (lb/qtr)	9,000	-	6,507	-	3,168	18,675
	Total (tons/year)	18.85	-	13.69	-	5.14	37.7
	Less ERCs (tons/year)[1]	-8.85					
	CEQA Emissions (ltons/year)						28.8
	CEQA Emissions (lb/day)[2]						158.0
CO	Total (lb/hr)	8.74	-	8.20	-	1.91	18.84
	Total (lb/day)	174.82	-	126.62	-	31.20	332.6
	Total Qtr_1 (lb/qtr)	4,279	-	3,697	-	1,046	9,022
	Total Qtr_2 (lb/qtr)	8,593	-	7,424	-	1,255	17,273
	Total Qtr_3 (lb/qtr)	11,695	-	10,104	-	1,287	23,087
	Total Qtr_4 (lb/qtr)	7,704	-	6,656	-	1,255	15,615
	Total (tons/year)	16.14	-	14.00	-	2.04	32.2
SOx	Total (lb/hr)	0.01	-	0.01	-	0.01	0.03
	Total (lb/day)	0.28	-	0.20	-	0.10	0.6
	Total Qtr_1 (lb/qtr)	7	-	6	-	3	16
	Total Qtr_2 (lb/qtr)	14	-	12	-	4	29
	Total Qtr_3 (lb/qtr)	19	-	16	-	4	39
	Total Qtr_4 (lb/qtr)	12	-	10	-	4	27
	Total (tons/year)	0.03	-	0.02	-	0.01	0.1
PM_{10}	Total (lb/hr)	0.59	1.69	0.23	29.09	0.18	31.78
	Total (lb/day)	11.78	33.81	3.63	495.46	3.14	547.8
	Total Qtr_1 (lb/qtr)	288	1,691	106	17,154	104	19,343
	Total Qtr_2 (lb/qtr)	579	1,691	213	22,478	125	25,086
	Total Qtr_3 (lb/qtr)	788	1,691	290	24,633	128	27,529
	Total Qtr_4 (lb/qtr)	519	1,691	191	21,991	125	24,517
	Total (tons/year)	1.09	3.38	0.40	37.92	0.20	43.0
$PM_{2.5}$	Total (lb/hr)	0.59	0.22	0.23	4.46	0.18	5.68
	Total (lb/day)	11.78	4.36	3.63	75.97	3.14	98.9
	Total Qtr_1 (lb/qtr)	288	218	106	2,630	104	3,346
	Total Qtr_2 (lb/qtr)	579	218	213	3,447	125	4,581
	Total Qtr_3 (lb/qtr)	788	218	290	3,777	128	5,201
	Total Qtr_4 (lb/qtr)	519	218	191	3,372	125	4,425
	Total (tons/year)	1.09	0.44	0.40	5.81	0.20	7.9

[1] The methodology in the SMAQMD's Guide to Air Quality Assesment, July 2004, Table 4.3, specifies that emissions that have been offset by the use of Emission Reduction Credits (ERCs) required by the permitting process not be included in the project total. These "surplus" emissions are already considered to have been mitigated by the use of ERCs.

[2] The daily emissions for CEQA purposes were determined by dividing the maximum project emissions by 365 days/year.

Table 3. Operation Limits Based on Tier III Screening Engines				
Estimated Maximum Hours of Operation				
hr/Qtr_1	hr/Qtr_2	hr/Qtr_3	hr/Qtr_4	hr/year
584	1,173	1,596	1,051	4,404
Requested Maximum Fuel Usage				
gal/Qtr_1	gal/Qtr_2	gal/Qtr_3	gal/Qtr_4	gal/year
34,664	69,613	94,743	62,408	246,629

