Appendix E

Air Quality

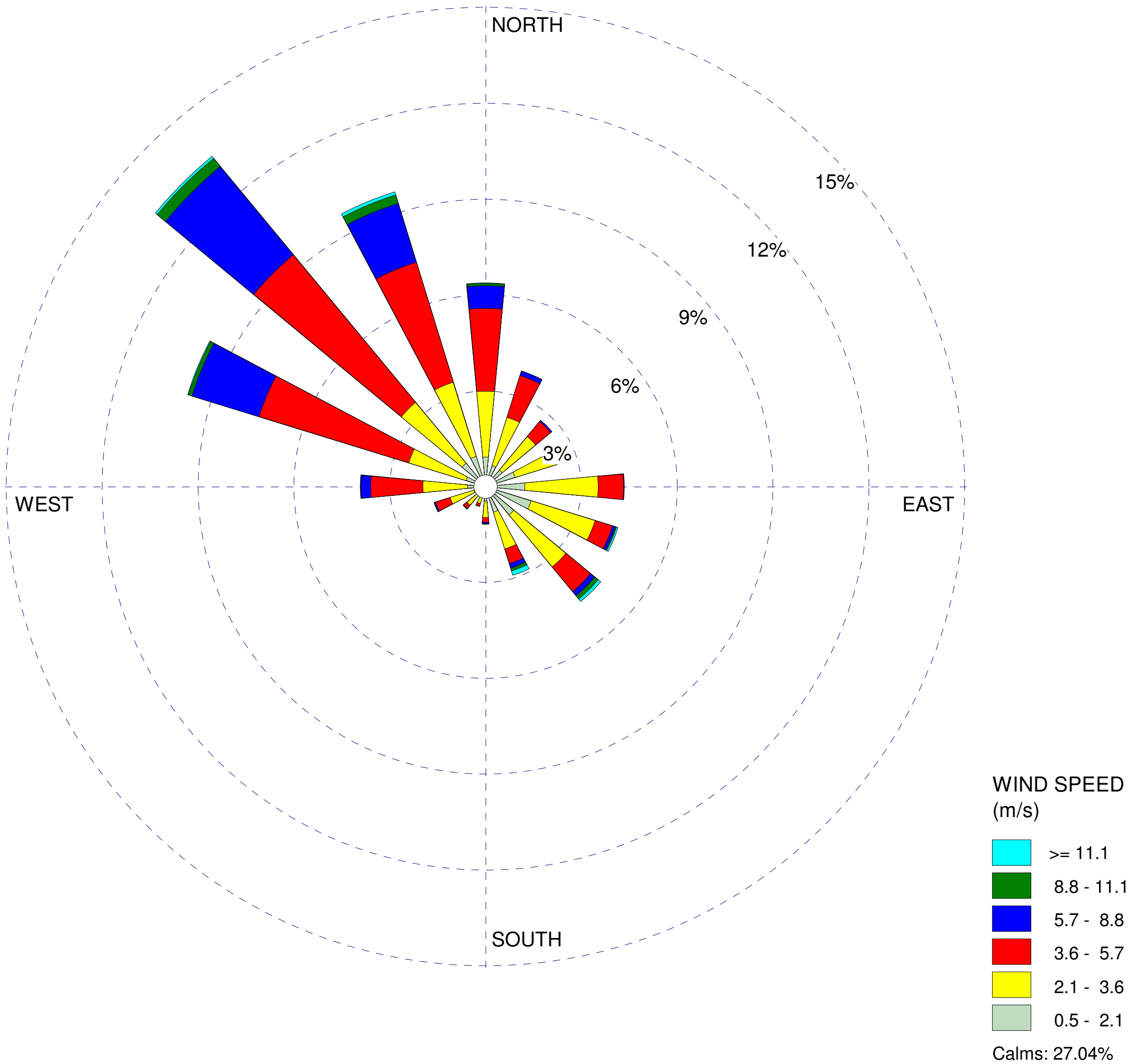
Appendix E-1

Seasonal and Annual Wind Roses

WIND ROSE PLOT:

Bakersfield Meadows Field Airport 2006-2010
SJVAPCD Processed, March 2012

DISPLAY:
Wind Speed
Direction (blowing from)



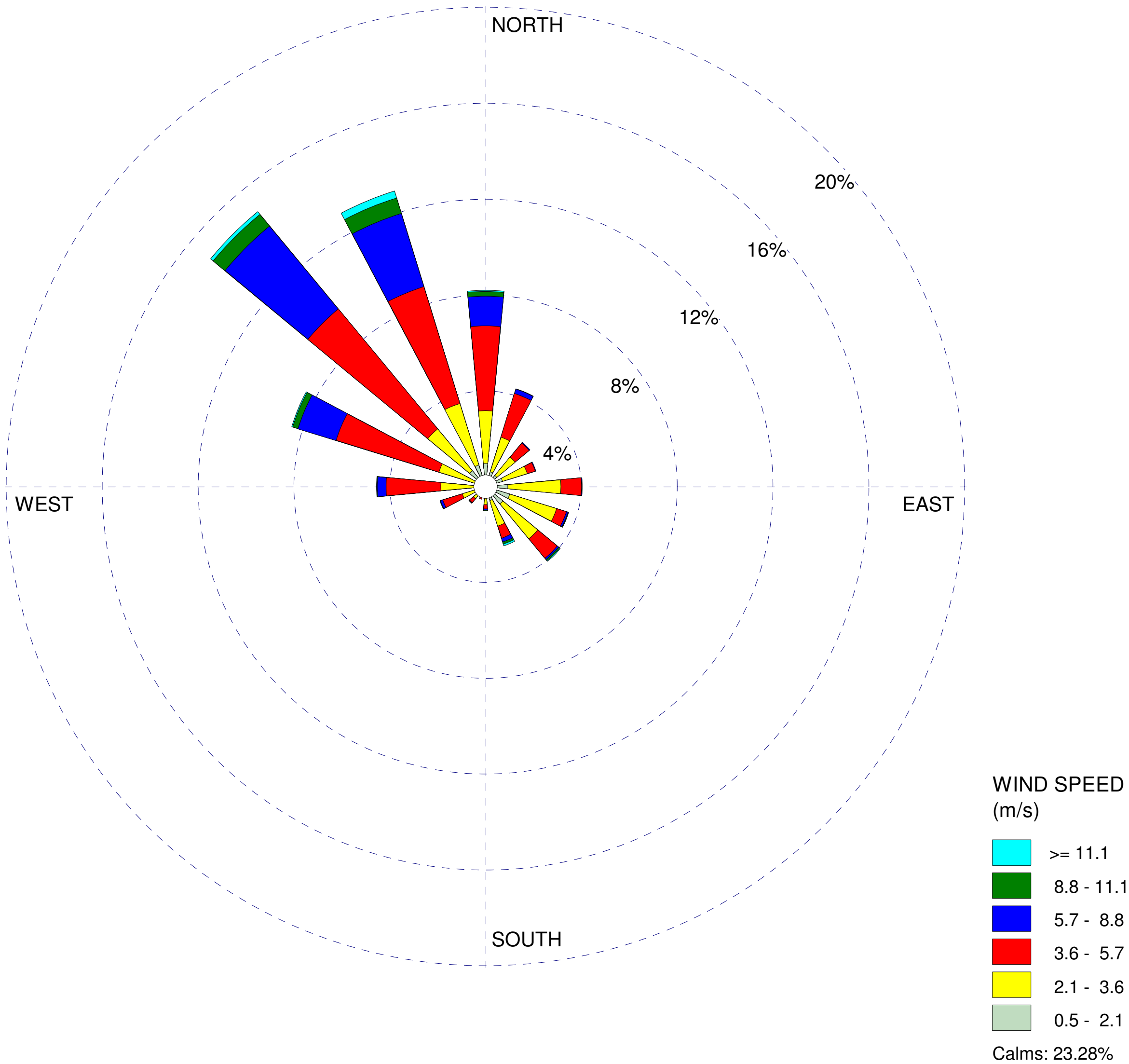
COMMENTS:	DATA PERIOD: **Start Date: 1/1/2006 - 00:00** **End Date: 12/31/2010 - 23:00**	COMPANY NAME: **URS**
		MODELER: **LMB**
	CALM WINDS: **27.04%**	TOTAL COUNT: **43746 hrs.**
	AVG. WIND SPEED: **2.91 m/s**	DATE: **3/8/2012**
		PROJECT NO.:

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Bakersfield Meadows Field Airport 2006-2010
SJVAPCD Processed, March 2012

DISPLAY:
Wind Speed
Direction (blowing from)



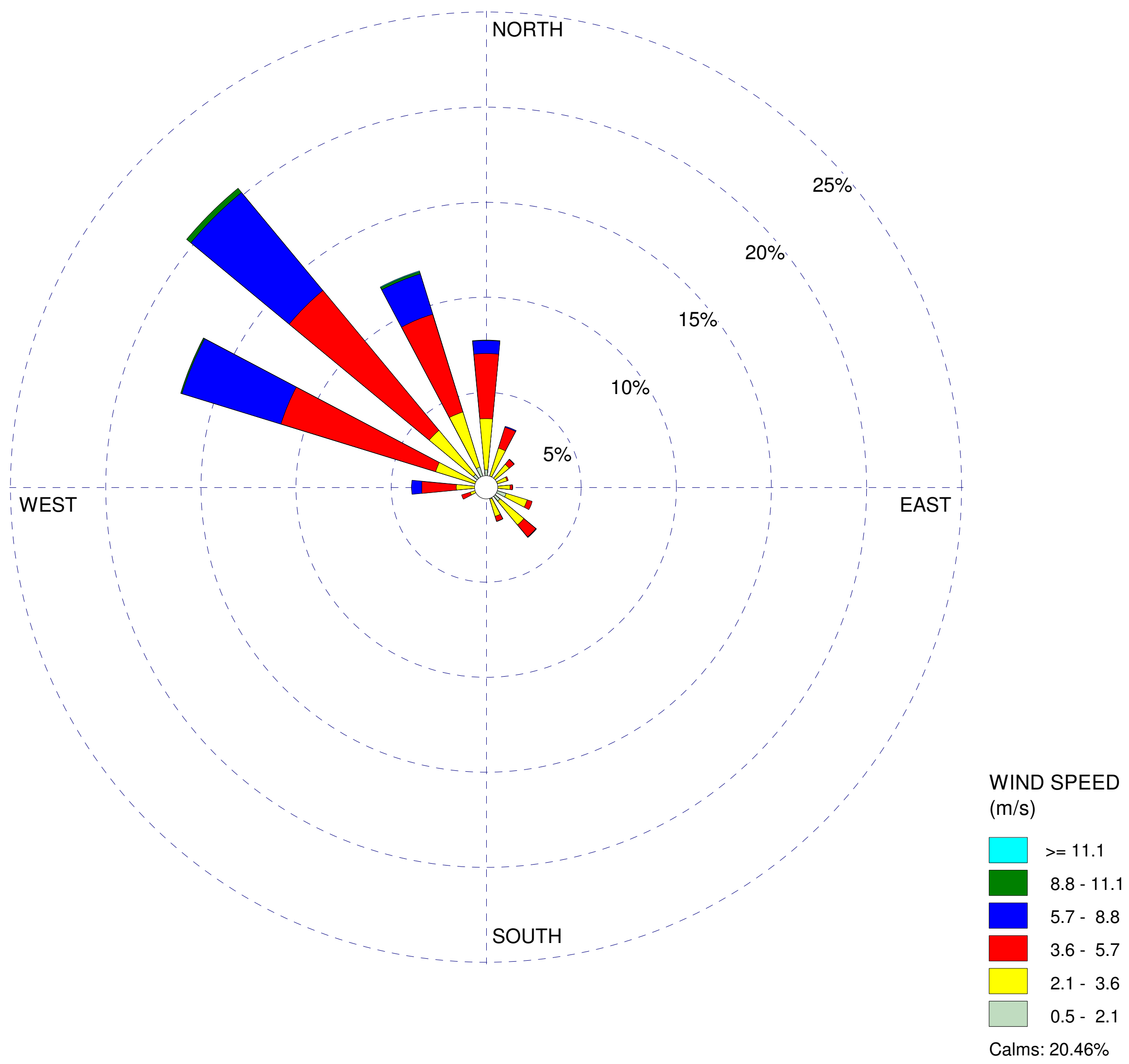
COMMENTS: Spring Season	DATA PERIOD: **Start Date: 3/1/2006 - 00:00** **End Date: 5/31/2010 - 23:00**	COMPANY NAME: **URS**	
		MODELER: **LMB**	
	CALM WINDS: **23.28%**	TOTAL COUNT: **11024 hrs.**	
	AVG. WIND SPEED: **3.28 m/s**	DATE: **4/9/2012**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Bakersfield Meadows Field Airport 2006-2010
SJVAPCD Processed, March 2012

DISPLAY:
Wind Speed
Direction (blowing from)



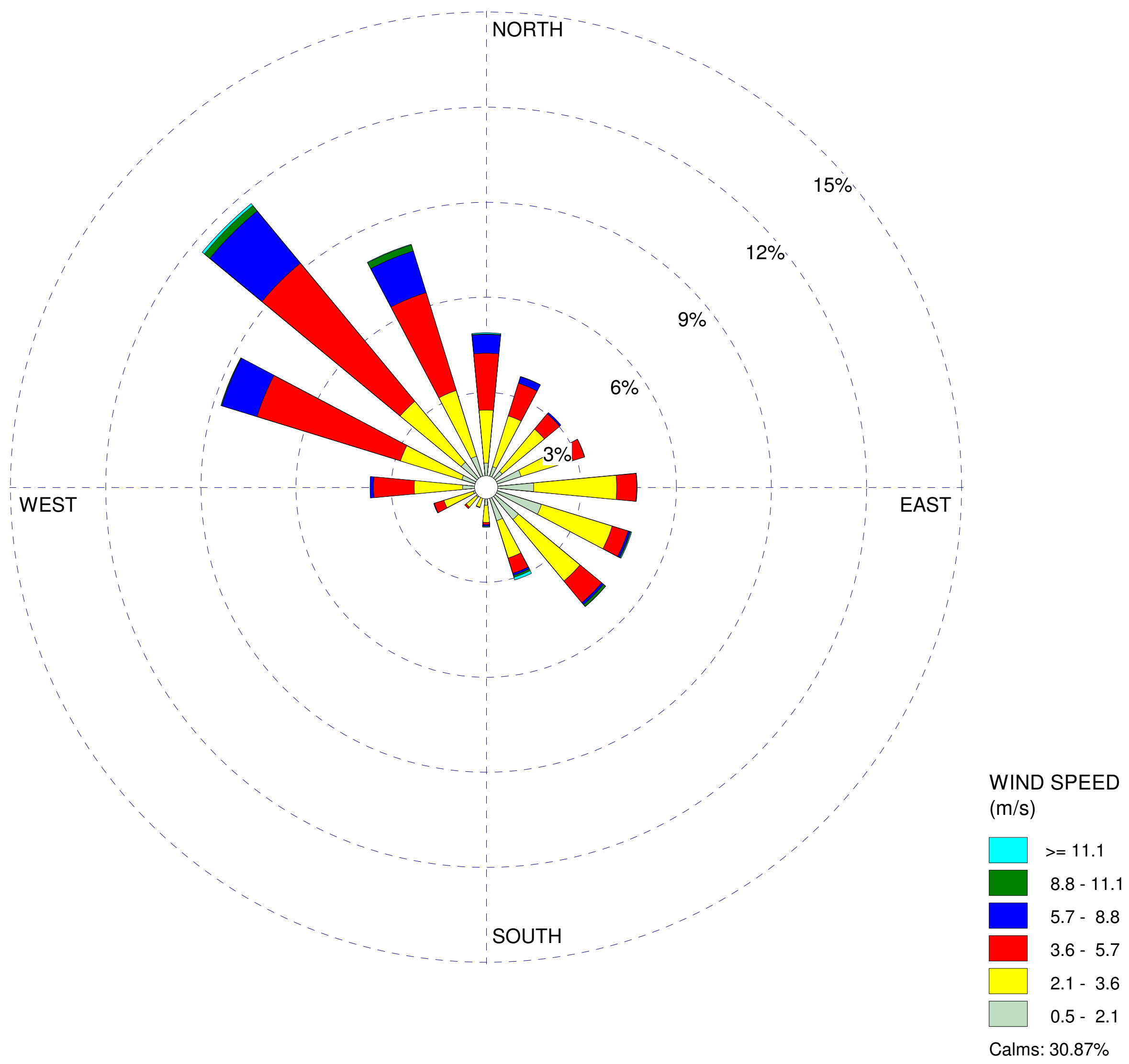
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Summer Season	**Start Date: 6/1/2006 - 00:00** **End Date: 8/31/2010 - 23:00**	**URS**	
		MODELER: **LMB**	
	CALM WINDS: **20.46%**	TOTAL COUNT: **11003 hrs.**	
	AVG. WIND SPEED: **3.40 m/s**	DATE: **4/9/2012**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Bakersfield Meadows Field Airport 2006-2010
SJVAPCD Processed, March 2012

DISPLAY:
Wind Speed
Direction (blowing from)



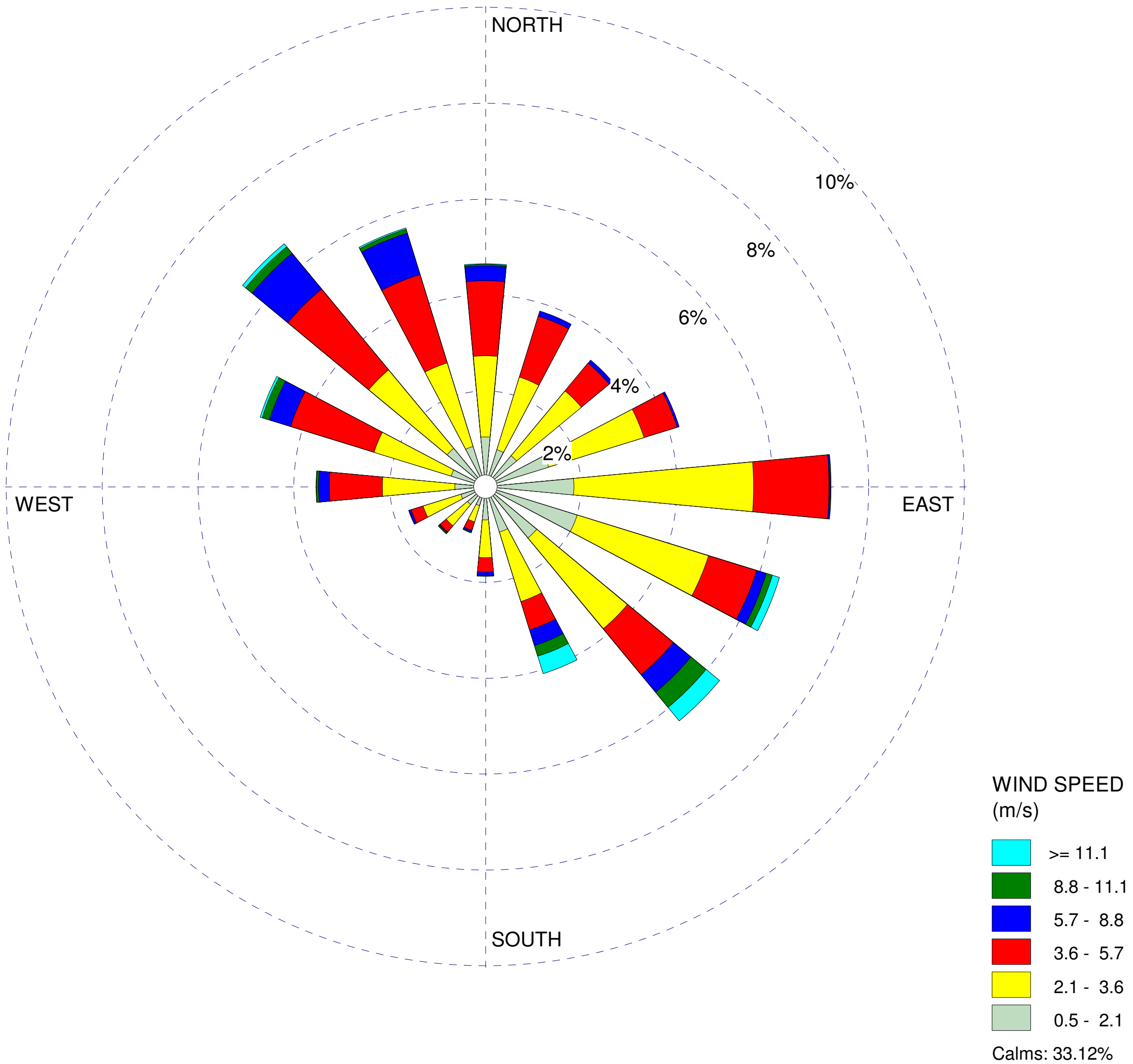
COMMENTS: Fall Season	DATA PERIOD: **Start Date: 9/1/2006 - 00:00** **End Date: 11/30/2010 - 23:00**	COMPANY NAME: **URS**	
		MODELER: **LMB**	
	CALM WINDS: **30.87%**	TOTAL COUNT: **10905 hrs.**	
	AVG. WIND SPEED: **2.53 m/s**	DATE: **4/9/2012**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Bakersfield Meadows Field Airport 2006-2010
SJVAPCD Processed, March 2012

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS: Winter Season	DATA PERIOD: **Start Date: 1/1/2006 - 00:00** **End Date: 12/31/2010 - 23:00**	COMPANY NAME: **URS**	
		MODELER: **LMB**	
	CALM WINDS: **33.12%**	TOTAL COUNT: **10790 hrs.**	
	AVG. WIND SPEED: **2.42 m/s**	DATE: **4/9/2012**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Appendix E-2

Construction Criteria Pollutant and Greenhouse Gas Emissions

Estimated Daily Maximum Construction Emissions of Criteria Pollutants (lbs/day)						
Activity	**PM_{10}**	**$PM_{2.5}$**	**CO**	**ROG**	**NO_x**	**SO_2**
Project Construction Emissions						
On-Site Combustion Emissions						
Construction Equipment - On-road	7.84	7.06	61.80	22.69	127.81	0.13
Construction Equipment - Off-road	13.28	12.22	126.21	38.72	181.10	0.32
Worker Vehicles	0.01	0.00	3.00	0.23	0.24	0.008
Delivery Trucks	1.824	1.654	2.205	1.359	5.138	0.004
Linear Combustion Emissions	0.00	0.00	155.42	44.31	258.98	0.00
On-Site Fugitive Emissions						
Construction Equipment - On-road	55.98	5.60				
Construction Equipment - Off-road	0.94	0.09				
Worker Vehicles	4.42	0.44				
Delivery Trucks	143.40	14.34				
Construction Activity	36.28	11.55				
Linear Fugitive Emissions	0.00	0.00				
Subtotal of Project Emissions	**263.95**	**52.96**	**348.63**	**107.31**	**573.26**	**0.46**
Off-Site Construction Emissions						
Off-Site Combustion Emissions						
Worker Vehicles	0.39	0.20	230.14	7.08	27.55	0.272
Delivery Trucks	11.02	9.45	15.40	3.40	78.16	0.07
Off-Site Paved Road Fugitive Dust Emissions						
Worker Vehicles	0.85	0.21				
Delivery Trucks	13.87	3.40				
Subtotal of Off-Site Emissions	**26.13**	**13.26**	**245.54**	**10.48**	**105.71**	**0.35**
Total Maximum Daily Emissions (lbs/day)	**290**	**66**	**594**	**118**	**679**	**1**

Estimated Annual Maximum Construction Emissions of Criteria Pollutants (tons/yr)						
Activity	**PM_{10}**	**$PM_{2.5}$**	**CO**	**ROG**	**NO_x**	**SO_2**
Project Construction Emissions						
On-Site Combustion Emissions						
Construction Equipment - On-road	0.78	0.70	7.68	2.77	15.84	0.02
Construction Equipment - Off-road	1.48	1.37	17.68	5.41	26.24	0.03
Worker Vehicles	0.00	0.00	0.43	0.03	0.03	0.001
Delivery Trucks	0.158	0.143	0.291	0.179	0.678	0.001
Linear Combustion Emissions	0.14	0.13	12.89	3.86	21.52	0.03
On-Site Fugitive Emissions						
Construction Equipment - On-road	6.04	0.60				
Construction Equipment - Off-road	0.15	0.01				
Worker Vehicles	0.76	0.08				
Delivery Trucks	12.24	1.22				
Construction Activity	4.76	1.54				
Linear Fugitive Emissions	0.11	0.01				
Subtotal of Project Emissions	**29.20**	**5.80**	**38.98**	**12.25**	**64.31**	**0.08**
Off-Site Construction Emissions						
Off-Site Combustion Emissions						
Worker Vehicles	0.07	0.03	33.08	1.02	3.96	0.039
Delivery Trucks	1.00	0.86	2.03	0.45	10.32	0.01
Off-Site Paved Road Fugitive Dust Emissions						
Worker Vehicles	0.14	0.04				
Delivery Trucks	1.27	0.31				
Subtotal of Off-Site Emissions	**2.48**	**1.24**	**35.11**	**1.47**	**14.28**	**0.05**
Total Maximum Annual Emissions (tons/year)	**32**	**7**	**74**	**14**	**79**	**0**

Estimated Emissions of GHG Pollutants, Entire Construction Period (tons)				
Activity	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Project Construction Emissions				
On-Site Combustion Emissions				
Construction Equipment - On-road	5,749.3	0.1	0.1	5,781.3
Construction Equipment - Off-road	9,143.5	1.6	0.2	9,243.2
Worker Vehicles	271.9	0.0	0.0	275.4
Delivery Trucks	388.2	0.0	0.0	390.0
Linear Combustion Emissions	2,682.5	0.3	0.0	2,701.6
Subtotal of Project Emissions	**18,235.3**	**2.0**	**0.4**	**18,391.6**
Off-Site On-Road Emissions				
Off-Site Combustion Emissions				
Worker Vehicles	15,381.0	3.6	1.8	16,023.5
Delivery Trucks	5,841.8	0.3	0.2	5,903.8
Subtotal of Off-Site Emissions	**21,222.8**	**3.9**	**2.0**	**21,927.3**
Total Maximum Daily Emissions (tons)	**39,458.2**	**5.9**	**2.4**	**40,318.8**

Estimated Emissions of GHG Pollutants, Entire Construction Period (metric tonnes)				
Activity	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Project Construction Emissions				
On-Site Combustion Emissions				
Construction Equipment - On-road	5,215.7	0.1	0.1	5,244.7
Construction Equipment - Off-road	8,294.8	1.4	0.2	8,385.2
Worker Vehicles	246.6	0.0	0.0	249.9
Delivery Trucks	352.2	0.0	0.0	353.8
Linear Combustion Emissions	2,433.5	0.3	0.0	2,450.9
Subtotal of Project Emissions	**16,542.8**	**1.8**	**0.3**	**16,684.5**
Off-Site On-Road Emissions				
Off-Site Combustion Emissions				
Worker Vehicles	13,953.4	3.3	1.7	14,536.2
Delivery Trucks	5,299.6	0.2	0.2	5,355.8
Subtotal of Off-Site Emissions	**19,253.0**	**3.5**	**1.8**	**19,892.1**
Total Maximum Daily Emissions (tonnes)	**35,795.8**	**5.3**	**2.2**	**36,576.6**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Carbon Monoxide (CO)

ON-SITE

CO

MONTHLY EMISSIONS (lbs/day)

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																																																	
18 cy fill mat'l haul truck	0	0	13	13	26	26	26	26	13	13	13	13	7	7	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	4	1	1	1	0	0	0	0	0	0	0
Bus	3	3	3	3	4	4	4	4	4	4	7	7	7	7	7	7	9	9	9	13	13	13	13	18	18	18	18	18	18	18	18	18	18	18	18	16	16	16	13	13	7	7	4	4	3	3	3	1	1
Concrete Pumper Truck	0	0	0	0	0	3	3	3	3	3	3	3	3	4	4	4	3	3	3	3	3	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dump Truck	4	5	5	4	4	4	4	4	4	4	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	4	4	4	3	1	1	1	1	1	0	0	0	0
Diesel Tractor (Yard Dog)	0	0	0	0	0	3	3	3	3	3	3	6	6	6	6	6	12	12	12	12	12	12	12	15	15	15	15	15	15	15	15	15	15	15	15	6	6	6	6	6	6	6	0	0	0	0	0	0	0
Service Truck - 1 ton	3	3	3	5	5	5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1
Pile Driver Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck - Fuel/Lube	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
Tractor Truck 5th Wheel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks - Pickup 3/4 ton	3	3	3	3	3	4	4	5	10	10	10	10	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	10	10	6	6	6	6	3
Trucks - 3 ton	1	1	1	1	1	3	3	3	5	5	5	5	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	5	4	4	4	4	3	3	3	1	1	1	1	0	0	0
Truck - Water	7	7	7	7	7	7	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1
Off Road Vehicles																																																	
Air Compressor 185 CFM	3	3	3	3	4	4	4	4	4	4	4	4	4	8	8	8	10	10	10	13	13	13	13	15	15	15	15	15	15	15	15	15	15	15	15	10	10	10	8	8	8	8	5	5	5	3	3	1	1
Air Compressor 750 CFM	0	0	0	0	2	2	2	2	3	3	3	3	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Articulating Boom Platform	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bob cat loader	0	0	2	2	2	2	2	8	8	8	8	8	6	6	6	6	6	6	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0	0	0	0	0	0	0
Bulldozer D10R	17	17	17	11	11	11	11	11	11	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulldozer D6C	9	9	9	9	6	6	6	6	6	6	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Trowel Machine	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
Concrete Vibrators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cranes - Mobile 35 ton	0	0	0	0	0	0	2	2	2	6	6	6	6	11	11	11	11	11	11	11	11	11	11	11	11	11	8	8	8	8	8	8	8	8	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2
Cranes - Mobile 45 ton	0	0	0	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4	8	8	8	8	8	8	8	8	8	8	8	4	4	4	4	4	4	4	4	4	4	4	2	2	0	0	0	0	0	0	0
Crane - Mobile 65 ton	0	0	0	0	0	0	0	0	0	0	0	2	2	4	8	10	10	10	12	12	12	12	12	12	12	12	12	12	12	12	10	10	8	4	4	4	4	4	2	2	2	2	2	2	2	0	0	0	0
Cranes 100 / 150 ton cap	0	0	0	0	0	0	0	0	0	0	1	1	3	3	4	4	5	5	5	5	5	5	5	5	5	5	5	5	3	3	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel Powered Welder	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	5	5	5	5	5	7	7	7	7	7	7	7	7	7	4	4	4	4	4	3	3	3	3	3	1	1	1	1	1	1	1
Excavator - Backhoe/loader	3	3	5	7	7	7	7	7	7	7	7	3	3	3	3	3	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	2	2	2	0	0	0	0	0	0	0
Excavator - Earth Scraper 637	56	56	56	56	32	32	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator - loader	4	4	4	4	4	4	4	4	4	4	4	4	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0
Excavator - Motor Grader (CAT140H)	0	3	3	3	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	0	0	0	0	6	6	6	6	3	3	3	0	0	0	0	0	0	0
Excavator - Trencher (CAT320)	0	0	0	0	0	7	7	7	7	7	7	7	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fired Heaters (2,000 BTU)	0	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
Forklift	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1
Fusion Welder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Haul / 600 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Haul / 1,000 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Light Plants	0	0	1	1	3	3	3	3	1	1	2	2	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1
Man lifts - telescoping	0	0	0	0	0	0	0	0	5	5	5	9	9	9	9	9	9	9	9	14	14	14	14	19	19	19	19	19	19	19	19	19	19	19	19	14	14	14	9	9	9	9	5	5	5	5	2	2	2
Man lift - scissor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portable Compaction Roller	0	0	12	12	12	12	12	12	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	0	0	5	5	5	5	5	5	0	0	0	5	5	5	2	2	0	0	0	0	0	0	0
Portable Compaction - Vibratory Plate	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portable Compaction - Ram	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumps	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Portable Power Generators	8	8	8	8	12	12	12	12	12	20	20	20	20	20	20	31	31	31	31	31	31	31	41	41	41	41	41	41	41	41	41	41	41	41	41	31	31	31	31	20	20	20	20	20	20	10	10	10	4
Truck Crane - Greater than 300 ton	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	5	5	7	7	9	9	9	9	9	9	9	9	9	7	7	5	5	5	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0
Truck Crane - Greater than 200 ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	3	3	3	4	4	4	4	4	4	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vibratory Roller Ingersol-Rand 20 ton	8	8	8	8	8	8	8	8	8	5	5	5	5	5	3	3	3	3	0	0	0	0	0	0	0	0	0	5	5	5	5	0	0	0	0	0	0	3	3	3	3	0	0	0	0	0	0	0	0
WORKER VEHICLES																																																	
Personal commuting vehicles	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	3	3	3	3	4	4	4	4	5	5	5	6	6	6	6	6	6	6	6	6	5	5	5	4	3	3	2	1	1	1	1	1	1	1
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Import fill trucks	10	10	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ONSITE TOTAL (lbs/day)	**146**	**151**	**180**	**181**	**185**	**200**	**175**	**153**	**145**	**150**	**155**	**158**	**159**	**171**	**174**	**185**	**193**	**196**	**195**	**211**	**214**	**212**	**223**	**239**	**230**	**225**	**219**	**236**	**237**	**226**	**220**	**201**	**196**	**190**	**175**	**157**	**158**	**166**	**154**	**130**	**113**	**109**	**65**	**65**	**61**	**43**	**36**	**33**	**23**

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
OFF-SITE	**WORKER VEHICLES**																									
	Personal commuting vehicles	7	12	16	20	30	38	45	60	67	80	100	112	132	155	187	211	230	244	257	272	286	320	344	370	393
	DELIVERY TRUCKS																									
	Light delivery truck (e.g. Fed-Ex)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Heavy delivery truck (e.g. flat beds carrying construction eqp)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	Import fill trucks	46	46	46	46	46	46	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LINEARS																									
	ON ROAD																									
	Dump Truck	0	0	0	0	0	0	0	0	0	0	5	5	8	8	8	8	8	8	8	8	5	5	0	0	0
	Service Truck (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	4	4	4	4	4	4	0	0	0
	Pipe Haul Truck and Trailer (HHDT-DSL)	0	0	0	0	0	0	0	0	0	0	4	4	4	4	4	4	3	3	3	3	3	3	0	0	0
	3/4 Ton Pickup (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	6	6	6	6	6	6	10	10	10	10	10	10	0	0	0
	Truck - water	0	0	0	0	0	0	0	0	0	0	3	3	5	5	5	5	5	5	5	5	3	3	0	0	0
	OFF ROAD																									
	Air Compressor (185 CFM)	0	0	0	0	0	0	0	0	0	0	3	3	5	5	8	8	8	8	5	5	3	3	0	0	0
	Bore Machine (Hydraulic)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	0	0	0	0	0	0
	12 Ton Hydra Crane	0	0	0	0	0	0	0	0	0	0	3	5	5	8	8	8	8	8	8	8	5	5	0	0	0
	Backhoe/loader	0	0	0	0	0	0	0	0	0	0	10	10	16	16	16	16	16	16	16	16	10	10	0	0	0
	Excavator - Trencher	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	0	0	0
	Forklift	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	2	2	2	2	2	2	1	0	0	0
	Welding Generator	0	0	0	0	0	0	0	0	0	0	16	16	16	16	16	16	16	16	16	16	16	16	0	0	0
	3 to 5 Ton AC Roller	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	0	0	0
	Pipe Bending Machine	0	0	0	0	0	0	0	0	0	0	3	3	7	7	7	7	7	7	7	3	3	0	0	0	0
	RAIL																									
	AIR COMPRESSOR 185	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	0	0	0	0	0	0	0	0
	BOOM TRUCK 12 TON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
	CAT 325 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0
	CAT 330 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
	CAT DOZER D-6	0	0	0	0	0	0	0	0	0	0	0	0	9	9	0	0	4	0	0	0	0	0	0	0	0
	CAT MODEL 12 MOTOR GRADER	0	0	0	0	0	0	0	0	0	0	0	0	6	6	3	3	3	0	0	0	0	0	0	0	0
	CAT ROLLER-COMPACTOR 563	0	0	0	0	0	0	0	0	0	0	0	0	5	5	2	0	0	0	0	0	0	0	0	0	0
	CAT RUBBER TIRE LOADER 966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	0	0	0	0	0	0	0	0
	CAT SCRAPER 615	0	0	0	0	0	0	0	0	0	0	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0
	CRANE-ROUGH TERRAIN 45T	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
	GENSET 5KW	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
	JOHN DEERE TRACTOR 9400	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
	PICK-UP CRAFT	0	0	0	0	0	0	0	0	0	0	0	0	10	10	10	10	10	0	0	0	0	0	0	0	0
	PICK-UP OVERHEAD	0	0	0	0	0	0	0	0	0	0	0	0	7	22	22	18	18	0	0	0	0	0	0	0	0
	RAIL BALLAST REGULATOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0
	RAIL CLIP MACHINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0
	RAIL MOVER-SHUTTLE WAGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	0	0	0	0	0	0	0	0
	RAIL TAMPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0
	RAIL WELDER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	RAMEX WALK BEHIND COMPACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TRI-AXLE DUMP TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	5	8	3	0	0	0	0	0	0	0	0	0	0
	TRUCK FLATBED 14 FOOT	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4	4	4	0	0	0	0	0	0	0	0
	TRUCK TRACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
	WATER TRUCK, 4M ON-ROAD	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	WELDING MACHINE 350 AMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LINEARS TOTAL (lbs/day)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**56**	**65**	**143**	**162**	**155**	**151**	**155**	**94**	**91**	**86**	**69**	**65**	**0**	**0**	**0**
	OFFSITE VEHICLES TOTAL (lbs/day)	**69**	**73**	**77**	**82**	**91**	**99**	**107**	**75**	**82**	**96**	**115**	**127**	**148**	**170**	**202**	**226**	**246**	**260**	**273**	**288**	**301**	**335**	**359**	**385**	**408**
	TOTAL PROJECT (lbs/day)	215	224	257	263	276	300	281	229	227	245	327	350	449	503	530	562	594	550	559	586	584	612	582	624	638

	Month	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
OFF-SITE	**WORKER VEHICLES**																								
	Personal commuting vehicles	398	437	468	483	486	491	484	479	458	433	420	381	369	313	255	202	137	110	109	109	101	86	79	59
	DELIVERY TRUCKS																								
	Light delivery truck (e.g. Fed-Ex)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Heavy delivery truck (e.g. flat beds carrying construction eqp)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	Import fill trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LINEARS																								
	ON ROAD																								
	Dump Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Service Truck (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pipe Haul Truck and Trailer (HHDT-DSL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3/4 Ton Pickup (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Truck - water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OFF ROAD																								
	Air Compressor (185 CFM)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bore Machine (Hydraulic)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	12 Ton Hydra Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Backhoe/loader	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Excavator - Trencher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Forklift	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Welding Generator	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3 to 5 Ton AC Roller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pipe Bending Machine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RAIL																								
	AIR COMPRESSOR 185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BOOM TRUCK 12 TON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT 325 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT 330 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT DOZER D-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT MODEL 12 MOTOR GRADER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT ROLLER-COMPACTOR 563	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT RUBBER TIRE LOADER 966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT SCRAPER 615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CRANE-ROUGH TERRAIN 45T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GENSET 5KW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JOHN DEERE TRACTOR 9400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PICK-UP CRAFT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PICK-UP OVERHEAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RAIL BALLAST REGULATOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RAIL CLIP MACHINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RAIL MOVER-SHUTTLE WAGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RAIL TAMPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RAIL WELDER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RAMEX WALK BEHIND COMPACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TRI-AXLE DUMP TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TRUCK FLATBED 14 FOOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TRUCK TRACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WATER TRUCK, 4M ON-ROAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WELDING MACHINE 350 AMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LINEARS TOTAL (lbs/day)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	OFFSITE VEHICLES TOTAL (lbs/day)	**413**	**453**	**484**	**499**	**501**	**506**	**499**	**495**	**473**	**449**	**435**	**397**	**384**	**329**	**270**	**217**	**153**	**125**	**125**	**125**	**117**	**101**	**94**	**75**
	TOTAL PROJECT (lbs/day)	638	671	719	735	727	726	700	690	663	624	593	555	551	482	400	330	262	190	190	186	159	138	127	98

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Carbon Dioxide (CO2)

ON-SITE

CO_2 — MONTHLY EMISSIONS (lbs/day)

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																																																	
18 cy fill mat'l haul truck	0	0	2,861	2,861	5,722	5,722	5,722	5,722	2,861	2,861	2,861	2,861	1,431	1,431	1,431	1,431	1,431	1,431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	858	858	858	858	286	286	286	0	0	0	0	0	0	0
Bus	572	572	572	572	858	858	858	858	858	858	1,431	1,431	1,431	1,431	1,431	1,431	2,003	2,003	2,003	2,861	2,861	2,861	2,861	4,006	4,006	4,006	4,006	4,006	4,006	4,006	4,006	4,006	4,006	4,006	4,006	3,433	3,433	3,433	2,861	2,861	1,431	1,431	858	858	572	572	572	286	286
Concrete Pumper Truck	0	0	0	0	0	572	572	572	572	572	572	572	572	858	858	858	572	572	572	572	572	0	0	0	0	0	0	286	286	286	286	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dump Truck	858	1,144	1,144	858	858	858	858	858	858	858	572	572	572	572	572	0	0	0	0	0	0	0	0	0	0	0	0	572	572	572	572	572	572	572	572	572	858	858	858	572	286	286	286	286	286	0	0	0	0
Diesel Tractor (Yard Dog)	0	0	0	0	0	649	649	649	649	649	649	1,298	1,298	1,298	1,298	1,298	2,596	2,596	2,596	2,596	2,596	2,596	2,596	3,245	3,245	3,245	3,245	3,245	3,245	3,245	3,245	3,245	3,245	3,245	3,245	1,298	1,298	1,298	1,298	1,298	1,298	1,298	0	0	0	0	0	0	0
Service Truck - 1 ton	572	572	572	1,144	1,144	1,144	1,144	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	286	286	286	286	286	286	286
Pile Driver Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck - Fuel/Lube	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	136	136	136	136	136	136	136	0	0	0
Tractor Truck 5th Wheel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks - Pickup 3/4 ton	680	680	680	680	680	816	952	1,088	2,041	2,041	2,041	2,041	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	2,041	2,041	1,360	1,360	1,360	1,360	680
Trucks - 3 ton	286	286	286	286	286	572	572	572	1,144	1,144	1,144	1,144	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,144	858	858	858	858	572	572	572	286	286	286	286	0	0	0
Truck - Water	1,431	1,431	1,431	1,431	1,431	1,431	858	858	858	858	858	858	858	858	858	858	858	858	858	858	858	858	858	572	858	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	286	286	286	286	286	286	286
Off Road Vehicles																																																	
Air Compressor 185 CFM	214	214	214	214	320	320	320	320	320	320	320	320	320	641	641	641	854	854	854	1,068	1,068	1,068	1,068	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	854	854	854	641	641	641	641	427	427	427	214	214	107	107
Air Compressor 750 CFM	0	0	0	0	225	225	225	225	450	450	450	450	450	450	450	901	901	901	901	901	901	901	901	901	901	901	901	901	901	450	450	450	450	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Articulating Boom Platform	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bob cat loader	0	0	168	168	168	168	168	672	672	672	672	672	504	504	504	504	504	504	336	336	336	336	336	336	0	0	0	0	0	0	0	0	0	0	0	168	168	168	168	168	168	168	0	0	0	0	0	0	0
Bulldozer D10R	4,584	4,584	4,584	3,056	3,056	3,056	3,056	3,056	3,056	1,528	1,528	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulldozer D6C	1,164	1,164	1,164	1,164	776	776	776	776	776	776	388	388	388	388	388	0	0	0	0	0	0	0	0	0	0	0	0	388	388	388	388	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Trowel Machine	0	0	0	0	0	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	0	0	0	0	0	0	0	0	138	138	138	138	138	138	0	0	0	0	0	0	0
Concrete Vibrators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cranes - Mobile 35 ton	0	0	0	0	0	0	215	215	215	862	862	862	862	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,508	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	431	431	431	431	431	431	431	431	431	431	431	215	215	215	215
Cranes - Mobile 45 ton	0	0	0	0	0	0	0	0	0	0	690	690	690	690	690	690	690	690	1,381	1,381	1,381	1,381	1,381	1,381	1,381	1,381	1,381	1,381	1,381	690	690	690	690	690	690	690	690	690	690	690	345	345	0	0	0	0	0	0	0
Crane - Mobile 65 ton	0	0	0	0	0	0	0	0	0	0	0	345	345	690	1,381	1,726	1,726	1,726	2,071	2,071	2,071	2,071	2,071	2,071	2,071	2,071	2,071	2,071	2,071	2,071	1,726	1,726	1,381	690	690	690	690	690	345	345	345	345	345	345	345	0	0	0	0
Cranes 100 / 150 ton cap	0	0	0	0	0	0	0	0	0	0	482	482	964	964	1,446	1,446	1,927	1,927	1,927	1,927	1,927	1,927	1,927	1,927	1,927	1,927	1,927	1,927	964	964	482	482	482	482	482	482	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel Powered Welder	0	0	0	507	507	507	507	507	507	507	507	507	507	507	507	761	761	761	1,015	1,015	1,015	1,015	1,015	1,269	1,269	1,269	1,269	1,269	1,269	1,269	1,269	1,269	761	761	761	761	761	507	507	507	507	507	254	254	254	254	152	152	101
Excavator - Backhoe/loader	481	481	721	961	961	961	961	961	961	961	961	481	481	481	481	481	240	240	240	240	240	240	240	240	0	0	0	0	0	0	0	0	0	0	0	481	481	481	481	240	240	240	0	0	0	0	0	0	0
Excavator - Earth Scraper 637	14,837	14,837	14,837	14,837	8,478	8,478	4,239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator - loader	636	636	636	636	636	636	636	636	636	636	636	636	318	318	0	0	0	0	0	0	0	0	0	0	0	0	0	318	318	318	318	0	0	0	0	0	0	318	318	318	0	0	0	0	0	0	0	0	0
Excavator - Motor Grader (CAT140H)	0	431	431	431	1,292	1,292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	431	431	431	431	0	0	0	0	861	861	861	861	431	431	431	0	0	0	0	0	0	0
Excavator - Trencher (CAT320)	0	0	0	0	0	901	901	901	901	901	901	901	901	901	901	901	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fired Heaters (2,000 BTU)	0	0	0	0	327	327	327	327	246	246	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	409	246	246	246	164	164	164	164	164	164	164	164	164	164	164	82	82	82
Forklift	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	352	352	352	352	352	352	352	352	352	352	352	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	88	88	88	88	44	44	44
Fusion Welder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Haul / 600 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Haul / 1,000 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,302	1,302	1,302	1,302	1,302	1,302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Light Plants	82	82	164	327	655	655	655	655	327	327	491	491	655	655	819	819	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	819	819	819	819	819	819	819	819	819	409	409	409	409	409	327	327	164	164
Man lifts - telescoping	0	0	0	0	0	0	0	0	495	495	495	990	990	990	990	990	990	990	990	1,484	1,484	1,484	1,484	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,484	1,484	1,484	990	990	990	990	495	495	495	495	198	198	198
Man lift - scissor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portable Compaction Roller	0	0	1,694	1,694	1,694	1,694	1,694	1,694	678	678	678	678	678	678	678	678	678	678	678	678	678	678	678	678	0	0	0	0	678	678	678	678	678	678	0	0	0	678	678	678	339	339	0	0	0	0	0	0	0
Portable Compaction - Vibratory Plate	0	0	0	0	0	0	0	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	0	0	0	0	0	56	56	56	56	0	0	0	0	74	74	74	74	74	37	37	0	0	0	0	0	0	0
Portable Compaction - Ram	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumps	246	246	246	491	491	491	491	491	491	491	491	491	491	491	491	491	491	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	246	164	164	164	164	164	164	164
Portable Power Generators	906	906	906	906	1,358	1,358	1,358	1,358	1,358	2,264	2,264	2,264	2,264	2,264	2,264	3,396	3,396	3,396	3,396	3,396	3,396	3,396	4,528	4,528	4,528	4,528	4,528	4,528	4,528	4,528	4,528	4,528	4,528	4,528	4,528	3,396	3,396	3,396	3,396	2,264	2,264	2,264	2,264	2,264	2,264	1,132	1,132	1,132	453
Truck Crane - Greater than 300 ton	0	0	0	0	0	0	0	0	0	0	0	774	774	774	774	774	1,547	1,547	2,321	2,321	3,095	3,095	3,095	3,095	3,095	3,095	3,095	3,095	3,095	2,321	2,321	1,547	1,547	1,547	774	774	774	774	774	0	0	0	0	0	0	0	0	0	0
Truck Crane - Greater than 200 ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	482	482	482	482	482	964	964	964	1,446	1,446	1,446	1,446	1,446	1,446	1,446	964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vibratory Roller Ingersol-Rand 20 ton	1,394	1,394	1,394	1,394	1,394	1,394	1,394	1,394	1,394	929	929	929	929	929	465	465	465	465	0	0	0	0	0	0	0	0	0	929	929	929	929	0	0	0	0	0	0	465	465	465	465	0	0	0	0	0	0	0	0
WORKER VEHICLES																																																	
Personal commuting vehicles	15	25	34	44	65	82	98	131	146	175	218	243	288	338	407	460	502	533	561	594	623	697	749	806	857	867	954	1,021	1,054	1,060	1,071	1,055	1,045	998	945	915	832	805	683	555	440	299	239	238	238	221	187	171	129
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Heavy delivery truck (e.g. flat beds carrying construction eqp)	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424
Import fill trucks	2,035	2,035	2,035	2,035	2,035	2,035	2,035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ONSITE TOTAL (lbs/day)	**31,956**	**32,684**	**37,738**	**37,663**	**36,386**	**39,086**	**33,350**	**27,289**	**25,261**	**24,850**	**26,290**	**26,569**	**27,276**	**28,924**	**30,028**	**31,302**	**33,671**	**34,758**	**34,786**	**38,170**	**38,973**	**38,475**	**40,030**	**42,556**	**41,639**	**40,061**	**38,414**	**41,373**	**40,983**	**38,592**	**36,812**	**33,288**	**32,262**	**31,299**	**28,576**	**26,047**	**25,906**	**27,086**	**25,338**	**21,353**	**18,073**	**17,467**	**10,114**	**10,113**	**9,147**	**6,855**	**5,875**	**5,303**	**3,850**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Carbon Dioxide (CO2)