Table 4. Aerojet Mining Project - Emissions Summary (With Tier III Screening Engines)							
		Plant Engines	Plant Fugitive	Offroad Vehicles	Unpaved Roads	Onroad Vehicles	Emission Totals
HC	Total (lb/hr)	2.92	-	0.31	-	0.37	3.59
	Total (lb/day)	58.35	-	4.89	-	6.50	69.7
	Total Qtr_1 (lb/qtr)	1,704	-	143	-	215	2,061
	Total Qtr_2 (lb/qtr)	3,421	-	287	-	258	3,966
	Total Qtr_3 (lb/qtr)	4,657	-	390	-	264	5,311
	Total Qtr_4 (lb/qtr)	3,067	-	257	-	258	3,582
	Total (tons/year)	6.42	-	0.54	-	0.42	7.4
NOx	Total (lb/hr)	8.56	-	8.57	-	4.71	21.84
	Total (lb/day)	171.22	-	123.78	-	78.79	373.8
	Total Qtr_1 (lb/qtr)	4,999	-	3,614	-	2,640	11,253
	Total Qtr_2 (lb/qtr)	10,039	-	7,258	-	3,168	20,465
	Total Qtr_3 (lb/qtr)	13,663	-	9,878	-	3,249	26,790
	Total Qtr_4 (lb/qtr)	9,000	-	6,507	-	3,168	18,675
	Total (tons/year)	18.85	-	13.69	-	5.14	37.7
	Less ERCs (tons/year)[1]	-8.85					
	CEQA Emissions (ltons/year)						28.8
	CEQA Emissions (lb/day)[2]						158.0
CO	Total (lb/hr)	8.75	-	8.20	-	1.91	18.86
	Total (lb/day)	175.05	-	126.62	-	31.20	332.9
	Total Qtr_1 (lb/qtr)	5,111	-	3,697	-	1,046	9,854
	Total Qtr_2 (lb/qtr)	10,264	-	7,424	-	1,255	18,943
	Total Qtr_3 (lb/qtr)	13,969	-	10,104	-	1,287	25,360
	Total Qtr_4 (lb/qtr)	9,201	-	6,656	-	1,255	17,112
	Total (tons/year)	19.27	-	14.00	-	2.04	35.3
SOx	Total (lb/hr)	0.01	-	0.01	-	0.01	0.03
	Total (lb/day)	0.28	-	0.20	-	0.10	0.6
	Total Qtr_1 (lb/qtr)	8	-	6	-	3	17
	Total Qtr_2 (lb/qtr)	17	-	12	-	4	32
	Total Qtr_3 (lb/qtr)	23	-	16	-	4	42
	Total Qtr_4 (lb/qtr)	15	-	10	-	4	29
	Total (tons/year)	0.03	-	0.02	-	0.01	0.1
PM_{10}	Total (lb/hr)	0.59	1.69	0.23	29.09	0.18	31.78
	Total (lb/day)	11.80	33.81	3.63	495.46	3.14	547.8
	Total Qtr_1 (lb/qtr)	344	1,691	106	17,154	104	19,399
	Total Qtr_2 (lb/qtr)	692	1,691	213	22,478	125	25,198
	Total Qtr_3 (lb/qtr)	941	1,691	290	24,633	128	27,682
	Total Qtr_4 (lb/qtr)	620	1,691	191	21,991	125	24,617
	Total (tons/year)	1.30	3.38	0.40	37.92	0.20	43.2
$PM_{2.5}$	Total (lb/hr)	0.59	0.22	0.23	4.46	0.18	5.68
	Total (lb/day)	11.80	4.36	3.63	75.97	3.14	98.9
	Total Qtr_1 (lb/qtr)	344	218	106	2,630	104	3,402
	Total Qtr_2 (lb/qtr)	692	218	213	3,447	125	4,694
	Total Qtr_3 (lb/qtr)	941	218	290	3,777	128	5,354
	Total Qtr_4 (lb/qtr)	620	218	191	3,372	125	4,525
	Total (tons/year)	1.30	0.44	0.40	5.81	0.20	8.2

[1] The methodology in the SMAQMD's Guide to Air Quality Assesment, July 2004, Table 4.3, specifies that emissions that have been offset by the use of Emission Reduction Credits (ERCs) required by the permitting process not be included in the project total. These "surplus" emissions are already considered to have been mitigated by the use of ERCs.

[2] The daily emissions for CEQA purposes were determined by dividing the maximum project emissions by 365 days/year.

Table 5. Mobile Aggregate Processing Plant Technical Data.

Engine #	Description	Make	Model	Tier	Max HP	BSFC g/BHP-h[1]	Load Factor[2]	Maximum Fuel Use							Maximum Hours of Operation					
								gal/hr	gal/day	gal/Qtr$_1$	gal/Qtr$_2$	gal/Qtr$_3$	gal/Qtr$_4$	gal/year	hr/day[3]	hr/Qtr$_1$	hr/Qtr$_2$	hr/Qtr$_3$	hr/Qtr$_4$	hr/year
1	Crusher	CAT	C-15	3	540	161.0	0.78	21.2	424.1	10,381	20,847	28,373	18,690	78,291						
2	Crusher	CAT	C-15	3	540	161.0	0.78	21.2	424.1	10,381	20,847	28,373	18,690	78,291						
3	Screen	Perkins	3056	2	173.7	163.0	0.78	6.9	138.1	3,381	6,789	9,240	6,087	25,497	20	490	983	1,338	881	3,692
4	Screen	Perkins	3056	2	173.7	163.0	0.78	6.9	138.1	3,381	6,789	9,240	6,087	25,497						
5	Screen	Perkins	3056	2	173.7	163.0	0.78	6.9	138.1	3,381	6,789	9,240	6,087	25,497						
6	Feeder	Deutz	2012	2	93.8	157.3	0.78	3.6	72.0	1,762	3,539	4,817	3,173	13,291						
3A	Alternate	CAT	C6.6	3	174.3	163.0	0.78	6.9	138.6	4,047	8,126	11,060	7,285	25,585						
4A	Alternate	CAT	C6.6	3	174.3	163.0	0.78	6.9	138.6	4,047	8,126	11,060	7,285	25,585	20	584	1,173	1,596	1,051	4,404
5A	Alternate	CAT	C6.6	3	174.3	163.0	0.78	6.9	138.6	4,047	8,126	11,060	7,285	25,585						
Total								66.7	1334.6	32,667	65,602	89,284	58,812	246,365						
Total (Alternate Screens)								66.8	1336.0	32,702	65,672	89,379	58,875	246,629						
Requested Permit Limit										**32,667**	**65,602**	**89,284**	**58,812**	**246,365**						
Requested Permit Limit (Alternate Screens)										**34,664**	**69,613**	**94,743**	**62,408**	**246,629**						

[1]Worst-case (highest) BSFC over power range from manufacturer. Where BSFC curve not available, 163.0 g/BHP-h (7,000 BTU/BHP-hr) was substituted from AP-42, Table 3.3.1.
[2]From CARB's Carl Moyer Program Guidelines, Appendix B-13 for Crushing/Processing.
[3]Maximum Daily Operation Estimated by Granite Construction Company

Table 6. Portable Aggregate Processing Plant Emission Factors[1]

Permit Emission Factors Based on Tier II Screen Engines							Permit Emission Factors Based on Tier III Engines						
grams/bhp-hr[1]							grams/bhp-hr[1]						
Engine #	HC	NOx	CO	SOx	PM10	PM2.5[3]	Engine #	HC	NOx	CO	SOx	PM10	PM2.5[3]
1	1.0	3.0	2.6	0.005	0.15	0.15	1	1.0	3.0	2.6	0.005	0.15	0.15
2	1.0	3.0	2.6	0.005	0.22	0.22	2	1.0	3.0	2.6	0.005	0.22	0.22
3	1.0	4.2	3.7	0.005	0.22	0.22	3A	1.0	2.3	3.7	0.005	0.22	0.22
4	1.0	4.2	3.7	0.005	0.22	0.22	4A	1.0	2.3	3.7	0.005	0.22	0.22
5	1.0	4.2	3.7	0.005	0.22	0.22	5A	1.0	2.3	3.7	0.005	0.22	0.22
6	1.0	5.6	3.7	0.005	0.30	0.30	6	1.0	5.6	3.7	0.005	0.30	0.30
grams/gallon[2]							grams/gal[2]						
Engine #	HC	NOx	CO	SOx	PM10	PM2.5[3]	Engine #	HC	NOx	CO	SOx	PM10	PM2.5[3]
1	19.86	59.59	51.64	0.10	2.98	2.98	1	19.86	59.59	51.64	0.10	2.98	2.98
2	19.86	59.59	51.64	0.10	4.37	4.37	2	19.86	59.59	51.64	0.10	4.37	4.37
3	19.62	81.81	72.59	0.10	4.32	4.32	3A	19.62	45.52	72.59	0.10	4.32	4.32
4	19.62	81.81	72.59	0.10	4.32	4.32	4A	19.62	45.52	72.59	0.10	4.32	4.32
5	19.62	81.81	72.59	0.10	4.32	4.32	5A	19.62	45.52	72.59	0.10	4.32	4.32
6	20.32	113.82	75.20	0.10	6.10	6.10	6	20.32	113.82	75.20	0.10	6.10	6.10

[1]Emission Factors from SMAQMD IC Engine Policy Manual with the exception of SOx, which is based on 15 ppm S in fuel.