OFF-SITE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
WORKER VEHICLES																									
Personal commuting vehicles	837	1,441	1,934	2,497	3,664	4,629	5,520	7,415	8,245	9,927	12,310	13,762	16,308	19,127	23,026	26,019	28,397	30,137	31,729	33,615	35,250	39,447	42,401	45,600	48,495
DELIVERY TRUCKS																									
Light delivery truck (e.g. Fed-Ex)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Heavy delivery truck (e.g. flat beds carrying construction eqp)	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182
Import fill trucks	22,394	22,394	22,394	22,394	22,394	22,394	22,394	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINEARS																									
ON ROAD																									
Dump Truck	0	0	0	0	0	0	0	0	0	0	1,144	1,144	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,717	1,144	1,144	0	0	0
Service Truck (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	572	572	572	572	572	572	858	858	858	858	858	858	0	0	0
Pipe Haul Truck and Trailer (HHDT-DSL)	0	0	0	0	0	0	0	0	0	0	858	858	858	858	858	858	572	572	572	572	572	572	0	0	0
3/4 Ton Pickup (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	1,360	1,360	1,360	1,360	1,360	1,360	2,041	2,041	2,041	2,041	2,041	2,041	0	0	0
Truck - water	0	0	0	0	0	0	0	0	0	0	572	572	1,144	1,144	1,144	1,144	1,144	1,144	1,144	1,144	572	572	0	0	0
OFF ROAD																									
Air Compressor (185 CFM)	0	0	0	0	0	0	0	0	0	0	214	214	427	427	641	641	641	641	427	427	214	214	0	0	0
Bore Machine (Hydraulic)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	233	233	233	233	233	0	0	0	0	0	0
12 Ton Hydra Crane	0	0	0	0	0	0	0	0	0	0	964	1,927	1,927	2,891	2,891	2,891	2,891	2,891	2,891	2,891	1,927	1,927	0	0	0
Backhoe/loader	0	0	0	0	0	0	0	0	0	0	1,442	1,442	2,403	2,403	2,403	2,403	2,403	2,403	2,403	2,403	1,442	1,442	0	0	0
Excavator - Trencher	0	0	0	0	0	0	0	0	0	0	0	427	427	427	427	427	427	427	427	427	427	427	0	0	0
Forklift	0	0	0	0	0	0	0	0	0	0	88	88	176	176	176	176	176	176	176	176	176	88	0	0	0
Welding Generator	0	0	0	0	0	0	0	0	0	0	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811	0	0	0
3 to 5 Ton AC Roller	0	0	0	0	0	0	0	0	0	0	0	299	299	299	299	299	299	299	299	299	299	299	0	0	0
Pipe Bending Machine	0	0	0	0	0	0	0	0	0	0	347	347	694	694	694	694	694	694	694	347	347	0	0	0	0
RAIL																									
AIR COMPRESSOR 185	0	0	0	0	0	0	0	0	0	0	0	0	0	214	214	214	214	0	0	0	0	0	0	0	0
BOOM TRUCK 12 TON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	286	286	286	0	0	0	0	0	0	0	0
CAT 325 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	471	471	0	0	0	0	0	0	0	0	0	0	0
CAT 330 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	798	0	0	0	0	0	0	0	0	0	0
CAT DOZER D-6	0	0	0	0	0	0	0	0	0	0	0	0	1,429	1,429	0	0	714	0	0	0	0	0	0	0	0
CAT MODEL 12 MOTOR GRADER	0	0	0	0	0	0	0	0	0	0	0	0	861	861	431	431	431	0	0	0	0	0	0	0	0
CAT ROLLER-COMPACTOR 563	0	0	0	0	0	0	0	0	0	0	0	0	678	678	339	0	0	0	0	0	0	0	0	0	0
CAT RUBBER TIRE LOADER 966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,608	1,608	1,608	0	0	0	0	0	0	0	0
CAT SCRAPER 615	0	0	0	0	0	0	0	0	0	0	0	0	2,763	1,381	0	0	0	0	0	0	0	0	0	0	0
CRANE-ROUGH TERRAIN 45T	0	0	0	0	0	0	0	0	0	0	0	0	0	345	345	0	0	0	0	0	0	0	0	0	0
GENSET 5KW	0	0	0	0	0	0	0	0	0	0	0	0	0	302	151	0	0	0	0	0	0	0	0	0	0
JOHN DEERE TRACTOR 9400	0	0	0	0	0	0	0	0	0	0	0	0	1,602	0	0	0	0	0	0	0	0	0	0	0	0
PICK-UP CRAFT	0	0	0	0	0	0	0	0	0	0	0	0	4,725	4,725	4,725	4,725	4,725	0	0	0	0	0	0	0	0
PICK-UP OVERHEAD	0	0	0	0	0	0	0	0	0	0	0	0	1,320	3,959	3,959	3,299	3,299	0	0	0	0	0	0	0	0
RAIL BALLAST REGULATOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	660	660	0	0	0	0	0	0	0	0
RAIL CLIP MACHINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	173	173	0	0	0	0	0	0	0	0
RAIL MOVER-SHUTTLE WAGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	660	660	660	0	0	0	0	0	0	0	0
RAIL TAMPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	660	660	0	0	0	0	0	0	0	0
RAIL WELDER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101	51	0	0	0	0	0	0	0	0
RAMEX WALK BEHIND COMPACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0
TRI-AXLE DUMP TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	1,144	1,717	572	0	0	0	0	0	0	0	0	0	0
TRUCK FLATBED 14 FOOT	0	0	0	0	0	0	0	0	0	0	0	0	286	286	858	858	858	0	0	0	0	0	0	0	0
TRUCK TRACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,116	1,116	0	0	0	0	0	0	0	0	0
WATER TRUCK, 4M ON-ROAD	0	0	0	0	0	0	0	0	0	0	0	0	286	286	286	286	286	0	0	0	0	0	0	0	0
WELDING MACHINE 350 AMP	0	0	0	0	0	0	0	0	0	0	0	0	51	51	51	51	51	0	0	0	0	0	0	0	0
LINEARS TOTAL (lbs/day)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9,373**	**11,062**	**29,431**	**31,502**	**31,623**	**30,352**	**30,581**	**15,906**	**15,692**	**15,113**	**11,830**	**11,395**	**0**	**0**	**0**
OFFSITE VEHICLES TOTAL (lbs/day)	**30,870**	**31,474**	**31,966**	**32,529**	**33,696**	**34,662**	**35,553**	**15,054**	**15,884**	**17,567**	**19,949**	**21,401**	**23,947**	**26,766**	**30,665**	**33,658**	**36,036**	**37,776**	**39,368**	**41,255**	**42,889**	**47,086**	**50,040**	**53,240**	**56,134**
TOTAL PROJECT (lbs/day)	62,826	64,158	69,705	70,193	70,082	73,748	68,903	42,343	41,144	42,416	55,611	59,032	80,654	87,192	92,316	95,312	100,288	88,441	89,847	94,538	93,692	96,956	90,069	95,795	97,773

Month	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
WORKER VEHICLES																								
Personal commuting vehicles	49,067	53,947	57,764	59,641	59,975	60,565	59,688	59,142	56,484	53,466	51,785	47,061	45,535	38,644	31,407	24,884	16,929	13,513	13,488	13,488	12,479	10,584	9,698	7,310
DELIVERY TRUCKS																								
Light delivery truck (e.g. Fed-Ex)	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Heavy delivery truck (e.g. flat beds carrying construction eqp)	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182	7,182
Import fill trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINEARS																								
ON ROAD																								
Dump Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Truck (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipe Haul Truck and Trailer (HHDT-DSL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/4 Ton Pickup (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck - water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF ROAD																								
Air Compressor (185 CFM)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bore Machine (Hydraulic)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 Ton Hydra Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Backhoe/loader	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator - Trencher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forklift	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Welding Generator	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 to 5 Ton AC Roller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipe Bending Machine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL																								
AIR COMPRESSOR 185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOOM TRUCK 12 TON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 325 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 330 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT DOZER D-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT MODEL 12 MOTOR GRADER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT ROLLER-COMPACTOR 563	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT RUBBER TIRE LOADER 966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT SCRAPER 615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRANE-ROUGH TERRAIN 45T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GENSET 5KW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JOHN DEERE TRACTOR 9400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PICK-UP CRAFT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PICK-UP OVERHEAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL BALLAST REGULATOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL CLIP MACHINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL MOVER-SHUTTLE WAGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL TAMPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL WELDER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAMEX WALK BEHIND COMPACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRI-AXLE DUMP TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK FLATBED 14 FOOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TRACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WATER TRUCK, 4M ON-ROAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WELDING MACHINE 350 AMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINEARS TOTAL (lbs/day)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
OFFSITE VEHICLES TOTAL (lbs/day)	**56,706**	**61,586**	**65,403**	**67,281**	**67,614**	**68,204**	**67,327**	**66,781**	**64,123**	**61,105**	**59,424**	**54,701**	**53,174**	**46,283**	**39,046**	**32,524**	**24,568**	**21,152**	**21,127**	**21,127**	**20,118**	**18,223**	**17,337**	**14,949**
TOTAL PROJECT (lbs/day)	96,767	100,000	106,777	108,263	106,206	105,016	100,615	99,043	95,422	89,681	85,471	80,607	80,260	71,621	60,399	50,596	42,036	31,266	31,241	30,274	26,973	24,098	22,640	18,800

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

ON-SITE

CH_4

MONTHLY EMISSIONS (lbs/day)

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																																																	
18 cy fill mat'l haul truck	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Pumper Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck - 1 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pile Driver Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tractor Truck 5th Wheel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - 3 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Off Road Vehicles																																																	
Air Compressor 185 CFM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.0	0.0
Air Compressor 750 CFM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	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	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Articulating Boom Platform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D10R	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Vibrators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	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	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Cranes - Mobile 45 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - Mobile 65 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	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	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes 100 / 150 ton cap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Powered Welder	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	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	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Backhoe/loader	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Earth Scraper 637	1.3	1.3	1.3	1.3	0.8	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0.0	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusion Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 1,000 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lifts - telescoping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Man lift - scissor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Vibratory Plate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Power Generators	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0	0.6	0.6	0.6	0.6	0.6	0.6	0.3	0.3	0.3	0.1
Truck Crane - Greater than 300 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	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	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 200 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Roller Ingersol-Rand 20 ton	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																																																	
Personal commuting vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Import fill trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ONSITE TOTAL (lbs/day)	**2.8**	**2.9**	**3.3**	**3.3**	**3.2**	**3.4**	**2.9**	**2.6**	**2.6**	**2.8**	**2.9**	**2.9**	**2.9**	**3.2**	**3.2**	**3.7**	**3.7**	**3.8**	**3.9**	**4.3**	**4.4**	**4.4**	**4.7**	**5.0**	**4.8**	**4.7**	**4.5**	**4.8**	**4.8**	**4.5**	**4.4**	**4.0**	**3.8**	**3.7**	**3.4**	**3.0**	**3.0**	**3.1**	**2.8**	**2.3**	**2.1**	**2.1**	**1.4**	**1.4**	**1.3**	**0.8**	**0.7**	**0.6**	**0.4**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Methane (CH4)

OFF-SITE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
WORKER VEHICLES																								
Personal commuting vehicles	0.2	0.3	0.5	0.6	0.9	1.1	1.3	1.7	1.9	2.3	2.9	3.2	3.8	4.5	5.4	6.1	6.7	7.1	7.5	7.9	8.3	9.3	10.0	10.7
DELIVERY TRUCKS																								
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Import fill trucks	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS																								
ON ROAD																								
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFF ROAD																								
Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.0	0.0
Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0
Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.0	0.0
Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0
3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0
RAIL																								
AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.1**	**1.4**	**2.9**	**3.2**	**3.1**	**3.0**	**3.1**	**1.9**	**1.8**	**1.7**	**1.4**	**1.3**	**0.0**	**0.0**
OFFSITE VEHICLES TOTAL (lbs/day)	**1.6**	**1.8**	**1.9**	**2.0**	**2.3**	**2.5**	**2.7**	**2.1**	**2.3**	**2.7**	**3.3**	**3.6**	**4.2**	**4.9**	**5.8**	**6.5**	**7.0**	**7.5**	**7.8**	**8.3**	**8.7**	**9.7**	**10.3**	**11.1**
TOTAL PROJECT (lbs/day)	4.4	4.7	5.2	5.3	5.5	5.9	5.6	4.7	4.9	5.4	7.2	7.9	10.0	11.2	12.1	13.2	13.8	13.2	13.6	14.3	14.5	15.3	15.1	16.1

Month	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
WORKER VEHICLES																									
Personal commuting vehicles	11.4	11.6	12.7	13.6	14.1	14.1	14.3	14.1	13.9	13.3	12.6	12.2	11.1	10.7	9.1	7.4	5.9	4.0	3.2	3.2	3.2	2.9	2.5	2.3	1.7
DELIVERY TRUCKS																									
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Import fill trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS																									
ON ROAD																									
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFF ROAD																									
Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL																									
AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
OFFSITE VEHICLES TOTAL (lbs/day)	**11.8**	**11.9**	**13.1**	**14.0**	**14.4**	**14.5**	**14.6**	**14.4**	**14.3**	**13.7**	**13.0**	**12.6**	**11.4**	**11.1**	**9.5**	**7.8**	**6.2**	**4.3**	**3.5**	**3.5**	**3.5**	**3.3**	**2.8**	**2.6**	**2.1**
TOTAL PROJECT (lbs/day)	16.6	16.6	17.6	18.8	19.2	19.0	19.0	18.4	18.1	17.4	16.4	15.6	14.4	14.2	12.3	10.1	8.3	6.4	4.9	4.9	4.9	4.1	3.5	3.3	2.5

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

N_2O

MONTHLY EMISSIONS (lbs/day)

ON-SITE

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																																																	
18 cy fill mat'l haul truck	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Pumper Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck - 1 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pile Driver Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tractor Truck 5th Wheel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - 3 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Off Road Vehicles																																																	
Air Compressor 185 CFM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Compressor 750 CFM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Articulating Boom Platform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D10R	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Vibrators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 45 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - Mobile 65 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes 100 / 150 ton cap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Powered Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Earth Scraper 637	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusion Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 1,000 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lifts - telescoping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lift - scissor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Vibratory Plate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Power Generators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 300 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 200 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Roller Ingersol-Rand 20 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																																																	
Personal commuting vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Import fill trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ONSITE TOTAL (lbs/day)	**0.6**	**0.6**	**0.7**	**0.7**	**0.7**	**0.7**	**0.6**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**	**0.7**	**0.7**	**0.8**	**0.8**	**0.9**	**0.9**	**0.9**	**0.9**	**1.0**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.8**	**0.8**	**0.7**	**0.7**	**0.7**	**0.6**	**0.5**	**0.5**	**0.6**	**0.5**	**0.4**	**0.4**	**0.4**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Nitrous Oxide (N2O)

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
OFF-SITE	**WORKER VEHICLES**																																																	
	Personal commuting vehicles	0.1	0.2	0.2	0.3	0.4	0.5	0.7	0.9	1.0	1.2	1.5	1.6	1.9	2.3	2.7	3.1	3.4	3.6	3.8	4.0	4.2	4.7	5.0	5.4	5.8	5.8	6.4	6.9	7.1	7.1	7.2	7.1	7.0	6.7	6.3	6.2	5.6	5.4	4.6	3.7	3.0	2.0	1.6	1.6	1.6	1.5	1.3	1.2	0.9
	DELIVERY TRUCKS																																																	
	Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Heavy delivery truck (e.g. flat beds carrying construction eqp)	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	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	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	0.2
	Import fill trucks	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	LINEARS																																																	
	ON ROAD																																																	
	Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	OFF ROAD																																																	
	Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL																																																	
	AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**0.2**	**0.3**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.3**	**0.3**	**0.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	OFFSITE VEHICLES TOTAL (lbs/day)	**1.0**	**1.1**	**1.1**	**1.2**	**1.3**	**1.5**	**1.6**	**1.1**	**1.2**	**1.4**	**1.7**	**1.9**	**2.2**	**2.5**	**3.0**	**3.3**	**3.6**	**3.8**	**4.0**	**4.2**	**4.4**	**4.9**	**5.3**	**5.7**	**6.0**	**6.1**	**6.6**	**7.1**	**7.3**	**7.4**	**7.4**	**7.3**	**7.3**	**6.9**	**6.6**	**6.4**	**5.8**	**5.6**	**4.8**	**4.0**	**3.2**	**2.3**	**1.8**	**1.8**	**1.8**	**1.7**	**1.5**	**1.4**	**1.1**
	TOTAL PROJECT (lbs/day)	1.6	1.7	1.8	1.9	2.0	2.2	2.2	1.7	1.7	1.9	2.4	2.7	3.1	3.5	4.0	4.4	4.7	4.9	5.1	5.4	5.6	6.1	6.2	6.6	6.9	7.0	7.5	8.0	8.2	8.2	8.2	8.0	8.0	7.6	7.2	6.9	6.4	6.2	5.4	4.4	3.6	2.6	2.1	2.1	2.0	1.9	1.6	1.5	1.2

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

NO_x

MONTHLY EMISSIONS (lbs/day)

ON-SITE

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
On-Road Vehicles																									
18 cy fill mat'l haul truck	0	0	28	28	57	57	57	57	28	28	28	28	14	14	14	14	14	14	0	0	0	0	0	0	0
Bus	6	6	6	6	9	9	9	9	9	9	14	14	14	14	14	14	20	20	20	28	28	28	28	40	40
Concrete Pumper Truck	0	0	0	0	0	6	6	6	6	6	6	6	6	9	9	9	6	6	6	6	6	0	0	0	0
Dump Truck	9	11	11	9	9	9	9	9	9	9	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0
Diesel Tractor (Yard Dog)	0	0	0	0	0	6	6	6	6	6	6	13	13	13	13	13	26	26	26	26	26	26	26	32	32
Service Truck - 1 ton	6	6	6	11	11	11	11	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Pile Driver Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck - Fuel/Lube	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tractor Truck 5th Wheel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks - Pickup 3/4 ton	6	6	6	6	6	7	8	9	17	17	17	17	29	29	29	29	29	29	29	29	29	29	29	29	29
Trucks - 3 ton	3	3	3	3	3	6	6	6	11	11	11	11	17	17	17	17	17	17	17	17	17	17	17	17	17
Truck - Water	14	14	14	14	14	14	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6	9
Off Road Vehicles																									
Air Compressor 185 CFM	2	2	2	2	3	3	3	3	3	3	3	3	3	7	7	7	9	9	9	11	11	11	11	13	13
Air Compressor 750 CFM	0	0	0	0	3	3	3	3	5	5	5	5	5	5	5	10	10	10	10	10	10	10	10	10	10
Articulating Boom Platform	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bob cat loader	0	0	2	2	2	2	2	7	7	7	7	7	5	5	5	5	5	5	3	3	3	3	3	3	0
Bulldozer D10R	40	40	40	26	26	26	26	26	26	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulldozer D6C	14	14	14	14	9	9	9	9	9	9	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0
Concrete Trowel Machine	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Concrete Vibrators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cranes - Mobile 35 ton	0	0	0	0	0	0	2	2	2	9	9	9	9	17	17	17	17	17	17	17	17	17	17	17	17
Cranes - Mobile 45 ton	0	0	0	0	0	0	0	0	0	0	7	7	7	7	7	7	7	7	13	13	13	13	13	13	13
Crane - Mobile 65 ton	0	0	0	0	0	0	0	0	0	0	0	3	3	7	13	17	17	17	20	20	20	20	20	20	20
Cranes 100 / 150 ton cap	0	0	0	0	0	0	0	0	0	0	4	4	9	9	13	13	17	17	17	17	17	17	17	17	17
Diesel Powered Welder	0	0	0	5	5	5	5	5	5	5	5	5	5	5	5	7	7	7	9	9	9	9	9	12	12
Excavator - Backhoe/loader	4	4	6	8	8	8	8	8	8	8	8	4	4	4	4	4	2	2	2	2	2	2	2	2	0
Excavator - Earth Scraper 637	131	131	131	131	75	75	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator - loader	6	6	6	6	6	6	6	6	6	6	6	6	3	3	0	0	0	0	0	0	0	0	0	0	0
Excavator - Motor Grader (CAT140H)	0	4	4	4	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator - Trencher (CAT320)	0	0	0	0	0	11	11	11	11	11	11	11	11	11	11	11	0	0	0	0	0	0	0	0	0
Fired Heaters (2,000 BTU)	0	0	0	0	3	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Forklift	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Fusion Welder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Haul / 600 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	11	11	11	11	11
Heavy Haul / 1,000 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	11	11	11
Light Plants	1	1	1	3	5	5	5	5	3	3	4	4	5	5	6	6	9	9	9	9	9	9	9	9	9
Man lifts - telescoping	0	0	0	0	0	0	0	0	5	5	5	9	9	9	9	9	9	9	9	14	14	14	14	19	19
Man lift - scissor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portable Compaction Roller	0	0	18	18	18	18	18	18	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	0
Portable Compaction - Vibratory Plate	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
Portable Compaction - Ram	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumps	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2
Portable Power Generators	9	9	9	9	13	13	13	13	13	22	22	22	22	22	22	32	32	32	32	32	32	32	43	43	43
Truck Crane - Greater than 300 ton	0	0	0	0	0	0	0	0	0	0	0	6	6	6	6	6	12	12	18	18	24	24	24	24	24
Truck Crane - Greater than 200 ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	4	4	9	9	9	13	13	13
Vibratory Roller Ingersol-Rand 20 ton	13	13	13	13	13	13	13	13	13	9	9	9	9	9	4	4	4	4	0	0	0	0	0	0	0
WORKER VEHICLES																									
Personal commuting vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELIVERY TRUCKS																									
Light delivery truck (e.g. Fed-Ex)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Import fill trucks	24	24	24	24	24	24	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ONSITE TOTAL (lbs/day)	**298**	**305**	**356**	**355**	**348**	**376**	**324**	**263**	**242**	**240**	**252**	**255**	**259**	**275**	**284**	**296**	**314**	**323**	**321**	**351**	**358**	**352**	**366**	**390**	**381**

CONSTRUCTION VEHICLES	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																								
18 cy fill mat'l haul truck	0	0	0	0	0	0	0	0	0	0	9	9	9	9	3	3	3	0	0	0	0	0	0	0
Bus	40	40	40	40	40	40	40	40	40	40	34	34	34	28	28	14	14	9	9	6	6	6	3	3
Concrete Pumper Truck	0	0	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dump Truck	0	0	6	6	6	6	6	6	6	6	6	9	9	9	6	3	3	3	3	3	0	0	0	0
Diesel Tractor (Yard Dog)	32	32	32	32	32	32	32	32	32	32	13	13	13	13	13	13	13	0	0	0	0	0	0	0
Service Truck - 1 ton	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	3	3	3	3
Pile Driver Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck - Fuel/Lube	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	0	0	0
Tractor Truck 5th Wheel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks - Pickup 3/4 ton	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	17	17	11	11	11	11	6
Trucks - 3 ton	17	17	17	17	17	17	17	17	17	11	9	9	9	9	6	6	6	3	3	3	3	0	0	0
Truck - Water	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	3	3	3	3
Off Road Vehicles																								
Air Compressor 185 CFM	13	13	13	13	13	13	13	13	13	13	9	9	9	7	7	7	7	4	4	4	2	2	1	1
Air Compressor 750 CFM	10	10	10	10	5	5	5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Articulating Boom Platform	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bob cat loader	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0	0	0	0	0	0	0
Bulldozer D10R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulldozer D6C	0	0	5	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Trowel Machine	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
Concrete Vibrators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cranes - Mobile 35 ton	17	12	12	12	12	12	12	12	12	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2
Cranes - Mobile 45 ton	13	13	13	13	7	7	7	7	7	7	7	7	7	7	7	3	3	0	0	0	0	0	0	0
Crane - Mobile 65 ton	20	20	20	20	20	17	17	13	7	7	7	7	7	3	3	3	3	3	3	3	0	0	0	0
Cranes 100 / 150 ton cap	17	17	17	9	9	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel Powered Welder	12	12	12	12	12	12	12	7	7	7	7	7	5	5	5	5	5	2	2	2	2	1	1	1
Excavator - Backhoe/loader	0	0	0	0	0	0	0	0	0	0	4	4	4	4	2	2	2	0	0	0	0	0	0	0
Excavator - Earth Scraper 637	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator - loader	0	0	3	3	3	3	0	0	0	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0
Excavator - Motor Grader (CAT140H)	0	0	4	4	4	4	0	0	0	0	9	9	9	9	4	4	4	0	0	0	0	0	0	0
Excavator - Trencher (CAT320)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fired Heaters (2,000 BTU)	3	3	3	3	3	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Forklift	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	0	0	0
Fusion Welder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Haul / 600 tn Crane	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Haul / 1,000 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Light Plants	9	9	9	9	9	9	6	6	6	6	6	6	6	6	6	3	3	3	3	3	3	3	1	1
Man lifts - telescoping	19	19	19	19	19	19	19	19	19	19	14	14	14	9	9	9	9	5	5	5	5	2	2	2
Man lift - scissor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portable Compaction Roller	0	0	0	7	7	7	7	7	7	0	0	0	7	7	7	4	4	0	0	0	0	0	0	0
Portable Compaction - Vibratory Plate	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Portable Compaction - Ram	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumps	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1
Portable Power Generators	43	43	43	43	43	43	43	43	43	43	32	32	32	32	22	22	22	22	22	22	11	11	11	4
Truck Crane - Greater than 300 ton	24	24	24	24	18	18	12	12	12	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0
Truck Crane - Greater than 200 ton	13	13	13	13	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vibratory Roller Ingersol-Rand 20 ton	0	0	9	9	9	9	0	0	0	0	0	0	4	4	4	4	0	0	0	0	0	0	0	0
WORKER VEHICLES																								
Personal commuting vehicles	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELIVERY TRUCKS																								
Light delivery truck (e.g. Fed-Ex)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Import fill trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ONSITE TOTAL (lbs/day)	**367**	**352**	**381**	**378**	**356**	**340**	**307**	**298**	**289**	**263**	**238**	**238**	**250**	**234**	**198**	**168**	**163**	**94**	**94**	**85**	**63**	**54**	**49**	**36**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Nitrogen Oxides (NOx)

OFF-SITE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
WORKER VEHICLES																																																	
Personal commuting vehicles	1	1	2	2	4	4	5	7	8	10	12	13	16	19	22	25	28	29	31	33	34	38	41	44	47	48	52	56	58	58	59	58	57	55	52	50	46	44	37	30	24	16	13	13	13	12	10	9	7
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Heavy delivery truck (e.g. flat beds carrying construction eqp)	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
Import fill trucks	229	229	229	229	229	229	229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINEARS																																																	
ON ROAD																																																	
Dump Truck	0	0	0	0	0	0	0	0	0	0	11	11	17	17	17	17	17	17	17	17	11	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Truck (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	6	6	6	6	6	6	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipe Haul Truck and Trailer (HHDT-DSL)	0	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/4 Ton Pickup (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	11	11	11	11	11	11	17	17	17	17	17	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck - water	0	0	0	0	0	0	0	0	0	0	6	6	11	11	11	11	11	11	11	11	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF ROAD																																																	
Air Compressor (185 CFM)	0	0	0	0	0	0	0	0	0	0	2	2	4	4	7	7	7	7	4	4	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bore Machine (Hydraulic)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 Ton Hydra Crane	0	0	0	0	0	0	0	0	0	0	9	17	17	26	26	26	26	26	26	26	17	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Backhoe/loader	0	0	0	0	0	0	0	0	0	0	13	13	21	21	21	21	21	21	21	21	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator - Trencher	0	0	0	0	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forklift	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Welding Generator	0	0	0	0	0	0	0	0	0	0	17	17	17	17	17	17	17	17	17	17	17	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 to 5 Ton AC Roller	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipe Bending Machine	0	0	0	0	0	0	0	0	0	0	3	3	6	6	6	6	6	6	6	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL																																																	
AIR COMPRESSOR 185	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOOM TRUCK 12 TON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 325 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 330 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT DOZER D-6	0	0	0	0	0	0	0	0	0	0	0	0	15	15	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT MODEL 12 MOTOR GRADER	0	0	0	0	0	0	0	0	0	0	0	0	9	9	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT ROLLER-COMPACTOR 563	0	0	0	0	0	0	0	0	0	0	0	0	7	7	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT RUBBER TIRE LOADER 966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT SCRAPER 615	0	0	0	0	0	0	0	0	0	0	0	0	27	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRANE-ROUGH TERRAIN 45T	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GENSET 5KW	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JOHN DEERE TRACTOR 9400	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PICK-UP CRAFT	0	0	0	0	0	0	0	0	0	0	0	0	28	28	28	28	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PICK-UP OVERHEAD	0	0	0	0	0	0	0	0	0	0	0	0	10	30	30	25	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL BALLAST REGULATOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL CLIP MACHINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL MOVER-SHUTTLE WAGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL TAMPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAIL WELDER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAMEX WALK BEHIND COMPACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRI-AXLE DUMP TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	11	17	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK FLATBED 14 FOOT	0	0	0	0	0	0	0	0	0	0	0	0	3	3	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRUCK TRACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WATER TRUCK, 4M ON-ROAD	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WELDING MACHINE 350 AMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINEARS TOTAL (lbs/day)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**87**	**103**	**256**	**275**	**266**	**254**	**259**	**147**	**145**	**140**	**109**	**105**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
OFFSITE VEHICLES TOTAL (lbs/day)	**308**	**309**	**309**	**310**	**311**	**312**	**313**	**85**	**86**	**88**	**90**	**92**	**94**	**97**	**101**	**103**	**106**	**107**	**109**	**111**	**112**	**116**	**119**	**122**	**125**	**126**	**131**	**134**	**136**	**136**	**137**	**136**	**136**	**133**	**130**	**128**	**124**	**122**	**116**	**109**	**102**	**95**	**91**	**91**	**91**	**90**	**88**	**88**	**85**
TOTAL PROJECT (lbs/day)	606	614	665	665	659	688	637	349	328	328	430	450	608	647	651	653	679	578	575	602	579	574	485	513	506	493	483	515	514	493	477	443	434	422	393	367	362	373	350	307	270	258	185	185	176	153	142	136	121

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

PM_{10} - Combustion

MONTHLY EMISSIONS (lbs/day)

ON-SITE

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13
On-Road Vehicles													
18 cy fill mat'l haul truck	0.00	0.00	1.77	1.77	3.53	3.53	3.53	3.53	1.77	1.77	1.77	1.77	0.88
Bus	0.35	0.35	0.35	0.35	0.53	0.53	0.53	0.53	0.53	0.53	0.88	0.88	0.88
Concrete Pumper Truck	0.00	0.00	0.00	0.00	0.00	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Dump Truck	0.53	0.71	0.71	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.35	0.35	0.35
Diesel Tractor (Yard Dog)	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.80	0.80
Service Truck - 1 ton	0.35	0.35	0.35	0.71	0.71	0.71	0.71	0.35	0.35	0.35	0.35	0.35	0.35
Pile Driver Truck	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
Truck - Fuel/Lube	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Tractor Truck 5th Wheel	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
Trucks - Pickup 3/4 ton	0.34	0.34	0.34	0.34	0.34	0.41	0.48	0.55	1.03	1.03	1.03	1.03	1.72
Trucks - 3 ton	0.18	0.18	0.18	0.18	0.18	0.35	0.35	0.35	0.71	0.71	0.71	0.71	1.06
Truck - Water	0.88	0.88	0.88	0.88	0.88	0.88	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Off Road Vehicles													
Air Compressor 185 CFM	0.23	0.23	0.23	0.23	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Air Compressor 750 CFM	0.00	0.00	0.00	0.00	0.24	0.24	0.24	0.24	0.48	0.48	0.48	0.48	0.48
Articulating Boom Platform	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
Bob cat loader	0.00	0.00	0.16	0.16	0.16	0.16	0.16	0.63	0.63	0.63	0.63	0.63	0.47
Bulldozer D10R	1.54	1.54	1.54	1.02	1.02	1.02	1.02	1.02	1.02	0.51	0.51	0.00	0.00
Bulldozer D6C	1.19	1.19	1.19	1.19	0.80	0.80	0.80	0.80	0.80	0.80	0.40	0.40	0.40
Concrete Trowel Machine	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Concrete Vibrators	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
Cranes - Mobile 35 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.21	0.21	0.85	0.85	0.85	0.85
Cranes - Mobile 45 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.38	0.38
Crane - Mobile 65 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.19
Cranes 100 / 150 ton cap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.30
Diesel Powered Welder	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Excavator - Backhoe/loader	0.35	0.35	0.53	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.35	0.35
Excavator - Earth Scraper 637	5.08	5.08	5.08	5.08	2.90	2.90	1.45	0.00	0.00	0.00	0.00	0.00	0.00
Excavator - loader	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.28
Excavator - Motor Grader (CAT140H)	0.00	0.39	0.39	0.39	1.16	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator - Trencher (CAT320)	0.00	0.00	0.00	0.00	0.00	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Fired Heaters (2,000 BTU)	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.08	0.08	0.13	0.13	0.13
Forklift	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Fusion Welder	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
Heavy Haul / 600 tn Crane	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
Heavy Haul / 1,000 tn Crane	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
Light Plants	0.03	0.03	0.05	0.10	0.20	0.20	0.20	0.20	0.10	0.10	0.15	0.15	0.20
Man lifts - telescoping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.42	0.42	0.85	0.85
Man lift - scissor	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
Portable Compaction Roller	0.00	0.00	1.53	1.53	1.53	1.53	1.53	1.53	0.61	0.61	0.61	0.61	0.61
Portable Compaction - Vibratory Plate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03
Portable Compaction - Ram	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
Pumps	0.08	0.08	0.08	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Portable Power Generators	0.75	0.75	0.75	0.75	1.12	1.12	1.12	1.12	1.12	1.87	1.87	1.87	1.87
Truck Crane - Greater than 300 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.22
Truck Crane - Greater than 200 ton	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
Vibratory Roller Ingersol-Rand 20 ton	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.47	0.47	0.47	0.47
WORKER VEHICLES													
Personal commuting vehicles	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
DELIVERY TRUCKS													
Light delivery truck (e.g. Fed-Ex)	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
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Import fill trucks	1.51	1.51	1.51	1.51	1.51	1.51	1.51	0.00	0.00	0.00	0.00	0.00	0.00
ONSITE TOTAL (lbs/day)	**15.35**	**15.91**	**19.57**	**19.83**	**20.91**	**22.95**	**20.26**	**17.53**	**16.22**	**16.85**	**17.27**	**17.64**	**17.56**

CONSTRUCTION VEHICLES	14	15	16	17	18	19	20	21	22	23	24	25	26	27
On-Road Vehicles														
18 cy fill mat'l haul truck	0.88	0.88	0.88	0.88	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bus	0.88	0.88	0.88	1.24	1.24	1.24	1.77	1.77	1.77	1.77	2.47	2.47	2.47	2.47
Concrete Pumper Truck	0.53	0.53	0.53	0.35	0.35	0.35	0.35	0.35	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.35	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel Tractor (Yard Dog)	0.80	0.80	0.80	1.60	1.60	1.60	1.60	1.60	1.60	1.60	2.00	2.00	2.00	2.00
Service Truck - 1 ton	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Pile Driver Truck	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
Truck - Fuel/Lube	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Tractor Truck 5th Wheel	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
Trucks - Pickup 3/4 ton	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72
Trucks - 3 ton	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Truck - Water	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.35	0.53	0.35	0.35
Off Road Vehicles														
Air Compressor 185 CFM	0.69	0.69	0.69	0.92	0.92	0.92	1.15	1.15	1.15	1.15	1.37	1.37	1.37	1.37
Air Compressor 750 CFM	0.48	0.48	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Articulating Boom Platform	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
Bob cat loader	0.47	0.47	0.47	0.47	0.47	0.31	0.31	0.31	0.31	0.31	0.31	0.00	0.00	0.00
Bulldozer D10R	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
Bulldozer D6C	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Trowel Machine	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Concrete Vibrators	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
Cranes - Mobile 35 ton	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.06
Cranes - Mobile 45 ton	0.38	0.38	0.38	0.38	0.38	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Crane - Mobile 65 ton	0.38	0.76	0.95	0.95	0.95	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Cranes 100 / 150 ton cap	0.30	0.45	0.45	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Diesel Powered Welder	0.30	0.30	0.45	0.45	0.45	0.60	0.60	0.60	0.60	0.60	0.75	0.75	0.75	0.75
Excavator - Backhoe/loader	0.35	0.35	0.35	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.00	0.00	0.00
Excavator - Earth Scraper 637	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
Excavator - loader	0.28	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
Excavator - Motor Grader (CAT140H)	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
Excavator - Trencher (CAT320)	0.93	0.93	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fired Heaters (2,000 BTU)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Forklift	0.23	0.23	0.23	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Fusion Welder	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
Heavy Haul / 600 tn Crane	0.00	0.00	0.00	0.00	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.00
Heavy Haul / 1,000 tn Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.38	0.38	0.38	0.38	0.38	0.00	0.00
Light Plants	0.20	0.25	0.25	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Man lifts - telescoping	0.85	0.85	0.85	0.85	0.85	0.85	1.27	1.27	1.27	1.27	1.69	1.69	1.69	1.69
Man lift - scissor	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
Portable Compaction Roller	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.00	0.00	0.00
Portable Compaction - Vibratory Plate	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00
Portable Compaction - Ram	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
Pumps	0.15	0.15	0.15	0.15	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Portable Power Generators	1.87	1.87	2.80	2.80	2.80	2.80	2.80	2.80	2.80	3.74	3.74	3.74	3.74	3.74
Truck Crane - Greater than 300 ton	0.22	0.22	0.22	0.45	0.45	0.67	0.67	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Truck Crane - Greater than 200 ton	0.00	0.15	0.15	0.15	0.15	0.15	0.30	0.30	0.30	0.45	0.45	0.45	0.45	0.45
Vibratory Roller Ingersol-Rand 20 ton	0.47	0.24	0.24	0.24	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WORKER VEHICLES														
Personal commuting vehicles	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.07
DELIVERY TRUCKS														
Light delivery truck (e.g. Fed-Ex)	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
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Import fill trucks	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
ONSITE TOTAL (lbs/day)	**18.91**	**19.13**	**20.13**	**20.79**	**21.10**	**20.77**	**22.48**	**22.71**	**22.36**	**23.42**	**25.15**	**24.23**	**23.67**	**22.88**

CONSTRUCTION VEHICLES	28	29	30	31	32	33	34	35	36	37	38
On-Road Vehicles											
18 cy fill mat'l haul truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.53	0.53
Bus	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.12	2.12	2.12
Concrete Pumper Truck	0.18	0.18	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.53	0.53
Diesel Tractor (Yard Dog)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	0.80	0.80	0.80
Service Truck - 1 ton	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Pile Driver Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck - Fuel/Lube	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Tractor Truck 5th Wheel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trucks - Pickup 3/4 ton	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72
Trucks - 3 ton	1.06	1.06	1.06	1.06	1.06	1.06	1.06	0.71	0.53	0.53	0.53
Truck - Water	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Off Road Vehicles											
Air Compressor 185 CFM	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	0.92	0.92	0.92
Air Compressor 750 CFM	0.95	0.95	0.48	0.48	0.48	0.48	0.24	0.24	0.24	0.24	0.24
Articulating Boom Platform	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bob cat loader	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.16	0.16
Bulldozer D10R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozer D6C	0.40	0.40	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Trowel Machine	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12
Concrete Vibrators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes - Mobile 35 ton	1.06	1.06	1.06	1.06	1.06	1.06	1.06	0.42	0.42	0.42	0.42
Cranes - Mobile 45 ton	0.76	0.76	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Crane - Mobile 65 ton	1.15	1.15	1.15	0.95	0.95	0.76	0.38	0.38	0.38	0.38	0.38
Cranes 100 / 150 ton cap	0.60	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.15	0.00	0.00
Diesel Powered Welder	0.75	0.75	0.75	0.75	0.75	0.45	0.45	0.45	0.45	0.45	0.30
Excavator - Backhoe/loader	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.35	0.35
Excavator - Earth Scraper 637	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator - loader	0.28	0.28	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.28
Excavator - Motor Grader (CAT140H)	0.39	0.39	0.39	0.39	0.00	0.00	0.00	0.00	0.77	0.77	0.77
Excavator - Trencher (CAT320)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fired Heaters (2,000 BTU)	0.13	0.13	0.13	0.13	0.13	0.08	0.08	0.08	0.05	0.05	0.05
Forklift	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Fusion Welder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Haul / 600 tn Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Haul / 1,000 tn Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Light Plants	0.35	0.35	0.35	0.35	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Man lifts - telescoping	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.27	1.27	1.27
Man lift - scissor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portable Compaction Roller	0.00	0.61	0.61	0.61	0.61	0.61	0.61	0.00	0.00	0.00	0.61
Portable Compaction - Vibratory Plate	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.02	0.02	0.02
Portable Compaction - Ram	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Portable Power Generators	3.74	3.74	3.74	3.74	3.74	3.74	3.74	3.74	2.80	2.80	2.80
Truck Crane - Greater than 300 ton	0.89	0.89	0.67	0.67	0.45	0.45	0.45	0.22	0.22	0.22	0.22
Truck Crane - Greater than 200 ton	0.45	0.45	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vibratory Roller Ingersol-Rand 20 ton	0.47	0.47	0.47	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.24
WORKER VEHICLES											
Personal commuting vehicles	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06
DELIVERY TRUCKS											
Light delivery truck (e.g. Fed-Ex)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Import fill trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ONSITE TOTAL (lbs/day)	**24.89**	**25.09**	**23.86**	**23.21**	**21.16**	**20.62**	**19.99**	**18.17**	**16.43**	**16.57**	**17.55**

CONSTRUCTION VEHICLES	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles											
18 cy fill mat'l haul truck	0.53	0.18	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bus	1.77	1.77	0.88	0.88	0.53	0.53	0.35	0.35	0.35	0.18	0.18
Concrete Pumper Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	0.53	0.35	0.18	0.18	0.18	0.18	0.18	0.00	0.00	0.00	0.00
Diesel Tractor (Yard Dog)	0.80	0.80	0.80	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service Truck - 1 ton	0.35	0.35	0.35	0.35	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Pile Driver Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck - Fuel/Lube	0.14	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.00	0.00
Tractor Truck 5th Wheel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trucks - Pickup 3/4 ton	1.72	1.72	1.72	1.72	1.03	1.03	0.69	0.69	0.69	0.69	0.34
Trucks - 3 ton	0.53	0.35	0.35	0.35	0.18	0.18	0.18	0.18	0.00	0.00	0.00
Truck - Water	0.35	0.35	0.35	0.35	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Off Road Vehicles											
Air Compressor 185 CFM	0.69	0.69	0.69	0.69	0.46	0.46	0.46	0.23	0.23	0.11	0.11
Air Compressor 750 CFM	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Articulating Boom Platform	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bob cat loader	0.16	0.16	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozer D10R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozer D6C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Trowel Machine	0.12	0.12	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Vibrators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes - Mobile 35 ton	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.21	0.21	0.21	0.21
Cranes - Mobile 45 ton	0.38	0.38	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crane - Mobile 65 ton	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.00	0.00	0.00	0.00
Cranes 100 / 150 ton cap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel Powered Welder	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.09	0.09	0.06
Excavator - Backhoe/loader	0.35	0.18	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator - Earth Scraper 637	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator - loader	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator - Motor Grader (CAT140H)	0.77	0.39	0.39	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator - Trencher (CAT320)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fired Heaters (2,000 BTU)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.03	0.03
Forklift	0.23	0.23	0.23	0.23	0.08	0.08	0.08	0.08	0.04	0.04	0.04
Fusion Welder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Haul / 600 tn Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Haul / 1,000 tn Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Light Plants	0.25	0.25	0.13	0.13	0.13	0.13	0.13	0.10	0.10	0.05	0.05
Man lifts - telescoping	0.85	0.85	0.85	0.85	0.42	0.42	0.42	0.42	0.17	0.17	0.17
Man lift - scissor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portable Compaction Roller	0.61	0.61	0.31	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portable Compaction - Vibratory Plate	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portable Compaction - Ram	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.08	0.08	0.08	0.08	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Portable Power Generators	2.80	1.87	1.87	1.87	1.87	1.87	1.87	0.93	0.93	0.93	0.37
Truck Crane - Greater than 300 ton	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck Crane - Greater than 200 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vibratory Roller Ingersol-Rand 20 ton	0.24	0.24	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WORKER VEHICLES											
Personal commuting vehicles	0.05	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
DELIVERY TRUCKS											
Light delivery truck (e.g. Fed-Ex)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Import fill trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ONSITE TOTAL (lbs/day)	**16.34**	**13.83**	**11.85**	**11.61**	**6.73**	**6.73**	**6.21**	**4.44**	**3.81**	**3.47**	**2.53**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of PM10 from Combustion Exhaust