[2]Based on BSFC shown in Table 5.

[3]All engine PM is assumed to be $PM_{2.5}$

Table 7. Portable Aggregate Processing Plant Emissions

	Emissions Based on Tier II Screen Engines (lb/hr)							Emissions Based on Tier III Screen Engines (lb/hr)					
Engine #	HC	NOx	CO	SOx	PM10	PM2.5	Engine #	HC	NOx	CO	SOx	PM10	PM2.5
1	0.93	2.79	2.41	0.00	0.14	0.14	1	0.93	2.79	2.41	0.00	0.14	0.14
2	0.93	2.79	2.41	0.00	0.20	0.20	2	0.93	2.79	2.41	0.00	0.20	0.20
3	0.30	1.25	1.11	0.00	0.07	0.07	3A	0.30	0.70	1.11	0.00	0.07	0.07
4	0.30	1.25	1.11	0.00	0.07	0.07	4A	0.30	0.70	1.11	0.00	0.07	0.07
5	0.30	1.25	1.11	0.00	0.07	0.07	5A	0.30	0.70	1.11	0.00	0.07	0.07
6	0.16	0.90	0.60	0.00	0.05	0.05	6	0.16	0.90	0.60	0.00	0.05	0.05
Total (lb/hr)	2.91	10.21	8.74	0.01	0.59	0.59		2.92	8.56	8.75	0.01	0.59	0.59
Total (lb/day)	58.29	204.23	174.82	0.28	11.78	11.78		58.35	171.22	175.05	0.28	11.80	11.80
Total Qtr_1 (lb/qtr)	1,427	4,999	4,279	7	288	288		1,704	4,999	5,111	8	344	344
Total Qtr_2 (lb/qtr)	2,865	10,039	8,593	14	579	579		3,421	10,039	10,264	17	692	692
Total Qtr_3 (lb/qtr)	3,900	13,663	11,695	19	788	788		4,657	13,663	13,969	23	941	941
Total Qtr_4 (lb/qtr)	2,569	9,000	7,704	12	519	519		3,067	9,000	9,201	15	620	620
Total (tons/year)	5.38	18.85	16.14	0.03	1.09	1.09		6.42	18.85	19.27	0.03	1.30	1.30

Table 8. Aggregate Processing Plant Fugitive Emissions

Sand and Aggregate Processing Emissions Points	Throughput[1]					Emission Factors[2] PM10	Emission Factors[2] PM2.5	PM10 Emissions				PM2.5 Emissions			
	ton/hr	fraction	ton/day	ton/qtr	ton/yr	lb/ton	lb/ton	lb/hr	lb/day	lb/qtr	ton/yr	lb/hr	lb/day	lb/qtr	ton/yr
Unloading Transfer from Trucks (F1)	600	1.00	12,000	600,000	2,400,000	4.60E-05	1.30E-05	0.03	0.55	27.60	0.06	0.01	0.16	7.80	0.02
Vibrating Grizzly Feeder Transfer (F1-VG1)	600	1.00	12,000	600,000	2,400,000	4.60E-05	1.30E-05	0.03	0.55	27.60	0.06	0.01	0.16	7.80	0.02
Conveyor Transfer Point (F1-C1)	600	1.00	12,000	600,000	2,400,000	4.60E-05	1.30E-05	0.03	0.55	27.60	0.06	0.01	0.16	7.80	0.02
Screening #1 (S1)	600	1.00	12,000	600,000	2,400,000	7.40E-04	5.00E-05	0.44	8.88	444.00	0.89	0.03	0.60	30.00	0.06
Conveyor Transfer Point (S1-C1)	600	1.00	12,000	600,000	2,400,000	4.60E-05	1.30E-05	0.03	0.55	27.60	0.06	0.01	0.16	7.80	0.02
Conveyor Transfer Point (S1-C2)	0	0.00	0	0	0	4.60E-05	1.30E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conveyor Transfer Point (S1-C3)	270	0.45	5,400	270,000	1,080,000	4.60E-05	1.30E-05	0.01	0.25	12.42	0.02	0.00	0.07	3.51	0.01
Conveyor Transfer Point (S1-C4)	330	0.55	6,600	330,000	1,320,000	4.60E-05	1.30E-05	0.02	0.30	15.18	0.03	0.00	0.09	4.29	0.01
Screening #2 (S2)	330	0.55	6,600	330,000	1,320,000	7.40E-04	5.00E-05	0.24	4.88	244.20	0.49	0.02	0.33	16.50	0.03
Conveyor Transfer Point (S2-C1)	330	0.55	6,600	330,000	1,320,000	4.60E-05	1.30E-05	0.02	0.30	15.18	0.03	0.00	0.09	4.29	0.01
Conveyor Transfer Point (S2-C2)	313	0.52	6,260	313,000	1,252,000	4.60E-05	1.30E-05	0.01	0.29	14.40	0.03	0.00	0.08	4.07	0.01
Conveyor Transfer Point (S2-C3)	17	0.03	340	17,000	68,000	4.60E-05	1.30E-05	0.00	0.02	0.78	0.00	0.00	0.00	0.22	0.00
Primary Crushing (RC1)	192	0.32	3,840	192,000	768,000	5.40E-04	1.00E-04	0.10	2.07	103.68	0.21	0.02	0.38	19.20	0.04
Vibrating Grizzly Feeder (RC1-VG1)	313	0.52	6,260	313,000	1,252,000	4.60E-05	1.30E-05	0.01	0.29	14.40	0.03	0.00	0.08	4.07	0.01
Conveyor Transfer Point (RC1-C1)	192	0.32	3,840	192,000	768,000	4.60E-05	1.30E-05	0.01	0.18	8.83	0.02	0.00	0.05	2.50	0.00
Conveyor Transfer Point (RC1-C2)	121	0.20	2,420	121,000	484,000	4.60E-05	1.30E-05	0.01	0.11	5.57	0.01	0.00	0.03	1.57	0.00
Conveyor Transfer Point (RC1-C3)	313	0.52	6,260	313,000	1,252,000	4.60E-05	1.30E-05	0.01	0.29	14.40	0.03	0.00	0.08	4.07	0.01
Screening #3 (S3)	559	0.93	11,180	559,000	2,236,000	7.40E-04	5.00E-05	0.41	8.27	413.66	0.83	0.03	0.56	27.95	0.06
Conveyor Transfer Point (S3-C1)	559	0.93	11,180	559,000	2,236,000	4.60E-05	1.30E-05	0.03	0.51	25.71	0.05	0.01	0.15	7.27	0.01
Conveyor Transfer Point (S3-C2)	246	0.41	4,920	246,000	984,000	4.60E-05	1.30E-05	0.01	0.23	11.32	0.02	0.00	0.06	3.20	0.01
Conveyor Transfer Point (S3-C3)	0	0.00	0	0	0	4.60E-05	1.30E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conveyor Transfer Point (S3-C4)	313	0.52	6,260	313,000	1,252,000	4.60E-05	1.30E-05	0.01	0.29	14.40	0.03	0.00	0.08	4.07	0.01
Secondary Crushing (RC2)	246	0.41	4,920	246,000	984,000	5.40E-04	1.00E-04	0.13	2.66	132.84	0.27	0.02	0.49	24.60	0.05
Conveyor Transfer Point (RC2-C1)	246	0.41	4,920	246,000	984,000	4.60E-05	1.30E-05	0.01	0.23	11.32	0.02	0.00	0.06	3.20	0.01
Conveyor Transfer Point (RC2-C2)	246	0.41	4,920	246,000	984,000	4.60E-05	1.30E-05	0.01	0.23	11.32	0.02	0.00	0.06	3.20	0.01
Conveyor Transfer Point (RC2-C3)	246	0.41	4,920	246,000	984,000	4.60E-05	1.30E-05	0.01	0.23	11.32	0.02	0.00	0.06	3.20	0.01
Stacking Conveyor Transfer Point (SC1)	270	0.45	5,400	270,000	1,080,000	4.60E-05	1.30E-05	0.01	0.25	12.42	0.02	0.00	0.07	3.51	0.01
Stacking Conveyor Transfer Point (SC2)	17	0.03	340	17,000	68,000	4.60E-05	1.30E-05	0.00	0.02	0.78	0.00	0.00	0.00	0.22	0.00
Stacking Conveyor Transfer Point (SC3)	313	0.52	6,260	313,000	1,252,000	4.60E-05	1.30E-05	0.01	0.29	14.40	0.03	0.00	0.08	4.07	0.01
Stacking Conveyor Transfer Point (SC4)	0	0.00	0	0	0	4.60E-05	1.30E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loader Transfer to Trucks	600	1.00	12,000	600,000	2,400,000	4.60E-05	1.30E-05	0.03	0.55	27.60	0.06	0.01	0.16	7.80	0.02
Total								**1.69**	**33.81**	**1,690.51**	**3.38**	**0.22**	**4.36**	**217.77**	**0.44**