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
OFF-SITE	**WORKER VEHICLES**																																																	
	Personal commuting vehicles	0.07	0.12	0.16	0.21	0.31	0.39	0.46	0.62	0.69	0.83	1.03	1.15	1.36	1.60	1.92	2.18	2.37	2.52	2.65	2.81	2.95	3.30	3.54	3.81	4.05	4.10	4.51	4.83	4.99	5.01	5.06	4.99	4.94	4.72	4.47	4.33	3.93	3.81	3.23	2.63	2.08	1.42	1.13	1.13	1.13	1.04	0.88	0.81	0.61
	DELIVERY TRUCKS																																																	
	Light delivery truck (e.g. Fed-Ex)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Heavy delivery truck (e.g. flat beds carrying construction eqp)	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67
	Import fill trucks	8.31	8.31	8.31	8.31	8.31	8.31	8.31	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	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	LINEARS																																																	
	ON ROAD																																																	
	Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.71	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	0.71	0.71	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck (MHD-DSL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.35	0.35	0.35	0.35	0.35	0.53	0.53	0.53	0.53	0.53	0.53	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pipe Haul Truck and Trailer (HHDT-DSL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.53	0.53	0.53	0.53	0.53	0.35	0.35	0.35	0.35	0.35	0.35	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3/4 Ton Pickup (MHD-DSL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.69	0.69	0.69	0.69	0.69	1.03	1.03	1.03	1.03	1.03	1.03	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Truck - water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.35	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.35	0.35	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	OFF ROAD																																																	
	Air Compressor (185 CFM)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.46	0.46	0.69	0.69	0.69	0.69	0.46	0.46	0.23	0.23	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Bore Machine (Hydraulic)	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	0.09	0.09	0.09	0.09	0.09	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	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
	12 Ton Hydra Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.60	0.60	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.60	0.60	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Backhoe/loader	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	1.06	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.06	1.06	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Excavator - Trencher	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Forklift	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.08	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Welding Generator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3 to 5 Ton AC Roller	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pipe Bending Machine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.25	0.25	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	RAIL																																																	
	AIR COMPRESSOR 185	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	0.23	0.23	0.23	0.23	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	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
	BOOM TRUCK 12 TON	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	0.18	0.18	0.18	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	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
	CAT 325 BACKHOE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	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	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	0.00	0.00	0.00
	CAT 330 BACKHOE	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	0.17	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	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	0.00	0.00
	CAT DOZER D-6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.84	0.00	0.00	0.42	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	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
	CAT MODEL 12 MOTOR GRADER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.77	0.39	0.39	0.39	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	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
	CAT ROLLER-COMPACTOR 563	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.61	0.31	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	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	0.00	0.00
	CAT RUBBER TIRE LOADER 966	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	0.45	0.45	0.45	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	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
	CAT SCRAPER 615	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.52	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	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	0.00	0.00	0.00
	CRANE-ROUGH TERRAIN 45T	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	0.19	0.19	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	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	0.00	0.00
	GENSET 5KW	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	0.18	0.09	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	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	0.00	0.00
	JOHN DEERE TRACTOR 9400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	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	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	0.00	0.00	0.00	0.00
	PICK-UP CRAFT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.91	0.91	0.91	0.91	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	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
	PICK-UP OVERHEAD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	1.56	1.56	1.30	1.30	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	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
	RAIL BALLAST REGULATOR	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	0.26	0.26	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	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
	RAIL CLIP MACHINE	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	0.13	0.13	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	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
	RAIL MOVER-SHUTTLE WAGON	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	0.26	0.26	0.26	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	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
	RAIL TAMPER	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	0.26	0.26	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	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
	RAIL WELDER	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	0.06	0.03	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	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
	RAMEX WALK BEHIND COMPACTOR	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	0.00	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	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	0.00	0.00	0.00
	TRI-AXLE DUMP TRUCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	1.06	0.35	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	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	0.00	0.00
	TRUCK FLATBED 14 FOOT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.53	0.53	0.53	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	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
	TRUCK TRACTOR	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	0.26	0.26	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	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	0.00
	WATER TRUCK, 4M ON-ROAD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.18	0.18	0.18	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	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
	WELDING MACHINE 350 AMP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	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	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
	LINEARS TOTAL (lbs/day)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**6.05**	**6.97**	**15.26**	**16.71**	**15.65**	**14.98**	**15.45**	**9.91**	**9.68**	**9.34**	**7.39**	**7.06**	**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**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
	OFFSITE VEHICLES TOTAL (lbs/day)	**11.09**	**11.14**	**11.19**	**11.23**	**11.33**	**11.41**	**11.49**	**3.33**	**3.40**	**3.54**	**3.74**	**3.86**	**4.08**	**4.31**	**4.64**	**4.89**	**5.09**	**5.23**	**5.37**	**5.52**	**5.66**	**6.01**	**6.26**	**6.53**	**6.77**	**6.82**	**7.22**	**7.54**	**7.70**	**7.73**	**7.78**	**7.70**	**7.66**	**7.44**	**7.18**	**7.04**	**6.65**	**6.52**	**5.94**	**5.34**	**4.79**	**4.13**	**3.84**	**3.84**	**3.84**	**3.76**	**3.60**	**3.52**	**3.33**
	TOTAL PROJECT (lbs/day)	26.44	27.06	30.75	31.07	32.24	34.36	31.75	20.86	19.62	20.40	27.06	28.47	36.90	39.93	39.41	40.00	41.33	36.24	35.82	37.35	35.76	35.44	29.68	31.68	31.00	30.49	30.10	32.43	32.79	31.58	30.99	28.86	28.28	27.43	25.35	23.47	23.22	24.07	22.29	19.17	16.65	15.73	10.57	10.57	10.05	8.19	7.41	6.99	5.86

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of PM2.5 from Combustion Exhaust

$PM_{2.5}$ - Combustion

MONTHLY EMISSIONS (lbs/day)

ON-SITE

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
On-Road Vehicles																		
18 cy fill mat'l haul truck	0.0	0.0	1.6	1.6	3.2	3.2	3.2	3.2	1.6	1.6	1.6	1.6	0.8	0.8	0.8	0.8	0.8	0.8
Bus	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	1.1	1.1
Concrete Pumper Truck	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.3	0.3
Dump Truck	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4
Service Truck - 1 ton	0.3	0.3	0.3	0.6	0.6	0.6	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Pile Driver Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Tractor Truck 5th Wheel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.9	0.9	0.9	0.9	1.6	1.6	1.6	1.6	1.6	1.6
Trucks - 3 ton	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0
Truck - Water	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Off Road Vehicles																		
Air Compressor 185 CFM	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.6	0.6	0.6	0.8	0.8
Air Compressor 750 CFM	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.9	0.9	0.9
Articulating Boom Platform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.4	0.4	0.4	0.4	0.4	0.4
Bulldozer D10R	1.4	1.4	1.4	0.9	0.9	0.9	0.9	0.9	0.9	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	1.1	1.1	1.1	1.1	0.7	0.7	0.7	0.7	0.7	0.7	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0
Concrete Trowel Machine	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Concrete Vibrators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.8	0.8	0.8	0.8	1.4	1.4	1.4	1.4	1.4
Cranes - Mobile 45 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Crane - Mobile 65 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.7	0.9	0.9	0.9
Cranes 100 / 150 ton cap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.4	0.4	0.6	0.6
Diesel Powered Welder	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4
Excavator - Backhoe/loader	0.3	0.3	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.3	0.2	0.2
Excavator - Earth Scraper 637	4.7	4.7	4.7	4.7	2.7	2.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0.0	0.4	0.4	0.4	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.0	0.0
Fired Heaters (2,000 BTU)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Forklift	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	0.3	0.3
Fusion Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Heavy Haul / 1,000 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3
Man lifts - telescoping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Man lift - scissor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0.0	0.0	1.4	1.4	1.4	1.4	1.4	1.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Portable Compaction - Vibratory Plate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Portable Power Generators	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.7	1.7	1.7	1.7	1.7	1.7	2.6	2.6	2.6
Truck Crane - Greater than 300 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.4	0.4
Truck Crane - Greater than 200 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Vibratory Roller Ingersol-Rand 20 ton	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2
WORKER VEHICLES																		
Personal commuting vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DELIVERY TRUCKS																		
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Import fill trucks	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ONSITE TOTAL (lbs/day)	**14.0**	**14.6**	**17.9**	**18.1**	**19.1**	**20.9**	**18.5**	**16.0**	**14.8**	**15.4**	**15.8**	**16.1**	**16.0**	**17.2**	**17.5**	**18.4**	**19.0**	**19.2**

CONSTRUCTION VEHICLES	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																															
18 cy fill mat'l haul truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus	1.1	1.6	1.6	1.6	1.6	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	1.9	1.9	1.9	1.6	1.6	0.8	0.8	0.5	0.5	0.3	0.3	0.3	0.2	0.2
Concrete Pumper Truck	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	1.4	1.4	1.4	1.4	1.4	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck - 1 ton	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pile Driver Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Tractor Truck 5th Wheel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	0.9	0.9	0.6	0.6	0.6	0.6	0.3
Trucks - 3 ton	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.6	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.0	0.0	0.0
Truck - Water	0.5	0.5	0.5	0.5	0.5	0.3	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Off Road Vehicles																															
Air Compressor 185 CFM	0.8	1.1	1.1	1.1	1.1	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	0.8	0.8	0.8	0.6	0.6	0.6	0.6	0.4	0.4	0.4	0.2	0.2	0.1	0.1
Air Compressor 750 CFM	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.4	0.4	0.4	0.4	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
Articulating Boom Platform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D10R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Vibrators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2
Cranes - Mobile 45 ton	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - Mobile 65 ton	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.9	0.9	0.7	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0
Cranes 100 / 150 ton cap	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Powered Welder	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Excavator - Backhoe/loader	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Earth Scraper 637	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.7	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	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	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Fusion Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 1,000 tn Crane	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Man lifts - telescoping	0.8	1.2	1.2	1.2	1.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.2	1.2	1.2	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.4	0.2	0.2	0.2
Man lift - scissor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.6	0.6	0.6	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Vibratory Plate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Power Generators	2.6	2.6	2.6	2.6	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	2.6	2.6	2.6	2.6	1.7	1.7	1.7	1.7	1.7	1.7	0.9	0.9	0.9	0.3
Truck Crane - Greater than 300 ton	0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0.6	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 200 ton	0.1	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Roller Ingersol-Rand 20 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																															
Personal commuting vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DELIVERY TRUCKS																															
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Import fill trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ONSITE TOTAL (lbs/day)	**19.0**	**20.5**	**20.7**	**20.4**	**21.4**	**23.0**	**22.1**	**21.6**	**20.9**	**22.7**	**22.9**	**21.8**	**21.2**	**19.3**	**18.8**	**18.2**	**16.5**	**15.0**	**15.1**	**16.0**	**14.9**	**12.6**	**10.8**	**10.6**	**6.1**	**6.1**	**5.7**	**4.0**	**3.5**	**3.2**	**2.3**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of PM2.5 from Combustion Exhaust

OFF-SITE (months 1–25)

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
WORKER VEHICLES																									
Personal commuting vehicles	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.7	1.9	2.0	2.1
DELIVERY TRUCKS																									
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Import fill trucks	7.1	7.1	7.1	7.1	7.1	7.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS																									
ON ROAD																									
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.6	0.6	0.0	0.0	0.0
Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0
Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0
3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.9	0.9	0.9	0.9	0.9	0.9	0.0	0.0	0.0
Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3	0.3	0.0	0.0	0.0
OFF ROAD																									
Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.4	0.6	0.6	0.6	0.6	0.4	0.4	0.2	0.2	0.0	0.0	0.0
Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0.6	0.0	0.0	0.0
Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.0	1.0	0.0	0.0	0.0
Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.0	0.0	0.0
3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0
Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.0	0.0	0.0	0.0
RAIL																									
AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.4	1.4	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.5**	**6.4**	**14.0**	**15.3**	**14.3**	**13.7**	**14.1**	**9.0**	**8.8**	**8.5**	**6.7**	**6.4**	**0.0**	**0.0**	**0.0**
OFFSITE VEHICLES TOTAL (lbs/day)	**9.5**	**9.5**	**9.5**	**9.6**	**9.6**	**9.7**	**9.7**	**2.6**	**2.7**	**2.8**	**2.9**	**2.9**	**3.0**	**3.2**	**3.3**	**3.5**	**3.6**	**3.6**	**3.7**	**3.8**	**3.9**	**4.0**	**4.2**	**4.3**	**4.4**
TOTAL PROJECT (lbs/day)	23.5	24.1	27.4	27.7	28.7	30.6	28.2	18.6	17.5	18.1	24.1	25.4	33.0	35.7	35.1	35.5	36.7	31.9	31.5	32.8	31.3	30.9	25.6	27.3	26.6

OFF-SITE (months 26–49)

Month	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
WORKER VEHICLES																								
Personal commuting vehicles	2.2	2.4	2.5	2.6	2.6	2.7	2.6	2.6	2.5	2.3	2.3	2.1	2.0	1.7	1.4	1.1	0.7	0.6	0.6	0.6	0.5	0.5	0.4	0.3
DELIVERY TRUCKS																								
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Import fill trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS																								
ON ROAD																								
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFF ROAD																								
Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL																								
AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
OFFSITE VEHICLES TOTAL (lbs/day)	**4.5**	**4.7**	**4.9**	**4.9**	**4.9**	**5.0**	**4.9**	**4.9**	**4.8**	**4.7**	**4.6**	**4.4**	**4.3**	**4.0**	**3.7**	**3.4**	**3.1**	**2.9**	**2.9**	**2.9**	**2.9**	**2.8**	**2.7**	**2.6**
TOTAL PROJECT (lbs/day)	26.1	25.6	27.6	27.8	26.7	26.1	24.2	23.7	23.0	21.2	19.6	19.5	20.3	18.9	16.3	14.2	13.6	9.0	9.0	8.6	6.9	6.3	5.9	4.9

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

SO_2

MONTHLY EMISSIONS (lbs/day)

ON-SITE

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																																																	
18 cy fill mat'l haul truck	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Pumper Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck - 1 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pile Driver Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tractor Truck 5th Wheel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - 3 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Off Road Vehicles																																																	
Air Compressor 185 CFM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Compressor 750 CFM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Articulating Boom Platform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D10R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Vibrators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 45 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - Mobile 65 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes 100 / 150 ton cap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Powered Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Earth Scraper 637	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusion Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 1,000 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lifts - telescoping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lift - scissor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Vibratory Plate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Power Generators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 300 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 200 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Roller Ingersol-Rand 20 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																																																	
Personal commuting vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Import fill trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ONSITE TOTAL (lbs/day)	**0.3**	**0.3**	**0.4**	**0.4**	**0.4**	**0.4**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.5**	**0.5**	**0.4**	**0.4**	**0.5**	**0.4**	**0.4**	**0.4**	**0.4**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.0**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Sulfur Dioxide (SO2)

OFF-SITE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
WORKER VEHICLES																																																	
Personal commuting vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Import fill trucks	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS																																																	
ON ROAD																																																	
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFF ROAD																																																	
Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL																																																	
AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
OFFSITE VEHICLES TOTAL (lbs/day)	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.1**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**0.3**	**0.3**	**0.4**	**0.4**	**0.4**	**0.4**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**	**0.6**	**0.7**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.5**	**0.5**	**0.4**	**0.4**	**0.3**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.1**
TOTAL PROJECT (lbs/day)	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.4	0.4	0.4	0.6	0.6	0.8	0.9	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

ROG

ON-SITE

MONTHLY EMISSIONS (lbs/day)

CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
On-Road Vehicles																									
18 cy fill mat'l haul truck	0.0	0.0	6.2	6.2	12.4	12.4	12.4	12.4	6.2	6.2	6.2	6.2	3.1	3.1	3.1	3.1	3.1	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.9	1.9	1.9	3.1	3.1	3.1	3.1	3.1	3.1	4.3	4.3	4.3	6.2	6.2	6.2	6.2	8.7	8.7
Concrete Pumper Truck	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.2	1.2	1.2	1.2	1.2	0.0	0.0	0.0	0.0
Dump Truck	1.9	2.5	2.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.2	1.2	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	0.0	0.0	0.0	0.0	0.0	1.4	1.4	1.4	1.4	1.4	1.4	2.8	2.8	2.8	2.8	2.8	5.6	5.6	5.6	5.6	5.6	5.6	5.6	7.0	7.0
Service Truck - 1 ton	1.2	1.2	1.2	2.5	2.5	2.5	2.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Pile Driver Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Tractor Truck 5th Wheel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.9	0.9	0.9	0.9	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Trucks - 3 ton	0.6	0.6	0.6	0.6	0.6	1.2	1.2	1.2	2.5	2.5	2.5	2.5	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Truck - Water	3.1	3.1	3.1	3.1	3.1	3.1	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.2	1.9
Off Road Vehicles																									
Air Compressor 185 CFM	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.9	2.9	2.9	3.9	3.9	3.9	4.9	4.9	4.9	4.9	5.9	5.9
Air Compressor 750 CFM	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Articulating Boom Platform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0.0	0.0	0.6	0.6	0.6	0.6	0.6	2.6	2.6	2.6	2.6	2.6	1.9	1.9	1.9	1.9	1.9	1.9	1.3	1.3	1.3	1.3	1.3	1.3	0.0
Bulldozer D10R	4.5	4.5	4.5	3.0	3.0	3.0	3.0	3.0	3.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	2.3	2.3	2.3	2.3	1.5	1.5	1.5	1.5	1.5	1.5	0.8	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Concrete Vibrators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	1.6	1.6	1.6	1.6	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Cranes - Mobile 45 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Crane - Mobile 65 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.9	1.8	2.2	2.2	2.2	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Cranes 100 / 150 ton cap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.9	0.9	1.3	1.3	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Diesel Powered Welder	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.4	2.4
Excavator - Backhoe/loader	0.6	0.6	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	0.6	0.6	0.6	0.6	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0
Excavator - Earth Scraper 637	14.7	14.7	14.7	14.7	8.4	8.4	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0.0	0.7	0.7	0.7	2.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0.0	0.0	0.0	0.0	0.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Forklift	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Fusion Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Heavy Haul / 1,000 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	1.1
Light Plants	0.1	0.1	0.2	0.4	0.8	0.8	0.8	0.8	0.4	0.4	0.6	0.6	0.8	0.8	1.0	1.0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Man lifts - telescoping	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	4.9	4.9	4.9	4.9	6.6	6.6
Man lift - scissor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0.0	0.0	2.8	2.8	2.8	2.8	2.8	2.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.0
Portable Compaction - Vibratory Plate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Portable Compaction - Ram	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0.3	0.3	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Portable Power Generators	2.9	2.9	2.9	2.9	4.3	4.3	4.3	4.3	4.3	7.2	7.2	7.2	7.2	7.2	7.2	10.7	10.7	10.7	10.7	10.7	10.7	10.7	14.3	14.3	14.3
Truck Crane - Greater than 300 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.7	0.7	1.3	1.3	2.0	2.0	2.7	2.7	2.7	2.7	2.7
Truck Crane - Greater than 200 ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.9	0.9	0.9	1.3	1.3	1.3
Vibratory Roller Ingersol-Rand 20 ton	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.1	1.1	1.1	1.1	1.1	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																									
Personal commuting vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4
DELIVERY TRUCKS																									
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Import fill trucks	6.5	6.5	6.5	6.5	6.5	6.5	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ONSITE TOTAL (lbs/day)	**46.2**	**47.6**	**57.7**	**58.6**	**62.9**	**68.5**	**61.3**	**51.5**	**46.9**	**48.9**	**50.5**	**52.6**	**50.8**	**54.5**	**55.5**	**58.9**	**63.0**	**63.8**	**62.1**	**68.1**	**68.8**	**67.6**	**71.5**	**77.9**	**75.8**

CONSTRUCTION VEHICLES	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																								
18 cy fill mat'l haul truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	1.9	1.9	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	7.4	7.4	7.4	6.2	6.2	3.1	3.1	1.9	1.9	1.2	1.2	1.2	0.6	0.6
Concrete Pumper Truck	0.0	0.0	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck	0.0	0.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.2	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck - 1 ton	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Pile Driver Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Tractor Truck 5th Wheel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.9	0.9	0.6	0.6	0.6	0.6	0.3
Trucks - 3 ton	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	2.5	1.9	1.9	1.9	1.9	1.2	1.2	1.2	0.6	0.6	0.6	0.6	0.0	0.0	0.0
Truck - Water	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Off Road Vehicles																								
Air Compressor 185 CFM	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	3.9	3.9	3.9	2.9	2.9	2.9	2.9	2.0	2.0	2.0	1.0	1.0	0.5	0.5
Air Compressor 750 CFM	1.7	1.7	1.7	1.7	0.9	0.9	0.9	0.9	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Articulating Boom Platform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D10R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	0.0	0.0	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Vibrators	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	2.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.4
Cranes - Mobile 45 ton	1.8	1.8	1.8	1.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - Mobile 65 ton	2.7	2.7	2.7	2.7	2.7	2.2	2.2	1.8	0.9	0.9	0.9	0.9	0.9	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0
Cranes 100 / 150 ton cap	1.8	1.8	1.8	0.9	0.9	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Powered Welder	2.4	2.4	2.4	2.4	2.4	2.4	2.4	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.3	0.3	0.2
Excavator - Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Earth Scraper 637	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0.0	0.0	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0.0	0.0	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	1.4	1.4	1.4	1.4	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Forklift	1.2	1.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.3	0.3	0.3	0.3	0.1	0.1	0.1
Fusion Welder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 1,000 tn Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	1.4	1.4	1.4	1.4	1.4	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.2	0.2
Man lifts - telescoping	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	4.9	4.9	4.9	3.3	3.3	3.3	3.3	1.6	1.6	1.6	1.6	0.7	0.7	0.7
Man lift - scissor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	1.1	0.0	0.0	0.0	1.1	1.1	1.1	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Vibratory Plate	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Portable Power Generators	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	10.7	10.7	10.7	10.7	7.2	7.2	7.2	7.2	7.2	7.2	3.6	3.6	3.6	1.4
Truck Crane - Greater than 300 ton	2.7	2.7	2.7	2.7	2.0	2.0	1.3	1.3	1.3	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 200 ton	1.3	1.3	1.3	1.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Roller Ingersol-Rand 20 ton	0.0	0.0	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																								
Personal commuting vehicles	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DELIVERY TRUCKS																								
Light delivery truck (e.g. Fed-Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy delivery truck (e.g. flat beds carrying construction eqp)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Import fill trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ONSITE TOTAL (lbs/day)	**74.1**	**72.2**	**77.0**	**76.7**	**73.9**	**72.1**	**67.3**	**65.7**	**64.3**	**60.1**	**51.4**	**52.0**	**53.7**	**49.3**	**41.4**	**35.6**	**35.0**	**20.8**	**20.8**	**19.9**	**13.8**	**11.7**	**10.4**	**7.8**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Reactive Organic Gases (ROG)

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
OFF-SITE																																																	
WORKER VEHICLES																																																	
Personal commuting vehicles	0.2	0.4	0.5	0.6	0.9	1.2	1.4	1.8	2.1	2.5	3.1	3.4	4.1	4.8	5.7	6.5	7.1	7.5	7.9	8.4	8.8	9.8	10.6	11.4	12.1	12.2	13.5	14.4	14.9	15.0	15.1	14.9	14.8	14.1	13.3	12.9	11.7	11.4	9.6	7.8	6.2	4.2	3.4	3.4	3.4	3.1	2.6	2.4	1.8
DELIVERY TRUCKS																																																	
Light delivery truck (e.g. Fed-Ex)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Heavy delivery truck (e.g. flat beds carrying construction eqp)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Import fill trucks	10.3	10.3	10.3	10.3	10.3	10.3	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS																																																	
ON ROAD																																																	
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.9	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	1.9	1.9	1.9	1.9	1.2	1.2	1.2	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.9	0.9	0.9	0.9	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OFF ROAD																																																	
Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	2.0	2.9	2.9	2.9	2.9	2.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.8	1.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL																																																	
AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.7	2.7	2.7	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.5	3.5	2.9	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	3.7	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	1.9	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**18.1**	**20.8**	**43.5**	**47.3**	**45.8**	**44.0**	**44.3**	**29.2**	**28.2**	**27.1**	**21.4**	**20.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
OFFSITE VEHICLES TOTAL (lbs/day)	**13.9**	**14.0**	**14.1**	**14.3**	**14.6**	**14.8**	**15.0**	**5.2**	**5.5**	**5.9**	**6.5**	**6.8**	**7.5**	**8.2**	**9.1**	**9.9**	**10.5**	**10.9**	**11.3**	**11.8**	**12.2**	**13.2**	**14.0**	**14.8**	**15.5**	**15.6**	**16.9**	**17.8**	**18.3**	**18.4**	**18.5**	**18.3**	**18.1**	**17.5**	**16.7**	**16.3**	**15.1**	**14.8**	**13.0**	**11.2**	**9.6**	**7.6**	**6.8**	**6.8**	**6.8**	**6.5**	**6.0**	**5.8**	**5.2**
TOTAL PROJECT (lbs/day)	60.1	61.6	71.8	72.9	77.5	83.3	76.4	56.8	52.4	54.8	75.1	80.2	101.8	110.0	110.4	112.8	117.8	104.0	101.6	107.0	102.4	101.1	85.5	92.7	91.3	89.7	89.1	94.8	95.0	92.2	90.6	85.6	83.8	81.8	76.8	67.7	67.1	68.4	62.3	52.6	45.2	42.6	27.6	27.6	26.7	20.3	17.7	16.2	13.0

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

CO_2e

MONTHLY EMISSIONS (lbs/day)

	CONSTRUCTION VEHICLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
ON-SITE	**On-Road Vehicles**																						
	18 cy fill mat'l haul truck	0	0	2,876	2,876	5,753	5,753	5,753	5,753	2,876	2,876	2,876	2,876	1,438	1,438	1,438	1,438	1,438	1,438	0	0	0	0
	Bus	575	575	575	575	863	863	863	863	863	863	1,438	1,438	1,438	1,438	1,438	1,438	2,013	2,013	2,013	2,876	2,876	2,876
	Concrete Pumper Truck	0	0	0	0	0	575	575	575	575	575	575	575	575	863	863	863	575	575	575	575	575	0
	Dump Truck	863	1,151	1,151	863	863	863	863	863	863	863	575	575	575	575	575	0	0	0	0	0	0	0
	Diesel Tractor (Yard Dog)	0	0	0	0	0	652	652	652	652	652	652	1,305	1,305	1,305	1,305	1,305	2,610	2,610	2,610	2,610	2,610	2,610
	Service Truck - 1 ton	575	575	575	1,151	1,151	1,151	1,151	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575
	Pile Driver Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Truck - Fuel/Lube	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274
	Tractor Truck 5th Wheel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Trucks - Pickup 3/4 ton	684	684	684	684	684	821	958	1,095	2,053	2,053	2,053	2,053	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422
	Trucks - 3 ton	288	288	288	288	288	575	575	575	1,151	1,151	1,151	1,151	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726
	Truck - Water	1,438	1,438	1,438	1,438	1,438	1,438	863	863	863	863	863	863	863	863	863	863	863	863	863	863	863	863
	Off Road Vehicles																						
	Air Compressor 185 CFM	217	217	217	217	326	326	326	326	326	326	326	326	326	651	651	651	869	869	869	1,086	1,086	1,086
	Air Compressor 750 CFM	0	0	0	0	228	228	228	228	456	456	456	456	456	456	456	912	912	912	912	912	912	912
	Articulating Boom Platform	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bob cat loader	0	0	170	170	170	170	170	681	681	681	681	681	511	511	511	511	511	511	340	340	340	340
	Bulldozer D10R	4,624	4,624	4,624	3,082	3,082	3,082	3,082	3,082	3,082	1,541	1,541	0	0	0	0	0	0	0	0	0	0	0
	Bulldozer D6C	1,176	1,176	1,176	1,176	784	784	784	784	784	784	392	392	392	392	392	0	0	0	0	0	0	0
	Concrete Trowel Machine	0	0	0	0	0	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
	Concrete Vibrators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cranes - Mobile 35 ton	0	0	0	0	0	0	218	218	218	872	872	872	872	1,526	1,526	1,526	1,526	1,526	1,526	1,526	1,526	1,526
	Cranes - Mobile 45 ton	0	0	0	0	0	0	0	0	0	0	697	697	697	697	697	697	697	697	1,395	1,395	1,395	1,395
	Crane - Mobile 65 ton	0	0	0	0	0	0	0	0	0	0	0	349	349	697	1,395	1,743	1,743	1,743	2,092	2,092	2,092	2,092
	Cranes 100 / 150 ton cap	0	0	0	0	0	0	0	0	0	0	486	486	973	973	1,459	1,459	1,946	1,946	1,946	1,946	1,946	1,946
	Diesel Powered Welder	0	0	0	513	513	513	513	513	513	513	513	513	513	513	513	770	770	770	1,026	1,026	1,026	1,026
	Excavator - Backhoe/loader	486	486	729	972	972	972	972	972	972	972	972	486	486	486	486	486	243	243	243	243	243	243
	Excavator - Earth Scraper 637	14,945	14,945	14,945	14,945	8,540	8,540	4,270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Excavator - loader	642	642	642	642	642	642	642	642	642	642	642	642	321	321	0	0	0	0	0	0	0	0
	Excavator - Motor Grader (CAT140H)	0	434	434	434	1,303	1,303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Excavator - Trencher (CAT320)	0	0	0	0	0	910	910	910	910	910	910	910	910	910	910	910	0	0	0	0	0	0
	Fired Heaters (2,000 BTU)	0	0	0	0	330	330	330	330	248	248	413	413	413	413	413	413	413	413	413	413	413	413
	Forklift	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	358	358	358	358	358	358
	Fusion Welder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Heavy Haul / 600 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,315	1,315	1,315	1,315	1,315
	Heavy Haul / 1,000 tn Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,315	1,315	1,315
	Light Plants	83	83	165	330	661	661	661	661	330	330	496	496	661	661	826	826	1,156	1,156	1,156	1,156	1,156	1,156
	Man lifts - telescoping	0	0	0	0	0	0	0	0	502	502	502	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,507	1,507	1,507
	Man lift - scissor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Portable Compaction Roller	0	0	1,712	1,712	1,712	1,712	1,712	1,712	685	685	685	685	685	685	685	685	685	685	685	685	685	685
	Portable Compaction - Vibratory Plate	0	0	0	0	0	0	0	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
	Portable Compaction - Ram	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pumps	248	248	248	496	496	496	496	496	496	496	496	496	496	496	496	496	496	248	248	248	248	248
	Portable Power Generators	916	916	916	916	1,374	1,374	1,374	1,374	1,374	2,291	2,291	2,291	2,291	2,291	2,291	3,436	3,436	3,436	3,436	3,436	3,436	3,436
	Truck Crane - Greater than 300 ton	0	0	0	0	0	0	0	0	0	0	0	783	783	783	783	783	1,565	1,565	2,348	2,348	3,130	3,130
	Truck Crane - Greater than 200 ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	486	486	486	486	486	973	973	973
	Vibratory Roller Ingersol-Rand 20 ton	1,405	1,405	1,405	1,405	1,405	1,405	1,405	1,405	1,405	937	937	937	937	937	468	468	468	468	0	0	0	0
	WORKER VEHICLES																						
	Personal commuting vehicles	15	26	35	45	66	83	99	133	148	178	220	246	292	342	412	466	508	540	568	602	631	706
	DELIVERY TRUCKS																						
	Light delivery truck (e.g. Fed-Ex)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Heavy delivery truck (e.g. flat beds carrying construction eqp)	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426
	Import fill trucks	2,044	2,044	2,044	2,044	2,044	2,044	2,044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ONSITE TOTAL (lbs/day)	**32,197**	**32,930**	**38,023**	**37,949**	**36,661**	**39,382**	**33,604**	**27,509**	**25,471**	**25,062**	**26,515**	**26,800**	**27,512**	**29,178**	**30,294**	**31,587**	**33,975**	**35,073**	**35,110**	**38,528**	**39,340**	**38,840**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Greenhouse Gases, as Carbon Dioxide Equivalent (CO2e)

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
OFF-SITE	**WORKER VEHICLES**																						
	Personal commuting vehicles	872	1,501	2,014	2,601	3,817	4,822	5,751	7,725	8,589	10,342	12,824	14,337	16,989	19,926	23,987	27,106	29,583	31,396	33,055	35,019	36,722	41,095
	DELIVERY TRUCKS																						
	Light delivery truck (e.g. Fed-Ex)	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465
	Heavy delivery truck (e.g. flat beds carrying construction eqp)	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256
	Import fill trucks	22,624	22,624	22,624	22,624	22,624	22,624	22,624	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LINEARS																						
	ON ROAD																						
	Dump Truck	0	0	0	0	0	0	0	0	0	0	1,151	1,151	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,151	1,151
	Service Truck (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	575	575	575	575	575	575	863	863	863	863	863	863
	Pipe Haul Truck and Trailer (HHDT-DSL)	0	0	0	0	0	0	0	0	0	0	863	863	863	863	863	863	575	575	575	575	575	575
	3/4 Ton Pickup (MHD-DSL)	0	0	0	0	0	0	0	0	0	0	1,376	1,376	1,376	1,376	1,376	1,376	2,064	2,064	2,064	2,064	2,064	2,064
	Truck - water	0	0	0	0	0	0	0	0	0	0	575	575	1,151	1,151	1,151	1,151	1,151	1,151	1,151	1,151	575	575
	OFF ROAD																						
	Air Compressor (185 CFM)	0	0	0	0	0	0	0	0	0	0	217	217	434	434	651	651	651	651	434	434	217	217
	Bore Machine (Hydraulic)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234	234	234	234	234	0	0	0
	12 Ton Hydra Crane	0	0	0	0	0	0	0	0	0	0	973	1,946	1,946	2,919	2,919	2,919	2,919	2,919	2,919	2,919	1,946	1,946
	Backhoe/loader	0	0	0	0	0	0	0	0	0	0	1,457	1,457	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	1,457	1,457
	Excavator - Trencher	0	0	0	0	0	0	0	0	0	0	0	430	430	430	430	430	430	430	430	430	430	430
	Forklift	0	0	0	0	0	0	0	0	0	0	90	90	179	179	179	179	179	179	179	179	179	90
	Welding Generator	0	0	0	0	0	0	0	0	0	0	1,832	1,832	1,832	1,832	1,832	1,832	1,832	1,832	1,832	1,832	1,832	1,832
	3 to 5 Ton AC Roller	0	0	0	0	0	0	0	0	0	0	0	303	303	303	303	303	303	303	303	303	303	303
	Pipe Bending Machine	0	0	0	0	0	0	0	0	0	0	351	351	701	701	701	701	701	701	701	351	351	0
	RAIL																						
	AIR COMPRESSOR 185	0	0	0	0	0	0	0	0	0	0	0	0	0	217	217	217	217	0	0	0	0	0
	BOOM TRUCK 12 TON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	288	288	288	0	0	0	0	0
	CAT 325 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	472	472	0	0	0	0	0	0	0	0
	CAT 330 BACKHOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	799	0	0	0	0	0	0	0
	CAT DOZER D-6	0	0	0	0	0	0	0	0	0	0	0	0	1,432	1,432	0	0	716	0	0	0	0	0
	CAT MODEL 12 MOTOR GRADER	0	0	0	0	0	0	0	0	0	0	0	0	864	864	432	432	432	0	0	0	0	0
	CAT ROLLER-COMPACTOR 563	0	0	0	0	0	0	0	0	0	0	0	0	680	680	340	0	0	0	0	0	0	0
	CAT RUBBER TIRE LOADER 966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,610	1,610	1,610	0	0	0	0	0
	CAT SCRAPER 615	0	0	0	0	0	0	0	0	0	0	0	0	2,768	1,384	0	0	0	0	0	0	0	0
	CRANE-ROUGH TERRAIN 45T	0	0	0	0	0	0	0	0	0	0	0	0	0	346	346	0	0	0	0	0	0	0
	GENSET 5KW	0	0	0	0	0	0	0	0	0	0	0	0	0	303	151	0	0	0	0	0	0	0
	JOHN DEERE TRACTOR 9400	0	0	0	0	0	0	0	0	0	0	0	0	1,604	0	0	0	0	0	0	0	0	0
	PICK-UP CRAFT	0	0	0	0	0	0	0	0	0	0	0	0	4,730	4,730	4,730	4,730	4,730	0	0	0	0	0
	PICK-UP OVERHEAD	0	0	0	0	0	0	0	0	0	0	0	0	1,322	3,965	3,965	3,304	3,304	0	0	0	0	0
	RAIL BALLAST REGULATOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	661	661	0	0	0	0	0
	RAIL CLIP MACHINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	0	0	0
	RAIL MOVER-SHUTTLE WAGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	661	661	661	0	0	0	0	0
	RAIL TAMPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	661	661	0	0	0	0	0
	RAIL WELDER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	51	0	0	0	0	0
	RAMEX WALK BEHIND COMPACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0
	TRI-AXLE DUMP TRUCK	0	0	0	0	0	0	0	0	0	0	0	0	1,151	1,726	575	0	0	0	0	0	0	0
	TRUCK FLATBED 14 FOOT	0	0	0	0	0	0	0	0	0	0	0	0	288	288	863	863	863	0	0	0	0	0
	TRUCK TRACTOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,117	1,117	0	0	0	0	0	0
	WATER TRUCK, 4M ON-ROAD	0	0	0	0	0	0	0	0	0	0	0	0	288	288	288	288	288	0	0	0	0	0
	WELDING MACHINE 350 AMP	0	0	0	0	0	0	0	0	0	0	0	0	51	51	51	51	51	0	0	0	0	0
	LINEARS TOTAL (lbs/day)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9,460**	**11,166**	**29,595**	**31,683**	**31,804**	**30,529**	**30,765**	**16,058**	**15,841**	**15,256**	**11,944**	**11,503**
	OFFSITE VEHICLES TOTAL (lbs/day)	**31,217**	**31,847**	**32,359**	**32,946**	**34,162**	**35,168**	**36,096**	**15,446**	**16,310**	**18,063**	**20,545**	**22,058**	**24,710**	**27,647**	**31,708**	**34,827**	**37,304**	**39,117**	**40,776**	**42,741**	**44,443**	**48,816**
	TOTAL PROJECT (lbs/day)	63,414	64,777	70,382	70,895	70,823	74,549	69,700	42,955	41,782	43,125	56,520	60,024	81,817	88,508	93,806	96,943	102,044	90,249	91,727	96,525	95,727	99,159

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of Greenhouse Gases, as Carbon Dioxide Equivalent (CO2e)

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
0	0	0	0	0	0	0	0	0	0	0	0	0	863	863	863	863	288	288	288	0	0	0	0	0	0	0
2,876	4,027	4,027	4,027	4,027	4,027	4,027	4,027	4,027	4,027	4,027	4,027	4,027	3,452	3,452	3,452	2,876	2,876	1,438	1,438	863	863	575	575	575	288	288
0	0	0	0	0	288	288	288	288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	575	575	575	575	575	575	575	575	575	863	863	863	575	288	288	288	288	288	0	0	0	0
2,610	3,262	3,262	3,262	3,262	3,262	3,262	3,262	3,262	3,262	3,262	3,262	3,262	1,305	1,305	1,305	1,305	1,305	1,305	1,305	0	0	0	0	0	0	0
575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	288	288	288	288	288	288	288
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	137	137	137	137	137	137	137	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	3,422	2,053	2,053	1,369	1,369	1,369	1,369	684
1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,151	863	863	863	863	575	575	575	288	288	288	288	0	0	0
863	575	863	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	575	288	288	288	288	288	288	288
1,086	1,303	1,303	1,303	1,303	1,303	1,303	1,303	1,303	1,303	1,303	1,303	1,303	869	869	869	651	651	651	651	434	434	434	217	217	109	109
912	912	912	912	912	912	912	456	456	456	456	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
340	340	0	0	0	0	0	0	0	0	0	0	0	170	170	170	170	170	170	170	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	392	392	392	392	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
141	141	141	141	141	141	0	0	0	0	0	0	0	0	141	141	141	141	141	141	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,526	1,526	1,526	1,526	1,090	1,090	1,090	1,090	1,090	1,090	1,090	1,090	436	436	436	436	436	436	436	436	436	436	436	218	218	218	218
1,395	1,395	1,395	1,395	1,395	1,395	1,395	697	697	697	697	697	697	697	697	697	697	697	349	349	0	0	0	0	0	0	0
2,092	2,092	2,092	2,092	2,092	2,092	2,092	2,092	1,743	1,743	1,395	697	697	697	697	697	349	349	349	349	349	349	349	0	0	0	0
1,946	1,946	1,946	1,946	1,946	1,946	973	973	486	486	486	486	486	486	0	0	0	0	0	0	0	0	0	0	0	0	0
1,026	1,283	1,283	1,283	1,283	1,283	1,283	1,283	1,283	1,283	770	770	770	770	770	513	513	513	513	513	257	257	257	257	154	154	103
243	243	0	0	0	0	0	0	0	0	0	0	0	486	486	486	486	243	243	243	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	321	321	321	321	0	0	0	0	0	0	321	321	321	0	0	0	0	0	0	0	0	0
0	0	0	0	0	434	434	434	434	0	0	0	0	869	869	869	869	434	434	434	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
413	413	413	413	413	413	413	413	413	413	248	248	248	165	165	165	165	165	165	165	165	165	165	165	83	83	83
358	358	358	358	358	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	90	90	90	90	45	45	45
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,315	1,315	1,315	1,315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,315	1,315	1,315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,156	1,156	1,156	1,156	1,156	1,156	1,156	1,156	1,156	826	826	826	826	826	826	826	826	826	413	413	413	413	413	330	330	165	165
1,507	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	2,009	1,507	1,507	1,507	1,005	1,005	1,005	1,005	502	502	502	502	201	201	201
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
685	685	0	0	0	0	685	685	685	685	685	685	0	0	0	685	685	685	342	342	0	0	0	0	0	0	0
0	0	0	0	0	56	56	56	56	0	0	0	0	75	75	75	75	75	38	38	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
248	248	248	248	248	248	248	248	248	248	248	248	248	248	248	248	248	248	248	248	165	165	165	165	165	165	165
4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	3,436	3,436	3,436	3,436	2,291	2,291	2,291	2,291	2,291	2,291	1,145	1,145	1,145	458
3,130	3,130	3,130	3,130	3,130	3,130	3,130	2,348	2,348	1,565	1,565	1,565	783	783	783	783	783	0	0	0	0	0	0	0	0	0	0
1,459	1,459	1,459	1,459	1,459	1,459	1,459	973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	937	937	937	937	0	0	0	0	0	0	468	468	468	468	0	0	0	0	0	0	0	0
759	817	868	879	966	1,034	1,068	1,074	1,085	1,069	1,059	1,011	957	927	843	815	692	562	446	303	242	242	242	223	190	174	131
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40,412	**42,960**	**42,032**	**40,439**	**38,775**	**41,757**	**41,362**	**38,946**	**37,148**	**33,592**	**32,555**	**31,582**	**28,832**	**26,280**	**26,137**	**27,327**	**25,560**	**21,538**	**18,233**	**17,622**	**10,207**	**10,206**	**9,234**	**6,917**	**5,927**	**5,350**	**3,884**

23	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*
44,172	47,505	50,521	51,116	56,200	60,177	62,133	62,480	63,095	62,181	61,612	58,843	55,699	53,948	49,027	47,437	40,258	32,719	25,924	17,636	14,077	14,052	14,052	13,000	11,026	10,103	7,616
465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465	465
7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256	7,256
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
51,893	**55,226**	**58,242**	**58,838**	**63,921**	**67,898**	**69,854**	**70,201**	**70,816**	**69,903**	**69,333**	**66,564**	**63,420**	**61,669**	**56,748**	**55,158**	**47,979**	**40,440**	**33,645**	**25,358**	**21,799**	**21,773**	**21,773**	**20,722**	**18,747**	**17,824**	**15,337**
92,305	98,187	100,274	99,277	102,696	109,655	111,216	109,147	107,965	103,494	101,888	98,146	92,252	87,949	82,885	82,486	73,539	61,978	51,878	42,980	32,005	31,979	31,007	27,638	24,674	23,174	19,221

PM_{10} - Fugitives

ON-SITE

CONSTRUCTION VEHICLES	Round Trips per day per unit	Round Trip Distance (miles/vehicle/day)	MONTHLY EMISSIONS (lbs/day) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
On-Road Vehicles																							
18 cy fill mat'l haul truck	1	1.8	0.0	0.0	9.3	9.3	18.7	18.7	18.7	18.7	9.3	9.3	9.3	9.3	4.7	4.7	4.7	4.7	4.7	4.7	0.0	0.0	0.0
Bus	1	0.75	0.6	0.6	0.6	0.6	0.9	0.9	0.9	0.9	0.9	0.9	1.4	1.4	1.4	1.4	1.4	1.4	2.0	2.0	2.0	2.8	2.8
Concrete Pumper Truck	2	0.75	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.3	2.3	2.3	1.6	1.6	1.6	1.6	1.6
Dump Truck	8	0.75	6.8	9.1	9.1	6.8	6.8	6.8	6.8	6.8	6.8	6.8	4.6	4.6	4.6	4.6	4.6	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5
Service Truck - 1 ton	10	0.5	3.8	3.8	3.8	7.6	7.6	7.6	7.6	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Pile Driver Truck	2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	8	0.75	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Tractor Truck 5th Wheel	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	10	0.5	4.6	4.6	4.6	4.6	4.6	5.5	6.4	7.4	13.8	13.8	13.8	13.8	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Trucks - 3 ton	2	0.5	0.3	0.3	0.3	0.3	0.3	0.7	0.7	0.7	1.3	1.3	1.3	1.3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Truck - Water	4	1	9.6	9.6	9.6	9.6	9.6	9.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
Off Road Vehicles																							
Air Compressor 185 CFM	1	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Compressor 750 CFM	1	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Articulating Boom Platform	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D10R	0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	1	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Vibrators	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Cranes - Mobile 45 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Crane - Mobile 65 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.4	0.4	0.4
Cranes 100 / 150 ton cap	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Powered Welder	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Backhoe/loader	0	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Earth Scraper 637	0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	5	0.5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.2	1.2	1.2	1.2	1.2
Fusion Welder	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 1,000 tn Crane	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lifts - telescoping	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Man lift - scissor	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Portable Compaction Roller	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Vibratory Plate	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Power Generators	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 300 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3
Truck Crane - Greater than 200 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Vibratory Roller Ingersol-Rand 20 ton	2	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																							
Personal commuting vehicles			0.8	1.4	1.8	2.4	3.5	4.4	5.3	7.1	7.9	9.5	11.7	13.1	15.6	18.3	22.0	24.8	27.1	28.8	30.3	32.1	33.6
DELIVERY TRUCKS																							
Light delivery truck (e.g. Fed-Ex)			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Heavy delivery truck (e.g. flat beds carrying construction eqp)			20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
Import fill trucks			121.5	121.5	121.5	121.5	121.5	121.5	121.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CONSTRUCTION ACTIVITY																							
Dirt Piling - Bob cat loader			0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Dirt Piling - Trencher (CAT320)			0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Dirt Piling - Backhoe/loader			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Dirt Piling - loader			0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grading - Earth Scraper 637			0.8	0.8	0.8	0.8	0.5	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grading - Motor Grader (CAT140H)			0.0	0.1	0.1	0.1	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozing - Bulldozer D10R			25.1	25.1	25.1	16.7	16.7	16.7	16.7	16.7	16.7	8.4	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozing - Bulldozer D6C			25.1	25.1	25.1	25.1	16.7	16.7	16.7	16.7	16.7	16.7	8.4	8.4	8.4	8.4	8.4	0.0	0.0	0.0	0.0	0.0	0.0
Covered Storage Piles			1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6													
ONSITE TOTAL (lbs/day)			**228.4**	**231.3**	**241.2**	**234.9**	**237.1**	**241.0**	**238.4**	**115.7**	**112.7**	**106.1**	**98.4**	**91.9**	**99.5**	**103.2**	**107.1**	**97.1**	**99.8**	**101.5**	**98.6**	**101.5**	**103.1**

Monthly Emissions of PM10 from Fugitive Sources

OFF-SITE

Month	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
WORKER VEHICLES																					
Personal commuting vehicles	0.2	0.3	0.4	0.5	0.7	0.8	1.0	1.4	1.5	1.8	2.2	2.5	3.0	3.5	4.2	4.8	5.2	5.5	5.8	6.1	6.4
DELIVERY TRUCKS																					
Light delivery truck (e.g. Fed-Ex)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Heavy delivery truck (e.g. flat beds carrying construction eqp)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Import fill trucks	10.2	10.2	10.2	10.2	10.2	10.2	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS																					
ON ROAD																					
Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	1.6
Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8
Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.0
OFF ROAD																					
Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3
Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CONSTRUCTION ACTIVITY																					
Dirt piling - Backhoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Dirt piling - Excavator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dirt piling - CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dirt piling - CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dirt piling - CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dirt piling - CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grading - CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Grading - CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Storage Piles											0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
RAIL																					
AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0
CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0
GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.0	0.0	0.0	0.0
PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.9	1.9	1.6	1.6	0.0	0.0	0.0	0.0
RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0
RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0
RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0
TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.9	0.9	0.9	0.0	0.0	0.0	0.0
TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0
WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0
WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.7**	**5.7**	**13.3**	**15.7**	**15.4**	**14.2**	**14.2**	**8.6**	**8.6**	**8.6**	**6.6**
OFFSITE VEHICLES TOTAL (lbs/day)	**14.0**	**14.1**	**14.2**	**14.3**	**14.5**	**14.7**	**14.9**	**5.0**	**5.1**	**5.4**	**5.9**	**6.1**	**6.6**	**7.1**	**7.8**	**8.4**	**8.8**	**9.1**	**9.4**	**9.8**	**10.1**
TOTAL PROJECT (lbs/day)	242.4	245.5	255.4	249.2	251.7	255.7	253.3	120.7	117.9	111.6	109.0	103.7	119.5	126.1	130.4	119.7	122.8	119.2	116.6	119.8	119.8

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.
3. According to schedule on "onsite equipment" tab, site prep/pilling occurs in months 1-8. Assume onsite covered storage piles are only present during these months.
4. Assume linear covered storage piles are present during entire 12 months of linear construction, months 11-22.

22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	2.8	2.8	0.9	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.8	2.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.4	3.4	3.4	2.8	2.8	1.4	1.4	0.9	0.9	0.6	0.6	0.6	0.3	0.3
0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	6.8	6.8	6.8	4.6	2.3	2.3	2.3	2.3	2.3	0.0	0.0	0.0	0.0
0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	13.8	13.8	9.2	9.2	9.2	9.2	4.6
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	1.3	1.0	1.0	1.0	1.0	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.0	0.0	0.0
5.7	5.7	3.8	5.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2	1.2	1.2	1.2	1.2	1.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.3	0.3	0.3	0.3	0.2	0.2	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0
0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37.6	40.5	43.5	46.3	46.8	51.5	55.1	56.9	57.2	57.8	57.0	56.4	53.9	51.0	49.4	44.9	43.5	36.9	30.0	23.7	16.2	12.9	12.9	12.9	11.9	10.1	9.3	7.0
1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.2	0.2	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	8.4	8.4	8.4	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
105.6	**108.4**	**111.0**	**115.3**	**113.9**	**118.5**	**136.0**	**137.8**	**137.9**	**138.3**	**127.7**	**127.1**	**124.5**	**120.7**	**121.0**	**118.8**	**117.4**	**110.0**	**96.1**	**86.1**	**78.5**	**58.9**	**58.9**	**54.0**	**50.6**	**45.9**	**44.8**	**37.9**

22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
7.2	7.7	8.3	8.9	9.0	9.8	10.5	10.9	11.0	11.1	10.9	10.8	10.3	9.8	9.5	8.6	8.3	7.1	5.7	4.5	3.1	2.5	2.5	2.5	2.3	1.9	1.8	1.3
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5																											
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
10.8	**11.4**	**11.9**	**12.5**	**12.6**	**13.5**	**14.2**	**14.5**	**14.6**	**14.7**	**14.5**	**14.4**	**13.9**	**13.4**	**13.1**	**12.2**	**11.9**	**10.7**	**9.4**	**8.2**	**6.7**	**6.1**	**6.1**	**6.1**	**5.9**	**5.6**	**5.4**	**5.0**
122.4	119.8	123.0	127.8	126.5	132.0	150.2	152.3	152.4	153.0	142.2	141.6	138.4	134.1	134.1	131.0	129.3	120.7	105.5	94.3	85.3	65.0	65.0	60.1	56.5	51.5	50.2	42.8

$PM_{2.5}$ - Fugitives

MONTHLY EMISSIONS (lbs/day)

ON-SITE

CONSTRUCTION VEHICLES	Round Trips per day per unit	Round Trip Distance (miles/vehicle/day)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On-Road Vehicles																																																			
18 cy fill mat'l haul truck	1	1.8	0.0	0.0	0.9	0.9	1.9	1.9	1.9	1.9	0.9	0.9	0.9	0.9	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bus	1	0.75	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Concrete Pumper Truck	2	0.75	0.0	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck	8	0.75	0.7	0.9	0.9	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.5	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0
Diesel Tractor (Yard Dog)	2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Truck - 1 ton	10	0.5	0.4	0.4	0.4	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pile Driver Truck	2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Fuel/Lube	8	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0
Tractor Truck 5th Wheel	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trucks - Pickup 3/4 ton	10	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.7	1.4	1.4	1.4	1.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	1.4	1.4	0.9	0.9	0.9	0.9	0.5
Trucks - 3 ton	2	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	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	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck - Water	4	1	1.0	1.0	1.0	1.0	1.0	1.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Off Road Vehicles																																																			
Air Compressor 185 CFM	1	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Compressor 750 CFM	1	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Articulating Boom Platform	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bob cat loader	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D10R	0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer D6C	0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Trowel Machine	1	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Vibrators	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 35 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes - Mobile 45 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - Mobile 65 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cranes 100 / 150 ton cap	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diesel Powered Welder	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Backhoe/loader	0	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Earth Scraper 637	0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - loader	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Motor Grader (CAT140H)	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator - Trencher (CAT320)	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fired Heaters (2,000 BTU)	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	5	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fusion Welder	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 600 tn Crane	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Haul / 1,000 tn Crane	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Light Plants	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lifts - telescoping	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Man lift - scissor	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction Roller	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Vibratory Plate	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Compaction - Ram	0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portable Power Generators	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 300 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck Crane - Greater than 200 ton	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Roller Ingersol-Rand 20 ton	2	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WORKER VEHICLES																																																			
Personal commuting vehicles			0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.7	0.8	0.9	1.2	1.3	1.6	1.8	2.2	2.5	2.7	2.9	3.0	3.2	3.4	3.8	4.0	4.4	4.6	4.7	5.1	5.5	5.7	5.7	5.8	5.7	5.6	5.4	5.1	4.9	4.5	4.3	3.7	3.0	2.4	1.6	1.3	1.3	1.3	1.2	1.0	0.9	0.7
DELIVERY TRUCKS																																																			
Light delivery truck (e.g. Fed-Ex)			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	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	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	0.2
Heavy delivery truck (e.g. flat beds carrying construction eqp)			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	2.0	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	2.0	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	2.0	2.0
Import fill trucks			12.2	12.2	12.2	12.2	12.2	12.2	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CONSTRUCTION ACTIVITY																																																			
Dirt Piling - Bob cat loader			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dirt Piling - Trencher (CAT320)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dirt Piling - Backhoe/loader			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dirt Piling - loader			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grading - Earth Scraper 637			0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grading - Motor Grader (CAT140H)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozing - Bulldozer D10R			8.3	8.3	8.3	5.5	5.5	5.5	5.5	5.5	5.5	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozing - Bulldozer D6C			8.3	8.3	8.3	8.3	5.5	5.5	5.5	5.5	5.5	5.5	2.8	2.8	2.8	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Covered Storage Piles			0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3																																									
ONSITE TOTAL (lbs/day)			**34.6**	**34.9**	**35.9**	**33.3**	**31.6**	**32.0**	**31.8**	**19.5**	**19.0**	**16.4**	**13.7**	**11.1**	**11.9**	**12.3**	**12.7**	**9.7**	**10.0**	**10.2**	**9.9**	**10.2**	**10.3**	**10.6**	**10.9**	**11.1**	**11.5**	**11.4**	**11.8**	**15.6**	**15.7**	**15.7**	**15.8**	**12.8**	**12.7**	**12.4**	**12.1**	**12.1**	**11.9**	**11.8**	**11.0**	**9.6**	**8.6**	**7.9**	**5.9**	**5.9**	**5.4**	**5.1**	**4.6**	**4.5**	**3.8**

Hydrogen Energy California Project
4/11/2012
Monthly Emissions of PM2.5 from Fugitive Sources

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
OFF-SITE	**WORKER VEHICLES**																																																	
	Personal commuting vehicles	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.6	0.6	0.7	0.9	1.0	1.2	1.3	1.4	1.4	1.5	1.6	1.8	1.9	2.0	2.2	2.2	2.4	2.6	2.7	2.7	2.7	2.7	2.7	2.5	2.4	2.3	2.1	2.0	1.7	1.4	1.1	0.8	0.6	0.6	0.6	0.6	0.5	0.4	0.3
	DELIVERY TRUCKS																																																	
	Light delivery truck (e.g. Fed-Ex)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Heavy delivery truck (e.g. flat beds carrying construction eqp)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	Import fill trucks	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	LINEARS																																																	
	ON ROAD																																																	
	Dump Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Service Truck (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pipe Haul Truck and Trailer (HHDT-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3/4 Ton Pickup (MHD-DSL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck - water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	OFF ROAD																																																	
	Air Compressor (185 CFM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Bore Machine (Hydraulic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12 Ton Hydra Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Backhoe/loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Excavator - Trencher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Welding Generator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3 to 5 Ton AC Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pipe Bending Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CONSTRUCTION																																																	
	Dirt piling - Backhoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dirt piling - Excavator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dirt piling - CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dirt piling - CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dirt piling - CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dirt piling - CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Grading - CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Grading - CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Storage Piles											0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1																											
	RAIL																																																	
	AIR COMPRESSOR 185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BOOM TRUCK 12 TON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT 325 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT 330 BACKHOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT DOZER D-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT MODEL 12 MOTOR GRADER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT ROLLER-COMPACTOR 563	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT RUBBER TIRE LOADER 966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CAT SCRAPER 615	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CRANE-ROUGH TERRAIN 45T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	GENSET 5KW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JOHN DEERE TRACTOR 9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PICK-UP CRAFT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PICK-UP OVERHEAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL BALLAST REGULATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL CLIP MACHINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL MOVER-SHUTTLE WAGON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL TAMPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAIL WELDER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RAMEX WALK BEHIND COMPACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TRI-AXLE DUMP TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TRUCK FLATBED 14 FOOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TRUCK TRACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	WATER TRUCK, 4M ON-ROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	WELDING MACHINE 350 AMP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	LINEARS TOTAL (lbs/day)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	**0.6**	**1.4**	**1.6**	**1.6**	**1.5**	**1.5**	**0.9**	**0.9**	**0.9**	**0.7**	**0.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	OFFSITE VEHICLES TOTAL (lbs/day)	**3.4**	**3.5**	**3.5**	**3.5**	**3.6**	**3.6**	**3.7**	**1.2**	**1.3**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.9**	**2.1**	**2.2**	**2.2**	**2.3**	**2.4**	**2.5**	**2.7**	**2.8**	**2.9**	**3.1**	**3.1**	**3.3**	**3.5**	**3.6**	**3.6**	**3.6**	**3.6**	**3.5**	**3.4**	**3.3**	**3.2**	**3.0**	**2.9**	**2.6**	**2.3**	**2.0**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**	**1.4**	**1.3**	**1.2**
	TOTAL PROJECT (lbs/day)	38.1	38.4	39.4	36.9	35.2	35.6	35.4	20.7	20.3	17.8	15.7	13.3	14.9	15.7	16.2	13.3	13.6	13.3	13.1	13.5	13.5	13.9	13.7	14.1	14.6	14.5	15.2	19.0	19.3	19.3	19.4	16.3	16.3	15.9	15.4	15.3	14.9	14.7	13.6	11.9	10.6	9.5	7.4	7.4	6.9	6.5	6.0	5.8	5.0

Notes:

1. According to schedules provided by Fluor, Linear construction (except rail) takes place in months 11-22.
2. According to schedules provided by Fluor, Rail construction occurs in months 13-17.
3. According to schedule on "onsite equipment" tab, site prep/pilling occurs in months 1-8. Assume covered storage piles are only present during these months.
4. Assume linear covered storage piles are present during entire 12 months of linear construction, months 11-22.

PROJECT MONTHLY EMISSIONS (lbs/month)

PROJECT EMISSIONS (on-site + linears)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
CO	3,222	3,320	3,952	3,991	4,067	4,408	3,847	3,371	3,186	3,290	4,650	4,916	6,641	7,324	7,225	7,394	7,670	6,382	6,299	6,551	6,233	6,091
CO2	703,040	719,044	830,245	828,597	800,494	859,890	733,697	600,356	555,736	546,695	784,578	827,886	1,247,557	1,329,371	1,356,321	1,356,399	1,413,544	1,114,617	1,110,530	1,172,230	1,117,660	1,097,139
CH4	62	64	73	73	70	75	63	58	57	61	87	94	127	139	139	147	150	127	127	133	128	125
N2O	13	13	15	15	15	16	14	12	11	11	16	17	20	21	22	23	24	25	25	27	25	25
NOx	6,550	6,711	7,829	7,819	7,657	8,282	7,121	5,796	5,326	5,286	7,469	7,879	11,316	12,114	12,101	12,084	12,612	10,347	10,259	10,813	10,275	10,061
PM10 - comb + fug	5,362.0	5,439.8	5,736.1	5,603.1	5,676.4	5,807.0	5,691.5	2,931.3	2,836.7	2,705.6	2,781.5	2,688.9	3,205.3	3,400.2	3,461.5	3,221.3	3,305.3	3,103.7	3,027.8	3,121.3	3,076.8	3,101.8
PM2.5 - comb + fug	1,070.8	1,088.6	1,183.4	1,132.3	1,115.6	1,165.1	1,105.5	780.7	744.1	699.9	781.8	753.1	951.8	1,021.6	1,012.7	952.5	980.7	866.5	849.2	883.1	847.9	838.3
SO2	7	7	8	8	8	9	8	6	6	6	9	9	14	14	15	15	15	12	12	13	12	12
ROG	1,017	1,046	1,268	1,289	1,384	1,507	1,350	1,134	1,032	1,076	1,511	1,615	2,074	2,240	2,228	2,264	2,361	2,047	1,986	2,095	1,985	1,932
CO2e	708,343	724,467	836,506	834,869	806,541	866,396	739,285	605,201	560,370	551,369	791,452	835,251	1,256,345	1,338,945	1,366,145	1,366,549	1,424,275	1,124,895	1,120,929	1,183,254	1,128,243	1,107,556

12-month Rolling Emissions (tons/yr)

PROJECT EMISSIONS (on-site + linears)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
CO	-	-	-	-	-	-	-	-	-	-	-	23	25	27	28	30	32	33	34	36	37	39
CO2	-	-	-	-	-	-	-	-	-	-	-	4395	4667	4973	5236	5499	5806	5933	6122	6408	6689	6964
CH4	-	-	-	-	-	-	-	-	-	-	-	0	0	0	1	1	1	1	1	1	1	1
N2O	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
NOx	-	-	-	-	-	-	-	-	-	-	-	42	44	47	49	51	54	55	56	59	61	64
PM10 - comb + fug	-	-	-	-	-	-	-	-	-	-	-	26.6	25.6	24.5	23.4	22.2	21.0	19.7	18.3	18.4	18.5	18.7
PM2.5 - comb + fug	-	-	-	-	-	-	-	-	-	-	-	5.8	5.8	5.7	5.6	5.5	5.5	5.3	5.2	5.2	5.3	5.4
SO2	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
ROG	-	-	-	-	-	-	-	-	-	-	-	8	8	9	9	10	10	10	11	11	12	12
CO2e	-	-	-	-	-	-	-	-	-	-	-	4430	4704	5011	5276	5542	5851	5980	6171	6460	6744	7022

Construction days per month: 22

ONSITE MONTHLY EMISSIONS (lbs/month)

ONSITE EMISSIONS (no linears)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
CO	3,222	3,320	3,952	3,991	4,067	4,408	3,847	3,371	3,186	3,290	3,411	3,481	3,491	3,759	3,822	4,078	4,251	4,317	4,291	4,653	4,706	4,659
CO2	703,040	719,044	830,245	828,597	800,494	859,890	733,697	600,356	555,736	546,695	578,374	584,527	600,074	636,327	660,620	688,647	740,771	764,687	765,299	839,744	857,402	846,445
CH4	62	64	73	73	70	75	63	58	57	61	63	64	63	69	71	80	82	84	86	95	96	96
N2O	13	13	15	15	15	16	14	12	11	11	12	12	12	13	14	15	16	17	17	19	20	19
NOx	6,550	6,711	7,829	7,819	7,657	8,282	7,121	5,796	5,326	5,286	5,545	5,616	5,694	6,058	6,254	6,503	6,914	7,105	7,066	7,732	7,867	7,742
PM10 - comb + fug	5,362.0	5,439.8	5,736.1	5,603.1	5,676.4	5,807.0	5,691.5	2,931.3	2,836.7	2,705.6	2,545.7	2,410.1	2,576.2	2,687.3	2,777.8	2,579.9	2,653.7	2,697.0	2,626.1	2,727.2	2,768.0	2,814.2
PM2.5 - comb + fug	1,070.8	1,088.6	1,183.4	1,132.3	1,115.6	1,165.1	1,105.5	780.7	744.1	699.9	648.7	599.1	614.3	649.6	662.6	618.5	637.3	647.2	634.5	675.3	683.5	682.0
SO2	7	7	8	8	8	9	8	6	6	6	6	6	6	7	7	8	8	8	8	9	9	9
ROG	1,017	1,046	1,268	1,289	1,384	1,507	1,350	1,134	1,032	1,076	1,112	1,156	1,117	1,200	1,220	1,295	1,386	1,405	1,365	1,499	1,514	1,488
CO2e	708,343	724,467	836,506	834,869	806,541	866,396	739,285	605,201	560,370	551,369	583,325	589,594	605,257	641,919	666,468	694,913	747,446	771,617	772,428	847,622	865,481	854,479

12-month Rolling Emissions (tons/yr)

ONSITE EMISSIONS (no linears)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
CO	-	-	-	-	-	-	-	-	-	-	-	22	22	22	22	22	22	22	22	23	24	24
CO2	-	-	-	-	-	-	-	-	-	-	-	4170	4119	4078	3993	3923	3893	3845	3861	3981	4132	4281
CH4	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
N2O	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
NOx	-	-	-	-	-	-	-	-	-	-	-	40	39	39	38	38	37	37	37	38	39	40
PM10 - comb + fug	-	-	-	-	-	-	-	-	-	-	-	26.4	25.0	23.6	22.1	20.6	19.1	17.5	16.0	15.9	15.9	15.9
PM2.5 - comb + fug	-	-	-	-	-	-	-	-	-	-	-	5.7	5.4	5.2	5.0	4.7	4.5	4.2	4.0	3.9	3.9	3.9
SO2	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
ROG	-	-	-	-	-	-	-	-	-	-	-	7	7	7	7	7	7	7	7	7	8	8
CO2e	-	-	-	-	-	-	-	-	-	-	-	4203	4152	4110	4025	3955	3926	3878	3895	4016	4169	4320

Construction days per month: 22

ONSITE EMISSIONS (no linears)

	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
	4,903	5,250	5,061	4,949	4,808	5,185	5,206	4,968	4,840	4,426	4,305	4,173	3,853	3,464	3,485	3,662	3,384	2,860	2,484	2,407	1,437	1,437	1,338	939	800	726	510
CO	880,652	936,225	916,053	881,339	845,114	910,216	901,616	849,028	809,862	732,331	709,759	688,585	628,670	573,042	569,938	595,888	557,441	469,766	397,598	384,283	222,503	222,493	201,234	150,808	129,251	116,660	84,708
CO2	104	111	106	103	100	106	105	100	96	88	85	82	76	66	66	69	63	51	46	45	30	30	30	18	15	14	9
CH4	20	21	21	20	19	20	20	18	17	16	15	15	13	12	12	12	12	10	8	8	5	5	4	3	3	2	2
N2O	8,056	8,590	8,374	8,080	7,745	8,382	8,324	7,837	7,482	6,761	6,557	6,354	5,780	5,241	5,238	5,511	5,159	4,367	3,691	3,595	2,058	2,058	1,870	1,383	1,188	1,074	795
NOx	2,900.4	2,995.6	3,069.7	3,027.4	3,109.9	3,540.1	3,583.2	3,557.7	3,552.7	3,275.3	3,250.5	3,178.1	3,054.8	3,023.9	2,978.5	2,968.0	2,778.9	2,419.1	2,155.7	1,983.3	1,443.5	1,443.0	1,324.0	1,211.0	1,093.6	1,061.2	889.1
PM10 - comb + fug	709.6	750.1	740.3	726.1	720.0	842.0	849.9	825.1	813.0	705.3	693.1	674.6	629.5	595.9	593.8	610.4	569.9	489.1	427.5	405.8	264.6	264.5	243.4	200.3	177.4	168.0	134.1
PM2.5 - comb + fug	10	10	10	10	9	10	10	9	9	8	8	7	7	6	6	6	6	5	4	4	2	2	2	2	1	1	1
SO2	1,574	1,715	1,669	1,630	1,589	1,693	1,688	1,625	1,586	1,480	1,444	1,415	1,322	1,130	1,143	1,181	1,084	911	783	770	458	458	438	304	257	228	172
ROG	889,059	945,130	924,702	889,662	853,056	918,660	909,963	856,806	817,263	739,019	716,209	694,806	634,294	578,153	575,014	601,197	562,328	473,842	401,124	387,689	224,549	224,539	203,152	152,170	130,393	117,693	85,447
CO2e																											

ONSITE EMISSIONS (no linears)

	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
	39	38.98	38.19	37.00	36	35	33	33	32	31	30	29	29	28	27	26	25	24	23	22	20	18	17	15	14	12	11
CO	7012	7066	6900	6676	6421	6198	5942	5809	5659	5439	5235	5030	4904	4723	4550	4407	4263	4043	3791	3559	3265	3010	2756	2487	2237	2009	1766
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CH4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	64	64	63	61	59	57	55	53	52	50	48	46	45	43	42	41	39	37	35	33	30	28	25	23	21	19	16
NOx	18.8	19.0	18.9	18.7	18.5	18.7	18.8	19.1	19.3	19.4	19.5	19.5	19.6	19.6	19.6	19.5	19.4	18.8	18.1	17.3	16.3	15.3	14.4	13.4	12.4	11.4	10.4
PM10 - comb + fug	5.3	5.3	5.2	5.1	4.9	4.9	4.8	4.8	4.8	4.7	4.6	4.5	4.5	4.4	4.3	4.3	4.2	4.0	3.8	3.6	3.3	3.1	2.9	2.6	2.4	2.2	2.0
PM2.5 - comb + fug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO2	12.20	12.25	12.05	11.74	11.42	11.14	10.80	10.59	10.39	10.08	10	10	9	9	9	9	8	8	8	7	7	6	6	5	4	4	4
ROG	7071	7126	6960	6735	6479	6255	5998	5864	5712	5490	5284	5077	4950	4766	4591	4447	4302	4079	3825	3590	3294	3037	2780	2509	2257	2027	1782
CO2e																											

ONSITE EMISSIONS (no linears)

	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
	4,903	5,250	5,061	4,949	4,808	5,185	5,206	4,968	4,840	4,426	4,305	4,173	3,853	3,464	3,485	3,662	3,384	2,860	2,484	2,407	1,437	1,437	1,338	939	800	726	510
CO	880,652	936,225	916,053	881,339	845,114	910,216	901,616	849,028	809,862	732,331	709,759	688,585	628,670	573,042	569,938	595,888	557,441	469,766	397,598	384,283	222,503	222,493	201,234	150,808	129,251	116,660	84,708
CO2	104	111	106	103	100	106	105	100	96	88	85	82	76	66	66	69	63	51	46	45	30	30	30	18	15	14	9
CH4	20	21	21	20	19	20	20	18	17	16	15	15	13	12	12	12	12	10	8	8	5	5	4	3	3	2	2
N2O	8,056	8,590	8,374	8,080	7,745	8,382	8,324	7,837	7,482	6,761	6,557	6,354	5,780	5,241	5,238	5,511	5,159	4,367	3,691	3,595	2,058	2,058	1,870	1,383	1,188	1,074	795
NOx	2,900.4	2,995.6	3,069.7	3,027.4	3,109.9	3,540.1	3,583.2	3,557.7	3,552.7	3,275.3	3,250.5	3,178.1	3,054.8	3,023.9	2,978.5	2,968.0	2,778.9	2,419.1	2,155.7	1,983.3	1,443.5	1,443.0	1,324.0	1,211.0	1,093.6	1,061.2	889.1
PM10 - comb + fug	709.6	750.1	740.3	726.1	720.0	842.0	849.9	825.1	813.0	705.3	693.1	674.6	629.5	595.9	593.8	610.4	569.9	489.1	427.5	405.8	264.6	264.5	243.4	200.3	177.4	168.0	134.1
PM2.5 - comb + fug	10	10	10	10	9	10	10	9	9	8	8	7	7	6	6	6	6	5	4	4	2	2	2	2	1	1	1
SO2	1,574	1,715	1,669	1,630	1,589	1,693	1,688	1,625	1,586	1,480	1,444	1,415	1,322	1,130	1,143	1,181	1,084	911	783	770	458	458	438	304	257	228	172
ROG	889,059	945,130	924,702	889,662	853,056	918,660	909,963	856,806	817,263	739,019	716,209	694,806	634,294	578,153	575,014	601,197	562,328	473,842	401,124	387,689	224,549	224,539	203,152	152,170	130,393	117,693	85,447
CO2e																											

ONSITE EMISSIONS (no linears)

	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
	25	26.09	26.88	27.47	28	29	29	29	30	29	29	29	29	28	27	26	25	24	23	22	20	18	17	15	14	12	11
CO	4433	4608	4766	4889	4981	5092	5172	5215	5237	5183	5109	5030	4904	4723	4550	4407	4263	4043	3791	3559	3265	3010	2756	2487	2237	2009	1766
CO2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CH4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	41	43	44	45	46	47	48	48	48	48	47	46	45	43	42	41	39	37	35	33	30	28	25	23	21	19	16
NOx	16.1	16.4	16.6	16.8	17.0	17.5	17.9	18.4	18.8	19.1	19.3	19.5	19.6	19.6	19.6	19.5	19.4	18.8	18.1	17.3	16.3	15.3	14.4	13.4	12.4	11.4	10.4
PM10 - comb + fug	3.9	4.0	4.0	4.1	4.1	4.2	4.3	4.4	4.5	4.5	4.5	4.5	4.5	4.4	4.3	4.3	4.2	4.0	3.8	3.6	3.3	3.1	2.9	2.6	2.4	2.2	2.0
PM2.5 - comb + fug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO2	8.11	8.39	8.66	8.88	9.06	9.26	9.41	9.52	9.64	9.63	10	10	9	9	9	9	8	8	8	7	7	6	6	5	4	4	4
ROG	4473	4651	4811	4935	5028	5140	5221	5264	5286	5232	5157	5077	4950	4766	4591	4447	4302	4079	3825	3590	3294	3037	2780	2509	2257	2027	1782
CO2e																											

Emission Factors for Onroad Vehicles

ONSITE - 5 MPH							EF (lbs/mile)									
Onroad Vehicle	Fuel Type	Vehicle Type	Daily Vehicle Count	Round Trip Distance (miles/vehicle/day)	Trips per day	VMT (Daily Total)	TOC	CO	NOx	PM_{10}	SO_2	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
Personal Commuting Vehicles	G/D	LDA/ LDT		0.2	1	-	0.0012	0.0154	0.0012	0.0002	2.43E-05	0.0001	2.57E+00	9.55E-05	1.90E-04	2.604
Light delivery truck (e.g. Fed-Ex)	D	LHDT	10	0.5	1	5	0.0011	0.0073	0.0174	0.0003	1.10E-05	0.0003	1.16E+00	6.61E-05	2.20E-05	1.178
Heavy delivery truck (e.g. flat beds carrying construction eqp)	D	HHDT	50	1	1	50	0.0271	0.0434	0.1010	0.0063	8.16E-05	0.0057	8.48E+00	1.10E-04	1.76E-04	8.515
Import Fill Trucks - gravel	D	HHDT	160	1	1	160	0.0271	0.0434	0.1010	0.0063	0.0001	0.0057	8.4774	0.0001	0.0002	8.5153
Import Fill Trucks - dirt	D	HHDT	160	0.5	1	80	0.0271	0.0434	0.1010	0.0063	0.0001	0.0057	8.4774	0.0001	0.0002	8.5153

OFFSITE - 50 MPH							EF (lbs/mile)									
Onroad Vehicle	Fuel Type	Vehicle Type	Daily Vehicle Count	Round Trip Distance (miles/vehicle/day)	Trips per day	VMT (Daily Total)	TOC	CO	NOx	PM_{10}	SO_2	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
Personal Commuting Vehicles	G/D	LDA/ LDT		39.8	1	-	0.0002	0.0065	0.0008	0.0001	7.72E-06	0.0000	8.04E-01	9.55E-05	1.90E-04	0.838
Light delivery truck (e.g. Fed-Ex)	D	LHDT	10	39.5	1	395	0.0003	0.0013	0.0116	0.0001	1.10E-05	0.0001	1.16E+00	6.61E-05	2.20E-05	1.178
Heavy delivery truck (e.g. flat beds carrying construction eqp)	D	HHDT	50	39.0	1	1950	0.0017	0.0076	0.0377	0.0014	3.53E-05	0.0012	3.68E+00	1.10E-04	1.76E-04	3.721
Import Fill Trucks	D	HHDT	160	38	1	6080	0.0017	0.0076	0.0377	0.0014	0.0000	0.0012	3.6832	0.0001	0.0002	3.7210

Onsite distance for worker vehicles based on parking areas of 100m x 250 m. Assume average one way trip is 175m, round trip of 350 m, or 0.22 miles.
Emission factors from EMFAC2007 (version 2.3) for year 2010
Emission factors for personal commuting vehicles are based on the assumption 50% LDA and 50% LDT
CH_4 and N_2O emission factor for personal commuting vehicles is based on the average factor for gasoline and diesel passenger vehicles from CCAR, GRP Version 3.0, Table C.5
CH_4 and N_2O emission factor for light delivery trucks is based on the factor for diesel light duty trucks from CCAR, GRP Version 3.0, Table C.5
CH_4 and N_2O emission factor for heavy duty tucks is based on the factor for diesel heavy duty trucks from CCAR, GRP Version 3.0, Table C.5

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Number of Worker/ Day	34	59	79	101	149	188	224	301	335	403	500	559	663	777	935	1057	1154	1224	1289	1366	1432	1603	1723	1853
Avg Daily Vehicles/ Day	26	45	60	78	114	145	173	232	258	310	385	430	510	598	720	813	887	942	992	1051	1102	1233	1325	1425
Light delivery trucks	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Heavy delivery trucks	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Import fill trucks	160	160	160	160	160	160	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1970	1993	2192	2347	2423	2437	2461	2425	2403	2295	2172	2104	1912	1850	1570	1276	1011	688	549	548	548	507	430	394	297
1516	1533	1686	1805	1864	1874	1893	1865	1848	1765	1671	1618	1471	1423	1208	982	778	529	422	422	422	390	331	303	228
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Number of workers per commuter vehicle = 1.3
Actual worker schedule data updated 4/3/12 with data from Table 2-28 HECA Manpower R5 04 02 12.xls
Vehicle occupancy rate is based on information from Section 2.0 Project Description.

Assumptions:
Assumed average distance traveled off site for all employees commuting will be 20 miles
times 2 for return trip = 40 miles
22 days per month of construction, average

CO_2 GWP (SAR, 1996) = 1
CH_4 GWP (SAR, 1996) = 21
N_2O GWP (SAR, 1996) = 310

(2) grams to pounds conversion = 0.00220459

Onsite Fugitive Dust Emissions

ASSUMPTIONS:
1 month of dirt moving
22 construction days per month
10 construction hours per day

Dirt Piling or Material Handling

$E = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ USEPA AP42 Chapter 13.2.4 (Aggregate Handling And Storage Piles)

0.35 k for PM_{10}
0.053 k for $PM_{2.5}$
6.25 U = Mean Wind speed (mph) average for Bakersfield Airport 2000-2004
19 M = Moisture content of surface material (%) (average of soil borings taken onsite at 5 ft)
0.00006 lb of PM_{10}/ ton of material
0.00001 lb of $PM_{2.5}$/ ton of material

MATERIAL HANDLED (tons/day)	Mitigation Efficiency[1]	MONTH:	1	2	3	4	5	6	7	8	9	10	11	12
		# pieces of equip:	4	4	6	7	7	9	9	12	12	12	12	10
Bob cat loader	67%	tons/day material handled:	0	0	3,017	2,586	2,586	2,011	2,011	6,034	6,034	6,034	6,034	7,241
Excavator - Trencher (CAT320)	67%		0	0	0	0	0	4,023	4,023	3,017	3,017	3,017	3,017	3,620
Excavator - Backhoe/loader	67%		9,051	9,051	9,051	10,344	10,344	8,045	8,045	6,034	6,034	6,034	6,034	3,620
Excavator - loader	67%		9,051	9,051	6,034	5,172	5,172	4,023	4,023	3,017	3,017	3,017	3,017	3,620
		TOTAL material handled	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102

MATERIAL HANDLED (tons/day)	13	14	15	16	17	18	19	20	21	22	23
# pieces of equip:	8	8	7	7	4	4	3	3	3	3	3
Bob cat loader	6,788	6,788	7,758	7,758	13,577	13,577	12,068	12,068	12,068	12,068	12,068
Excavator - Trencher (CAT320)	4,526	4,526	5,172	5,172	0	0	0	0	0	0	0
Excavator - Backhoe/loader	4,526	4,526	5,172	5,172	4,526	4,526	6,034	6,034	6,034	6,034	6,034
Excavator - loader	2,263	2,263	0	0	0	0	0	0	0	0	0
TOTAL material handled	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102	18,102

24	25	26	27	28	29	30	31	32	33	34	35	36
3	0	0	0	1	1	1	1	0	0	0	0	3
12,068	0	0	0	0	0	0	0	0	0	0	0	6,034
0	0	0	0	0	0	0	0	0	0	0	0	0
6,034	0	0	0	0	0	0	0	0	0	0	0	12,068
0	0	0	0	18,102	18,102	18,102	18,102	0	0	0	0	0
18,102	0	0	0	18,102	18,102	18,102	18,102	0	0	0	0	18,102

37	38	39	40	41	42	43	44	45	46	47	48	49
3	4	4	3	2	2	0	0	0	0	0	0	0
6,034	4,526	4,526	6,034	9,051	9,051	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
12,068	9,051	9,051	6,034	9,051	9,051	0	0	0	0	0	0	0
0	4,526	4,526	6,034	0	0	0	0	0	0	0	0	0
18,102	18,102	18,102	18,102	18,102	18,102	0	0	0	0	0	0	0

Do not include capacity factor because emissions are based on material handled, not hours of operation.

15,341 yd^3/day 18,102 ton/day 2,360 density of soil (lb/yd^3)
337,500 yd^3 398,250 tons (USDA NRCS Physical Soil Properties from Kern County for Lockern-Buttonwillow clay)
Excavation 850,000 Cubic yds
Imported Fill 500,000 Cubic yds (assume 25% of entire site in any given month)

Grading Emissions Factor

To be used for all scraping and grading activities

$E = 0.051(S)^{2.0}$ for particles ≤ 15 um USEPA AP42 Chapter 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 - refers to
$E = 0.040(S)^{2.5}$ for TSP ≤ 30 um USEPA AP42 Chapter 11.9 (Western Surface Coal Mining), Table 11.9-1

multiply by 0.60 for PM_{10}
multiply TSP equation by 0.031 for $PM_{2.5}$
S = mean vehicle speed (mph)
S = 4.0 mph
1.28 lb ≤ 30 μm/VMT
0.82 lb ≤ 15 μm/VMT
PM_{10} = 0.49 lb PM_{10}/VMT
$PM_{2.5}$ = 0.04 lb $PM_{2.5}$/VMT

Equipment	Daily VMT	Mitigation Efficiency[1]	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/day)
Excavator - Earth Scraper 637	0.7	67%	0.113	0.009
Excavator - Motor Grader (CAT140H)	0.7	67%	0.113	0.009
		Total	**0.23**	**0.02**

Formula based on lbs per VMT, not hours, so no capacity factor included.

Bulldozing/Earth clearing

$E = 1.0(s)^{1.5}/(M)^{1.4}$ for particles ≤ 15 um USEPA AP42 Chapter 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 - refers to
$E = 5.7(s)^{1.2}/(M)^{1.3}$ for TSP ≤ 30 um USEPA AP42 Chapter 11.9 (Western Surface Coal Mining), Table 11.9-1, 11.9-3

multiply by 0.75 for PM_{10}
multiply TSP equation by 0.105 for $PM_{2.5}$
50 s = Silt content (%) (from soil boring B-4)
19 M = Moisture content of surface material (%) (average of soil borings taken onsite at 5 ft)
4.30 lb/hr of PM10
1.42 lb/hr of PM2.5

Equipment	Hours per day	Capacity Factor	Mitigation Efficiency[1]	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Bulldozer D10R	10	59.0%	67%	1.42	8.37	0.47	2.77
Bulldozer D6C	10	59.0%	67%	1.42	8.37	0.47	2.77
			Total	**2.84**	**16.74**	**0.94**	**5.54**

Cover Storage Pile

SCAQMD Table A9-9-E
E = 1.7 * G/1.5 * (365-H)/235 * I/15 * J
PM10 Emission factor from wind erosion of storage piles per day per acre
50 G = Silt content (%) (from soil boring B-4)
37 H = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Bakersfield Airport Station)
0.3 I = Percentage of time that the unobstructed wind speed exceeds 12 mph at mean pile height (wind speed percentage and average based on 2000-04 (5 yrs) of wind speed data as recorded at Bakersfield Airport station)
0.5 J = Fraction of TSP that is PM_{10} = 0.5
0.791 lb/acre/day

Source	Quantity	Size of Pile (acre)	Hours/Day	Mitigation Efficiency[1]	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Cover Storage Pile	25	0.25	24	67%	0.07	1.63	0.014	0.339

Pile size and number are assumed

Travel on unpaved roads

E = k * (s/12)^a * (W/3)^b USEPA AP42 Chapter 13.2.2 (Unpaved Roads)

Size specific emission factor for vehicle travel on unpaved roads at industrial sites (eqn 1a; lb/VMT)

Constants:	PM2.5	PM10	TSP
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45

4 s = Surface material silt content (%) (value for gravel road)
50 s = Surface material silt content (%) (value for dirt surfaces)
value listed in table W = Mean vehicle weight (ton)

Vehicle Type	Mean Vehicle Weight (tons)[2]	PM2.5 EF (lbs/VMT)	PM10 EF (lbs/VMT)	Mitigation Efficiency[1]	If weight = 0, where is source included
18 cy fill mat'l haul truck	30	0.16	1.57	67%	
Bus	15	0.12	1.15	67%	
Concrete Pumper Truck	30	0.16	1.57	67%	
Dump Truck	15	0.12	1.15	67%	
Diesel Tractor (Yard Dog)	11	0.10	1.00	67%	
Service Truck - 1 ton	15	0.12	1.15	67%	
Pile Driver Truck	15	0.12	1.15	67%	
Truck - Fuel/Lube	15	0.12	1.15	67%	
Tractor Truck 5th Wheel	11	0.10	1.00	67%	
Trucks - Pickup 3/4 ton	3	0.06	0.56	67%	
Trucks - 3 ton	11	0.10	1.00	67%	
Truck - Water	25	0.14	1.45	67%	
Air Compressor 185 CFM	0.5	0.02	0.25	67%	
Air Compressor 750 CFM	0.5	0.02	0.25	67%	
Articulating Boom Platform	5	0.07	0.70	67%	
Bob cat loader	0	0.00	0.00	67%	Dirt piling
Bulldozer D10R	0	0.00	0.00	67%	Bulldozing/earth clearing
Bulldozer D6C	0	0.00	0.00	67%	Bulldozing/earth clearing
Concrete Trowel Machine	15	0.12	1.15	67%	
Concrete Vibrators	0.25	0.02	0.18	67%	
Cranes - Mobile 35 ton	25	0.14	1.45	67%	
Cranes - Mobile 45 ton	35	0.17	1.69	67%	
Crane - Mobile 65 ton	45	0.19	1.89	67%	
Cranes 100 / 150 ton cap	50	0.20	1.98	67%	
Diesel Powered Welder	0.5	0.02	0.25	67%	
Excavator - Backhoe/loader	0	0.00	0.00	67%	Dirt piling
Excavator - Earth Scraper 637	0	0.00	0.00	67%	Grading
Excavator - loader	0	0.00	0.00	67%	Dirt piling
Excavator - Motor Grader (CAT140H)	0	0.00	0.00	67%	Grading
Excavator - Trencher (CAT320)	0	0.00	0.00	67%	Dirt piling
Fired Heaters (2,000 BTU)	0.25	0.02	0.18	67%	
Forklift	10	0.10	0.96	67%	
Fusion Welder	0.25	0.02	0.18	67%	
Heavy Haul / 600 tn Crane	75	0.24	2.38	67%	
Heavy Haul / 1,000 tn Crane	75	0.24	2.38	67%	
Light Plants	0.5	0.02	0.25	67%	
Man lifts - telescoping	7	0.08	0.82	67%	
Man lift - scissor	2.5	0.05	0.51	67%	
Portable Compaction Roller	3	0.06	0.56	67%	
Portable Compaction - Vibratory Plate	0.1	0.01	0.12	67%	
Portable Compaction - Ram	0.25	0.02	0.18	67%	
Pumps	0.1	0.01	0.12	67%	
Portable Power Generators	0.5	0.02	0.25	67%	
Truck Crane - Greater than 200 ton	50	0.20	1.98	67%	
Truck Crane - Greater than 300 ton	60	0.21	2.15	67%	
Vibratory Roller Ingersol-Rand 20 ton	20	0.13	1.31	67%	
worker personal vehicles	1.6	0.04	0.42	67%	
Light delivery truck (e.g. Fed-Ex)	9	0.09	0.91	67%	
Heavy delivery truck (e.g. flat beds carrying construction eqp)	17.5	0.12	1.23	67%	
Import Fill Trucks - gravel	25	0.14	1.45	67%	
Import Fill Trucks - dirt	25	1.41	14.07	96%	

Mitigation Measure[1]	Unpaved Roads	Soil import areas[3]
Apply water three times daily to all unpaved road surfaces[4]	45%	85%
Traffic speeds on all unpaved roads to be reduced to 15 mph or less[5]	40%	70%
Combined Mitigation Efficiency	**67%**	**96%**

Notes:

1. Mitigation efficiencies from CEQA Table 11-4 (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM_{10} Emissions - Constrution.")
2. Equipment weight from SCAQMD Table A9-9-D-3 and various websites.
3. Because the areas where soil is being imported are known to be subject to large amounts of fugitive emissions, extra care will be taken to keep the area watered and speeds extremely low. Thus, the upper value of the efficiency range has been assumed.
4. Water trucks operate at least 4 times per day.
5. Assumed maximum travel speed is 5 mph.

Off-Site Linears Fugitive Dust Emissions

ASSUMPTIONS:
12 months of soil disturbance
10 total construction hours per work day
22 construction days per month

Dirt Piling or Material Handling

$E = k * (0.0032) * (U/5)^{1.3} / (M/2)^{1.4}$ PM Emissions from Dirt Piling or Material Handling (lb/ton) from USEPA AP42, Chapter 13.2.4 (Aggregate Handling and Storage Piles)

0.053 k for PM2.5
0.35 k for PM10
6.25 U = Mean Wind speed (mph) average for Bakersfield Airport 2000-2004
15 M = Moisture content of surface material (%) (from SCAQMD Table A9-9-G-1 for moist dirt)
0.00001 lb of $PM_{2.5}$/ ton of material
0.00009 lb of PM_{10}/ ton of material

MATERIAL HANDLED (tons/day)	Mitigation Efficiency[1]	MONTH:	1	2	3	4	5	6	7	8	9	10
		# pieces of equip:	0	0	0	0	0	0	0	0	0	0
Backhoe	67%	tons/day material handled:	0	0	0	0	0	0	0	0	0	0
Excavator	67%		0	0	0	0	0	0	0	0	0	0
CAT 325 BACKHOE	67%		0	0	0	0	0	0	0	0	0	0
CAT 330 BACKHOE	67%		0	0	0	0	0	0	0	0	0	0
CAT DOZER D-6	67%		0	0	0	0	0	0	0	0	0	0
CAT RUBBER TIRE LOADER 966	67%		0	0	0	0	0	0	0	0	0	0
		TOTAL material handled	0	0	0	0	0	0	0	0	0	0

11	12	13	14	15	16	17	18	19	20	21	22	23
6	7	14	14	14	13	14	11	11	11	7	7	0
5454	4675	3896	3896	3896	4195	3896	4958	4958	4958	4675	4675	0
0	779	390	390	390	420	390	496	496	496	779	779	0
0	0	390	390	0	0	0	0	0	0	0	0	0
0	0	0	0	390	0	0	0	0	0	0	0	0
0	0	779	779	0	0	390	0	0	0	0	0	0
0	0	0	0	779	839	779	0	0	0	0	0	0
5454	5454	5454	5454	5454	5454	5454	5454	5454	5454	5454	5454	0

24	25	26	27	28	29	30	31	32	33	34	35	36
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

37	38	39	40	41	42	43	44	45	46	47	48	49
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

Disturbed Acreage

	Length (miles)	ROW width (ft)	Area (ft2)	Area (acres)
Electrical transmission line	2.1	100	1108800	25.45
Natural gas linear	13	50	3432000	78.78
Process water pipeline	14.4	50	3801600	87.27
CO_2 pipeline	3.4	50	897600	20.61
Potable water pipeline	1.2	10	63360	1.45
Railway	5.3	60	1679040	38.54
Sources:			TOTAL:	**252.11**

miles to feet conversion: 5280 ft/mile
ft2 to acres conversion: 0.000022956 acre / ft2

Lengths: email from William Becktel, 3/26/12
ROW Width: Table 2-01 March 20 from Fluor.doc

Assume tons/day of material is evenly split among the number of pieces of equipment operating in a given month.
Do not include capacity factor because emissions are based on material handled, not hours of operation.