[1]From Granite Construction Company

[2]From AP-42, Section 11.19.2, Controlled Emission Factors

Table 9. Mobile Mining Equipment Technical Data

Engine #	Description	Make	Model	Tier	Max HP	Year	Load Factor[1]	Maximum Operation[2] hrs/day	hr/Qtr$_1$	hr/Qtr$_2$	hr/Qtr$_3$	hr/Qtr$_4$	hrs/yr
1	Dozer	CAT	D-9	2	405	2002	0.59	20	584	1,173	1,596	1,051	4,404
2	Plant Feed Loader	CAT	988	3	475	2006	0.55	20	584	1,173	1,596	1,051	4,404
3	Loadout Loader	CAT	988	3	475	2006	0.55	20	584	1,173	1,596	1,051	4,404
4	Plant Feed/Loadout Loader	CAT	988	2	475	2002	0.55	10	292	586	798	526	2,202
5	Motor Grader	CAT	14	1	215	1996	0.61	5	146	293	399	263	1,101

[1]From CARB's Carl Moyer Program Guidelines, Table B-13

[2]Maximum daily operation from Granite Construction Company. Maximum quarterly and annual operation derived from portable aggregate processing plant permit limits.

Table 10. Mobile Mining Equipment Emission Factors							
		grams/BHP[1]					
Engine #	Description	HC	NOx	CO	SOx	PM10	PM2.5
1	Dozer	0.12	3.79	2.60	0.005	0.088	0.088
2	Plant Feed Loader	0.12	2.32	2.60	0.005	0.088	0.088
3	Loadout Loader	0.12	2.32	3.70	0.005	0.088	0.088
4	Plant Feed/Loadout Loader	0.12	3.79	3.70	0.005	0.088	0.088
5	Motor Grader	0.12	5.93	3.70	0.005	0.120	0.120
[1]From CARB's Carl Moyer Program Guidelines, Table B-12							

Table 11. Mobile Mining Equipment Emissions						
Engine #	HC	NOx	CO	SOx	PM10	PM2.5
1	0.06	2.00	1.37	0.003	0.05	0.05
2	0.07	1.34	1.50	0.003	0.05	0.05
3	0.07	1.34	2.13	0.003	0.05	0.05
4	0.07	2.18	2.13	0.003	0.05	0.05
5	0.03	1.71	1.07	0.001	0.03	0.03
Total (lb/hr)	0.31	8.57	8.20	0.012	0.23	0.23
Total (lb/day)	4.89	123.78	126.62	0.20	3.63	3.63
Total Qtr_1 (lb/qtr)	143	3,614	3,697	6	106	106
Total Qtr_2 (lb/qtr)	287	7,258	7,424	12	213	213
Total Qtr_3 (lb/qtr)	390	9,878	10,104	16	290	290
Total Qtr_4 (lb/qtr)	257	6,507	6,656	10	191	191
Total (tons/year)	0.54	13.69	14.00	0.02	0.40	0.40