4622 yd^3/day — 5454 ton/day
1,220,222 yd^3 — 1,439,862 tons — 2360 density of soil (lb/yd^3) (USDA NRCS Physical Soil Properties from Kern County Lockern-Buttonwillow clay soil)
252.11 acres = 1,220,222 cubic yds, assume depth of soils moved is 1 yd

Grading Emissions Factor To be used for all scraping and grading activities

$E = 0.051(S)^{2.0}$ for particles ≤ 15 um USEPA AP42 Chapter 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 - refers to
$E = 0.040(S)^{2.5}$ for TSP ≤ 30 um USEPA AP42 Chapter 11.9 (Western Surface Coal Mining), Table 11.9-1

multiply by 0.60 for PM_{10}
multiply TSP equation by 0.031 for $PM_{2.5}$
S = mean vehicle speed (mph)

S = 4.0 mph
1.28 lb ≤ 30 μm/VMT
0.82 lb ≤ 15 μm/VMT
PM_{10} = 0.49 lb PM_{10}/VMT
$PM_{2.5}$ = 0.04 lb $PM_{2.5}$/VMT

Equipment	Daily VMT	Mitigation Efficiency[1]	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/day)
CAT MODEL 12 MOTOR GRADER	0.7	67%	0.113	0.009
CAT SCRAPER 615	0.7	67%	0.113	0.009
		Total	**0.23**	**0.02**

Formula based on lbs per VMT, not hours, so no capacity factor included.

Storage Piles

SCAQMD Table A9-9-E

E = 1.7 * G/1.5 * (365-H)/235 * I/15 * J

PM10 Emission factor from wind erosion of storage piles per day per acre

50	G = Silt content (%) (from Geotechnical Investigaion, AFC Appendix P)
37	H = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Bakersfield Airport Station)
0.3	I = Percentage of time that the unobstructed wind speed exceeds 12 mph at mean pile height (based on 2000-04 (5 yrs) of wind speed data as recorded at Bakersfield Airport station)
0.5	J = Fraction of TSP that is PM_{10} = 0.5
0.791	lb/acre/day

Source	Quantity	Size of Pile (acre)	Mitigation Efficiency[1]	PM_{10} Emissions (lbs/day)	$PM_{2.5}$ Emissions (lbs/day)
Storage Piles	8	0.25	67%	0.52	0.109

Pile size and number are assumed

Days per year accounts for weekend days also, not just work days

Assume PM2.5 is 20.8% of PM10

Travel on unpaved roads

E = k * (s/12)^a * (W/3)^b — USEPA AP42 Chapter 13.2.2 (Unpaved Roads)

Size specific emission factor for vehicle travel on unpaved roads at industrial sites (eqn 1a; lb/VMT)

Constants:	PM2.5	PM10	TSP
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45

4	s = Surface material silt content (%) (value for gravel road)
value listed in table	W = Mean vehicle weight (ton)

Vehicle Type	Round Trips /Day/ Unit	Round Trip Distance on Dirt Surface (mile)	Mean Vehicle Weight (tons)[2]	PM2.5 EF (lbs/VMT)	PM_{10} EF (lbs/VMT)	Mitigation Efficiency[1]	If weight = 0, where is source included
ON ROAD							
Dump Truck	4	0.25	17	0.12	1.22	67%	
Service Truck (MHD-DSL)	1	0.125	4	0.06	0.64	67%	
Pipe Haul Truck and Trailer (HHDT-DSL)			15	0.12	1.15	67%	
Truck (Pickup 3/4 Ton) - MHD-DSL	2	0.25	1	0.03	0.34	67%	
Truck - water	4	0.25	25	0.14	1.45	67%	
OFF ROAD							
Air Compressor	0			0.00	0.00	67%	
Bore Machine (Hydraulic)	0			0.00	0.00	67%	
Crane	1	0.25	12	0.10	1.04	67%	
Backhoe	0		0	0.00	0.00	67%	Dirt piling
Excavator	1	0.25	0	0.00	0.00	67%	Dirt piling
Forklift	4	0.25	10	0.10	0.96	67%	
Welding Generator	0			0.00	0.00	67%	
Roller	4	0.25	20	0.13	1.31	67%	
Pipe Bending Machine	0			0.00	0.00	67%	
RAIL							
AIR COMPRESSOR 185	0	0	1	0.03	0.34	67%	
BOOM TRUCK 12 TON	4	0.25	12	0.10	1.04	67%	
CAT 325 BACKHOE	4	0.25	0	0.00	0.00	67%	Dirt piling
CAT 330 BACKHOE	4	0.25	0	0.00	0.00	67%	Dirt piling
CAT DOZER D-6	4	0.25	0	0.00	0.00	67%	Dirt piling
CAT MODEL 12 MOTOR GRADER	4	0.25	0	0.00	0.00	67%	Grading
CAT ROLLER-COMPACTOR 563	4	0.25	3	0.06	0.56	67%	
CAT RUBBER TIRE LOADER 966	4	0.25	0	0.00	0.00	67%	Dirt piling
CAT SCRAPER 615	4	0.25	0	0.00	0.00	67%	Grading
CRANE-ROUGH TERRAIN 45T	4	0.25	45	0.19	1.89	67%	
GENSET 5KW	0	0	0.5	0.02	0.25	67%	
JOHN DEERE TRACTOR 9400	4	0.25	20	0.13	1.31	67%	
PICK-UP CRAFT	4	0.25	10	0.10	0.96	67%	
PICK-UP OVERHEAD	4	0.25	10	0.10	0.96	67%	
RAIL BALLAST REGULATOR	4	0.25	1	0.03	0.34	67%	
RAIL CLIP MACHINE	4	0.25	0.3	0.02	0.20	67%	
RAIL MOVER-SHUTTLE WAGON	4	0.25	27.5	0.15	1.51	67%	
RAIL TAMPER	4	0.25	27	0.15	1.50	67%	
RAIL WELDER	0	0	0.5	0.02	0.25	67%	
RAMEX WALK BEHIND COMPACTOR	4	0.25	0.1	0.01	0.12	67%	
TRI-AXLE DUMP TRUCK	4	0.25	17	0.12	1.22	67%	
TRUCK FLATBED 14 FOOT	4	0.25	10	0.10	0.96	67%	
TRUCK TRACTOR	4	0.25	10	0.10	0.96	67%	
WATER TRUCK, 4M ON-ROAD	4	0.25	25	0.14	1.45	67%	
WELDING MACHINE 350 AMP	0	0	0.5	0.02	0.25	67%	

Mitigation Measure[1]	Unpaved Roads
Apply water three times daily to all unpaved road surfaces[3]	45%
Traffic speeds on all unpaved roads to be reduced to 15 mph or less[4]	40%
Combined Mitigation Efficiency	**67%**

Notes:

1. Mitigation efficiencies from CEQA Table 11-4 (South Coast Air Quality Management District, 1993, CEQA Air Quality Handbook, Table 11-4: Mitigation for PM_{10} Emissions - Constrution.")
2. Equipment weight from SCAQMD Table A9-9-D-3 and various websites.
3. Water trucks operate at least 4 times per day.
4. Assumed maximum travel speed is 5 mph.

Fugitive Dust on Paved Roads

AP 42 13.2.1 Paved Roads, updated January 2011

For a daily basis,
E = [k (sL)^0.91 x (W)^1.02](1-P/4N) equation (2)

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period
W = average weight (tons) of vehicles treaveling the road
k = particle size multiplier for particle size range and units of interest
sL = road surface silt loading (g/m^2)
N = number of days in the averaging period

	k
	lb/VMT
PM2.5	0.00054
PM10	0.00

Table 13.2.1-1
PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Heavy Duty Trucks

			Empty	Full	
W=	17.5	tons, average	5	30	tons
sL=	0.031	g/m2 Default value from URBEMIS 9.2 for Kern County			
P=	36	days/year Buttonwillow Station 1940-2011, WRCC			

E=
0.00041 lb/VMT PM2.5 large delivery trucks
0.00169 lb/VMT PM10 large delivery trucks

Light Duty (Delivery) Trucks

W= 9 tons, average
sL= 0.031 g/m2 Default value from URBEMIS 9.2 for Kern County
P= 36 days/year Buttonwillow Station 1940-2011, WRCC

E=
0.00021 lb/VMT PM2.5 large delivery trucks
0.00086 lb/VMT PM10 large delivery trucks

Worker Vehicles

W= 1.6 tons
sL= 0.031 g/m2 Default value from URBEMIS 9.2 for Kern County
P= 36 days/year Buttonwillow Station 1940-2011, WRCC

E=
0.00004 lb/VMT PM2.5 O&M vehicles
0.00015 lb/VMT PM10 O&M vehicles

Emission Factors for Onsite Equipment

					Emission Factors (lbs/hr)									
Equipment Description	**EMFAC designation**	**Horsepower**	**Source**	**Capacity Factor[1]**	**CO**	**CO_2**	**CH_4**	**N_2O**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**ROG[2]**	**CO_2e**
On-Road Vehicles														
18 cy fill mat'l haul truck	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Bus	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Concrete Pumper Truck	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Dump Truck	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Diesel Tractor (Yard Dog)	HHD-DSL		EMFAC	46.5%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Service Truck - 1 ton	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Pile Driver Truck	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Truck - Fuel/Lube	MHD-DSL		EMFAC	41.0%	0.155	33.180	0.0002	0.001	0.279	0.017	0.015	3.09E-04	0.014	33.39
Tractor Truck 5th Wheel	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Trucks - Pickup 3/4 ton	MHD-DSL		EMFAC	41.0%	0.155	33.180	0.0002	0.001	0.279	0.017	0.015	3.09E-04	0.014	33.39
Trucks - 3 ton	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Truck - Water	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0013	0.001	0.694	0.043	0.039	0.001	0.151	70.16
Off Road Vehicles	**Fuel Type**													
Air Compressor 185 CFM	D	50	OFFROAD - Air Compressors	48.0%	0.269	22.251	0.009	0.001	0.227	0.024	0.022	0.000	0.102	22.619
Air Compressor 750 CFM	D	120	OFFROAD - Air Compressors	48.0%	0.331	46.908	0.008	0.001	0.529	0.050	0.046	0.001	0.090	47.498
Articulating Boom Platform	D	50	OFFROAD - Aerial Lifts	50.5%	0.246	38.038	0.006	0.001	0.396	0.032	0.030	0.000	0.061	38.328
Bobcat Loader	D	50	OFFROAD - Rubber Tired Loaders	54.0%	0.363	31.122	0.011	0.001	0.311	0.029	0.027	0.000	0.120	31.523
Bulldozer D10R	D	500	OFFROAD - Crawler Tractors	59.0%	0.951	258.997	0.023	0.006	2.236	0.087	0.080	0.003	0.254	261.224
Bulldozer D6.C	D	120	OFFROAD - Crawler Tractors	59.0%	0.485	65.751	0.012	0.001	0.767	0.067	0.062	0.001	0.129	66.415
Concrete Trowel Machine	D	50	OFFROAD - Surfacing Equipment	49.0%	0.140	14.095	0.004	0.001	0.136	0.012	0.011	0.000	0.048	14.360
Concrete Vibrators	Electric	50	N/A	43.0%										
Cranes - Mobile 35 ton	D	120	OFFROAD - Cranes	43.0%	0.361	50.103	0.008	0.001	0.550	0.049	0.045	0.001	0.092	50.696
Cranes - Mobile 45 ton	D	175	OFFROAD - Cranes	43.0%	0.482	80.272	0.009	0.002	0.775	0.044	0.041	0.001	0.103	81.078
Crane - Mobile 65 ton	D	175	OFFROAD - Cranes	43.0%	0.482	80.272	0.009	0.002	0.775	0.044	0.041	0.001	0.103	81.078
Cranes 100 / 150 ton cap	D	250	OFFROAD - Cranes	43.0%	0.295	112.058	0.009	0.003	0.993	0.035	0.032	0.001	0.104	113.128
Diesel Powered Welder	D	25	OFFROAD - Welders	45.0%	0.060	11.276	0.002	0.000	0.104	0.007	0.006	0.000	0.022	11.404
Backhoe/loader	D	120	OFFROAD - Tractors/Loaders/Backhoes	46.5%	0.352	51.682	0.006	0.001	0.455	0.038	0.035	0.001	0.069	52.232
Earth Scraper	D	500	OFFROAD - Scrapers	66.0%	1.212	321.140	0.029	0.006	2.826	0.110	0.101	0.003	0.319	323.489
Loader	D	120	OFFROAD - Rubber Tired Loaders	54.0%	0.415	58.861	0.009	0.001	0.600	0.052	0.048	0.001	0.097	59.463
Motor Grader	D	120	OFFROAD - Graders	57.5%	0.530	74.898	0.011	0.001	0.771	0.067	0.062	0.001	0.125	75.553
Excavator - Trencher	D	120	OFFROAD - Trenchers	69.5%	0.468	64.837	0.012	0.001	0.785	0.067	0.061	0.001	0.128	65.498
Fired Heaters	D	25	OFFROAD - Other Construction Equipment	62.0%	0.054	13.205	0.001	0.000	0.101	0.004	0.004	0.000	0.016	13.323
Forklift	D	50	OFFROAD - Forklifts	30.0%	0.167	14.659	0.004	0.001	0.145	0.013	0.012	0.000	0.048	14.925
Fusion Welder	Electric	50	N/A	45.0%										
Heavy Haul / Cranes	D	750	OFFROAD - Cranes	43.0%	0.891	302.773	0.024	0.008	2.451	0.088	0.081	0.003	0.262	305.888
Heavy Haul / Cranes	D	750	OFFROAD - Cranes	43.0%	0.891	302.773	0.024	0.008	2.451	0.088	0.081	0.003	0.262	305.888
Light Plants	D	25	OFFROAD - Other Construction Equipment	62.0%	0.054	13.205	0.001	0.000	0.101	0.004	0.004	0.000	0.016	13.323
Man lifts - telescoping	D	50	OFFROAD - Aerial Lifts	50.5%	0.184	19.595	0.006	0.001	0.188	0.017	0.015	0.000	0.065	19.893
Man lift - scissor	Electric		N/A	50.5%										
Portable Compaction Roller	D	120	OFFROAD - Rollers	57.5%	0.406	58.936	0.009	0.001	0.624	0.053	0.049	0.001	0.098	59.541
Portable Compaction - Vibratory Plate	D	15	OFFROAD - Plate Compactors	43.0%	0.026	4.310	0.000	0.000	0.031	0.001	0.001	0.000	0.005	4.372
Portable Compaction - Vibratory Ram	D	50	OFFROAD - Surfacing Equipment	49.0%	0.140	14.095	0.004	0.001	0.136	0.012	0.011	0.000	0.048	14.360
Pumps	D	25	OFFROAD - Other Construction Equipment	62.0%	0.054	13.205	0.001	0.000	0.101	0.004	0.004	0.000	0.016	13.323
Portable Power Generators	D	50	OFFROAD - Generator Sets	74.0%	0.276	30.595	0.009	0.001	0.291	0.025	0.023	0.000	0.097	30.953
Truck Crane - Greater than 300 ton	D	500	OFFROAD - Cranes	43.0%	0.529	179.940	0.014	0.006	1.421	0.052	0.048	0.002	0.155	181.979
Truck Crane - Greater than 200 ton	D	250	OFFROAD - Cranes	43.0%	0.295	112.058	0.009	0.003	0.993	0.035	0.032	0.001	0.104	113.128
Vibratory Roller 20 ton	D	175	OFFROAD - Rollers	43.0%	0.619	108.049	0.011	0.002	1.009	0.055	0.050	0.001	0.124	108.896

Notes:

[1] Capacity factors from SCAQMD Table A9-8-D

[2] Assuming ROGs are equivalent to VOCs

- Emission factors for on-road vehicles are based on results from Emfac Emissions Model 2007 Version 2.3 (HHDT-DSL=heavy heavy-duty trucks-diesel; MHD-DSL=medium heavy duty-diesel). EMFAC scenario year was 2010 and the selected area was Kern County. PM_{10} values include break wear and tire wear.

- Emission factors for off-road vehicles are based on output from Offroad 2007, calendar year 2013 for Kern County.
  On-Road Vehicles:
    - $PM_{2.5}$ Fraction of PM_{10}, Diesel: 0.920
  Off-Road Vehicles:
    - PM2.5 Fraction of PM10, Diesel: 0.920

- CH_4 and N_2O factors are derived from California Climate Action Registry General Reporting Protocol Version 3.0 (April 2008), Table C.5 for LDT, MHD, and HHD diesel fueled trucks in the San Joaquin Valley Air Basin (MHD =HHD). These emissions are in g/mile. On-road vehicles are limited to 10 mph, which is used to convert to lb/hr. (See GHG Reference Info tab)

- N_2O factors for off-road vehicles are derived from California Climate Action Registry General Reporting Protocol Version 3.0 (April 2008), Table C.5 (distillate fuel factors for the industrial sector) using the following to convert from kg/gallon to lb/hp-hour, and then multiplying by the rated horsepower rating: 1 gallon/137,000 Btu, 7,000 Btu/hp-hour, and 2.2046 lb/kg. CH_4 factors are from the SCAQMD data.

CO_2 GWP (SAR, 1996) =	1
CH_4 GWP (SAR, 1996) =	21
N_2O GWP (SAR, 1996) =	310

Construction Equipment Usage Schedule (on-site)

Month

EQUIPMENT	# of units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
On Road Vehicles																																																		
18 cy fill mat'l haul truck	185			10	10	20	20	20	20	10	10	10	10	5	5	5	5	5	5																		3	3	3	3	1	1	1							
Bus	365	2	2	2	2	3	3	3	3	3	3	5	5	5	5	5	5	7	7	7	10	10	10	10	14	14	14	14	14	14	14	14	14	14	14	14	12	12	12	10	10	5	5	3	3	2	2	2	1	1
Concrete Pumper Truck	39						2	2	2	2	2	2	2	2	3	3	3	2	2	2	2	2							1	1	1	1																		
Dump Truck	76	3	4	4	3	3	3	3	3	3	3	2	2	2	2	2													2	2	2	2	2	2	2	2	2	3	3	3	2	1	1	1	1	1				
Diesel Tractor (Yard Dog)	236						2	2	2	2	2	2	4	4	4	4	4	8	8	8	8	8	8	8	10	10	10	10	10	10	10	10	10	10	10	10	4	4	4	4	4	4	4							
Service Truck - 1 ton	99	2	2	2	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1
Pile Driver Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Truck - Fuel/Lube	85	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1			
Tractor Truck 5th Wheel	0																																																	
Trucks - Pickup 3/4 ton	931	5	5	5	5	5	6	7	8	15	15	15	15	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	15	15	10	10	10	10	5
Trucks - 3 ton	185	1	1	1	1	1	2	2	2	4	4	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	3	3	3	3	2	2	2	1	1	1	1			
Truck - Water	127	5	5	5	5	5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1
Off Road Vehicles																																																		
Air Compressor 185 CFM	327	2	2	2	2	3	3	3	3	3	3	3	3	3	6	6	6	8	8	8	10	10	10	10	12	12	12	12	12	12	12	12	12	12	12	12	8	8	8	6	6	6	6	4	4	4	2	2	1	1
Air Compressor 750 CFM	98					1	1	1	1	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Articulating Boom Platform	0																																																	
Bob cat loader	62			1	1	1	1	1	4	4	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2												1	1	1	1	1	1	1							
Bulldozer D10R	23	3	3	3	2	2	2	2	2	2	1	1																																						
Bulldozer D6C	33	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1													1	1	1	1																		
Concrete Trowel Machine	58						2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2									2	2	2	2	2	2							
Concrete Vibrators	140	4	4	4	4	4	4	4	4	4	8	8	8	8	8	8	8	8	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2															
Cranes - Mobile 35 ton	176							1	1	1	4	4	4	4	7	7	7	7	7	7	7	7	7	7	7	7	7	5	5	5	5	5	5	5	5	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
Cranes - Mobile 45 ton	84											2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	1	1							
Crane - Mobile 65 ton	126												1	1	2	4	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4	2	2	2	2	2	1	1	1	1	1	1	1				
Cranes 100 / 150 ton cap	70											1	1	2	2	3	3	4	4	4	4	4	4	4	4	4	4	4	4	2	2	1	1	1	1	1	1													
Diesel Powered Welder	643				10	10	10	10	10	10	10	10	10	10	10	10	15	15	15	20	20	20	20	20	25	25	25	25	25	25	25	25	25	15	15	15	15	15	10	10	10	10	10	5	5	5	5	3	3	2
Excavator - Backhoe/loader	68	2	2	3	4	4	4	4	4	4	4	4	2	2	2	2	2	1	1	1	1	1	1	1	1												2	2	2	2	1	1	1							
Excavator - Earth Scraper 637	38	7	7	7	7	4	4	2																																										
Excavator - loader	33	2	2	2	2	2	2	2	2	2	2	2	2	1	1														1	1	1	1							1	1	1									
Excavator - Motor Grader (CAT140H)	24		1	1	1	3	3																						1	1	1	1					2	2	2	2	1	1	1							
Excavator - Trencher (CAT320)	22						2	2	2	2	2	2	2	2	2	2	2																																	
Fired Heaters (2,000 BTU)	166					4	4	4	4	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	2	2	2	2	2	2	2	2	2	2	2	1	1	1
Forklift	285	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8	8	8	8	8	8	8	8	8	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	1	1	1
Fusion Welder	83					2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
Heavy Haul / 600 tn Crane	9																		1	1	1	1	1	1	1	1	1																							
Heavy Haul / 1,000 tn Crane	6																				1	1	1	1	1	1																								
Light Plants	433	1	1	2	4	8	8	8	8	4	4	6	6	8	8	10	10	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	10	10	10	10	10	10	10	10	10	5	5	5	5	5	4	4	2	2
Man lifts - telescoping	506									5	5	5	10	10	10	10	10	10	10	10	15	15	15	15	20	20	20	20	20	20	20	20	20	20	20	20	15	15	15	10	10	10	10	5	5	5	5	2	2	2
Man lift - scissor	540								5	5	5	5	10	10	10	10	10	10	10	10	15	15	15	15	20	20	20	20	20	20	20	20	20	20	20	20	15	15	15	10	10	10	10	10	10	10	10	5	5	5
Portable Compaction Roller	82			5	5	5	5	5	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					2	2	2	2	2	2				2	2	2	1	1							
Portable Compaction - Vibratory Plate	126								6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						3	3	3	3					4	4	4	4	4	2	2							
Portable Compaction - Ram	0																																																	
Pumps	182	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2
Portable Power Generators	608	4	4	4	4	6	6	6	6	6	10	10	10	10	10	10	15	15	15	15	15	15	15	20	20	20	20	20	20	20	20	20	20	20	20	20	15	15	15	15	10	10	10	10	10	10	5	5	5	2
Truck Crane - Greater than 200 ton	68												1	1	1	1	1	2	2	3	3	4	4	4	4	4	4	4	4	4	3	3	2	2	2	1	1	1	1	1										
Truck Crane - Greater than 300 ton	34															1	1	1	1	1	2	2	2	3	3	3	3	3	3	3	2																			
Vibratory Roller Ingersol-Rand 20 ton	53	3	3	3	3	3	3	3	3	3	2	2	2	2	2	1	1	1	1										2	2	2	2							1	1	1	1								
Onsite Total	**7534**	**60**	**62**	**80**	**96**	**119**	**129**	**124**	**136**	**133**	**142**	**149**	**160**	**168**	**176**	**180**	**190**	**202**	**196**	**198**	**215**	**214**	**212**	**212**	**234**	**230**	**228**	**225**	**234**	**230**	**224**	**220**	**206**	**193**	**190**	**180**	**163**	**165**	**164**	**149**	**136**	**120**	**119**	**72**	**72**	**66**	**55**	**41**	**37**	**28**
Schedule																																																		
Site Mobilization																																																		
Site Prep/Piling																																																		
Construction																																																		
Commissioning & Start-up																																																		

Notes: Preliminary and Confidential
1 These are approximate values

Emission Factors for Off-Site Linears Equipment

					Emission Factors (lbs/hr)									
Equipment Description	**EMFAC designation**	**Horsepower**	**Source**	**Capacity Factor**[1]	**CO**	**CO_2**	**CH_4**	**N_2O**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**ROG**[2]	**CO_2e**
On-Road Vehicles					EMFAC									
Dump Truck	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0018	0.001	0.694	0.043	0.039	0.001	0.151	70.165
Service Truck	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0018	0.001	0.694	0.043	0.039	0.001	0.151	70.165
Pipe Haul Truck and Trailer (HHDT-DSL	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0018	0.001	0.694	0.043	0.039	0.001	0.151	70.165
Trucks - Pickup 3/4 ton	MHD-DSL		EMFAC	41.0%	0.155	33.180	0.0018	0.001	0.279	0.017	0.015	0.000	0.014	33.558
Truck - Water	HHD-DSL		EMFAC	41.0%	0.320	69.786	0.0018	0.001	0.694	0.043	0.039	0.001	0.151	70.165
Off Road Vehicles	**Fuel Type**													
Air Compressor	D	50	OFFROAD - Air Compressors	48.0%	0.269	22.251	0.009	0.001	0.227	0.024	0.022	0.000	0.102	22.619
Bore Machine (Hydraulic)	D	50	OFFROAD - Bore/Drill Rigs	75.0%	0.228	31.009	0.003	0.001	0.257	0.012	0.011	0.000	0.029	31.238
Crane	D	250	OFFROAD - Cranes	43.0%	0.295	112.058	0.009	0.003	0.993	0.035	0.032	0.001	0.104	113.128
Backhoe	D	120	OFFROAD - Tractors/Loaders/Backhoes	46.5%	0.352	51.682	0.006	0.001	0.455	0.038	0.035	0.001	0.069	52.232
Excavator	D	120	OFFROAD - Excavators	58.0%	0.517	73.557	0.010	0.001	0.678	0.058	0.054	0.001	0.108	74.181
Forklift	D	50	OFFROAD - Forklifts	30.0%	0.167	14.659	0.004	0.001	0.145	0.013	0.012	0.000	0.048	14.925
Generator (Welding)	D	50	OFFROAD - Generator Sets	74.0%	0.276	30.595	0.009	0.001	0.291	0.025	0.023	0.000	0.097	30.953
Roller	D	50	OFFROAD - Rollers	57.5%	0.291	25.960	0.009	0.001	0.258	0.024	0.022	0.000	0.102	26.328
Pipe Bending Machine	D	50	OFFROAD - Other Construction Equipment	62.0%	0.265	27.964	0.007	0.001	0.258	0.020	0.019	0.000	0.075	28.281
RAIL														
AIR COMPRESSOR 185	D	49	OFFROAD - Air Compressors	48.0%	0.269	22.251	0.009	0.001	0.227	0.024	0.022	0.000	0.102	22.616
BOOM TRUCK 12 TON	D	300	EMFAC	41.0%	0.320	69.786	0.002	0.001	0.694	0.043	0.039	0.001	0.151	70.165
CAT 325 BACKHOE	D	168	OFFROAD - Tractors/Loaders/Backhoes	46.5%	0.585	101.296	0.009	0.000	0.768	0.043	0.039	0.001	0.098	101.482
CAT 330 BACKHOE	D	222	OFFROAD - Tractors/Loaders/Backhoes	46.5%	0.366	171.583	0.011	0.000	1.163	0.037	0.034	0.002	0.120	171.811
CAT DOZER D-6	D	185	OFFROAD - Crawler Tractors	59.0%	0.744	121.079	0.015	0.000	1.250	0.071	0.065	0.001	0.167	121.395
CAT MODEL 12 MOTOR GRADER	D	140	OFFROAD - Graders	57.5%	0.530	74.898	0.011	0.000	0.771	0.067	0.062	0.001	0.125	75.134
CAT ROLLER-COMPACTOR 563	D	145	OFFROAD - Rollers	57.5%	0.406	58.936	0.009	0.000	0.624	0.053	0.049	0.001	0.098	59.122
CAT RUBBER TIRE LOADER 966	D	253	OFFROAD - Rubber Tired Loaders	54.0%	0.368	148.843	0.011	0.000	1.210	0.042	0.038	0.002	0.126	149.081
CAT SCRAPER 615	D	265	OFFROAD - Scrapers	66.0%	0.641	209.282	0.020	0.000	2.044	0.079	0.073	0.002	0.225	209.709
CRANE-ROUGH TERRAIN 45T	D	173	OFFROAD - Cranes	43.0%	0.482	80.272	0.009	0.000	0.775	0.044	0.041	0.001	0.103	80.467
GENSET 5KW	D	5	OFFROAD - Generator Sets	74.0%	0.069	10.198	0.001	0.000	0.105	0.006	0.006	0.000	0.015	10.228
JOHN DEERE TRACTOR 9400	D	410	OFFROAD - Tractors/Loaders/Backhoes	46.5%	0.744	344.544	0.021	0.000	2.062	0.070	0.064	0.004	0.229	344.977
PICK-UP CRAFT	D	385	OFFROAD - Other Construction Equipment	62.0%	0.523	254.010	0.013	0.000	1.516	0.049	0.045	0.002	0.145	254.285
PICK-UP OVERHEAD	D	260	OFFROAD - Other Construction Equipment	62.0%	0.587	106.420	0.008	0.000	0.799	0.042	0.038	0.001	0.093	106.597
RAIL BALLAST REGULATOR	D	240	OFFROAD - Other Construction Equipment	62.0%	0.587	106.420	0.008	0.000	0.799	0.042	0.038	0.001	0.093	106.597
RAIL CLIP MACHINE	D	80	OFFROAD - Other Construction Equipment	62.0%	0.265	27.964	0.007	0.000	0.258	0.020	0.019	0.000	0.075	28.107
RAIL MOVER-SHUTTLE WAGON	D	250	OFFROAD - Other Construction Equipment	62.0%	0.587	106.420	0.008	0.000	0.799	0.042	0.038	0.001	0.093	106.597
RAIL TAMPER	D	260	OFFROAD - Other Construction Equipment	62.0%	0.587	106.420	0.008	0.000	0.799	0.042	0.038	0.001	0.093	106.597
RAIL WELDER	D	58	OFFROAD - Welders	45.0%	0.060	11.276	0.002	0.000	0.104	0.007	0.006	0.000	0.022	11.317
RAMEX WALK BEHIND COMPACTOR	D	10	OFFROAD - Plate Compactors	43.0%	0.026	4.310	0.000	0.000	0.031	0.001	0.001	0.000	0.005	4.319
TRI-AXLE DUMP TRUCK	D	450	EMFAC	41.0%	0.320	69.786	0.002	0.001	0.694	0.043	0.039	0.001	0.151	70.165
TRUCK FLATBED 14 FOOT	D	362	EMFAC	41.0%	0.320	69.786	0.002	0.001	0.694	0.043	0.039	0.001	0.151	70.165
TRUCK TRACTOR	D	450	OFFROAD - Off-Highway Trucks	41.0%	0.636	272.089	0.020	0.000	1.783	0.063	0.058	0.003	0.217	272.500
WATER TRUCK, 4M ON-ROAD	D	300	EMFAC	41.0%	0.320	69.786	0.002	0.001	0.694	0.043	0.039	0.001	0.151	70.165
WELDING MACHINE 350 AMP	D	25	OFFROAD - Welders	45.0%	0.060	11.276	0.002	0.000	0.104	0.007	0.006	0.000	0.022	11.317

Notes:

1 Capacity factors from SCAQMD Table A9-8-D

2 Assuming ROGs are equivalent to VOCs

- Emission factors for on-road vehicles are based on results from Emfac Emissions Model 2010 Version 2.3 (LDT-DSL=light duty class II trucks-diesel; HHDT-DSL=heavy heavy-duty trucks-diesel; MHD-DSL=medium heavy duty-diesel). EMFAC scenario year was 2010.

- Emission factors for off-road vehicles are based on output from Offroad 2007, calendar year 2013 for Kern County.
  On-Road Vehicles:
    - $PM_{2.5}$ Fraction of PM_{10}, Diesel: 0.920
  Off-Road Vehicles:
    - PM2.5 Fraction of PM10, Diesel: 0.920

- CH_4 and N_2O factors are derived from California Climate Action Registry General Reporting Protocol Version 3.0 (April 2008), Table C.5 for LDT, MHD, and HHD diesel fueled trucks in the San Joaquin Valley Air Basin (MHD =HHD). These emissions are in g/mile. On-road vehicles are limited to 10 mph, which is used to convert to lb/hr. (See GHG Reference Info tab)
- N_2O factors for off-road vehicles are derived from California Climate Action Registry General Reporting Protocol Version 3.0 (April 2008), Table C.5 (distillate fuel factors for the industrial sector) using the following to convert from kg/gallon to lb/hp-hour, and then multiplying by the rated horsepower rating: 1 gallon/137,000 Btu, 7,000 Btu/hp-hour, and 2.2046 lb/kg. CH_4 factors are from the SCAQMD data.

CO_2 GWP (SAR, 1996) =	1
CH_4 GWP (SAR, 1996) =	21
N_2O GWP (SAR, 1996) =	310

Construction Equipment Usage Schedule (off-site linears)

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
EQUIPMENT	# of units																																																	
ON ROAD																																																		
Dump Truck	64											4	4	6	6	6	6	6	6	6	6	4	4																											
Service Truck (MHD-DSL)												2	2	2	2	2	2	3	3	3	3	3	3																											
Pipe Haul Truck and Trailer (HHDT-DSL	30											3	3	3	3	3	3	2	2	2	2	2	2																											
Truck (Pickup 3/4 Ton) - MHD-DSL	150											10	10	10	10	10	10	15	15	15	15	15	15																											
Truck - water	40											2	2	4	4	4	4	4	4	4	4	2	2																											
OFF ROAD																																																		
Air Compressor	48											2	2	4	4	6	6	6	6	4	4	2	2																											
Bore Machine (Hydraulic)	5															1	1	1	1	1																														
Crane	60											2	4	4	6	6	6	6	6	6	6	4	4																											
Backhoe	104											6	6	10	10	10	10	10	10	10	10	6	6																											
Excavator	11												1	1	1	1	1	1	1	1	1	1	1																											
Forklift	42											2	2	4	4	4	4	4	4	4	4	4	2																											
Welding Generator	96											8	8	8	8	8	8	8	8	8	8	8	8																											
Roller	22												2	2	2	2	2	2	2	2	2	2	2																											
Pipe Bending Machine	36											2	2	4	4	4	4	4	4	4	2	2																												
RAIL																																																		
AIR COMPRESSOR 185	8													0	2	2	2	2																																
BOOM TRUCK 12 TON	3													0	0	1	1	1																																
CAT 325 BACKHOE	2													1	1	0	0	0																																
CAT 330 BACKHOE	1													0	0	1	0	0																																
CAT DOZER D-6	5													2	2	0	0	1																																
CAT MODEL 12 MOTOR GRADER	7													2	2	1	1	1																																
CAT ROLLER-COMPACTOR 563	5													2	2	1	0	0																																
CAT RUBBER TIRE LOADER 966	6													0	0	2	2	2																																
CAT SCRAPER 615	3													2	1	0	0	0																																
CRANE-ROUGH TERRAIN 45T	2													0	1	1	0	0																																
GENSET 5KW	6													0	4	2	0	0																																
JOHN DEERE TRACTOR 9400	1													1	0	0	0	0																																
PICK-UP CRAFT	15													3	3	3	3	3																																
PICK-UP OVERHEAD	24													2	6	6	5	5																																
RAIL BALLAST REGULATOR	2													0	0	0	1	1																																
RAIL CLIP MACHINE	2													0	0	0	1	1																																
RAIL MOVER-SHUTTLE WAGON	3													0	0	1	1	1																																
RAIL TAMPER	2													0	0	0	1	1																																
RAIL WELDER	3													0	0	0	2	1																																
RAMEX WALK BEHIND COMPACTOR	1													0	1	0	0	0																																
TRI-AXLE DUMP TRUCK	12													4	6	2	0	0																																
TRUCK FLATBED 14 FOOT	11													1	1	3	3	3																																
TRUCK TRACTOR	2													0	0	1	1	0																																
WATER TRUCK, 4M ON-ROAD	5													1	1	1	1	1																																
WELDING MACHINE 350 AMP	5													1	1	1	1	1																																
TOTAL	**874**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**43**	**48**	**84**	**98**	**96**	**93**	**97**	**72**	**70**	**67**	**55**	**51**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Notes: Preliminary and Confidential
1 These are approximate values
2 Construction Equipment Assumptions - Natural Gas line work begins in month 11 and ends in month 20. Process water line work begins in month 11 and ends in month 17 Potable Water line work begins in month 17 and ends in month 20. CO2 line work begins in month 17 and ends in month 22. Transmission line work begins in month 17 and ends in month 22. Rail spur line work begins in month 13 and ends in month 17

MODEL INPUTS
COMBUSTION - Short-term (Month 6)

equipment / vehicles	TOTAL EMISSION RATE (lb/day)				
	$PM_{2.5}$	PM_{10}	CO	NO_2	SO_2
Worker vehicles	0.0	0.0	0.5	0.0	0.0
Delivery trucks	0.3	0.3	2.2	5.1	0.0
Soil import	1.4	1.5	10.4	24.2	0.0
Construction equip	19.3	21.1	187.3	347.0	0.4

equipment / vehicles	number of sources in the model	operating hours per day in the model	MODEL EMISSION RATE per source (lb/hr/source)				
			$PM_{2.5}$ 24hr	PM_{10} 24hr	CO 1 & 8 hr	NO_2 1-hr	SO_2 1,3 & 24 hr
Worker vehicles	36	10	1.30E-05	1.67E-05	1.36E-03	1.09E-04	2.14E-06
Delivery trucks	26	10	1.10E-03	1.22E-03	8.48E-03	1.98E-02	1.59E-05
Soil import	67	10	2.04E-03	2.25E-03	1.55E-02	3.62E-02	2.92E-05
Construction equip	58	10	3.32E-02	3.64E-02	3.23E-01	5.98E-01	6.57E-04

SOURCE PARAMETERS

Source ID	Source Description	Easting (m)	Northing (m)	Base elevation (m)	Stack Height (m)	Temperature K	Exit Velocity (m/s)	Stack diameter (m)	Emissions per source: $PM_{2.5}$ 24hr lb/hr	PM_{10} 24hr lb/hr	CO 1hr & 8hr lb/hr	NO_2 1hr lb/hr	SO_2 1, 3 and 24hr lb/hr
Worker vehicles[1]	Worker vehicles for commuting to/from site			87.9348	0.3	622	0.001	0.051	1.30E-05	1.67E-05	1.36E-03	1.09E-04	2.14E-06
Delivery trucks[2]	Light and heavy duty delivery trucks			87.9348	3	622	57.5	0.127	1.10E-03	1.22E-03	8.48E-03	1.98E-02	1.59E-05
Soil import[2]	Importing soil for fill			87.9348	3	622	57.5	0.127	2.04E-03	2.25E-03	1.55E-02	3.62E-02	2.92E-05
Construction equipment[2]	All construction equipment			87.9348	3	622	59.9	0.102	3.32E-02	3.64E-02	3.23E-01	5.98E-01	6.57E-04

Notes:

1. Stack parameters for worker vehicles modified to reflect realistic stack height and stack diameter for a typical passenger vehicle. Exit velocity was set at 0.001 m/s, per guidance from SJVAPCD for horizontal stacks.
2. Reference for truck stack parameters and worker vehicle temperature: Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines, California EPA-Air Resources Board, October 2000.

	Average horsepower:	HP used for stack params
Worker vehicles	195.5	200
Delivery trucks	275	300
Construction equipment	170	200

MODEL INPUTS
COMBUSTION - Long-term (Months 1-12)

equipment / vehicles	TOTAL EMISSION RATE (tons/year) $PM_{2.5}$	PM_{10}	CO	NO_2	SO_2
Worker vehicles	0.00	0.00	0.08	0.01	0.00
Delivery trucks	0.14	0.16	1.09	2.54	0.00
Soil import	0.11	0.12	0.80	1.87	0.00
Construction equip	2.07	2.26	20.60	37.22	0.04

equipment / vehicles	number of sources in the model	Annual Hours of Operation	MODEL EMISSION RATE per source (lb/hr/source) $PM_{2.5}$ annual	PM_{10} annual	CO annual	NO_2 annual	SO_2 annual
Worker vehicles	36	2640	1.68E-05	2.17E-05	1.76E-03	1.41E-04	2.79E-06
Delivery trucks	26	2640	4.17E-03	4.60E-03	3.18E-02	7.41E-02	5.98E-05
Soil import	67	2640	1.19E-03	1.31E-03	9.06E-03	2.11E-02	1.70E-05
Construction equip	142	2640	1.10E-02	1.21E-02	1.10E-01	1.99E-01	2.21E-04

SOURCE PARAMETERS

Source ID	Source Description	Easting (m)	Northing (m)	Base elevation (m)	Stack Height (m)	Temperature K	Exit Velocity (m/s)	Stack diameter (m)	Emissions per source $PM_{2.5}$ annual lb/hr	PM_{10} annual lb/hr	CO annual lb/hr	NO_2 annual lb/hr	SO_2 annual lb/hr
Worker vehicles[1]	Worker vehicles for commuting to/from site			87.9348	0.3	622	0.001	0.051	1.68E-05	2.17E-05	1.76E-03	1.41E-04	2.79E-06
Delivery trucks[2]	Light and heavy duty delivery trucks			87.9348	3	622	57.5	0.127	4.17E-03	4.60E-03	3.18E-02	7.41E-02	5.98E-05
Soil import[2]	Importing soil for fill			87.9348	3	622	57.5	0.127	1.19E-03	1.31E-03	9.06E-03	2.11E-02	1.70E-05
Construction equipment[2]	All construction equipment			87.9348	3	622	59.9	0.102	1.10E-02	1.21E-02	1.10E-01	1.99E-01	2.21E-04

Notes:

1. Stack parameters for worker vehicles modified to reflect realistic stack height and diameter for a typical passenger vehicle. Exit velocity was set at 0.001 m/s, per guidance from SJVAPCD for horizontal stacks.

2. Reference for truck stack parameters and worker vehicle temperature: Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines, California EPA-Air Resources Board, October 2000.

	Average horsepower:	HP used for stack params
Construction equipment	170	200
Worker vehicles	195.5	200
Delivery trucks	275	300

MODEL INPUTS
COMBUSTION - Short-term (Month 24)

equipment / vehicles	TOTAL EMISSION RATE (lb/day)				
	$PM_{2.5}$	PM_{10}	CO	NO_2	SO_2
Worker vehicles	0.0	0.1	4.8	0.4	0.0
Delivery trucks	0.3	0.3	2.2	5.1	0.0
Soil import	-	-	-	-	-
Construction equip	22.6	24.8	231.6	384.9	0.5

equipment / vehicles	number of sources in the model	operating hours per day in the model	MODEL EMISSION RATE per source (lb/hr/source)				
			$PM_{2.5}$ 24hr	PM_{10} 24hr	CO 1 & 8 hr	NO_2 1-hr	SO_2 1,3 & 24 hr
Worker vehicles	36	10	1.28E-04	1.64E-04	1.34E-02	1.07E-03	2.11E-05
Delivery trucks	26	10	1.10E-03	1.22E-03	8.48E-03	1.98E-02	1.59E-05
Soil import	-	-	-	-	-	-	-
Construction equip	58	10	3.90E-02	4.27E-02	3.99E-01	6.64E-01	7.81E-04

SOURCE PARAMETERS

Source ID	Source Description	Easting (m)	Northing (m)	Base elevation (m)	Stack Height (m)	Temperature K	Exit Velocity (m/s)	Stack diameter (m)	Emissions per source: $PM_{2.5}$ 24hr lb/hr	PM_{10} 24hr lb/hr	CO 1hr & 8hr lb/hr	NO_2 1hr lb/hr	SO_2 1, 3 and 24hr lb/hr
Worker vehicles[1]	Worker vehicles for commuting to/from site			87.9348	0.3	622	0.001	0.051	1.28E-04	1.64E-04	1.34E-02	1.07E-03	2.11E-05
Delivery trucks[2]	Light and heavy duty delivery trucks			87.9348	3	622	57.5	0.127	1.10E-03	1.22E-03	8.48E-03	1.98E-02	1.59E-05
Soil import[2]	Importing soil for fill			-	-	-	-	-	-	-	-	-	-
Construction equipment[2]	All construction equipment			87.9348	3	622	59.9	0.102	3.90E-02	4.27E-02	3.99E-01	6.64E-01	7.81E-04

Notes:

1. Stack parameters for worker vehicles modified to reflect realistic stack height and diameter for a typical passenger vehicle. Exit velocity was set at 0.001 m/s, per guidance from SJVAPCD for horizontal stacks.
2. Reference for truck stack parameters and worker vehicle temperature: Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines, California EPA-Air Resources Board, October 2000.