Table 12. Unpaved Roads and Surfaces - Technical Data

Vehicle Description	Avg. Vehicle Wt. (Tons)[1]	Avg. Silt Content (%)[2]	Vehicle Miles Traveled (VMT)[3]							Emission Factors[2] PM_{10}	Emission Factors[2] $PM_{2.5}$	Control Efficiency[4]
			VMT/hr	VMT/day	VMT/Qtr$_1$	VMT/Qtr$_2$	VMT/Qtr$_3$	VMT/Qtr$_4$	VMT/yr	lb/VMT	lb/VMT	%
Mobile Mining Equipment												
CAT D-9 Dozer	54.40	8.3	3.00	60.0	1752	3518	4788	3154	13,212	3.97	0.61	93
CAT 988 Plant Feed Loader	61.65	8.3	3.00	60.0	1752	3518	4788	3154	13,212	4.20	0.64	93
CAT 988 Loadout Loader	61.65	8.3	3.00	60.0	1752	3518	4788	3154	13,212	4.20	0.64	93
CAT 988 Plant Feed/Loadout Loader	61.65	8.3	3.00	30.0	1752	3518	4788	3154	13,212	4.20	0.64	93
CAT 14H Motor Grader	20.51	8.3	3.00	15.0	1752	3518	4788	3154	13,212	2.56	0.39	93
On-Road Vehicles												
F3600 Water Truck[5]	17.00	8.3	3.00	40.0	2600	3120	3200	3120	12,040	2.35	0.36	93
2.5T Mechanic/Service Truck[5]	13.00	8.3	3.00	3.0	195	234	240	234	903	2.08	0.32	93
Chevy 2500 Fuel/Lube Truck	7.42	8.3	3.00	3.0	195	234	240	234	903	1.62	0.25	93
Ford F-150 Gasoline	5.36	8.3	1.00	20.0	1300	1560	1600	1560	6,020	1.40	0.21	93
Ford F-250 Diesel	7.90	8.3	1.50	30.0	1950	2340	2400	2340	9,030	1.66	0.26	93
Ford F-250 Diesel	7.90	8.3	1.50	30.0	1950	2340	2400	2340	9,030	1.66	0.26	93
Worker Trips	5.4	8.3	30	75.0	4875	5850	6000	5850	22,575	1.40	0.21	93
Haul Trucks[5]	27.5	8.3	100	2,000	65,000	78,000	80,000	78,000	250,000	2.92	0.45	93
Total			58.0	426.0					376,560			

[1]From Manufacturer's Data

[2]From AP-42, Chapter 13.2.2 (December 2003)

[3]Assumed 3 mph average speed for loaders, dozers, and graders. Based Truck Calculations on 7500 VMT/yr or 5000 VMT/yr, 200 days worked at 20 hours a day.

[4]Reductions due to limiting vehicle speed to 15 mph, improving surfaces with aggregate and watering , from Fugitive Dust Control Technology, Orlemann et.al., Noyes Data Corporation, 1983.

[5]Weight Estimated

Table 13. Unpaved Roads and Surfaces - Emissions														
	PM_{10} Emissions							$PM_{2.5}$ Emissions						
Vehicle Description	lb/hr	lb/day	lb/Qtr$_1$	lb/Qtr$_2$	lb/Qtr$_3$	lb/Qtr$_4$	ton/yr	lb/hr	lb/day	lb/Qtr$_1$	lb/Qtr$_2$	lb/Qtr$_3$	lb/Qtr$_4$	ton/yr
Mobile Mining Equipment														
CAT D-9 Dozer	0.83	16.66	486	977	1329	876	1.8	0.13	2.55	75	150	204	134	0.281
CAT 988 Plant Feed Loader	0.88	17.62	514	1033	1406	926	1.9	0.14	2.70	79	158	216	142	0.297
CAT 988 Loadout Loader	0.88	17.62	514	1033	1406	926	1.9	0.14	2.70	79	158	216	142	0.297
CAT 988 Plant Feed/Loadout Loader	0.88	8.81	514	1033	1406	926	1.9	0.14	1.35	79	158	216	142	0.297
CAT 14H Motor Grader	0.54	2.68	313	630	857	564	1.2	0.08	0.41	48	97	131	87	0.181
On-Road Vehicles														
F3600 Water Truck	0.49	6.58	428	513	526	513	1.0	0.08	1.01	66	79	81	79	0.152
2.5T Mechanic/Service Truck	0.44	0.44	28	34	35	34	0.1	0.07	0.07	4	5	5	5	0.010
Chevy 2500 Fuel/Lube Truck	0.34	0.34	22	26	27	26	0.1	0.05	0.05	3	4	4	4	0.008
Ford F-150 Gasoline	0.10	1.96	127	153	157	153	0.3	0.02	0.30	20	23	24	23	0.045
Ford F-250 Diesel	0.17	3.49	227	273	280	273	0.5	0.03	0.54	35	42	43	42	0.081
Ford F-250 Diesel	0.17	3.49	227	273	280	273	0.5	0.03	0.54	35	42	43	42	0.081
Worker Trips	2.94	7.34	477	572	587	572	1.1	0.45	1.13	73	88	90	88	0.169
Haul Trucks	20.42	408.43	13,274	15,929	16,337	15,929	25.5	3	63	2,035	2,442	2,505	2,442	3.914
Total	29.09	495.46	17,154	22,478	24,633	21,991	37.9	4.46	75.97	2,630	3,447	3,777	3,372	5.81

Table 14. On-Road Vehicles - Technical Data

Onsite Heavy Duty Diesel Trucks

								Maximum Operation					
Truck #	Description	Make	Model	Category	Max HP	Year	Avg. Speed (mph)	VMT/day	VMT/Qtr_1	VMT/Qtr_2	VMT/Qtr_3	VMT/Qtr_4	VMT/yr
1	Water Truck		F3600	54,000 GVWR	340	2000	15	40	2,600	3,120	3,200	3,120	12,040
2	Mechanic/Service Truck		2.5T	54,000 GVWR	300	2005	15	3	195	234	240	234	903
3	Fuel/Lube Truck		2500	26,000 GVWR	330	2003	15	3	195	234	240	234	903

Onsite Medium Duty Trucks

								Maximum Operation					
Truck #	Description	Make - Fuel	Model	Category	Max HP	Year	Fuel	VMT/day	VMT/Qtr_1	VMT/Qtr_2	VMT/Qtr_3	VMT/Qtr_4	VMT/yr
4	Pickup	Ford - Gasoline	F-150	6,250 GVWR	202	2004	Gasoline	20	1,300	1,560	1,600	1,560	6,020
5	Pickup	Ford - Diesel	F-250	9,600 GVWR	325	2006	Diesel	30	1,950	2,340	2,400	2,340	9,030
6	Pickup	Ford - Diesel	F-250	9,600 GVWR	325	2002	Diesel	30	1,950	2,340	2,400	2,340	9,030

Onsite Aggregate Haul Trucks

	Maximum Material Transferred		Trip Dist.		Average	Peak	Peak	Maximum Operation					
Truck #	TPD	TPY	miles	tons/trip	trips/day	trips/day	trips/yr	VMT/day	VMT/Qtr_1	VMT/Qtr_2	VMT/Qtr_3	VMT/Qtr_4	VMT/yr
Haul	22,000	2,750,000	2.0	22	500	1,000	125,000	2,000	65,000	78,000	80,000	78,000	250,000

Table 15. On-Road Vehicle Emissions						
	Emissions Factors (grams/mile)[1]					
Engine #	HC	NOx	CO	SOx	PM10	PM2.5
1	0.51	17.58	6.85	0.011	0.403	0.403
2	0.26	11.63	6.85	0.011	0.252	0.252
3	0.08	5.39	4.55	0.021	0.216	0.216
4	0.08	0.24	1.51	0.011	0.05	0.05
5	0.36	5.27	1.43	0.005	0.10	0.10
6	0.58	6.44	2.12	0.005	0.13	0.13
Haul	1.45	17.31	6.85	0.021	0.70	0.70
Total (lb/hr)	0.37	4.71	1.91	0.01	0.18	0.18
Total (lb/day)	6.50	78.79	31.20	0.10	3.14	3.14
Total Qtr_1 (lb/qtr)	215	2640	1046	3	104	104
Total Qtr_2 (lb/qtr)	258	3168	1255	4	125	125
Total Qtr_3 (lb/qtr)	264	3249	1287	4	128	128
Total Qtr_4 (lb/qtr)	258	3168	1255	4	125	125
Total (tons/year)	0.42	5.14	2.04	0.01	0.20	0.20

[1]Emission factors from CARB's Carl Moyer Program Guidelines and from EMFAC2002.