	Average horsepower:	HP used for stack params
Worker vehicles	195.5	200
Delivery trucks	275	300
Construction equipment	170	200

MODEL INPUTS
COMBUSTION - Long-term (Months 20-31)

equipment / vehicles	TOTAL EMISSION RATE (tons/year) $PM_{2.5}$	PM_{10}	CO	NO_2	SO_2
Worker vehicles	0.01	0.01	0.68	0.05	0.00
Delivery trucks	0.04	0.04	0.29	0.68	0.00
Soil import	-	-	-	-	-
Construction equip	2.81	3.07	28.62	47.37	0.06

equipment / vehicles	number of sources in the model	Annual Hours of Operation	MODEL EMISSION RATE per source (lb/hr/source) $PM_{2.5}$ annual	PM_{10} annual	CO annual	NO_2 annual	SO_2 annual
Worker vehicles	36	2640	1.37E-04	1.76E-04	1.43E-02	1.15E-03	2.26E-05
Delivery trucks	26	2640	1.10E-03	1.22E-03	8.48E-03	1.98E-02	1.59E-05
Soil import	-	2640	-	-	-	-	-
Construction equip	142	2640	1.50E-02	1.64E-02	1.53E-01	2.53E-01	2.96E-04

SOURCE PARAMETERS

Source ID	Source Description	Easting (m)	Northing (m)	Base elevation (m)	Stack Height (m)	Temperature K	Exit Velocity (m/s)	Stack diameter (m)	Emissions per source $PM_{2.5}$ annual lb/hr	PM_{10} annual lb/hr	CO annual lb/hr	NO_2 annual lb/hr	SO_2 annual lb/hr
Worker vehicles[1]	Worker vehicles for commuting to/from site			87.9348	0.3	622	0.001	0.051	1.37E-04	1.76E-04	1.43E-02	1.15E-03	2.26E-05
Delivery trucks[2]	Light and heavy duty delivery trucks			87.9348	3	622	57.5	0.127	1.10E-03	1.22E-03	8.48E-03	1.98E-02	1.59E-05
Soil import[2]	Importing soil for fill			-	-	-	-	-	-	-	-	-	-
Construction equipment[2]	All construction equipment			87.9348	3	622	59.9	0.102	1.50E-02	1.64E-02	1.53E-01	2.53E-01	2.96E-04

Notes:

1. Stack parameters for worker vehicles modified to reflect realistic stack height and diameter for a typical passenger vehicle. Exit velocity was set at 0.001 m/s, per guidance from SJVAPCD for horizontal stacks.

2. Reference for truck stack parameters and worker vehicle temperature: Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines, California EPA-Air Resources Board, October 2000.

	Average horsepower:	HP used for stack params
Construction equipment	170	200
Worker vehicles	195.5	200
Delivery trucks	275	300

MODEL INPUTS
FUGITIVES - Short-term (Month 6)

Location	X (m)	Y (m)	AREA (m2)
Parking1	215	100	21500
Parking2	215	100	21500
Parking3	215	100	21500
Parking4	215	100	21500
Parking5	215	100	21500
Parking6	215	100	21500
Delivery / Construction Laydown	1075	290	311750
Soil import	600	600	360000
Construction area	677	677	458,306

Project Site	453	acres	(from Project Description section 2.1.8)
% disturbed in one month	25%		
Acreage disturbed in one month	113.25	acres	

Fugitive Source	Operating Hours per day	TOTAL EMISSION RATE (lb/day)		MODEL EMISSION RATE (g/s-m2)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Parking1	10	0.1	0.7	4.31E-08	4.31E-07
Parking2	10	0.1	0.7	4.31E-08	4.31E-07
Parking3	10	0.1	0.7	4.31E-08	4.31E-07
Parking4	10	0.1	0.7	4.31E-08	4.31E-07
Parking5	10	0.1	0.7	4.31E-08	4.31E-07
Parking6	10	0.1	0.7	4.31E-08	4.31E-07
Delivery Trucks	10	2.2	21.9	8.84E-08	8.84E-07
Soil import	10	12.2	121.5	4.25E-07	4.25E-06
Construction Equipment	10	17.2	93.2	4.74E-07	2.56E-06

Construction Activity — Fugitives from these activities are included above with "Construction equipment"
- Dirt Piling / Material Handling
- Grading
- Bulldozing / Earth clearing
- Covered Storage Piles

MODEL INPUTS
FUGITIVES - Long-term (Months 1-12)

Location	X (m)	Y (m)	AREA (m2)
Parking1	215	100	21500
Parking2	215	100	21500
Parking3	215	100	21500
Parking4	215	100	21500
Parking5	215	100	21500
Parking6	215	100	21500
Delivery / Construction Laydown	1075	290	311750
Soil import	600	600	360000
Construction area	1250	1100	1,374,919

Project Site	453	acres	(from Project Description section 2.1.8)
% disturbed in one year	75%		
Acreage disturbed in one year	339.75	acres	

Fugitive Source	Annual hours of operation	TOTAL EMISSION RATE (tons/yr)		MODEL EMISSION RATE (g/s-m2)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Parking1	2640	0.0	0.1	5.61E-08	5.61E-07
Parking2	2640	0.0	0.1	5.61E-08	5.61E-07
Parking3	2640	0.0	0.1	5.61E-08	5.61E-07
Parking4	2640	0.0	0.1	5.61E-08	5.61E-07
Parking5	2640	0.0	0.1	5.61E-08	5.61E-07
Parking6	2640	0.0	0.1	5.61E-08	5.61E-07
Delivery Trucks	2640	0.3	2.9	8.84E-08	8.84E-07
Soil import	2640	0.9	9.4	2.48E-07	2.48E-06
Construction Equipment	2640	2.2	10.9	1.50E-07	7.60E-07

Construction Activity — Fugitives from these activities are included above with "Construction equipment"
- Dirt Piling / Material Handling
- Grading
- Bulldozing / Earth clearing
- Covered Storage Piles

MODEL INPUTS
FUGITIVES - Short-term (Month 24)

Location	X (m)	Y (m)	AREA (m2)
Parking1	215	100	21500
Parking2	215	100	21500
Parking3	215	100	21500
Parking4	215	100	21500
Parking5	215	100	21500
Parking6	215	100	21500
Delivery / Construction Laydown	1075	290	311750
Soil import	-	-	-
Construction area	677	677	458,306

Project Site	453	acres	(from Project Description section 2.1.8)
% disturbed in one month	25%		
Acreage disturbed in one month	113.25	acres	

Fugitive Source	Operating Hours per day	TOTAL EMISSION RATE (lb/day)		MODEL EMISSION RATE (g/s-m2)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Parking1	10	0.7	7.3	4.25E-07	4.25E-06
Parking2	10	0.7	7.3	4.25E-07	4.25E-06
Parking3	10	0.7	7.3	4.25E-07	4.25E-06
Parking4	10	0.7	7.3	4.25E-07	4.25E-06
Parking5	10	0.7	7.3	4.25E-07	4.25E-06
Parking6	10	0.7	7.3	4.25E-07	4.25E-06
Delivery Trucks	10	2.2	21.9	8.84E-08	8.84E-07
Soil import	-	-	-	-	-
Construction Equipment	10	4.6	45.6	1.26E-07	1.25E-06

Construction Activity — Fugitives from these activities are included above with "Construction equipment"
- Dirt Piling / Material Handling
- Grading
- Bulldozing / Earth clearing
- Covered Storage Piles

MODEL INPUTS
FUGITIVES - Long-term (Months 20-31)

Location	X (m)	Y (m)	AREA (m2)
Parking1	215	100	21500
Parking2	215	100	21500
Parking3	215	100	21500
Parking4	215	100	21500
Parking5	215	100	21500
Parking6	215	100	21500
Delivery / Construction Laydown	1075	290	311750
Soil import	-	-	-
Construction area	1250	1100	1,374,919

Project Site	453	acres	(from Project Description section 2.1.8)
% disturbed in one year	75%		
Acreage disturbed in one year	339.75	acres	

Fugitive Source	Annual hours of operation	TOTAL EMISSION RATE (tons/yr)		MODEL EMISSION RATE (g/s-m2)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Parking1	2640	0.1	1.0	4.55E-07	4.55E-06
Parking2	2640	0.1	1.0	4.55E-07	4.55E-06
Parking3	2640	0.1	1.0	4.55E-07	4.55E-06
Parking4	2640	0.1	1.0	4.55E-07	4.55E-06
Parking5	2640	0.1	1.0	4.55E-07	4.55E-06
Parking6	2640	0.1	1.0	4.55E-07	4.55E-06
Delivery Trucks	2640	0.3	2.9	8.84E-08	8.84E-07
Soil import	-	-	-	-	-
Construction Equipment	2640	0.8	6.7	5.23E-08	4.63E-07

Construction Activity — Fugitives from these activities are included above with "Construction equipment"

- Dirt Piling / Material Handling
- Grading
- Bulldozing / Earth clearing
- Covered Storage Piles

Appendix E-3

Operational Criteria Pollutant Emissions

Appendix E-3
Hydrogen Energy California LLC
HECA Project
Operational Criteria Pollutant Emissions

4/24/2012

HECA Total Combined Annual Criteria Pollutant Emissions

Equipment \ Pollutant	NO_X	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$
	tons/year					
HRSG/CTG (1)	109.7	92.9	15.3	17.2	54.6	54.6
Coal Dryer(1)	17.4	13.3	2.4	2.8	5.6	5.6
Auxiliary Boiler	1.4	8.6	0.9	0.5	1.2	1.2
Tail Gas Thermal Oxidizer	13.4	11.2	0.3	8.3	0.4	0.4
CO_2 Vent		124.1	2.8			
Gasification Flare	3.2	18.5	0.01	0.02	0.03	0.03
Rectisol Flare	1.2	0.8	0.01	0.3	0.03	0.03
SRU Flare	0.2	0.2	0.003	0.4	0.006	0.006
Cooling Towers (2)					25.5	15.3
Emergency Generators(3)	0.2	0.8	0.1	0.001	0.02	0.02
Fire Water Pump	0.09	0.2	0.01	0.0003	0.001	0.001
Nitric Acid Unit	17					
Urea Pastillation Unit					0.2	0.2
Ammonium Nitrate Unit					0.8	0.8
Ammonia Startup Heater	0.04	0.14	0.02	0.01	0.02	0.02
Material Handling (4)					1.9	1.9
Fugitives		4.6	13.4			
Total Annual	**163.7**	**275.2**	**35.4**	**29.5**	**90.3**	**80.2**

Source: HECA Project

Notes:

(1) Total annual HRSG and Coal Dryer emissions represent the maximum annual emissions during normal operations plus startup and shutdown emissions

(2) Includes contributions from all three cooling towers

(3) Includes contributions from both emergency generators

(4) Material handling emissions are shown as the contribution of all dust collection points.

CO = carbon monoxide

HRSG=Heat Recovery Steam Generator

CTG = combustion turbine generator

NO_X = nitrogen oxides

PM_{10}= particulate matter less than 10 microns in diameter

$PM_{2.5}$ =particulate matter less than 2.5 microns in diameter ($PM_{2.5}$ is assumed to equal PM_{10})

SO_2 = sulfur dioxide

VOCs = volatile organic compounds

Basis: MHI GT - Model: M501GAC

With PSA Off-gas and H2-rich Gas Duct Firing
Maximum Emissions based on Case 1 - On-peak with duct-firing at 97F ambient

CGT Max Fuel Input =	2583	x 10^6 Btu/hr (HHV) of syngas
Duct Firing Max Fuel Input =	278	x 10^6 Btu/hr (HHV) of PSA Off-gas and H2-rich syngas
HRSG stack gas =	255,463	lbmol/hr, dry, corrected to 15% O2

Total HRSG Flue Gas Emission Rates with Duct Firing of PSA Off-gas and H2-rich syngas

	Emission Factors lb/10^6 Btu (HHV)	Basis
NOx	0.011	2.5 ppmc
CO	0.008	3 ppmc
VOC	0.0015	1 ppmc
$PM_{10}/PM_{2.5}$	0.008	filterable (front-half) + condensible (back half)
SO2**	0.0002	2 ppmv total sulfur in syngas, 10 ppmv sulfur in PSA Off-gas
NH3		5 ppmc ammonia slip

Notes: Emission Factors are based on the maximum emissions from all of the cases examined (On-peak and Off-peak)
ppmc denotes ppm by volume, dry, corrected to 15% O2
** Maximum SO2 emission occurs for OFF-peak, 97 deg F (Case 2)

Maximum short-term emissions from HRSG stack, normal operations on peak

HRSG Emissions	lb/hr	Basis
NOx	25.0	Case 1 (ON Peak, 97 deg Ambient)
CO	18.3	Case 1 (ON Peak, 97 deg Ambient)
VOC	3.5	Case 1 (ON Peak, 97 deg Ambient)
$PM_{10}/PM_{2.5}$	12.9	Case 3 (ON Peak, 39 deg Ambient)
SO2**	4.1	Case 2 (OFF Peak, 97 deg Ambient)
NH3	18.5	Case 1 (ON Peak, 97 deg Ambient)

	Exhaust gas (lbmol/hr)	Exit velocity (m/s)	Exhaust flow (ft3/sec)	Exit velocity (ft/sec)
min HRSG fluegas to HRSG stack during ON peak (Case 1) =	167,092	16.40	22,356.58	53.81
Min HRSG fluegas to HRSG stack during OFF Peak (Case 2) =	126,704	12.44	16,952.70	40.80
HRSG fluegas to HRSG stack during ON Peak (Case 3) =	176,804	17.35	23,655.98	56.94

Annual average emissions from HRSG Stack
Basis: Case 5 (ON Peak, Avg. Ambient)

HRSG Emissions	lb/hr
NOx	24.9
CO	18.2
VOC	3.5
$PM_{10}/PM_{2.5}$	12.8
SO2*	4.1
NH3	18.4

	Exhaust gas (lbmol/hr)	Exit velocity (m/s)
HRSG fluegas to HRSG stack (Case 5) =	171,498	16.83

Maximum short-term emissions from coal dryer stack

Coal Dryer Emissions	lb/hr	Basis
NOx	4.4	Case 1 (ON Peak, 97 deg Ambient)
CO	3.2	Case 1 (ON Peak, 97 deg Ambient)
VOC	0.6	Case 1 (ON Peak, 97 deg Ambient)
$PM_{10}/PM_{2.5}$	1.4	Case 3 (ON Peak, 39 deg Ambient)
SO2	0.9	Case 2 (OFF Peak, 97 deg Ambient)
NH3	3.2	Case 1 (ON Peak, 97 deg Ambient)

*Baghouse PM control to 0.001 gr/dscf

	Exhaust gas (lbmol/hr)	Exit velocity (m/s)
Min HRSG fluegas to coal dryer (Case 4) =	28,788	5.84

Note: Coal dryer emission rates are relatively constant for both On- and OFF-peak operation.

Annual average emissions from coal dryer stack
Basis: Case 5 (ON Peak, Avg. Ambient)

Coal Dryer Emissions	lb/hr
NOx	4.2
CO	3.1
VOC	0.6
$PM_{10}/PM_{2.5}$	1.4
SO2	0.7
NH3	3.1

*Baghouse PM control to 0.001 gr/dscf

	Exhaust gas (lbmol/hr)	Exit velocity (m/s)
HRSG fluegas to coal dryer (Case 5) =	29,102	5.90

Startup/Shutdown - HRSG Stack & Coal Drying Stack
Information provided by MHI

Expected Emissions vs. CTG Load (Natural Gas)				
	CTG load			
	80%	40%	20%	units
NOx	42	25	18	ppmc
CO	130	2900	5000	ppmc
VOC	1.1	9	50	ppmc
$PM_{10}/PM_{2.5}$	15	15	15	lb/hr
SOx*	0.4	0.4	0.4	ppmc

* 0.4 ppmc SO2 in fluegas corresponds to about 12.6 ppmv total sulfur in natural gas fuel.

Expected Emissions vs. CTG Load (Syngas)		
	CTG load	
	40%	units
NOx	19	ppmc
CO	39	ppmc
VOC	2	ppmc
$PM_{10}/PM_{2.5}$	13	lb/hr
SOx	2	ppmvw

Compound	lb/lbmol
NO2	46.01
CO	28.01
VOC	16.04
SO2	64.06
NH3	17.03

HRSG/Coal Drying Total Exhaust Flow Basis								
Load/Fuel	80% on NG		40% on NG		20% on NG		40% on Syngas	
O2 mol% (wet)	11.41%		14.15%		15.22%		11.74%	
H2O mol% (wet)	14.10%		10.63%		9.28%		10.50%	
MW	27.79	lb/lbmol	28.05	lb/lbmol	28.16	lb/lbmol	27.66	lb/lbmol
HRSG flue gas*	167,600	lbmol/hr	138,400	lbmol/hr	127,400	lbmol/hr	140,200	lbmol/hr
NOx Stack Conc (assumed)	4	ppmc	25	ppmc	18	ppmc	10	ppmc
CO Stack Conc (assumed)	5	ppmc	400	ppmc	1000	ppmc	20	ppmc
VOC Stack Conc (assumed)	2	ppmc	9	ppmc	50	ppmc	2	ppmc
NH3 slip	5	ppmc	0		0		5	ppmc
Turbine Fuel Flow							14,218	lbmol/hr
HRSG flue gas (wet)	4,657,604	lb/hr	3,882,120	lb/hr	3,587,584	lb/hr	3,877,932	lb/hr
HRSG flue gas (dry, corrected to 15% O2)	185,516	lbmol/hr	106,371	lbmol/hr	81,062	lbmol/hr	165,183	lbmol/hr
Duct Burner Gas HHV							85	MMBtu/hr
Coal Drying Flow (wet)			480,180	lb/hr			480,180	lb/hr

*Includes gas routed to coal dryer.

HRSG Startup													
Step	Duration (hrs)		SO2	NOx	CO	$PM_{10}/PM_{2.5}$	VOC	NH3	Description	Flow (lbmol/hr)	Exhaust flow (ft3/sec)	Exit velocity (ft/sec)	Exit velocity (m/s)
1. 20% on NG	0.5	lb/hr	2.1	67.1	2270	15.0	65	0	CTG ignition and synchronization	127,400	17,045.88	41.03	12.51
		lb	1.0	33.6	1135	7.5	32.4	0.0					
2. 40% on NG	2	lb/hr	2.4	107.2	1044	13.1	13	0	HRSG/STG Warm-up, Ramp CTG to 40%	121,300	16,229.71	39.06	11.91
		lb	4.8	214	2088	26.3	26.8	0.0					
3. 40% on Syngas	50	lb/hr	2.4	66.6	81	13	4.6	0.0	CTG fuel change over, Start up PSA/Ammonia/Urea Plant	123,100	16,470.54	39.64	12.08
		lb	120	3329	4052	657	232	0.0					
Tons/Startup			**0.06**	**1.79**	**3.64**	**0.35**	**0.15**	**0.00**					

*Coal drying starts at step 2 above.

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Coal Drying Startup													
Step	Duration (hrs)		SO2	NOx	CO	$PM_{10}/PM_{2.5}$	VOC	NH3	Description	Flow (lbmol/hr)	Exhaust flow (ft3/sec)	Exit velocity (ft/sec)	Exit velocity (m/s)
2. 40% on NG	2	lb/hr	0.3	15.1	147.4	0.9	1.9	0.0	Gasifier fuel changeover	17,100	2,287.95	11.38	3.47
		lb	0.7	30.3	294.7	1.9	3.8	0.0					
3. 40% on Syngas	50	lb/hr	0.3	9.4	11.5	0.9	0.7	0.0	GTG fuel change over, Start up PSA/Ammonia/Urea Plant	17,400	2,328.09	11.58	3.53
		lb	16.9	470	573	47	33	0.0					
Tons/Startup			**0.01**	**0.25**	**0.43**	**0.02**	**0.02**	**0.00**					

*PM emission rate based on 0.001 grain/dscf

HRSG Shutdown													
Step	Duration (hrs)		SO2	NOx	CO	$PM_{10}/PM_{2.5}$	VOC	NH3	Description	Flow (lbmol/hr)	Exhaust flow (ft3/sec)	Exit velocity (ft/sec)	Exit velocity (m/s)
1. 40% on Syngas	4	lb/hr	2.4	66.6	81.0	13	4.6	0.0	PSA, Ammonia and Urea plant shutdown, Gasifier to 60%, CTG to 40%	123,100	16,470.54	39.64	12.08
		lb	9.6	266	324	52.6	18.5	0.0					
2. 40% on NG	3	lb/hr	2.7	122	1191	15.0	15.3	0.0	CTG fuel change over, Gasifier depressurization	138,400	18,517.65	44.57	13.58
		lb	8.2	367	3574	45.0	45.9	0.0					
3. 20% on NG	2	lb/hr	2.1	67.1	2270	15.0	64.8	0.0	Minimum plant load on NG	127,400	17,045.88	41.03	12.51
		lb	4.2	134	4539	30.0	129.7	0.0					
Tons/Shutdown			**0.01**	**0.38**	**4.22**	**0.06**	**0.10**	**0.00**					

Coal Drying Shutdown													
Step	Duration (hrs)		SO2	NOx	CO	$PM_{10}/PM_{2.5}$	VOC	NH3	Description	Flow (lbmol/hr)	Exhaust flow (ft3/sec)	Exit velocity (ft/sec)	Exit velocity (m/s)
1. 40% on Syngas	4	lb/hr	0.3	9.4	11.5	0.9	0.7	0.0	PSA, Ammonia and Urea plant shutdown, Gasifier to 60%, CTG to 40%	17,400	2,328.09	11.58	3.53
		lb	1.4	37.6	45.8	3.8	2.6	0.0					
Tons/Startup			**0.00**	**0.02**	**0.02**	**0.00**	**0.00**	**0.00**					

*PM emission rate based on 0.001 grain/dscf

CTG steady state operation at 80% load on natural gas for 2 weeks per year

HRSG Emissions - Natural Gas Operations													
Step	Duration (hrs)		SO2	NOx (4 ppmc)	CO (5 ppmc)	$PM_{10}/PM_{2.5}$	VOC (2 ppmc)	NH3 (5 ppmc)	Description	Flow (lbmol/hr)	Exhaust flow (ft3/sec)	Exit velocity (ft/sec)	Exit velocity (m/s)
1. 80% on NG	336	lb/hr	4.7	34.1	26.0	15.0	5.9	15.8	CTG operation at 80% load on NG	150,700	20,163.37	48.53	14.79
		lb	1596	11469	8727	5040	1995	5298					
Tons/yr			**0.80**	**5.73**	**4.36**	**2.52**	**1.00**	**2.65**					
Natural gas heat input (HHV)	2400	Emission Factors lb/MMBtu (HHV)	0.002	0.015	0.011	0.007	0.003	0.007					

Heat Input = 2167x10^6 Btu/hr, LHV (approx 2400x10^6 btu/hr, HHV)

HRSG & Coal Dryer Maximum Annual Operation Emissions

	HRSG, ton/yr				**Gasifier Coal Dryer, ton/yr**		
	SU & SD	**Normal Op**	**Nat Gas BU**	**Total**	**SU & SD**	**Normal Op**	**Total**
NOx	4.34	99.6	5.73	109.7	0.54	16.9	17.4
CO	15.7	72.8	4.36	92.9	0.91	12.4	13.3
VOC	0.49	13.9	1.00	15.3	0.04	2.4	2.4
$PM_{10}/PM_{2.5}$	0.82	51.3	2.52	54.6	0.05	5.6	5.6
SO2*	0.147	16.3	0.80	17.2	0.02	2.8	2.8
NH3	0.00	73.6	2.65	76.3	0.00	12.5	12.5

Maximum Annual Operation:

SU & SD	2	per year
Normal op	8000	hr/yr
Nat gas op	336	hr/yr

Annualized Startup/Shut down Emission rate for NO2 1-hr NAAQS				
Source	**HRSG**		**Coal Dryer**	
Emission Scenario	Startup, Shutdown, Natural Gas	Normal On-peak (Case 1)	Startup, Shutdown	Normal On-peak (Case 1)
Emission rate (lb/hr)	2.30	25.01	0.12	4.4

Normal operations are higher, therefore normal operating emissions used in NAAQS modeling

CALCULATIONS FOR COMBINED CYCLE EMISSIONS

Basis: MHI Data for 501GAC, 1 on 1 with O2 Blown Gasifier (Lee Ranch Coal 75cal%/ Carson High Sulfur Coke 25cal%)

	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**
Ambient temp, deg F	97	97	39	39	65	65
ON Peak/OFF Peak	ON	OFF	ON	OFF	ON	OFF
HRSG Flue Gas Split to Coal Dryer						
Flue gas to coal dryer, lbmol/hr (wet)	29,208	28,996	28,996	28,788	29,102	28,996
Flue gas to HRSG stack, lbmol/hr (w)	167,092	126,704	176,804	142,412	171,498	135,904
Coal Dryer Stack Emissions						
NOx, lb/hr	4.4	4.3	4.1	3.8	4.2	4.0
CO, lb/hr	3.2	3.1	3.0	2.8	3.1	2.9
VOC, lb/hr	0.61	0.59	0.57	0.52	0.59	0.55
Particulate, lb/hr (3)	1.4	1.4	1.4	1.4	1.4	1.4
SO2, lb/hr	0.7	0.9	0.7	0.8	0.7	0.8
NH3, lb/hr	3.23	3.16	3.0	2.8	3.1	2.9
HRSG Stack Emissions						
NOx, lb/hr	25.01	18.7	24.96	18.7	24.9	18.6
CO, lb/hr	18.3	13.6	18.2	13.6	18.2	13.6
VOC, lb/hr	3.48	2.60	3.47	2.59	3.47	2.59
Particulate, lb/hr	12.77	12.21	12.89	12.48	12.82	12.36
SO2, lb/hr	4.06	4.09	4.09	4.03	4.07	3.98
NH3, lb/hr	18.5	13.8	18.4	13.8	18.4	13.8

Notes:
(1) "ppmc" denotes parts per million by volume, dry, corrected to 15% O2
(2) Sulfur in the PSA Off-gas is based on the total sulfur quantity in the feed to the PSA
(3) PM emission from coal dryer based on stack baghouse outlet dust loading of 0.001 grain/dscf.

4/17/2012

Description

Mainly used for startups, could be used for other purposes, primarily during power block outages.

Maximum steam generation 150,000 lb/hr
Maximum heat release 213 10^6 Btu/hr, HHV
Natural gas fuel, only

Emission factors		
	lb/10^6 Btu, HHV	**Basis**
SO2	0.00204	12.65 ppmv total sulfur in pipeline natural gas (max short-term)
NOx	0.006	Low NOx burner and SCR, 5 ppmvd (3% O2)
CO	0.037	50 ppmvd (3% O2)
$PM_{10}/PM_{2.5}$	0.005	Similar equipment from previous project
VOC	0.004	Similar equipment from previous project
NH3	0.0022	5 ppmvd (3% O2) NH3 slip

Emissions		
	Max short-term lb/hr (1)	**Annual average ton/yr (2)**
SO2	0.4	0.48
NOx	1.3	1.4
CO	7.9	8.6
$PM_{10}/PM_{2.5}$	1.07	1.17
VOC	0.85	0.93
NH3	0.47	0.51

Notes:

(1) Maximum 1-hr, 3-hr, 8-hr, and 24-hr average emission rates.

(2) Maximum annual capacity factor of 25% (i.e., annual fuel consumption less than 0.25 x 8760 hr/yr x 213 million Btu/hr = 466 billion Btu/yr)

TAIL GAS THERMAL OXIDIZER — Emissions Summary

4/17/2012

Description

The Tail Gas Thermal Oxidizer (TGTO) is primarily intended to safely dispose of SRU tail gas in the event of an emergency or upset. The TGTO will also be be used to dispose of waste gas during SRU startups and to futher dispose of miscellaneous vent streams from the gasification area. These vent streams may contain trace amounts of reduced sulfur compounds and/or ammonia that could cause nuisance odors if vented directly to the atmosphere.

Process Vent Disposal

Assume nominal natural gas fuel consumption = 13 million Btu/hr

Assume an allowance of 2 lb/hr SO2 emission to account for sulfur in the various vent streams plus fuel.

Emission Calculations

NOx =	0.24	lb/10^6 Btu, HHV (based on previous project, 54 ppmvd @ 3% O2)
=	3.1	lb/hr
CO =	0.2	lb/10^6 Btu, HHV (based on previous project, 74 ppmvd @ 3% O2)
=	2.6	lbhr
SO2 =	2	lb/hr
VOC =	0.006	lb/10^6 Btu, HHV (AP-42, Table1.4 -2)
=	0.1	lb/hr
$PM_{10}/PM_{2.5}$ =	0.008	lb/10^6 Btu, HHV (AP-42, Table1.4 -2)
=	0.1	lb/hr

SRU startup natural gas combustion products disposal

Waste gas

Natural gas fuel 80 x 10^6 Btu/hr, HHV

Emission Calculations

(emission factors same as above)

NOx =	0.24	lb/10^6 Btu, HHV
=	19.2	lbhr
CO =	0.2	lb/10^6 Btu, HHV
=	16.0	lbhr
SO2 =	0.00204	lb/10^6 Btu, HHV
=	0.16	lbhr
VOC =	0.006	lb/10^6 Btu, HHV
=	0.48	lbhr
$PM_{10}/PM_{2.5}$ =	0.008	lb/10^6 Btu, HHV
=	0.64	lbhr

Maximum Short-term Emission Rates

	lb/hr
NOx	22.3
CO	18.6
SO2	2.2
VOC	0.6
$PM_{10}/PM_{2.5}$	0.7

Annualized Startup Emission rate for NO2 1-hr NAAQS

lb/hr

0.1223

Normal operations are higher, therefore normal operating emissions used in NAAQS modeling

Annual Emission Calculations

Assumed annual operating scenario

TGTO normal operation for disposing miscellaneous vent gas

	8314	hr/yr
NOx =	13.0	ton/yr
CO =	10.8	ton/yr
SO2 =	8.3	ton/yr
VOC =	0.32	ton/yr
$PM_{10}/PM_{2.5}$ =	0.43	ton/yr

SRU startup hrs/yr =	48	(approx 2 events @ 80 x 10^6 Btu/hr)
NOx =	0.461	ton/yr
CO =	0.3840	ton/yr
SO2 =	0.0039	ton/yr
VOC =	0.0115	ton/yr
$PM_{10}/PM_{2.5}$ =	0.0154	ton/yr

Total annual emission

NOx =	13.43	ton/yr
CO =	11.19	ton/yr
SO2 =	8.32	ton/yr
VOC =	0.34	ton/yr
$PM_{10}/PM_{2.5}$ =	0.45	ton/yr

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CO2 Vent Maximum Operations

Short-term Emission Rates

Total flow =	761,400	lb/hr	*Based on 380.7 stph CO2 to pipeline from
=	17,584	lbmol/hr	Plant Performance Study
H2S =	10	ppmv	
=	6.0	lb/hr	
COS =	10	ppmv	
	10.6	lb/hr	
CO =	1000	ppmv	(ranges from 500 to 1000 ppmv)
=	492	lb/hr	
VOC (MeOH) =	40	ppmv	
	11	lb/hr (as CH4)	

Annual Emissions

Assume	21	days/yr CO2 venting at full rate
	10	ppmv COS, annual average concentration
H2S =	1.5	ton/yr (based on 10 ppmv)
COS =	2.7	ton/yr (as COS, based on 10 ppmv)
CO =	124	ton/yr (based on 1000 ppmv)
VOC =	2.8	ton/yr (as CH4, based on 40 ppmv)

Note: These emissions represent the maximum emissions associated with Infrequent venting of product CO2.

Emission factors

	lb/10^6 Btu, HHV	Basis
Normal Operation (each flare) - pilots only, natural gas fuel		
SO2	0.00204	12.65 ppmv total sulfur in pipeline natural gas
NOx	0.12	Supplier data
CO	0.08	Supplier data
$PM_{10}/PM_{2.5}$	0.003	Supplier data
VOC	0.0013	99% VOC destruction for typical natural gas
Gasifier Startup - waste gases or H2-rich gas to Gasification Flare		
SO2	negligible	Startup - no sulfur in startup feed
NOx	0.07	Supplier data
CO (1)	2	Supplier data (98% destruction of CO in waste gas)
CO (2)	0.37	Supplier data
$PM_{10}/PM_{2.5}$	negligible	Supplier data
VOC	negligible	no VOC in waste gas or H2-rich gas

(1) Unshifted syngas
(2) Shifted syngas

Short-term Emission Calculations
Normal Operation - include pilots only, natural gas fuel
Maximum emissions include max of startup or shutdown plus pilot

Gasification Flare pilot fuel = 0.5 x 10^6 Btu/hr
SRU and Rectisol Flares pilot fuel = 0.3 x 10^6 Btu/hr, each

	Pilot	Max hourly emissions	Max daily emissions
	lb/hr	lb/hr	lb/hr
Gasification Flare			
SO2	0.00102	6.0	0.2
NOx	0.06	351.2	35.7
CO	0.04	4772.0	283.0
$PM_{10}/PM_{2.5}$	0.0015	8.8	0.4
VOC	0.0007	3.8	0.2
SRU Flare			
SO2	0.0006	18.4	18.4
NOx	0.036	7.9	7.9
CO	0.0240	2.9	2.9
$PM_{10}/PM_{2.5}$	0.0009	0.1	0.1
VOC	0.0004	0.05	0.05
Rectisol Flare			
SO2	0.0006	15.0	15.0
NOx	0.036	51.6	51.6
CO	0.0240	34.4	34.4
$PM_{10}/PM_{2.5}$	0.0009	1.3	1.3
VOC	0.0004	0.6	0.6

Startup/Shutdown - Gasification Flare

*Based on Startup/Shutdown Procedures provided by MHI for the PurGen One Project

Startup								
Step	Duration (hrs)	Heat Input (mmbtu/hr)		SO2	Nox	CO	$PM_{10}/PM_{2.5}$	VOC
2. Flaring NG	3	2,926	lb/hr	6.0	351.2	234.1	8.8	3.8
			lb	17.9	1053.5	702.3	26.3	11.4
3. Flaring Unshifted Syngas	2	2,386	lb/hr	0.0	167.0	4772.0	0.0	0.0
			lb	0.0	334.0	9544.0	0.0	0.0
4. Flaring Shifted Syngas	5	2,413	lb/hr	0.0	168.9	892.8	0.0	0.0
			lb	0.0	844.6	4464.1	0.0	0.0
Tons/Startup				**0.01**	**1.12**	**7.36**	**0.01**	**0.01**

Shutdown								
Step	hrs	mmbtu/hr		SO2	Nox	CO	$PM_{10}/PM_{2.5}$	VOC
1. Flaring Shifted Syngas	4	2,413	lb/hr	0	169	893	0	0
			lb	0	676	3,571	0	0
Tons/Shutdown				**0.00**	**0.34**	**1.79**	**0.00**	**0.00**

Gasification Flare

Pilot gas = 4380 x 10^6 Btu

2 startups/shutdowns per year

Gasification Flare Annual Emissions

	ton/yr		
	S/U and S/D	**Pilot**	**Total**
SO2	0.02	0.004	0.022
NOx	2.91	0.263	3.170
CO	18.28	0.175	18.457
$PM_{10}/PM_{2.5}$	0.026	0.007	0.033
VOC	0.01	0.003	0.014

Annualized Startup/Shut down Emission rate for NO2 1-hr NAAQS

lb/hr
0.66

Startup/Shutdown Operation - SRU Flare

Acid gas vent to elevated flare prior to introducng to SRU

Acid gas = 4600 lb/hr SO2 = 72 lbmol/hr H2S

Assume 99.6% sulfur removal for caustic scrubber:

Scrubbed acid gas = 18.4 lb/hr SO2

plus approx 25,000 to 140,000 scf/hr of mostly CO2 and other inerts

Assume 36 x10^6 Btu/hr of natural gas assist fuel

added to scrubbed acid gas for flaring.

Approximate heating value of mixed gas to flare

= 36 x10^6 Btu /(140,000 + 36,000) scf

= 205 Btu/scf, adequate for combustion

Estimated Startup SRU Flare Emissions - flaring scrubbed acid gas

	lb/hr	
SO_2	18.4	***99.6% effective caustic scrubber***
NO_x	4.3	
CO	2.9	
$PM_{10}/PM_{2.5}$	0.11	
VOC	0.05	

(Emissions for NOX, CO, PM10, and VOC based on factors for natural gas pilots above)

SRU Flare

SRU startup vent gas to flare 1) = 40 hr /yr*

Pilot gas = 2628 x 10^6 Btu

SRU Flare Annual Emissions

	ton/yr		
	S/U and S/D	Pilot	Total
SO_2	0.368	0.003	0.371
NO_x	0.086	0.16	0.24
CO	0.058	0.11	0.16
$PM_{10}/PM_{2.5}$	0.002	0.004	0.006
VOC	0.001	0.002	0.003

Annualized Startup/Shut down Emission rate for NO2 1-hr NAAQS

lb/hr
0.02

Startup Operation - Rectisol Flare

CO2 gas vent to Rectisol Flare until within product specification

Vent gas flow = 4,542 lbmol/hr = 430 x 10^6 Btu/hr, HHV

Sulfur in vent gas = 50 ppmv,max

Estimated Startup Rectisol Flare Emissions

	lb/hr
SO_2	15
NO_x	51.6
CO	34.4
$PM_{10}/PM_{2.5}$	1.3
VOC	0.6

(Emissions for NOX, CO, PM10, and VOC based on factors for natural gas pilots above)

Rectisol Flare

Rectisol startup vent gas to flare = 40 hr /yr

Pilot gas = 2628 x 10^6 Btu

Rectisol Flare Annual Emissions

	ton/yr		
	S/U and S/D	Pilot	Total
SO_2	0.30	0.003	0.303
NO_x	1.03	0.2	1.190
CO	0.69	0.1	0.793
$PM_{10}/PM_{2.5}$	0.03	0.004	0.030
VOC	0.01	0.002	0.013

Annualized Startup/Shut down Emission rate for NO2 1-hr NAAQS

lb/hr
0.24

Flare Stack Parameters

4/17/2012

Parameter	Rectisol Flare (during startup and shutdown)	Rectisol Flare (during normal pilot gas mode)	Rectisol Flare Annualized for NO2 1-hr NAAQS	Gasification Flare (during startup flare nitrogen)	Gasification Flare (during startup flare unshifted syngas gas)	Gasification Flare (during startup flare shifted syngas, sweet)	Gasification Flare (during normal pilot gas mode)	Gasification Flare annualized for NO2 1-hr NAAQS	SRU Flare (during Gasifier Startup and Shutdown)	SRU Flare (during normal pilot gas mode)	SRU Flare Annualized for NO2 1-hr NAAQS
Heat release rate for flare+pilot, (10^6 Btu/hr HHV)	430	0.3	2.263	2,926	2,386	2,413	0.5	4.526	36	0.3	0.464
H = Total Heat release rate (cal/s)	3.01E+07	2.10E+04	1.58E+05	2.05E+08	1.67E+08	1.69E+08	3.50E+04	3.17E+05	2.52E+06	2.10E+04	3.25E+04
Fb = Buoyancy flux	5.00E+02	3.49E-01	2.63E+00	3.40E+03	2.77E+03	2.80E+03	5.81E-01	5.26E+00	4.18E+01	3.49E-01	5.40E-01
Q_H = sensible heat release rate	1.35E+07	9.45E+03	7.13E+04	9.22E+07	7.52E+07	7.60E+07	1.57E+04	1.43E+05	1.13E+06	9.45E+03	1.46E+04
Actual Stack height (m)	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
GEP stack height for modeling (m)	65	65	65	65	65	65	65	65	65	65	65
AERMOD Input parameters											
He = Effective stack height (m) as calculated in SCREEN3	82.13	65.53	66.39	107.84	103.85	104.06	65.68	66.94	70.23	65.53	65.65
T = Stack temperature (K)	1273	1273	1273	1273	1273	1273	1273	1273	1273	1273	1273
v = Exit velocity (m/s)	20	20	20	20	20	20	20	20	20	20	20
d = effective stack diameter (m)	3.636	0.096	0.264	9.486	8.565	8.614	0.124	0.373	1.052	0.096	0.119

Flare stack parameters are based on calculated using the SCREEN3 technique

Fb = Buoyancy flux = 1.66 x 10-5 x H

QH = sensible heat release rate = 0.45 x H

He = Effective stack height (m) = Hs + 4.56E-03 * H^0.478

BTU/hr to cal/sec 0.06999882

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Cooling Tower Operating Data and Emission Calculation				
Parameter	**Process**	**Power Block**	**ASU**	**Basis**
Cooling water (CW) circulation rate, gpm	162,582	95,500	44,876	Typical plant performance
CW circulation rate, million lb/hr	81	48	22	
CW dissolved solids, ppmw	9,000	9,000	2,000	(See note)
Drift, fraction of circulating CW	0.0005%	0.0005%	0.0005%	Expected BACT
PM10 emission rate, lb/hr	3.7	2.1	0.2	Calculated
PM10 emission rate, ton/yr	15.2	9.3	0.9	Calculated
PM2.5 emission rate, lb/hr	2.2	1.3	0.1	PM2.5 portion is equal to 60% of PM10
PM2.5 emission rate, ton/yr	9.1	5.6	0.6	PM2.5 portion is equal to 60% of PM10
Annual operation (hours/yr)	8314	8668	8314	
Cells per cooling tower	13	12	4	

Notes: Basis: Supplier data
Assumed maximum TDS in circulating cooling water, normally TDS will be less.
Each tower assumed to operate at full capacity, when operating.
Cooling water circulation rates and dissolved solids concentrations may vary, but in combination will not exceed the stated particulate emission rates.
Portion of PM10 that is PM2.5 60%

4/17/2012

Emergency Generator - Expected Emergency Operation and Maintenance

Total Hours of Operation	50	hr/yr
Generator Specification	2,922	Bhp

Generator Pollutant Emission Factors (per generator)

NOx (g/Bhp/hr)	0.50
CO (g/Bhp/hr)	2.60
VOC (g/Bhp/hr)	0.30
SO_2 (g/Bhp/hr)	N/A
$PM_{10} = PM_{2.5}$ (g/Bhp/hr)	0.07

Source: CARB Tier 4 Interim Standard

Generator Pollutant Emission Rates (per generator)

	Generator Emissions			
Pollutant	**lb/hr**	**lb/day**	**lb/yr**	**ton/yr**
NOx	3.22	3.22	161.04	0.08
CO	16.75	16.75	837.43	0.42
VOC	1.93	1.93	96.63	0.05
SO_2	0.03	0.03	1.40	0.00
$PM_{10} = PM_{2.5}$	0.45	0.45	22.55	0.01

Fuel sulfur content =	15	ppmw
SO_2 emissions =	0.20	lb SO_2/1000 gal
Fuel flow	140.00	gal/hr

Pounds per day assumes 1 hour of operation for maintenance and testing per engine.

Please note that there are two generators; all emissions are shown for individual generators.

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Modeling Worst-Case 1 hr Emissions (per generator) / **Annualized lb/hr for NO2 1-hr NAAQS**

NOx (g/sec)	0.4	0.0184
CO (g/sec)	2.1	
SO_2 (g/sec)	0.004	

Only NOx, CO, and SO_2 are considered for an average 1-hour Ambient Air Quality Standard.

Parameters

Days per year:	365
Hours per day:	24
Minutes per hour:	60
Seconds per minute:	60

Modeling Worst-Case 3 hr Emissions (per generator)

SO_2 (lb/3-hr)	0.03
SO_2 (g/sec)	0.001

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard.
Pounds per 3-hr assumes two (2) hours of operation.

Modeling Worst-Case 8 hr Emissions (per generator)

CO (lb/8-hr)	16.75
CO (g/sec)	0.26

Only CO is considered for an average 8-hour Ambient Air Quality Standard.
Pounds per 8-hr assumes two (2) hours of operation.

Modeling Worst-Case 24 Hour Emissions (per generator)

SO_2 (lb/24-hr)	0.03
SO_2 (g/sec)	0.0001
$PM_{10} = PM_{2.5}$ (lb/24-hr)	0.45
$PM_{10} = PM_{2.5}$ (g/sec)	0.002

Only SO_2 and PM are considered for an average 24-hour Ambient Air Quality Standard.
Pounds per 24-hr assumes two (2) hours of operation.

Modeling Annual Average Emissions (per generator) / **Annual Emissions (tons/yr)**

		per generator	both generators
NOx (g/sec)	0.002	0.081	0.161
CO (g/sec)	0.012	0.419	0.837
VOC (g/sec)	0.001	0.048	0.097
SO_2 (g/sec)	0.00002	0.001	0.001
$PM_{10} = PM_{2.5}$ (g/sec)	0.0003	0.011	0.023

4/17/2012

Fire Water Pump - Expected Emergency Operation and Maintenance

Total Hours of Operation	100	hr/yr
Fire Water Pump Specification	556	Bhp

Fire Water Pump Pollutant Emission Factors

NOx (g/Bhp/hr)	1.50
CO (g/Bhp/hr)	2.60
VOC (g/Bhp/hr)	0.14
SO_2 (g/Bhp/hr)	N/A
$PM_{10} = PM_{2.5}$ (g/Bhp/hr)	0.015

Source: CARB Tier 4 Interim Standard

Fire Water Pump Pollutant Emission Rates

	Fire Water Pump Emissions			
Pollutant	**lb/hr**	**lb/day**	**lb/yr**	**ton/yr**
NOx	1.84	3.68	183.86	0.1
CO	3.19	6.37	318.69	0.2
VOC	0.17	0.34	17.16	0.01
SO_2	0.01	0.01	0.56	0.0003
$PM_{10} = PM_{2.5}$	0.02	0.04	1.84	0.00

Fuel sulfur content =	15	ppmw
SO_2 emissions =	0.20	lb SO_2/1000 gal
Fuel flow	28.00	gal/hr

Pounds per day assumes two (2) hours of operation for maintenance and testing.

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Modeling Worst-Case 1 hr Emissions

		Annualized lb/hr for NO2 1-hr NAAQS
NOx (g/sec)	0.2	0.02
CO (g/sec)	0.4	
SO_2 (g/sec)	0.0007	

Only NOx, CO, and SO_2 are considered for an average 1-hour Ambient Air Quality Standard

Parameters

Days per year:	365
Hours per day:	24
Minutes per hour:	60
Seconds per minute:	60

Modeling Worst-Case 3 hr Emissions

SO_2 (lb/3-hr)	0.01
SO_2 (g/sec)	0.0005

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard.
Pounds per 3-hr assumes two (2) hours of operation.

Modeling Worst-Case 8 hr Emissions

CO (lb/8-hr)	6.37
CO (g/sec)	0.1

Only CO is considered for an average 8-hour Ambient Air Quality Standard.
Pounds per 8-hr assumes two (2) hours of operation.

Modeling Worst-Case 24 Hour Emissions

SO_2 (lb/24-hr)	0.01
SO_2 (g/sec)	0.0001
$PM_{10} = PM_{2.5}$ (lb/24-hr)	0.04
$PM_{10} = PM_{2.5}$ (g/sec)	0.0002

Only SO_2 and PM are considered for an average 24-hour Ambient Air Quality Standard.
Pounds per 24-hr assumes two (2) hours of operation.

Modeling Annual Average Emissions

		tons/yr
NOx (g/sec)	0.003	0.092
CO (g/sec)	0.005	0.159
VOC (g/sec)	0.0002	0.009
SO_2 (g/sec)	0.00001	0.000
$PM_{10} = PM_{2.5}$ (g/sec)	0.00003	0.001

Ammonia Synthesis Plant Startup Heater

Maximum heat release	55	10^6 Btu/hr, HHV
Maximum annual usage:	7,700	10^6 Btu/yr, HHV
(equivalent to	140	hours @ full capacity)

Emission factors

	lb/10^6 Btu, HHV	Basis
SO_2	0.00204	12.65 ppmv total sulfur in pipeline natural gas (max short-term)
NOx	0.011	Low NOx burner, 9 ppmvd (3% O2)
CO	0.037	50 ppmvd (3% O2)
$PM_{10}/PM_{2.5}$	0.005	Similar equipment from previous project
VOC	0.004	Similar equipment from previous project

	Max short-term lb/hr	Annual average ton/yr
SO_2	0.1	0.0079
NOx	0.6	0.0420
CO	2.0	0.1425
$PM_{10}/PM_{2.5}$	0.3	0.0193
VOC	0.2	0.0154

Used only for Ammonia Plant Startup only.
Natural gas fuel

Annualized Startup Emission rate for NO2 1-hr NAAQS

lb/hr
0.010

Urea HP & LP Absorber Emission Calculation

Reference Plant			HECA		
Plant Capacity =	3,360	tpd (metric)	Plant Capacity =	1,701	stpd
Urea HP Absorber NH3 =	11	kg/hr	Urea HP Absorber NH3 =	11.1	lb/hr
Urea LP Absorber NH3 =	2	kg/hr	Urea LP Absorber NH3 =	2.0	lb/hr

Reference plant information is from technical proposal provided by UreaCasale for the SCS PurGen One project.

Urea Pastillation Emission Calculation

Reference Plant			HECA		
Plant Max Capacity =	3,855	stpd	Plant Capacity =	1,701	stpd
Total Air Flow =	21,000	m^3/hr	NH3 Emission =	1.02	lb/hr
Ammonia Concentration =	50	mg/m^3	Urea Dust Emission =	0.05	lb/hr
Urea Dust =	0.001	gr/dscf	Annual operating hours	8052	hours/year
			PM Annual Emissions =	0.20	tons/yr

Reference plant information provided by Sandvik Fellbach for the SCS PurGen One project.
All PM emissions are PM2.5 or smaller

Nitric Acid Plant Emission Calculation

HECA		
Nitric Acid Production =	501	STPD
NOx Emissions Factor* =	0.20	lb/T
NOx Emissions =	4.18	lb/hr
NH3 Emissions =	0.5	lb/hr
Annual operating hours	8052	hours/year
NOx Annual Emissions =	16.8	tons/yr

*Emission factor based on use of the Udhe EnviNOx system. Approx 15 ppmv NOx in vent gas
50% NO2/NOx in-stack ratio used in NAAQS modeling

Ammonium Nitrate Plant Emission Calculation

HECA		
Ammonium Nitrate Production =	636	STPD
PM Emissions =	0.20	lb/hr
Annual operating hours	8000	hours/year
PM Annual Emissions =	0.80	tons/yr

Vendor provided emission rate
All PM emissions are PM2.5 or smaller

Material Handling Emissions								Stack Parameters for Modeling			
Emission Release Point	Operating Capacity		Flow	Grain Loading	Emissions			Stack Diameter	Stack Height	Stack velocity	Stack velocity
	hr/day	day/week	ACFM	gr/dscf	Total PM (lb/hr)	Total PM (tons/yr)		ft	ft	(ft/sec)	(m/s)
Coal/Coke Storage and Handling											
17 Coal Rail Unloading Station	8	5	20,000	0.001	0.17	0.18		3	30	47.2	14.4
18 Coal Transfer Tower	12	7	1,500	0.001	0.01	0.03		0.83	100	46.2	14.1
20 Coal/Coke Truck Unloading Station	12	5	80,000	0.001	0.69	1.07		6	60	47.2	14.4
22 Coal/Coke Transfer Tower B	12	5	1,500	0.001	0.01	0.02		0.83	100	46.2	14.1
19 Coal/Coke Crusher Building	12	7	1,500	0.001	0.01	0.03		0.83	100	46.2	14.1
Urea Storage and Handling											
30 Urea Bucket Elevator to Conveyor	24	7	1,500	0.001	0.01	0.06		0.83	50	46.2	14.1
31 Urea Transfer Tower 1	24	7	1500	0.001	0.01	0.06		0.83	100	46.2	14.1
32 Urea Transfer Tower 2	24	1.75	1500	0.001	0.01	0.01		0.83	100	46.2	14.1
33 Urea Transfer Tower 3	24	3.5	1500	0.001	0.01	0.03		0.83	100	46.2	14.1
34 Urea Transfer Tower 4	24	1.75	1500	0.001	0.01	0.01		0.83	100	46.2	14.1
35 Urea Transfer Tower 5	8	5	1500	0.001	0.01	0.01		0.83	100	46.2	14.1
23 Urea Loading Bldg Baghouse 1	8	5	20,000	0.001	0.17	0.18		3	30	47.2	14.4
24 Urea Loading Bldg Baghouse 2	8	5	10,000	0.001	0.09	0.09		2	30	53.1	16.2
Gasification Solids Storage and Handling											
25 Gasification Solids Bunker & Pad	24	7	-	-	0.02	0.09		NA			
28 Gasification Solids Transfer Tower	8	3	3,000	0.001	0.03	0.02		1.17	30	46.5	14.2
29 Gasification Solids Load-Out System	8	3	10,000	0.001	0.09	0.05		2	30	53.1	16.2
				Total =	**1.36**	**1.93**					

All PM emissions are PM2.5 or smaller

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Source	HRSG Stack[2] ON-Peak	HRSG Stack[2] OFF-Peak	Gasification Coal Dryer Stack[3]	Urea Plant Absorbers MP	Urea Plant Absorbers LP	Urea Pastillation Stack	Nitric Acid Plant Stack	Gasification Flare
Stack height, ft above grade[1]	213	213	305	130	50	50	145	250
Stack diameter, ft	23	23	16	1	1	1.5	8	9.8
Stack outlet temp, deg F	200	200	200	122	119	ambient	239	(NA)
Stack exit flow, act ft3/sec	22,357	16,953	3,852	19	19	111	860	varies per scenario
Stack exit velocity (ft/sec)	53.81	40.80	19.16	24.19	24.19	62.81	17.11	
Stack exit velocity (m/sec)	16.40	12.44	5.84	7.37	7.37	19.15	5.21	

Source	SRU Flare	Rectisol Flare	Cooling Towers (per cell)[4]	Tail Gas Oxidizer	Fire Pump Engine	Diesel Generator (ea.)	CO2 Vent	Aux Boiler	Ammonia Plant SU Heater	Ammonium Nitrate Vent
Stack height, ft above grade[1]	250	250	55	165	20	20	260	80	80	40
Stack diameter, ft	2	1.3	30	2.5	0.7	1.2	3.5	4.5	3.5	0.17
Stack outlet temp, deg F	(NA)	(NA)	75	1200	850	760	65	300	300	100
Stack exit flow, act ft3/sec	varies per scenario	varies per scenario	18,500	250	60	250	1,765	480	180	0.3
Stack exit velocity (ft/sec)			26.17	50.93	155.91	221.05	183.45	30.18	18.71	13.75
Stack exit velocity (m/sec)			7.98	15.52	47.52	67.38	55.92	9.20	5.70	4.19

Notes:
(1) Actual stack hieght for flares. Effective stack height for modeling was calculated based on GEP height of 65 meters. See Flare Stack Parameters tab in this workbook.
(2) Stack outlet temperature shown for HRSG is the estimated stack temperature after power cycle optimization. Case 1 On-Peak Power exit flow rate, Case 2 Off-Peak Power exit flow rate
(3) Flow rate shown in table for coal dryer is based on full load syn gas combustion for Case 4 (relatively constant for varying power plant loads and ambient temperatures).
(4) Nine cells estimated for power block cooling tower; 13 cells estimated for process cooling tower, and four cells estimated for the ASU cooling tower.
(5) Flare gas heat release, 10^6 Btu/hr, HHV; first value is normal pilot gas, second value is the maximum startup heat release

	Process Area											
	1	**2**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	
	Methanol	**Syn Gas**	**Shifted Syn Gas**	**Propylene**	**Sour Water**	**H_2S Laden Methanol**	**CO_2 Laden Methanol**	**Acid Gas**	**Ammonia-Laden Gas**	**Sulfur**	**TGTU Process Gas**	**Total**
Compound	**Annual Fugitive Emissions with LDAR Application (ton/yr)**											
CO_2		0.74	20.08		0.69	1.82	0.49	0.81	0.84		5.72	31.19
CH_4		0.05	0.14			0.00	0.00	0.00	0.00			0.19
CO		4.16	0.42		0.00	0.00	0.00	0.00	0.00		0.03	4.62
H_2S		0.06	0.20		0.05	0.07	0.00	0.53	0.07	0.00	0.16	1.14
NH_3		0.00			0.07				0.09			0.16
COS		0.02				0.00		0.01	0.00		0.00	0.03
CH_3OH	4.02					2.18	0.88	0.00				7.09
C_3H_6				6.33								6.33
HCN									0.00			0.00
Total VOC	**4.02**	**0.02**	**0.00**	**6.33**	**0.00**	**2.18**	**0.88**	**0.01**	**0.00**	**0.00**	**0.00**	**13.45**
Total percentage of VOC content of gas in each process area	100.00%	0.15%	0.00%	100.00%	0.00%	53.51%	64.10%	0.54%	0.07%	0.00%	0.03%	

Note: The following compounds are included as VOCs, although not all compounds are found in the gas in each process area.
CH_3OH, C_3H_6, COS, and HCN

Summary by Volume Source for Modeling - Emissions are divided by number of Volume Sources

"GASIFICATION" (Area #2)

	lb/hr/volume	lb/yr/volume
CO	0.316	2,772.38
H_2S	4.19E-03	36.69
NH_3	9.74E-06	8.53E-02
CH_3OH		
C_3H_6		
HCN		

3 number of Volume Sources
28 horizontal dimension (m)
46.48 release ht (m)
13.02 horizontal dimension (m)
43.24 vertical dimension (m)

"SHIFT" (Area #4, 6)

	lb/hr/volume	lb/yr/volume
CO	4.84E-02	424.19
H_2S	2.81E-02	245.74
NH_3	7.83E-03	68.56
CH_3OH		
C_3H_6		
HCN		

2 number of Volume Sources
35 horizontal dimension (m)
6.10 release ht (m)
16.28 horizontal dimension (m)
5.67 vertical dimension (m)

"AGR" (Area #1, #5, #7, #8, #9)

	lb/hr/volume	lb/yr/volume
CO	6.32E-04	5.54
H_2S	1.37E-01	1195.86
NH_3		
CH_3OH	1.62E+00	14172.79
C_3H_6	1.44E+00	12657.98
HCN		

1 number of Volume Sources
48 horizontal dimension (m)
6.10 release ht (m)
22.33 horizontal dimension (m)
5.67 vertical dimension (m)

"Sour Water Stripper" (Area #10)

	lb/hr/volume	lb/yr/volume
CO	1.02E-03	8.94
H_2S	1.68E-02	146.89
NH_3	2.06E-02	180.69
CH_3OH		
C_3H_6		
HCN	1.31E-04	1.15

1 number of Volume Sources
16 horizontal dimension (m)
6.10 release ht (m)
7.44 horizontal dimension (m)
5.67 vertical dimension (m)

"SRU" (Area #11, #12)

	lb/hr/volume	lb/yr/volume
CO	3.08E-03	27.01
H_2S	1.89E-02	165.37
NH_3		
CH_3OH		
C_3H_6		
HCN		

2 number of Volume Sources
16 horizontal dimension (m)
6.10 release ht (m)
7.44 horizontal dimension (m)
5.67 vertical dimension (m)

Note: Selective LDAR program was applied to Areas # 1, #5, #7, #8, #9, #10 due to high uncontrolled emissions for the VOCs (methanol and propylene) and hydrogen sulfide

Summary of Transportation Vehicles and Routes

4/17/2012

Commodity Handled	Petcoke	Coal	Liquid Sulfur	Gasification	Ammonia	Urea	UAN	Equipment	Miscellaneous
Expected plant operation									
Expected plant operation is 8000 hours / year									
The plant will operate 24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day
The plant will operate 333 days / year	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr
Shipment by trucks	100 %	0 %	75 %	25 %	75 %	25 %	50 %	100 %	100 %
Shipment by train	0 %	100 %	25 %	75 %	25 %	75 %	50 %	0 %	0 %
Production rate									
Required Normal Flow / day	1,140 tons / day	4,580 tons / day	100 tons / day	839 tons / day	500 tons / day	833 tons / day	1,392 tons / day		
Required Normal Flow / year	380,000 tons / yr	1,525,000 tons / yr	33,000 tons / yr	280,000 tons / yr	167,000 tons / yr	280,000 tons / yr	464,000 tons / yr		
Required Maximum Flow day	1,368 tons / day (3)	6,107 tons / day (4)	200 tons / day (5)	1,678 tons / day (6)	1,000 tons / day (6)	1,666 tons / day (6)	2,784 tons / day (6)		
Truck Shipments									
Truck Capacity	25 tons / truck		25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck
Required trucks loads for normal operation / day	46 trucks / day		4 trucks / day	8 trucks / day	15 trucks / day	8 trucks / day	28 trucks / day	2 trucks / day	3 trucks / day
Required trucks loads for normal operation / yr	15,200 truck / yr		990 truck / yr	2,800 truck / yr	5,010 truck / yr	2,800 truck / yr	9,280 truck / yr		
Required trucks loads for maximum operation /day	55 trucks / day		8 trucks / day	17 trucks / day	30 trucks / day	17 trucks / day	56 trucks / day		
Train Shipments									
Railcar Capacity		117 tons / car	100 tons / car	100 tons / car	117 tons / car	117 tons / car	117 tons / car		
Assume a train has 13,000 ton capacity									
Required railcars for normal operation / day		39 cars / day	0.25 cars / day	6 cars / day	1 cars / day	5 cars / day	6 cars / day		
Required railcar loads for normal operation / yr		13,034 cars / yr	83 cars / yr	2,800 cars / yr	357 cars / yr	1,795 cars / yr	1,983 cars / yr		
Required railcars for maximum operation / day		200 cars / day	1 cars / day	16 cars / day	2 cars / day	11 cars / day	12 cars / day		
Basis	- 91% availability - 25% petcoke (heat input) - 25 ton/truck - 7 days/week receiving - 25% excess truck	- 91% availability - 75% coal (heat input) per - 117 tons/car - 100% coal for maximum - Rack sized to handle two	- 91% availability - High sulfur case - 100 - 25 ton/truck - Weekdays only - Can only move up to 25% of	- 91% availability - 75% coal max annual - 100% capable by rail - 25% capable by truck - Maximun is double the daily	- 91% availability - 500 t/d NH3 sales - 75% by truck - Ability to ship 7500 tons over	- 91% availability - 75% by rail -empty 45 day storage in 10 d '	- 91% availability - 75% by rail -empty 45 day storage in 10 d	'	
Traffic route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route
Destination/Origin	Carson Refinery	None	California Sulfur	Various	Various	Various	Various	Various	Various
Address	1801 E Sepulveda, Carson		2509 E Grant Street, Wilmington						
Distance	140 Miles		142 Miles	80 Mile radius	40 mile radius	40 mile radius	40 mile ratius	40 mile ratius	40 mile ratius
Route	Alameda 405 Fwy 5 Fwy Stockdale hwy Morris Road Station Road Station Road		Grant Henry Ford Alameda 405 Fwy 5 Fwy Stockdale hwy Morris Road Station Road	40 mile radius Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	5 fwy Stockdale Hwy Dairy Road	5 fwy Stockdale Hwy Dairy Road
	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route
Destination/Origin	None	Elk Ranch New Mexico	In SJVAPCD	CEMEX, Victorville	Calamco	Oregon/Washington	Calamco	None	None
Address					Port Rd G15, Stockton, CA		Port Rd G15, Stockton, CA		
Distance		794 miles		198 miles	264 miles	628 Miles	264 miles		
Route		Kern County: 132.2 miles (County Line near Boron, CA to north prope Mine to Boron, CA: 662 miles Total Distance: 794.2 miles		SJVR/BNSF	SJVR/UPRR	SJVR/UPRR			

Notes

1) Equipment Maintenance Trucks are considered to be 2% of the total trucks per day for the feed and product operation.
2) Miscellaneous trucks are considered to be 3% of the total trucks per day for the feed and product operation.
3) The maximum flow rate of coke is ratioed up from the normal flow rate at 25% to 30% of feed
4) The maximum flow rate of coal is ratioed up from the normal flow rate at 75% to 100% of feed
5) The maximum flow rate of sulfur is 2 times the normal production
6) The maximum flow rate of these commodities is 2 times the normal production
7) The sources of flow data used in the Production Rate calculation were based on the flow rates provided in "Conference Note: Rail and Truck Traffic - Planning Session" and the "FertilizerProductMovement Update", 01-25-12.

Calculations for Trucks Operation Modeling

Data Supplied By Client					
Parameter	**Petcoke Trucks**		**Product Trucks**		**Miscellaneous Trucks**
	Running Emissions	**Idling Emissions**	**Running Emissions**	**Idling Emissions**	**Running Emissions**
Distance Traveled (mi)*	0.96		2.49		2.20
Per Truck Idle Time (hr)		0.083		0.083	
Maximum number of trucks or loads:					
1-hr	6	6	13	13	5
3-hr	17	17	39	39	5
8-hr	44	44	104	104	5
24-hr	55	55	130	130	5
Annual average trucks or loads	15,200	15,200	20,880	20,880	1,818

EMFAC2007 Emission Factors + Fugitive Dust (g/mi or g/idle-hour) For Truck Model year 2010

	Petcoke Trucks		**Product Trucks**		**Miscellaneous Trucks**
Pollutant	**Running Emissions (g/mile/trk)**	**Idling Emissions (g/idle-hour/trk)**	**Running Emissions (g/mile/trk)**	**Idling Emissions (g/idle-hour/trk)**	**Running Emissions (g/mile/trk)**
CO	3.03	43.69	3.03	43.69	3.03
NOx	5.43	122.65	5.43	122.65	5.43
ROG	1.39	7.74	1.39	7.74	1.39
SOx	0.03	0.06	0.03	0.06	0.03
PM10 *	0.92	0.11	0.92	0.11	0.92
PM2.5 *	0.29	0.10	0.29	0.10	0.29

EMFAC2007 is the approved federal model for vehicle combustion emissions

* PM10 and PM2.5 includes fugitive dust factor for paved roads obtained from AP-42 Ch. 13 plus PM factors from EMFAC 2007

PM factors from EMFAC = combustion exhaust + tire wear + break wear

EMFAC emissions are for fleet year 2010 travelling at 10 mph.

1-hr Emission Rates for AERMOD (g/s) all trucks

	Petcoke Trucks		**Product Trucks**		**Miscellaneous Trucks**
Pollutant	**Running Emissions**	**Idling Emissions (at each Idle Point)**	**Running Emissions**	**Idling Emissions (at each Idle Point)**	**Running Emissions**
CO	4.424E-03	5.562E-03	2.726E-02	1.319E-02	1.010E-02
NOx	7.929E-03	1.561E-02	4.886E-02	3.702E-02	1.810E-02
ROG	2.028E-03	9.859E-04	1.250E-02	2.337E-03	4.629E-03
SOx	4.383E-05	7.894E-06	2.701E-04	1.871E-05	1.000E-04
PM10	1.340E-03	1.451E-05	8.255E-03	3.441E-05	3.058E-03
PM2.5	4.273E-04	1.324E-05	2.633E-03	3.139E-05	9.754E-04

3-hr Emission Rates for AERMOD (g/s) all trucks

	Petcoke Trucks		**Product Trucks**		**Miscellaneous Trucks**
Pollutant	**Running Emissions**	**Idling Emissions (at each Idle Point)**	**Running Emissions**	**Idling Emissions (at each Idle Point)**	**Running Emissions**
CO	4.424E-03	5.562E-03	2.726E-02	1.319E-02	1.010E-02
NOx	7.929E-03	1.561E-02	4.886E-02	3.702E-02	1.810E-02
ROG	2.028E-03	9.859E-04	1.250E-02	2.337E-03	4.629E-03
SOx	4.383E-05	7.894E-06	2.701E-04	1.871E-05	1.000E-04
PM10	1.340E-03	1.451E-05	8.255E-03	3.441E-05	3.058E-03
PM2.5	4.273E-04	1.324E-05	2.633E-03	3.139E-05	9.754E-04

8-hour Emission Rates for AERMOD (g/s) all trucks

	Coke and Coal Trucks (@ 10 mph)		**Product Trucks (@ 10 mph)**		**Miscellaneous Trucks @ 10 mph**
Pollutant	**Running Emissions**	**Idling Emissions (at each Idle Point)**	**Running Emissions**	**Idling Emissions (at each Idle Point)**	**Running Emissions**
CO	4.424E-03	5.562E-03	2.726E-02	1.319E-02	1.010E-02
NOx	7.929E-03	1.561E-02	4.886E-02	3.702E-02	1.810E-02
ROG	2.028E-03	9.859E-04	1.250E-02	2.337E-03	4.629E-03
SOx	4.383E-05	7.894E-06	2.701E-04	1.871E-05	1.000E-04
PM10	1.340E-03	1.451E-05	8.255E-03	3.441E-05	3.058E-03
PM2.5	4.273E-04	1.324E-05	2.633E-03	3.139E-05	9.754E-04

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24-hour Emission Rates for AERMOD (g/s) all trucks

Pollutant	Petcoke Trucks		Product Trucks		Miscellaneous Trucks
	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions
CO	1.843E-03	2.318E-03	1.136E-02	5.495E-03	1.010E-02
NOx	3.304E-03	6.506E-03	2.036E-02	1.542E-02	1.810E-02
ROG	8.449E-04	4.108E-04	5.207E-03	0.000E+00	4.629E-03
SOx	1.826E-05	3.289E-06	1.125E-04	7.798E-06	1.000E-04
PM10	5.582E-04	6.047E-06	3.440E-03	1.434E-05	3.058E-03
PM2.5	1.781E-04	5.517E-06	1.097E-03	1.308E-05	9.754E-04

Annual Emission Rates for AERMOD (g/s) all trucks

Pollutant	Petcoke Trucks		Product Trucks		Miscellaneous Trucks
	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions
CO	1.396E-03	1.755E-03	4.983E-03	2.411E-03	3.839E-04
NOx	2.501E-03	4.926E-03	8.931E-03	6.767E-03	6.880E-04
ROG	6.398E-04	3.110E-04	2.284E-03	4.273E-04	1.760E-04
SOx	1.383E-05	2.490E-06	4.937E-05	3.421E-06	3.803E-06
PM10	4.226E-04	4.579E-06	1.509E-03	6.290E-06	1.162E-04
PM2.5	1.348E-04	4.177E-06	4.813E-04	5.738E-06	3.708E-05

Volume, Line Sources

Guidance for Air Dispersion Modeling, SJVAPCD, 2007 and Section 1.2.2 of Volume II of ISC User's Guide			
2.3.2 Oyo=12W/2.15			
Truck Traveling vol src		Truck Idling pt src	
6	ft Release height	12.6	ft Release height
12	ft Width	0.1	m diam
66.98	ft init horz dim Syo	51.71	m/s vel
5.58	ft init vert dim Szo	366	K Temp
		199.134	F Temp

Volume, Stand Alone

Guidance for Air Dispersion Modeling, SJVAPCD, 2007	
2.3.2 + modelers judgement + ISC guidance	
Truck Traveling vol src	
6	ft Release height
12	ft Width
2.79	ft init horz dim Syo
5.58	ft init vert dim Szo

Summary of On-Site Operations Truck Emissions — Emissions Summary

4/17/2012

Transportation Information		Notes
- Onsite Vehicle =	20 trucks	- Information Provided By Applicant
- Vehicle year=	2010	- Information Provided By Applicant
- Maximum annual mileage =	10,000 miles/truck-year	- All routine vehicular traffic is anticipated to travel exclusively on paved roads
		- Assumed 15 mph average speed within HECA facility

Calculations for Trucks Operation Modeling per Truck

	Onsite O&M Trucks
Mileage	
1-hr	1
3-hr	3
8-hr	9
24-hr	27
Annual average trucks or loads	10000

EMFAC2007 Emission Factors (g/mi) For Truck Model year 2010

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	0.229	0.920
NOx	0.064	0.672
ROG	0.014	0.085
SOx	0.011	0.005
PM10 *	0.167	0.176
PM2.5 *	0.054	0.062

EMFAC2007 is the approved federal model for vehicle combustion emissions
* PM10 and PM2.5 includes fugitive dust factor for paved roads obtained from AP-42 Ch. 13 plus PM factors from EMFAC 2007
PM factors from EMFAC = combustion exhaust + tire wear + break wear
EMFAC emissions are for fleet year 2010 travelling at 15 mph.

1-hr Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

3-hr Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

8-hour Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

24-hour Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

Annual Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

Fugitive Dust on Paved Road

4/17/2012

AP 42 13.2.1 Paved Roads, updated January 2011

For a daily basis,
E = [k (sL)^0.91 x (W)^1.02](1-P/4N) (2)

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period
W = average weight (tons) of vehicles traveling the road
k = particle size multiplier for particle size range and units of interest
sL = road surface silt loading (g/m^2)

	k
	g/VMT
PM2.5	0.25
PM10	1.00

Table 13.2.1-1
PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Large Trucks

			Empty truck	full truck	Load Capacity	
W=	17.5	tons, average	5	30	25	tons
sL=	0.031	g/m2 Default value from URBEMIS 9.2 for Kern County				
P=	36	days/year Buttonwillow Station 1940-2011, WRCC				

E=
0.19149 g/VMT PM2.5 large delivery trucks
0.76594 g/VMT PM10 large delivery trucks

Operation and Maintenance Vehicles

W=	3	tons
sL=	0.031	g/m2 Default value from URBEMIS 9.2 for Kern County
P=	36	days/year Buttonwillow Station 1940-2011, WRCC

E=
0.03169 g/VMT PM2.5 large delivery trucks
0.12675 g/VMT PM10 large delivery trucks
#vol sources= 10

Fugitive Dust on Paved Road

4/17/2012

Fertilizer Product + Sulfur Product trucks + Gas Solids trucks + Misc trucks

102	max trucks/day for Ammonia + Urea + UAN	24	hrs/day		
8	max trucks/day for Sulfur				
17	max trucks/day gas solids				
3	miscellaneous truck along this path				
130	Total product trucks max/day				

4000 meters, approximate length of road for product trucks: eastern fenceline to southern fenceline to middle loop and back out the opposite way
2.49 miles

0.47593	grams PM2.5/truck/day	62.059	g PM2.5/day for all product trucks	2.5858	g PM2.5/hr
1.90373	grams PM10/truck/day	248.237	g PM10/day for all product trucks	10.3432	g PM10/hr

# volume source in model		
73	3.5422E-02	g PM2.5/hr/volume source
	1.4169E-01	g PM10/hr/volume source

Coke feedstock trucks (no coal by truck)

55 max feedstock trucks/day

1539 meters, approximate length of road loop to truck feedstock unloading facility on east side
0.96 miles

0.18312	grams PM2.5/truck/day	10.071	g PM2.5/day for all product trucks	0.4196	g PM2.5/hr
0.73246	grams PM10/truck/day	40.285	g PM10/day for all product trucks	1.6786	g PM10/hr

# volume source in model		
34	1.2342E-02	g PM2.5/hr/volume source
	4.9369E-02	g PM10/hr/volume source

Miscellaneous Delivery Trucks

5 max trucks/day

3540 meters, approximate length of road from end of product truck south road, along southern fenceline, north toward main site, to parking lot and back
2.20 miles

0.421	grams PM2.5/truck/day	2.299	g PM2.5/day for all product trucks	0.0958	g PM2.5/hr
1.685	grams PM10/truck/day	9.196	g PM10/day for all product trucks	0.3832	g PM10/hr

# volume source in model		
5	1.9158E-02	g PM2.5/hr/volume source
	7.6631E-02	g PM10/hr/volume source

Assumed Number of Unit Trains (incoming/outgoing)

Averaging Period	Coal Unit Trains (incoming)	Unit Trains of Product (outgoing)	Maximum Total Trains per period
1-hr	1	1	1
3-hr	1	1	2
8-hr	2	1	3
24-hr	2	1	3
Annual average unit trains	109	153	262

# Cars Per train	120	46	
maximum # Cars Per day	200-240	42-46	
	Switching Enigne/ Rail car movers	Line-Haul Engine for Coal Train	Line-Haul Engine for Product Trains
Engine Power Rating (hp)		4400	3000
Notch Operation		1	1
Notch percentage of hp		5.0%	5.0%
Avg Notch horsepower	260	220	150
# of engines per train	1	2	2
hours to unload/load each train		2	1
max operating hours (hrs/day)	8		
max operating hours (hrs/year)	1248		

The majority of the time the line-haul engine will operate in Notch 1 or idling, therefore emissions were conservatively estimated for Notch 1 horsepower.

Notch percentage presented in PORT OF LONG BEACH AIR EMISSIONS INVENTORY for 2007 (POLB, Jan 2009) derived from EPA data.

For each coal train it takes 2 hours to complete the onsite loop to unload

For each product train it takes 1 hour to load

Switching Engine Emission Factors	CO	NOx	PM10	PM2.5	SO2	VOC
Tier 3 Emission Factor (g/bhp-hr)	2.4	5.0	0.10	0.097	0.124	0.63
Emissions (lbs/hr /engine)	1.37	2.86	0.06	0.06	0.07	0.36
Line-Haul Emission Factors						
Tier 3 Emission Factor (g/bhp-hr)	1.50	5.50	0.10	0.10	0.09	0.32
Coal Train Emissions (lbs/hr /engine)	0.73	2.67	0.05	0.05	0.04	0.15
Product Train Emissions (lbs/hr /engine)	0.50	1.82	0.03	0.03	0.03	0.10

1-hr Emission Rates

	CO	NOx	PM10	PM2.5	SO2	VOC
	1-hr Emission Rates (lb/hr) all trains					
Switching engines	1.37	2.86	0.06	0.06	0.07	0.36
Line-haul coal engines	1.45	5.33	0.10	0.09	0.09	0.31
	1-hr Emission Rates for AERMOD (lb/hr) all trains divided by number of volume sources					
All On-site Trains	2.7E-02	7.9E-02	1.5E-03	1.4E-03	1.5E-03	6.4E-03

During a given hour either the line-haul engines for the coal train or product train operate, not both, thus emissions from the larger coal trains are only included in the peak hour emissions.

3-hr Emission Rates

	CO	NOx	PM10	PM2.5	SO2	VOC
	3-hr Emission Rates (lb/period) all trains					
Switching engines	4.12	8.59	0.17	0.17	0.21	1.09
Line-haul coal engines	2.91	10.66	0.19	0.19	0.18	0.61
Line-haul product engines	0.99	3.63	0.07	0.06	0.06	0.21
	3-hr Emission Rates for AERMOD (lb/hr) all trains divided by number of volume sources					
All On-site Trains	2.6E-02	7.3E-02	1.4E-03	1.3E-03	1.4E-03	6.1E-03

In the maximum operations 3 hour period, the switching engine operates up to 3 hours, 1 coal train unloads in 2 hours and 1 product train loads in 1 hour.

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8-hour Emission Rates

	CO	NOx	PM10	PM2.5	SO2	VOC
	8-hr Emission Rates (lb/period) all trains					
Switching engines	11.00	22.91	0.46	0.44	0.57	2.89
Line-haul coal engines	5.81	21.32	0.39	0.38	0.35	1.22
Line-haul product engines	0.99	3.63	0.07	0.06	0.06	0.21
	8-hr Emission Rates for AERMOD (lb/hr) all trains divided by number of volume sources					
All On-site Trains	2.1E-02	5.8E-02	1.1E-03	1.1E-03	1.2E-03	5.2E-03

In the maximum operations 8 hour period, the switching engine operates up to 8 hours, 2 coal train unloads in 2 hours each and 1 product train loads in 1 hour.

24-hour Emission Rates

	CO	NOx	PM10	PM2.5	SO2	VOC
	24-hr Emission Rates (lb/period) all trains					
Switching engines	11.00	22.91	0.46	0.44	0.57	2.89
Line-haul coal engines	5.81	21.32	0.39	0.38	0.35	1.22
Line-haul product engines	0.99	3.63	0.07	0.06	0.06	0.21
	24-hr Emission Rates for AERMOD (lb/hr) all trains divided by number of volume sources					
All On-site Trains	7.1E-03	1.9E-02	3.7E-04	3.5E-04	3.9E-04	1.7E-03

In the maximum operations 24 hour period, the switching engine operates up to 8 hours, 2 coal train unloads in 2 hours each and 1 product train loads in 1 hour.

Annual Emission Rates

	CO	NOx	PM10	PM2.5	SO2	VOC
	Annual Emission Rates (tons/period) all trains					
Switching engines	0.86	1.79	0.04	0.03	0.04	0.23
Line-haul coal engines	0.16	0.58	0.01	0.01	0.01	0.03
Line-haul product engines	0.08	0.28	0.01	0.00	0.00	0.02
	Annual Emission Rates for AERMOD (tons/yr) all trains divided by number of volume sources					
All On-site Trains	1.0E-02	2.5E-02	4.9E-04	4.8E-04	5.6E-04	2.6E-03

AERMOD source parameters
Volume sources spaces every 20 widths

Width		10 ft
Release Height		15 ft
Sigma Y		93 ft
Sigma Z		14 ft
# of volumes	104	

Guidance for Air Dispersion Modeling, SJVAPCD, 2007 and Section 1.2.2 of Volume II of ISC User's Guide

4/17/2012

Emission Factors

40 CFR Part 1033

Table 2 of 1033.101 Switch Locomotive Emission Standards

		Standards (g/bhp-hr)			
Year of original manufacture	**Tier of standards**	**CO**	**NOx**	**PM**	**HC**
1973-2001	Tier 0	8.0	11.8	0.26	2.1
2002-2004	Tier 1	2.5	11	0.26	1.2
2004-2010	Tier 2	2.4	8.1	0.13	0.60
2011-2014	Tier 3	2.4	5.0	0.10	0.60
2015 or later	Tier 4	2.4	1.3	0.03	0.14

Table 1 to §1033.101—Line-Haul Locomotive Emission Standards

		Standards (g/bhp-hr)			
Year of original manufacture	**Tier of standards**	**CO**	**NO_X**	**PM**	**HC**
1973–1992	Tier 0	5	8	0.22	1
1993–2004	Tier 1	2.2	7.4	0.22	0.55
2005–2011	Tier 2	1.5	5.5	0.10	0.3
2012–2014	Tier 3	1.5	5.5	0.10	0.3
2015 or later	Tier 4	1.5	1.3	0.03	0.14

Reference: 40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards

Emission Factors For all Locomotives			
SOx	**CO_2**	**CH_4**	**N_2O**
g/gal	g/gal	g/gal	g/gal
1.88	10217	0.80	0.26

Locomotive Application	Conversion Factor (bhp-hr/gal)
Large Line-haul & Passenger	20.8
Small Line-haul	18.2
Switching	15.2

Notes:

New line-haul engines will be AC locomotives such as the GE Evolution Series, that meet Tier 3 emissions

New switching engines will meet Tier 3 emissions, they may be the Titan Trackmobile railcar movers or similar

EPA's Technical Highlights: Emission Factors for Locomotives, 2009 (http://www.epa.gov/nonroad/locomotv/420f09025.pdf).

Based on 300 ppm sulfur diesel fuel.

CH_4 and N_2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for

VOC emissions can be assumed to be equal to 1.053 times the HC emissions

$PM_{2.5}$ Fraction of PM_{10}, = 0.97

Appendix E-4

Response to PM2.5 Cooling Tower Data Requests from CEC and USEPA

APPLICANT RESPONSES TO

CALIFORNIA ENERGY COMMISSION AND ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE

PRELIMINARY DETERMINATION OF COMPLIANCE FOR THE HYDROGEN ENERGY CALIFORNIA (HECA) PROJECT (08-AFC-8)

Prepared for:

San Joaquin Valley Air Pollution Control District

Project Number S-1093741

Kern County, CA

Prepared on behalf of:

Hydrogen Energy California LLC

September 14, 2010

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APPLICANT RESPONSES TO CEC AND EPA COMMENTS ON THE JUNE 21, 2010 SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT PRELIMINARY DETERMINATION OF COMPLIANCE

ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS USED IN RESPONSES

ATC	Authority to Construct
BACT	Best Available Control Technology
BTU	British Thermal Unit
CARB	California Air Resources Board
CEC	California Energy Commission
CEIDARS	California Emission Inventory Data and Reporting System
CO	carbon monoxide
CO_2	carbon dioxide
CTG	combustion-turbine generator
GE	General Electric
GEP	Good Engineering Practice
HECA LLC	Hydrogen Energy California LLC
HECA	Hydrogen Energy California
HRSG	heat-recovery steam generator
IGCC	integrated gasification combined-cycle
lb/hr	pounds per hour
m	meters
NO_x	nitrogen oxides
PDOC	Preliminary Determination of Compliance
PM	particulate matter
PM_{10}	particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
SCAQMD	South Coast Air Quality Management District
SCR	selective catalytic reduction
SJVAPCD	San Joaquin Valley Air Pollution Control District
EPA	Environmental Protection Agency
VOC	volatile organic compound

INTRODUCTION

The Hydrogen Energy California (HECA) Project will produce low-carbon baseload electricity by capturing carbon dioxide (CO_2) and transporting it for enhanced oil recovery (EOR) and sequestration. The Project will gasify petroleum coke (petcoke) (or blends of petcoke and coal, as needed) to produce raw syngas and ultimately hydrogen to fuel a combustion turbine operating in combined cycle mode. The net electrical generation output from the Project will provide California with approximately 250 MW of low-carbon baseload power to the grid. The Gasification Block will also capture approximately 90 percent of the carbon from the raw syngas at steady-state operation, which will be transported to the Elk Hills Field for CO_2 EOR and sequestration. The Project will have significantly lower criteria pollutant emissions than a similarly sized petcoke-fired, coal-fired or integrated gasification combined-cycle (IGCC) power plant. To minimize air emissions, state-of-the art emission control technologies will be implemented for the HECA Project.

On June 26, 2009, HECA LLC (or the Applicant) submitted an application for an Authority to Construct (ATC) permit to San Joaquin Valley Air Pollution Control District (SJVAPCD). This application was deemed complete by SJVAPCD on August 3, 2009, and was assigned SJVAPCD Project Number S-1093741.

On June 21, 2010, SJVAPCD issued a Preliminary Determination of Compliance (PDOC) for public review and comment. The California Energy Commission (CEC) issued comments on the PDOC on August 3, 2010. Environmental Protection Agency (EPA) Region IX issued comments on the PDOC on August 16, 2010.

This document presents the Applicant's responses to the CEC's and EPA's comments on the PDOC.

RESPONSES TO CEC COMMENTS

CEC COMMENT

1. <u>Stack Heights and Good Engineering Practice:</u> The PDOC specifically notes the stack height for the CO2 Vent exceeds the de-minimis good engineering practice (GEP) height of 65 meters, but does not indicate either in the engineering evaluation discussion on page 20 or in the Air Quality Impact Analysis (AQIA) (Appendix H) whether and how this stack or all of the other proposed stacks that are above the de-minimis height meet GEP regulation requirements. This question about compliance with GEP stack height concerns all of the following:

Emissions Stack	*Height (meters)*
CO2 Vent	*79.2*
SRU Flare	*76.2*
Gasification Flare	*76.2*
Rectisol Flare	*76.2*

Staff believes that a brief note regarding compliance with GEP stack height should be added to the FDOC to complete the discussion regarding these sources/stacks.

RESPONSE

Good engineering practice (GEP) is defined as the height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, or wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles.[1]

The Building Profile Input Program Plume Rise Model Enhancements building downwash model was run to determine the GEP height for each stack. The output of this model shows that the GEP for the three flares and the carbon dioxide (CO_2) vent is 152.4 meters (m). This file was provided to SJVAPCD with the other air quality modeling files.

GEP is calculated based on the following equation

$$H_g = H + 1.5 * L$$

Where: H_g = GEP stack height (m)

H = height of the nearby structure (m)
L = lesser dimension of the height or projected width of the nearby structure (m)

The largest nearby structure is the gasifier building, which is 60.96 m high and 70.9 m long. Therefore, L = 60.96 m, H = 60.96 m, and H_g = 152.4 m.

The gasifier building is within five times L (3,048 m) from the three flares and the CO_2 vent; therefore, GEP for these stacks is calculated based on the gasifier building dimensions. The heights of the three flares and the CO_2 vent are thus well below the GEP height of 152.4 m.

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1 Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations), EPA-450/4-80-023R, June 1985.

CEC COMMENT

2. <u>Combined Cycle Combustion Turbine Generator (S-7616-9) Particulate Emissions:</u> The particulate matter (PM10/PM2.5) emission levels requested by the applicant for this emission unit are well above similar gas turbine emission rate limits considering fuel firing heat input levels. The applicant has not provided compelling technical rationale to explain why this gas turbine would need a particulate matter (PM) emission rate that is so much higher than other similar gas turbines, and staff believes that the other recently permitted turbine projects have established a reasonable Best Available Control Technology (BACT) emissions level, which based on staff's review of available source test data generally provides a 50 percent safety factor (i.e., actual emissions are generally no more than half the allowable emissions, which for example would mean that the expected actual PM emissions for the Carlsbad project turbines would be somewhere between 4 to 5 lbs/hour, or about half of the allowable 9.5 lbs/hour). A comparison of the estimated HECA-proposed PM emissions compared to similar, recently approved and on-going projects are as follows:

Project	***Gas Turbine***	***Lb/hr***	***Lb/ MMBtu***	***Lb/MW gross***
HECA – H_2 Fuel	*GE 7FB*	*18 (19.8)*	*0.0084 (0.0079)*	*(0.051) (0.051)*
HECA – Natural Gas		*18 (19.8)*	*0.0090 (0.0078)*	*0.066 (0.060)*
Allowable Emissions on Natural Gas:				
Avenal	*GE 7FA*	*8.91 (11.78)*	*0.0050 (0.0052)*	*0.034 (0.039)*
Inland Empire	*GE 107H*	*10*	*0.0040*	*0.026*
Carlsbad	*Siemens SGT6-PAC5000F*	*9.5*	*0.0046*	*0.034*
Value in "()" is duct firing value for projects with duct burners.				

Staff believes that the District should consider reducing the Particulate Matter (PM10/PM2.5) emission rate down to no more than 15 lbs/hour without duct firing and 16.8 lbs/hour with duct firing as BACT emission rates. These rates should provide an adequate safety margin compared to expected actual emissions and would also serve to reduce the total permitted annual PM2.5 emission rate to a level where the PM2.5 fraction of the cooling tower emissions are no longer an issue in regards to the potential for the site to exceed 100 tons per year of PM2.5 emissions, which would trigger the need for the project to obtain federal PM2.5 offsets.

RESPONSE

The Applicant is requesting additional time to address this comment.

CEC COMMENT

3. <u>Cooling Tower PM2.5 Fraction Assumption:</u> Staff believes that the rationale used by the applicant for the ratio of particulate matter less than 2.5 microns (PM2.5) to particulate matter less than 10 microns (PM10) of 0.6:1 for the cooling tower emissions is flawed. The rationale provided by the applicant notes that this ratio is cited in the South Coast Air Quality Management District's (SCAQMD's) particulate size fraction in the California Emission Inventory Development and Reporting System (CEIDARS) table from the SCAQMD CEQA website. However, the CEIDARS particulate size fraction data was originally produced by the California Air Resource Board (ARB) and review of the original CEIDARS particulate size fraction table from ARB shows that there is no cooling tower category and that the "other" category values have been used by SCAQMD in lieu of other available data for cooling towers in their version of the CEIDARS table. This shows that this particulate size fraction data is not specific to cooling towers and is not technically supportable. Staff is willing to accept a defendable cooling tower particulate size fraction reference; however, to date staff is not aware of such a defendable reference. Staff believes that the District should investigate this further and if possible provide a more technically defensible particulate size fraction reference and revise the cooling tower particulate matter (PM10 and PM2.5) emissions appropriately. If no specific particulate size fraction data reference for cooling towers is available, the District should assume 100 percent of the PM10 is PM2.5.

RESPONSE

The cooling tower total PM emissions are based on the maximum expected total dissolved solids in the cooling water, annual circulating water rate, and the use of a high-efficiency drift eliminator. The Applicant conservatively estimated that total PM emitted from the cooling tower will be equal to PM_{10} in diameter, and the quantity of PM emissions that are equal to $PM_{2.5}$ will be 60 percent of the PM_{10} emissions (a fraction or ratio of 0.6). This ratio used by the Applicant is based on the several justifications described below.

1. The "South Coast Air Quality Management District (SCAQMD) – Final Methodology to Calculate $PM_{2.5}$ and $PM_{2.5}$ Significance Thresholds, Appendix A – Updated California Emission Inventory Data and Reporting System (CEIDARS) Table with $PM_{2.5}$ Fractions[2]" provides the cooling tower ratios of 0.7 for the PM_{10} fraction of total PM, 0.6 for the $PM_{2.5}$ fraction of PM_{10}, and 0.42 for the $PM_{2.5}$ fraction of total PM. The Applicant consulted with SCAQMD staff and confirmed these PM size fractions were derived from PM profiles in the CEIDARS developed by the California Air Resources Board (CARB). The Applicant also confirmed that SCAQMD examined carefully, approved, and officially adopted this document in October 2006. Since then, SCAQMD has required all California Environmental Quality Act/National Environmental Policy Act projects to use this methodology and its PM size fractions to estimate their PM, PM_{10}, and $PM_{2.5}$ emissions from cooling towers. Therefore, the use of the 0.6 ratio of $PM_{2.5}$ to PM_{10} provided by this SCAQMD document is valid for estimating the HECA Project cooling tower $PM_{2.5}$ emissions, although the $PM_{2.5}$ emissions will be

[2] Final Methodology to Calculate $PM_{2.5}$ and $PM_{2.5}$ Significance Thresholds (October 2006) from http://www.aqmd.gov/ceqa/handbook/PM2_5/finalmeth.doc; and its Appendix A – Updated CEIDARS Table with $PM_{2.5}$ Fractions from http://www.aqmd.gov/ceqa/handbook/PM2_5/finalAppA.doc.

overestimated due to the assumption that all PM emissions are comprised of PM_{10}.

2. The Applicant conducted a query for cooling towers in California on the CEIDARS[3]. The query results show that all of the cooling towers from different source categories in California in 1995, 2000, 2005, and 2008 have an average $PM_{2.5}$-to-PM_{10} ratio of 0.636, and an average $PM_{2.5}$–to-PM ratio of 0.441 (see Attachment CEC-3-1). In addition, the Applicant, with assistance from CARB emission inventory staff (Gabe Ruiz and Darryl Look), gathered all the California power plant cooling tower emissions from CEIDARS (see Attachment CEC-3-2). Because only PM emissions were measured, $PM_{2.5}$ emissions are estimated from PM emissions. Attachment CEC-3-2 and Applicant discussions with CARB staff confirmed that the 0.7/0.6/0.42 $PM/PM_{10}/PM_{2.5}$ ratios were applied to most of the power plant cooling tower emission estimates. The average $PM_{2.5}$ fraction of PM_{10} is 0.633, and the average $PM_{2.5}$ fraction of PM is 0.478 for all power plant cooling towers in California. The $PM_{2.5}$ fractions of PM_{10} from the CEIDARS database for cooling towers from power plant cooling towers and from different source categories are very similar to the fraction the Applicant used in its cooling tower $PM_{2.5}$ emissions estimations. Therefore, in calculating the cooling tower PM emissions, the Applicant has accurately presented the $PM_{2.5}$ portion of PM_{10} emissions, and furthermore, by assuming 100 percent of the total PM emissions to be PM_{10}, the Applicant has significantly overestimated the $PM_{2.5}$ emissions.

3. The assumption that 100 percent of the PM emitted from a cooling tower is smaller than 2.5 microns is too conservative from a technical perspective. The drift droplets generally contain the chemical impurities (or minerals) in the water circulating through the tower, and these impurities can be converted to airborne emissions. There are currently few papers about $PM_{10}/PM_{2.5}$ emission factors for mechanical draft cooling tower processes. One good reference[4] from Joel Reisman and Gorden Frisbie confirms the point that only a small amount of the circulating water may be entrained in the air stream, and it appears that most of the particles emitted from the cooling tower are larger than PM_{10}. According to the conclusion of this paper, 85 percent of the mass that is emitted is larger than 10 microns, and only 15 percent is less than 10 microns. The Applicant also consulted with EPA Staff (J. David Mobley, Deputy Director, Atmospheric Modeling and Analysis Division, National Exposure Research Laboratory; Lee Beck, Senior Project Engineer, Emissions Characterization & Prevention Branch, Air Pollution Prevention and Control Division), and the staff agree with the methodology and conclusion of this paper.

4. It should be reiterated that the PM_{10} emissions from the cooling towers at HECA were estimated using U.S. EPA's AP-42 guidance[5] that conservatively assumes that all dissolved solids in the circulating water will be converted to airborne PM_{10}. The AP-42 document states " a *conservatively high* PM_{10} emission factor can be obtained by (a) multiplying the total liquid drift factor by the total dissolved solids (TDS) fraction in the circulating water and (b) assuming that, once the water

[3] CARB Emission Inventory Database (California Emission Inventory Development and Reporting System, CEIDARS) from http://www.arb.ca.gov/app/emsinv/emssumcat.php.
[4] Reisman, J. and Frisbie, G. (2002), Calculating realistic PM_{10} emissions from cooling towers. Environmental Progress, 21: 127–130. doi: 10.1002/ep.670210216.
[5] AP-42, CH 13.4: Wet Cooling Towers: (http://www.EPA.gov/ttnchie1/ap42/ch13/final/c13s04.pdf).

evaporates, all remaining solid particles are within the PM_{10} size range." This U.S. EPA guidance clearly describes that cooling tower emissions of PM_{10}, and thus $PM_{2.5}$, that are calculated with this technique are overestimated.

5. Data from the 2006 Micheletti study, "Atmospheric Emissions from Evaporative Cooling Towers"[6], confirm that the assumption that of all the particulate emissions are PM_{10} is an exaggeration. Mr. Micheletti calculated PM_{10} and $PM_{2.5}$ emission factors that are at least an order of magnitude less than the small particulate emissions that would be calculated using the U.S. EPA's conservatively high method. Even when Mr. Micheletti adjusted the U.S. EPA particulate emission factor for changes in drift rate and recirculating water TDS concentration, he calculated PM_{10} and $PM_{2.5}$ emission factors that are noticeably lower (see Attachment CEC-3-3). He determined that the fatal flaw in the U.S. EPA's method is the assumption that all of the total dissolved solids in the drift become PM_{10} or $PM_{2.5}$.

6. The CEC commissioned a study[7] of environmental effect from saltwater cooling towers. Although the focus of this study was the effects from saltwater cooling towers, some of the data are derived from non-saltwater cooling towers. The CEC study references the Micheletti study and agrees with the conclusion that "only a small fraction (less than 15%) of the residual particles will have an aerodynamic diameter of less than 10 microns", although they warn there may be uncertainties in the calculations. This study shows that the CEC believes that significantly less than 100% of the particulate matter emitted from cooling towers is PM_{10} and $PM_{2.5}$.

Compliance with the PM emissions from the cooling tower will be demonstrated through PDOC Conditions 14 and 15.

Based on the data presented above, in the ATC application, in the response to CEC Data Request 18, and presented by SJVAPCD in the PDOC, the Applicant conservatively assumed all PM emissions were 10 microns or smaller and 60 percent of those emissions were 2.5 microns or smaller. In addition, the Applicant overestimated the PM_{10} emissions by assuming that all PM is 10 microns or smaller. The Applicant believes the evaluation of the $PM_{2.5}$ emissions from the cooling tower presented in the PDOC is valid, and no change to the PDOC is warranted for the cooling tower $PM_{2.5}$ emissions.

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[6] Micheletti, W.C., 2006. "Atmospheric Emissions from Evaporative Cooling Towers." CTI Journal. Vol. 27, No. 1.
[7] CEC, Performance, Cost, And Environmental Effects Of Saltwater Cooling Towers, January 2010, CEC-500-2008-043.

ATTACHMENT CEC-3-1

ATTACHMENT CEC-3-1
CEIDARS DATABASE QUERY for COOLING TOWERS

DATA_SO	YEAR	AREA	SEASON	EMISSION_TYPE	SRC_TYPE	EIC	EICSUMN	EICSOUN	EICMATN	EICSUBN	TOG	ROG	COT	NOX	SOX	PM	PM10	PM2_5	PM2.5 Fraction of Total PM	PM10 Fraction of Total PM	PM2.5 Fraction of PM10
																SCAQMD CIEDARS data base summary			**0.420**	**0.700**	**0.600**
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	430-338-0	MINERAL PROCESSES	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0002	0.0001	0.0001	0.500	0.500	1.000
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	420-338-0	FOOD AND AGRICULTURE	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.1638	0.1146	0.0689	0.421	0.700	0.601
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	410-338-0	CHEMICAL	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0.0138	0.0096	0	0	0	0.1142	0.08	0.0479	0.419	0.701	0.599
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	320-338-0	PETROLEUM REFINING	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	2.1388	2.0747	0	0	0	2.2645	1.4118	1.2111	0.535	0.623	0.858
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	499-338-0	OTHER (INDUSTRIAL PROCESSES)	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0.0194	0.0136	0	0	0	0.9743	0.6836	0.4095	0.420	0.702	0.599
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	470-338-0	ELECTRONICS	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0201	0.0142	0.0084	0.418	0.706	0.592
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	460-338-0	GLASS AND RELATED PRODUCTS	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0336	0.0235	0.0141	0.420	0.699	0.600
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	450-338-0	WOOD AND PAPER	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0034	0.0025	0.0014	0.412	0.735	0.560
2009_Alma	2008	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	440-338-0	METAL PROCESSES	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.1705	0.1194	0.0716	0.420	0.700	0.600
																			0.440	**0.674**	**0.668**
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	499-338-0	OTHER (INDUSTRIAL PROCESSES)	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0.0136	0.0096	0	0	0	0.1477	0.1046	0.0621	0.420	0.708	0.594
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	470-338-0	ELECTRONICS	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.009	0.0063	0.0037	0.411	0.700	0.587
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	420-338-0	FOOD AND AGRICULTURE	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0094	0.0066	0.004	0.426	0.702	0.606
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	320-338-0	PETROLEUM REFINING	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	2.658	2.617	0	0	0	0.3166	0.1931	0.1757	0.555	0.610	0.910
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	410-338-0	CHEMICAL	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0.0042	0.0029	0	0	0	0	0	0			
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	310-338-0	OIL AND GAS PRODUCTION	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0072	0.0044	0.004	0.556	0.611	0.909
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	440-338-0	METAL PROCESSES	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0003	0.0002	0.0001	0.333	0.667	0.500
2009_Alma	2005	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	450-338-0	WOOD AND PAPER	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0071	0.005	0.003	0.423	0.704	0.600
																			0.446	**0.672**	**0.672**
2009_Alma	2000	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	410-338-0	CHEMICAL	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0.0036	0.0025	0	0	0	0.1997	0.1605	0.0839	0.420	0.804	0.523
2009_Alma	2000	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	330-338-0	PETROLEUM MARKETING	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0046	0.0032	0.0019	0.413	0.696	0.594
2009_Alma	2000	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	499-338-0	OTHER (INDUSTRIAL PROCESSES)	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0702	0.0557	0.0303	0.432	0.793	0.544
2009_Alma	2000	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	420-338-0	FOOD AND AGRICULTURE	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0063	0.0059	0.0026	0.413	0.937	0.441
2009_Alma	2000	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	470-338-0	ELECTRONICS	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.005	0.0035	0.0021	0.420	0.700	0.600
2009_Alma	2000	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	460-338-0	GLASS AND RELATED PRODUCTS	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0012	0.0008	0.0005	0.417	0.667	0.625
2009_Alma	2000	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	320-338-0	PETROLEUM REFINING	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	2.1455	2.0528	0	0	0	0.0934	0.057	0.0518	0.555	0.610	0.909
																			0.438	**0.744**	**0.605**
2009_Alma	1995	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	320-338-0	PETROLEUM REFINING	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	2.012	2.012	0	0	0	0.0008	0.0005	0.0004	0.500	0.625	0.800
2009_Alma	1995	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	410-338-0	CHEMICAL	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.2863	0.2475	0.1202	0.420	0.864	0.486
2009_Alma	1995	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	420-338-0	FOOD AND AGRICULTURE	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0047	0.0033	0.002	0.426	0.702	0.606
2009_Alma	1995	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	499-338-0	OTHER (INDUSTRIAL PROCESSES)	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0573	0.0437	0.0241	0.421	0.763	0.551
2009_Alma	1995	Statewide	Annual Ave	Grown and Controlled	STATIONAR`	460-338-0	GLASS AND RELATED PRODUCTS	COOLING TOWERS	HYDROCARBON COI	SUB-CATEGORY UN	0	0	0	0	0	0.0033	0.0033	0.0014	0.424	1.000	0.424
																			0.438	**0.791**	**0.573**
							OTHER (INDUSTRIAL PROCESSES)											average	0.423	0.741	0.572
																		average all	0.441	0.712	0.636

Source
http://www.arb.ca.gov/app/emsinv/emssumcat.php

ATTACHMENT CEC-3-2

ATTACHMENT CEC-3-2
CEIDARS DATABASE QUERY for POWER PLANT COOLING TOWER EMISSIONS

Cooling Tower PM, PM10, PM2_5 Emissions in tons per year selected by SCC= 38500101

CO	AB	DIS	FACID	FNAME	DEV	PROID	PRDESC	SCC	SCC1N	SCC3N	SCC6N	PM	PM10	PM2_5	PM2.5 Fraction of Total PM	PM10 Fraction of Total PM	PM2.5 Fraction of PM10
33	SC	SC	129816	INLAND EMPIRE ENERGY CENTER, LLC	12	1	800-MW NATURAL GAS-FIRED, COMBINED-CYCLE ELECTRIC GENERATING	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.4	0.28	0.168	0.420	0.700	0.600
33	SC	SC	129816	INLAND EMPIRE ENERGY CENTER, LLC	11	1	800-MW NATURAL GAS-FIRED, COMBINED-CYCLE ELECTRIC GENERATING	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.64	0.448	0.2688	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	17	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
34	SV	SAC	193	CARSON ENERGY/SMUD	3	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.762635714	0.533845	0.320307	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	11	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
34	SV	SAC	3456	SMUD COSUMNES POWER PLANT	3	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	1.843171429	1.29022	0.774132	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	15	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
34	SV	SAC	195	SACRAMENTO COGENERATION AUTHOY	4	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	1.247725	1.247725	0.5240445	0.420	1.000	0.420
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	9	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	10	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	6	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.371	0.26	0.156	0.420	0.701	0.600
34	SV	SAC	194	SACRAMENTO POWER AUTHORITY	2	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	2.434594643	1.70421625	1.02252975	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	13	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	8	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
15	SJV	SJU	3523	ELK HILLS POWER LLC	3	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	2.457142637	1.719999846	1.031999908	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	12	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	7	7	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.28	0.28	0.168	0.600	1.000	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	16	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
36	MD	MOJ	104701849	HIGH DESERT POWER PROJECT	14	1	COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.412	0.288365	0.173	0.420	0.700	0.600
57	SV	YS	257	WOODLAND BIOMASS POWER LTD	20	1	COOLING TOWER - CIRCULATION RATE	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.014285714	0.01	0.006	0.420	0.700	0.600
19	SC	SC	11034	TRIGEN-LA ENERGY CORP	16	1	DISTRICT HEATING AND COOLING	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	7.12	4.984	2.9904	0.420	0.700	0.600
19	SC	SC	9053	TRIGEN- LA ENERGY CORP	20	1	DISTRICT HEATING AND COOLING	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	1.23	0.861	0.5166	0.420	0.700	0.600
30	SC	SC	9217	TRIGEN-LA ENERGY CORP	3	1	DISTRICT HEATING AND COOLING	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.32	0.224	0.1344	0.420	0.700	0.600
36	MD	MOJ	104801880	RRI ENERGY COOLWATER, LLC.	90011	1	DRIFT CT UNIT 1	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.5997	0.5997	0.5997	1.000	1.000	1.000
36	MD	MOJ	104801880	RRI ENERGY COOLWATER, LLC.	90012	1	DRIFT CT UNIT 2	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.5997	0.5997	0.5997	1.000	1.000	1.000
36	MD	MOJ	104801880	RRI ENERGY COOLWATER, LLC.	90013	1	DRIFT CT UNIT 3	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	6.668	6.668	6.668	1.000	1.000	1.000
36	MD	MOJ	104801880	RRI ENERGY COOLWATER, LLC.	90014	1	DRIFT CT UNIT 4	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	6.668	6.668	6.668	1.000	1.000	1.000
33	SC	SC	68042	CORONA ENERGY PARTNERS, LTD	2	1	ELECTIC POWER AND STEAM COGENERATION FACILITY	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	5.45	3.815	2.289	0.420	0.700	0.600
19	SC	SC	51620	WHEELABRATOR NORWALK ENERGY CO INC	13	1	ELECTRIC POWER GENERATING FACILITY	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	3.16	2.212	1.3272	0.420	0.700	0.600
36	SC	SC	115315	RRI ENERGY ETIWANDA, INC.	1	1	ELECTRIC POWER GENERATION	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	114.16	79.912	47.9472	0.420	0.700	0.600
19	SC	SC	128243	BURBANK CITY,BURBANK WATER & POWER,SCPPA	1	1	ELECTRIC POWER GENERATION	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	1.24	0.868	0.5208	0.420	0.700	0.600
19	SC	SC	25638	BURBANK CITY, BURBANK WATER & POWER	16	1	ELECTRICAL UTILITY POWER PRODUCTION	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	4.15	2.905	1.743	0.420	0.700	0.600
27	NCC	MBU	220	CALPINE KING CITY COGEN, LLC	6	1	PEAKER COOLING TOWER	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.36	0.252	0.1512	0.420	0.700	0.600
19	SC	SC	14502	VERNON CITY, LIGHT & POWER DEPT	1	1	POWER GENERATION	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.85	0.595	0.357	0.420	0.700	0.600
19	SC	SC	800170	LA CITY, DWP HARBOR GENERATING STATION	7	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.05	0.035	0.021	0.420	0.700	0.600
19	SC	SC	800170	LA CITY, DWP HARBOR GENERATING STATION	5	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.07	0.049	0.0294	0.420	0.700	0.600
19	SC	SC	800170	LA CITY, DWP HARBOR GENERATING STATION	3	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.05	0.035	0.021	0.420	0.700	0.600
19	SC	SC	800170	LA CITY, DWP HARBOR GENERATING STATION	4	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.09	0.063	0.0378	0.420	0.700	0.600
19	SC	SC	800193	LA CITY, DWP VALLEY GENERATING STATION	6	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.04	0.028	0.0168	0.420	0.700	0.600
19	SC	SC	800170	LA CITY, DWP HARBOR GENERATING STATION	6	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	0.06	0.042	0.0252	0.420	0.700	0.600
19	SC	SC	800075	LA CITY, DWP SCATTERGOOD GENERATING STN	37	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	13.01	9.107	5.4642	0.420	0.700	0.600
19	SC	SC	800193	LA CITY, DWP VALLEY GENERATING STATION	7	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	2.25	1.575	0.945	0.420	0.700	0.600
19	SC	SC	800193	LA CITY, DWP VALLEY GENERATING STATION	8	1	POWER PLANT	38500101	COOLING TOWER	PROCESS COOLING	MECHANICAL DRAFT	9.7	6.79	4.074	0.420	0.700	0.600
														average	**0.478**	**0.742**	**0.633**

ATTACHMENT CEC-3-3

ATTACHMENT CEC-3-3

Calculated PM10 and PM2.5 Cooling Tower Emission Factors as a Function of Recirculating Water TDS

Recirculating Water TDS (ppm)	Maximum Drift Droplet Diameter for PM_{10} Particulates (µm)	Maximum Drift Droplet Diameter for $PM_{2.5}$ Particulates (µm)	Percent Particulate Emissions > 10 µm	Percent Particulate Emissions > 2.5 µm
500	168	41	68%	86%
1000	133	33	73%	88%
2500	86	24	78%	89%
5000	78	19	81%	90%
10000	63	14	83%	90%
20000	49	12	85%	91%
30000	41	11	86%	91%

Source: After Micheletti, W.C., 2006. "Atmospheric Emissions from Evaporative Cooling Towers." CTI Journal. Vol. 27, No. 1.

Notes:

1 Assumes spherical particulate matter having a density of 2.36 gm/cm^3 and 0.002% drift rate.

CEC COMMENT

4. <u>General Permit Conditions (All Permit Units):</u> The generic permit conditions that start and end the conditions for each permit unit are not provided consistently. For example, the Gasification Flare (S-7616-3-0) starts with 9 general conditions before the unit specific conditions and the Gasification Cooling Tower (S-7616-3-0) starts with five general conditions before the unit specific conditions. Staff believes that most if not all of these general conditions apply for all of the permit units and requests that the District review consistency of the presentation and inclusion of these general permit conditions across the 16 permit units. Staff also requests, if it is possible based on District permitting rules and policies, that these general, facility-wide conditions be separated into one set of conditions that apply to all relevant permit units. This would provide clarity and avoid a sixteen-fold duplication of conditions.

RESPONSE

The Applicant would agree to the CEC recommendation for the conditions.

CEC COMMENT

5. ***<u>Gasification System (S-7616-2-0) and Sulfur Recovery System (S-7616-5-0) Fugitive VOC Emission Source Inspection and Maintenance Requirements:</u> For later compliance demonstration clarity, staff requests that the conditions for these two permit units include more specificity on what parts of these permit units are subject to Rule 4455 – COMPONENTS AT PETROLEUM REFINERIES, GAS LIQUIDS PROCESSING FACILITIES AND CHEMICAL PLANTS, and that the conditions include the specific requirements of the rule.***

RESPONSE

The Applicant would agree to the SJVAPCD adding compliance demonstration conditions.

CEC COMMENT

***6. Flares and CO_2 Vent Conditions (S-7616-3-0, S-7616-6-0, S-7616-7-0, and S-7616-8-0) Consistency of Conditions:** There are certain general conditions (such as no public nuisance, general design conditions, and recordkeeping conditions) as well as other, more unit specific conditions such as emission rate limits that are applied very differently for these four similar event-based emission sources. While staff notes that different regulations such as federal New Source Performance Standards may apply to all of these sources and would require certain differences in the conditions for these four sources, staff believes that greater consistency in the conditions for these four sources, including conditions noted to be required under District Rule 4311 – FLARES, should be investigated and implemented consistently where appropriate.*

RESPONSE

The Applicant would agree to SJVAPCD standardizing the flare conditions, where applicable.

CEC COMMENT

7. ***CO2 Vent (S-7616-8-0) Condition 12:*** ***Staff requests that the methods and frequency (i.e., required for each venting event) for the vent gas composition monitoring that is required under Condition 12 be detailed in this or other conditions for this permit unit.***

RESPONSE

The CO_2 product stream will likely be continuously measured by gas chromatograph for trace constituents. The Applicant intends to use the equipment provided for this purpose to also verify compliance of trace, regulated emissions, as required, during an upset, infrequent CO_2 venting occurrence.

CEC COMMENT

8. <u>Auxiliary Boiler (S-7616-13-0) Conditions 28 and 30:</u> Conditions 28 and 30 appear to be redundant and staff recommends that one be deleted or that they be combined as necessary into a single condition.

RESPONSE

The Applicant would agree to the CEC recommendation for these conditions.

CEC COMMENT

9. <u>Firewater Pump Engine (S-7616-16-0) Conditions 15 and 16:</u> Conditions 15 and 16 appear to be redundant and staff recommends that one be deleted or that they be combined as necessary into a single condition.

RESPONSE

The Applicant would agree to the CEC recommendation for these conditions.

RESPONSES TO EPA COMMENTS

EPA COMMENT

1. ***<u>Annual Emissions Estimates:</u> Applicable federal requirements include thresholds for defining a major source of criteria pollutant or of hazardous air pollutant (HAP) emissions. For those sources where emission estimates and/or emission limits are relatively close to the federal thresholds, EPA encourages the following: (a) refinement of emissions and compliance demonstration methods that would ensure the thresholds would not be exceeded, and/or (b) a 5-10% buffer between the permitted emission limits and the federal threshold.***

We have identified estimated emissions of certain pollutants that are within a margin of less than 5% of the federal annual threshold limits. These limits include the nonattainment of New Source Review (NSR) threshold of 100 tons per year (tpy) for PM2.5 and the major source of Hazardous Air Pollutant (HAP) thresholds of 10 tpy for a single HAP and 25 tpy for cumulative HAP emissions. If the limits of these pollutants are relaxed, the facility would be subject to the applicable federal requirements; for PM2.5, nonattainment New Source Review would be required, and for HAP emissions, evaluation for case-by-case Maximum Available Control Technology (MACT) would be required. Each is further discussed below.

RESPONSE

The response to CEC Comment 3 above provides further discussion regarding the PM emissions from the cooling towers. HECA is requesting additional time to respond to CEC Comment 2 and EPA Comments 1 through 3 regarding the PM emissions from the turbine. The response to EPA Comment 4 below and the responses submitted to the requests for information that EPA issued in April 2010 provides further discussion of the hazardous air pollutant emissions from the CO_2 vent. These discussions include how compliance will be demonstrated.

EPA COMMENT

***2. PM2.5 Federal Nonattainment New Source Review (NSR) Applicability:** The San Joaquin Valley APCD presents the major source determination for all criteria pollutants on page 62 (Section VII.C.1.) of the engineering evaluation. PM2.5 is estimated at 198,650 pounds per year, or an equivalent of approximately 99.3 tons per year (tpy). As stated by the District in its evaluation, on May 8, 2008 EPA finalized regulations to implement the NSR program for PM2.5. A source that emits or has the potential to emit 100 tpy or more PM2.5 in a non-attainment area is defined as a major stationary source.*

The equipment primarily contributing to PM2.5 emissions includes the combined cycle combustion turbine generator (CTG) and the cooling towers; other equipment emitting PM2.5 includes the feedstock handling and combustion-related sources. The District has assumed that all PM10 estimated emissions from the CTG are PM2.5 emissions. The District has assumed that 60% of the PM10 estimated emissions from the cooling towers are PM2.5. If it is determined that the estimated emissions are not representative of the potential-to-emit (PTE) and equal or exceed 100 tpy, the following would also be required: the lowest achievable emission rate control technology and offsetting of PM2.5 emissions with creditable emission reductions.

Please note that in the event that PM2.5 offsets are required and the project proponent were to consider using SO2 reductions to offset the project's PM2.5 emissions, paragraph IV.G.5 of Part 51, Appendix S currently provides that offset requirements for direct PM2.5 emissions under Appendix S may be satisfied by offsetting reductions of emissions of SO2 only "if such offsets comply with an interprecursor trading hierarchy and ratio approved by the Administrator." Moreover, although the provisions concerning trading ratios for interpollutant trading for PM2.5 emissions and other aspects of EPA's PM2.5 NSR Implementation Rule (73 FR 28321 (May 16, 2008)) are currently subject to reconsideration by the Agency (see 74 FR 26098 (June 1, 2009)), the modeling conducted by EPA in the context of development of those ratios supports a significantly higher PM2.5 to SO2 ratio than the 1:1 ratio used by the District for PM10 to SO2 interpollutant trading.

RESPONSE

For a discussion of the cooling tower PM emissions, please see the response to CEC Comment 3 above. The Applicant is requesting additional time to respond to CEC Comment 2 and EPA Comments 1 through 3 regarding the PM emissions from the turbine.

EPA COMMENT

3. ***Annual Estimates of PM2.5 Emissions and Compliance Demonstration:*** ***As noted above, PM2.5 is estimated at 198,650 pounds per year, or an equivalent of approximately 99.3 tons per year (tpy) for the facility operations. (See Page 61, Table titled "Major Source Determination"; see also Appendix F) The equipment primarily contributing to the PM2.5 emissions estimate include the combined cycle combustion turbine generator (CTG) and the cooling towers. The PDOC indicates that these two sources together contribute an estimated 106.4 tpy of PM10 emissions and 96.8 tpy of PM2.5 emissions. The following highlights our comments regarding CTG and cooling tower PM2.5 emission estimates and the respective compliance demonstration methods.***

- ***Combustion Turbine Generator (S-7616-9-0)*** ***– It is assumed that the PM2.5 emissions from the CTG are equal to the PM10 emissions of 19.8 lbs/hr. EPA supports this assumption. Compliance demonstration for the source testing of PM10 emissions is proposed in Condition 47.***

  However, it is unclear why these estimated emissions are approximately twice what EPA has permitted and/or reviewed for similar CTGs. Given what appears to be additional conservatism in the hourly emissions, EPA requests further discussion in the engineering evaluation regarding the rationale supporting the higher value, as well as consideration of a further reduction of PM10 emission limits based on source test results. For example, has the District considered further reducing the PM10 emission limits presuming source tests demonstrate lower emissions, similar to the approach for NOx, CO and VOC emissions as proposed in Conditions 81-85.

- ***Cooling Towers Emissions (S-7616-4-0, S-7616-11-0, S-7616-2-0)*** ***– For all three cooling tower operations, the applicant estimates estimated that the PM2.5 emissions from the cooling towers are 60% of the PM10 emissions. (Additionally, the applicant estimates assumed that all PM emissions are PM10 emissions.) Compliance demonstration for PM10 emissions from this equipment is based on a calculation methodology. This methodology includes a 0.0005% drift rate (representing BACT) from the cooling tower drift eliminator, a total dissolved solids (TDS) concentration not to exceed 9,000 ppm, annual operations limited to 8,322 hours per year, and cooling water circulation rates specific to each operation. (See pages 43-44 of PDOC engineering evaluation.)***

  The applicant has assumed that the 60% PM2.5 size fraction is likely based on the California Air Resources Board (CARB) database information in its California Emission Inventory Development and Reporting System (CEIDARS). This assumption is based on the applicant's use of information from the South Coast Air Quality Management District (SCAQMD). It is our understanding that the SCAQMD has assumed a 60% size fraction, which is based on a CEIDARS value; however, this CEIDARS value is not specific for cooling towers. Therefore, EPA requests further justification of the size fraction of PM2.5 emissions from the cooling towers and/or additional compliance demonstration requirements. Otherwise, it should be assumed

that PM2.5 emissions from the cooling towers are equal to the estimated PM10 emissions.

With respect to the District's proposed compliance demonstration, it appears that the compliance demonstration options that EPA is considering may differ from the District's proposed requirements. We acknowledge that the District is requiring quarterly sampling of the blowdown water to estimate TDS. EPA understands that site-specific data is necessary to determine the correlation between TDS and particulate matter emissions (i.e., PM, PM10, PM2.5). PM, PM10, and PM2.5 can vary significantly with plant operations and maintenance. Therefore, in order to use a calculation method, as proposed by the District, site-specific data and testing is necessary to demonstrate compliance with the proposed emission limits. EPA is available to discuss this in more detail for the District's consideration.

RESPONSE

For a discussion of the cooling tower PM emissions, please see the response to CEC Comment 3 above. The Applicant is requesting additional time to respond to CEC Comment 2 and EPA Comments 1 through 3 regarding the PM emissions from the turbine.

EPA COMMENT

4. <u>Annual Estimates of HAP Emissions and Compliance Demonstration:</u> Hazardous air pollutant (HAP) emissions are discussed on pages 94-95 of the PDOC engineering evaluation and presented in Appendix I of the PDOC. To remain below the major source MACT threshold, a single HAP must be less than 10 tpy, and the combined HAPs must be less than 25 tpy. Although the HAP emissions section of the PDOC discusses the conduct of testing for speciated HAPs and total VOC source testing for the CTG, the process primarily contributing to the limit of not more than 10 tpy of a single HAP is the intermittent CO2 vent system, which is part of the CO2 recovery and vent system (S-7616-8-0). Operating scenarios for venting are described in the PDOC, pages 30-31.

Carbonyl sulfide emissions (COS) are estimated at 9.9 tpy. This estimate is based on imposing operating limits and therefore appears to be a synthetic area source. As a result, the District must require practically and federally enforceable potential-to-emit limits to assure this process is not emitting at the major source level of 10 tpy.

In order to remain below the 10 tpy threshold, the District has proposed permit conditions based on assumptions presented in the calculation methodology provided by the applicant. COS annual emission estimates are based on a maximum CO2 vent stream flow rate of 656,000 lbs/hr; proposed Condition 6 limits the vent stream flow rate. Furthermore, Condition 10 requires a gas flowmeter for the vent system flow rate, and Condition 11 requires recordkeeping of venting events. EPA understands this flow rate is estimated to be the same for both early and mature operating scenarios.

COS annual emission estimates are also based on operations of the CO2 recovery and vent system of not more than 504 hours per year (or an estimated 21 days per year); proposed Condition 7 limits the annual hours on a rolling 12-month period. Unlike the maximum vent stream flowrate, EPA understands that CO2 venting is expected to be less than one-half (e.g., 5-10 days) during mature operations compared to the early operating scenario.

Because the annual tons per year of HAPs is dependent on the hours of venting, including a method for tracking those hours is critical. The flowmeter or another piece of equipment should track the hours of venting. In addition, it is unclear whether the partial hours of venting, e.g., 30-minutes, 45-minutes, are accounted. Therefore, please provide permit conditions and/or require additional monitoring equipment with associated recordkeeping requirements that will assure an accurate accounting of the total hours of operation.

Also, EPA suggests that the District include a condition that includes a lower number of allowable annual hours upon achieving mature operations to provide additional assurance that HAP emissions will not exceed 9.9 tpy. Additionally, as outlined on pages 30-31, allowable CO2 venting events (associated with Condition 11) and associated recordkeeping should be included as permit conditions.

RESPONSE

The Applicant would accept a condition that tracks the partial hours of venting. The Applicant does not want a change to Condition 7, limiting the annual hours of operation, but would accept a change to Condition 11 to include a condition recording partial hours of operation.

EPA COMMENT

5. ***<u>Federal Requirements for Internal Combustion Engines:</u> Please include a discussion of the applicability of the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines (40 CFR Part 63, Subpart ZZZZ) and of the Standards of Performance for New Stationary Sources (NSPS) for Compression Ignition Internal Combustion Engines (40 CFR 60, Subpart IIII) as they may apply to the diesel fuel-fired emergency generator sets (S-7616-14-0, S-7616-15-0) and firewater pump engine (S-7616-16-0). Based on the applicability determination, EPA suggests that the District incorporate federally enforceable permit conditions to assure compliance with these requirements, as needed.***

RESPONSE

The Applicant would agree to the EPA recommendations for the internal combustion engines.

EPA COMMENT

6. ***Consistency of PDOC Information with PSD Information:* For the purposes of EPA's review of the PDOC evaluation and PDOC, although not required as part of our PSD permit application review and preparation of proposed permit conditions, we are in the process of identifying whether information provided by the Applicant through the PSD permit application process is consistent with the information in the District's evaluation. We would like to ensure that, at a minimum, those data sets and assumptions shared between the PSD and PDOC processes that contribute to the determination of the potential-to-emit, BACT, and assumptions for the air quality analysis/modeling are consistent. At this time, we simply would like to make the District aware that this evaluation is in process. To the extent that we identify inconsistencies during our review, we will address them as part of our PSD permit process.***

RESPONSE

The Applicant has no comment.

EPA COMMENT

7. <u>Equivalent Equipment, Internal Combustion Engines and Auxiliary Boiler:</u> The District has included conditions for this equipment (S-7616-13-0, S-7616-14-0, S-7616-15-0, S-7616-16-0) that allows for the use of equivalent equipment upon written District approval. As stated in the proposed permit conditions, approval is granted upon "...determination that the submitted design and performance of the proposed alternate equipment is equivalent to the specifically authorized equipment." EPA suggests that the District also evaluate the air quality modeled impacts of any proposed equivalent equipment.

RESPONSE

The Applicant would agree to SJVAPCD conducting air quality modeling of equivalent equipment if the emissions or stack parameters vary from that provided in the ATC application.

EPA COMMENT

8. <u>Operating Work Practices and Annual Hours of Operations:</u> EPA requests the following conditions be added for the equipment listed below:

- ***<u>Cooling Towers (S-7616-4-0, S-7616-11-0, S-7616-12-0)</u> – For each equipment, please include an operating limit of 8,322 hours per year, along with any necessary recordkeeping requirements.***

- ***<u>Sulfur Recovery System (S-7616-5-0)</u> – Condition 13 required the incinerator firebox temperature to be maintained above 1,200 deg F. Please include a condition that allows compliance demonstration with the temperature.***

- ***<u>Flares (S-7616-3-0, S-7616-6-0, S-7616-7-0)</u> – Condition 10 of the Rectisol AOR emergency flare (S-7616-7-0) allows operations for emergency situations. The PDOC references that the flare will be limited to 200 hours per year of non-emergency operations. Please include a description of the allowable emergency situations, as well as reference to the non-emergency operations.***

- ***<u>Auxiliary Boiler (S-7616-13-0)</u> – For each equipment, please include an operating limit of 2,190 hours per year, along with any necessary recordkeeping requirements. There is reference to flue gas recirculation in Condition 19. Please propose a permit condition that requires the operator to properly operate and maintain the FGR system, which is part of NOx control for the boiler.***

- ***<u>CO2 Recovery and Vent System (S-7616-8-0)</u> – As previously commented under the annual estimates of HAP emissions, allowable CO2 venting events (associated with Condition 11) and associated recordkeeping should be included as permit conditions. Furthermore, specifics about the monitoring requirements for CO, VOC and H2S in Condition 12 should be detailed. Under Condition 8, please clarify the reference for the ppm concentration limits.***

RESPONSE

The Applicant requests that the annual operating limits for the cooling towers be based on emissions, rather than hours of operation, because these may operate all hours of the year, but at partial capacity for a portion of the time.

The Applicant requests that the auxiliary boiler annual operating limits be based on maximum annual fuel consumption rate of 311 billion British Thermal Units (BTUs) per year, with no annual hours of operation limit.

The CO_2 product stream will likely be continuously measured by gas chromatograph for trace constituents. The Applicant intends to use the equipment provided for this purpose to also verify compliance of trace, regulated emissions, as required, during an upset, infrequent CO_2 venting occurrence.

The three flares are designed to handle emergency upset conditions that could happen at the facility. These events are never expected to occur, but the flares must be designed to safely dispose of the maximum gas stream. The gasification flare is designed to handle the maximum syngas production from two gasifiers that could occur due to a downstream failure event (or events). The sulfur recovery unit flare is designed to handle the unlikely case of both Claus trains failing simultaneously. The Rectisol flare is designed to handle total flow from an unlikely equipment failure event, such as a major failure in the acid gas removal (AGR) unit. The duration of these upset events is difficult to predict although HECA will do everything reasonably possible to correct the problem that has caused unplanned flaring in a timely manner and begin actions to minimize emissions and the amount of gas flared.

The Applicant would agree to the remaining EPA recommended conditions.

BACKGROUND

The cooling tower emission estimate uses what staff believes to be an inappropriate assumption that may underestimate the potential PM2.5 (particulate matter) emissions from the cooling towers. The Applicant uses a factor from a South Coast Air Quality Management District (SCAQMD) website table that indicates only 60 percent of the cooling tower PM10 emissions are PM2.5. This table value assumption comes from the Air Resources Board (ARB) CEIDARS (data base) "unspecified" category that clearly is not specific to cooling towers and has not been technically justified for cooling tower use. Staff believes that, unless the applicant can provide technically justified rationale to lower PM2.5 emissions, it should be conservatively assumed that all particulate from cooling tower drift is PM10 and PM2.5. Staff needs the applicant to revise the cooling tower emission calculations.

DATA REQUEST

18. Please recalculate the cooling tower particulate emissions considering the mist eliminator drift guarantee of 0.0005 percent of recirculating water flow, and assuming that all particulate emissions are both PM10 and PM2.5.

RESPONSE

The factor listed in the SCAQMD guidance indicating that particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) is 60 percent of total particulate matter less than 10 microns in diameter (PM_{10}) (*Updated CEIDARS Table with $PM_{2.5}$ Fractions)* is specified for cooling tower operation and is not specifically mentioned as being based on an "unspecified" category. Table 18-1 is a copy of the SCAQMD table, presented for reference. Furthermore, the Applicant believes that 60 percent is a conservative overestimate of the $PM_{2.5}$ emissions from the cooling towers as discussed below. Therefore, the Applicant wishes to use the 60 percent factor.

In determining PM emissions from cooling towers, the HECA Project conservatively estimated the total PM_{10} emissions by assuming the full concentration of dissolved solids in any exiting water droplets will be converted to airborne PM_{10}, rather than using either the recommended factor provided by the SCAQMD website (PM_{10} emission from cooling towers is 70 percent of the total PM emissions) or the U.S. EPA's AP-42 guidance, which confirms that it is conservative to use the assumption that all dissolved solids in any exiting water droplets will be converted to airborne PM_{10}. Section 13.4.2 of AP-42 states:

> "a conservatively high PM_{10} emission factor can be obtained by multiplying the total liquid drift factor by the total dissolved solids (TDS) fraction in the circulating water and by assuming that, once the water evaporates, all remaining solid particles are within the PM_{10} size range."

Other studies on similar subjects have also suggested that PM_{10} estimates made with the AP-42 assumptions (all particulate emissions is PM_{10}) may exaggerate actual emission rates from cooling towers (Michelleti, 2006). The studies further confirm that the assumption of all particulate emissions is $PM_{2.5}$ is an exaggeration.

For the $PM_{2.5}$ emission estimate, the HECA Project used the CEIDARS factor provided by SCAQMD guidance ($PM_{2.5}$ is 60 percent of total PM_{10}). This assumption is nearly identical to the request to use 100 percent of the PM_{10} as $PM_{2.5}$ if only a 70 percent PM_{10} to total solids factor were used in the initial PM_{10} calculation. For example, if the total solids were calculated to be 10, the PM_{10} would be 7 using the SCAQMD factor, and the $PM_{2.5}$ would be 7 using the approach from this data request. This approach compares well to the $PM_{2.5}$ of 6 using the Applicant's approach. However, both of these approaches are overly conservative, and the Applicant believes that 60 percent is applicable based on the following discussion.

Table 18-1
Updated CEIDARS Table with $PM_{2.5}$ Fractions

Source Classification Code (SCC) Main Category	SCC Subcategory	$PM_{2.5}$ Fraction of Total PM	PM_{10} Fraction of Total PM	$PM_{2.5}$ Fraction of PM_{10}
Asbestos Removal		0.500	0.500	1.000
Asphalt Paving/ Roofing	Fugitive Emissions	0.925	0.960	0.964
	Manufacturing	0.945	0.980	0.964
Burning	Agriculture/Field Crops, Weed Abatement	0.938	0.984	0.954
	Forest Management, Timber and Brush Fire	0.854	0.961	0.889
	Orchard Prunings	0.925	0.981	0.943
	Range Management, Waste Burning	0.932	0.983	0.948
	Unplanned Structural Fires	0.914	0.980	0.933
Cement Manufacturing		0.620	0.920	0.674
Chemical Manufacturing	Fertilizer-Urea	0.950	0.960	0.990
	Organic and Inorganic Chemicals	0.890	0.900	0.989
Coatings, Solvents, Inks And Dyes	Solvent Based	0.925	0.960	0.964
	Water-Based Coating	0.620	0.680	0.912
Consumer Products		0.925	0.960	0.964
Cooking	Baking, Charbroiling, Deep Fat Frying	0.420	0.700	0.600
Cooling Tower		0.420	0.700	0.600
Dry Cleaning		0.925	0.960	0.964
Electroplating	Hexavalent Chrome, Cadmium	1.000	1.000	1.000
	Zinc and Copper	0.925	0.960	0.964
External Combustion	Coal, Coke, Lignite	0.150	0.400	0.375
	Gaseous Fuel-Except Petroleum and Industrial Process Heaters	1.000	1.000	1.000
	Gaseous Fuel – Petroleum and Industrial Process Heater Only	0.930	0.950	0.979
	Liquid Fuel – Except Residual Oil	0.967	0.976	0.991
	Residual Oil – Except Utility Boilers	0.760	0.870	0.874
	Residual Oil – Utility Boilers Only	0.953	0.970	0.982
	Steel Furnace	0.930	0.980	0.949
	Wood/Bark Waste	0.927	0.997	0.930

Table 18-1
Updated CEIDARS Table with $PM_{2.5}$ Fractions (Continued)

Source Classification Code (SCC) Main Category	SCC Subcategory	$PM_{2.5}$ Fraction of Total PM	PM_{10} Fraction of Total PM	$PM_{2.5}$ Fraction of PM_{10}
Fabricated Metals	Abrasive Blasting	0.790	0.860	0.919
	Arc Welding, Oxy Fuel, Copper, Zinc, Bath	0.925	0.960	0.964
Food and Agriculture	Coffee Roasting	0.610	0.620	0.984
	Fermentation, Rendering, Fish and Nut Processing	0.420	0.700	0.600
	Grain Elevators	0.010	0.290	0.034
	Grain Milling, Drying	0.400	0.540	0.741
	Livestock Waste	0.420	0.700	0.600
Fugitive Dust	Agricultural Tilling Dust	0.101	0.454	0.222
	Construction and Demolition	0.102	0.489	0.208
	Landfill Dust	0.102	0.489	0.208
	Livestock Dust	0.055	0.482	0.114
	Paved Road Dust	0.077	0.457	0.169
	Unpaved Road Dust	0.126	0.594	0.212
Fugitive Emissions – Organic and Inorganic	Liquid Fuel Storage/Handling, Loading, Unloading Dispensing	0.925	0.960	0.964
	Natural Gas Production, Crude Oil Production, Petroleum Refining	0.555	0.610	0.910
	Organic and Inorganic Chemcals	0.925	0.960	0.964
	Processing	0.925	0.960	0.964
	Well Cellears, Pumps, Valves, Flages, Seals	0.925	0.960	0.964

Notes:

PM = particulate matter
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter
PM_{10} = particulate matter less than 10 microns in diameter
SCC = Source Classification Code

A U.S. EPA report provided a calculated estimate on the effect of evaporation on droplet size, which presented an equivalent PM size generation as a function of droplet size (U.S. EPA, 1998) (see Figure 18-1 and Attachment 18-1).

Using manufacturer-provided data on mass distribution of drift droplet size for cooling tower drift dispersed from Marley TU10 and TU12 Excel Drift Eliminators, particulate emissions from the HECA Project cooling towers can be calculated as shown in Table 18-2.

Figure 18-1
Particle Size as Function of Droplet Size

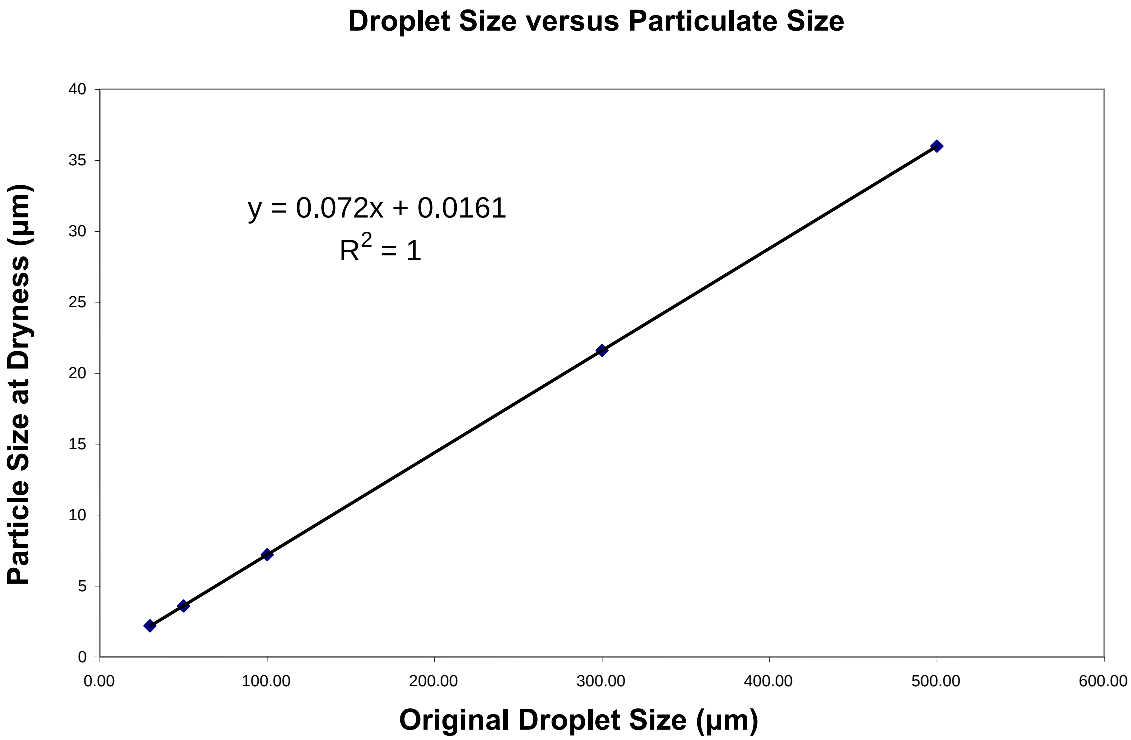


Table 18-2
Cooling Tower Droplet Mass Distribution (U.S. EPA)

Droplet Size (Microns)[1]	Mass Fraction[1]	PM Diameter (Microns)[2]
525	0.2%	37.82
375	1.0%	27.02
230	5.0%	16.58
170	10.0%	12.26
115	20.0%	8.30
65	40.0%	4.70
35	60.0%	2.54
15	80.0%	1.10
10	88.0%	0.74

Notes:

[1] Data provided by Marley for Marley TU10 and TU12 Excel Drift Eliminators. Mass Fraction specifies the fraction of particle with diameter larger than the specified diameter—0.2 percent of the drift will have particle sizes larger than 525 microns.

[2] Correlating particle size at dryness based on the data provided in EPA-450/3-87-010a.

A plot of particle distribution based on the last column of Table 18-2 is shown in Figure 18-2.

As shown in Figure 18-2, $PM_{2.5}$ emissions from cooling tower drift using the U.S. EPA methodology are approximately 40 percent of the total particulate emissions. Figure 18-2 shows that the HECA Project's assumption that $PM_{2.5}$ emissions are 60 percent of the PM_{10} (which was assumed as 100 percent particulates) is indeed conservative.

Another approach to estimating fine particulate emissions from cooling towers based on a representative drift droplet size distribution and TDS in the water was also commonly used (Aull, 1999). This approach was presented at the 94th Annual Air & Waste Management Association's Annual Meeting (June 2001) and presented in the State Water Resources Control Board's Draft Substitute Environmental Document on the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling as an alternative approach to better estimate fine particulate emissions from cooling towers (Reisman, 2001). By assuming that, shortly after being emitted into ambient air, each water droplet was to evaporate into a single, solid, spherical salt (sodium chloride) particle, particulate emissions from the HECA Project cooling towers can be calculated as shown in Table 18-3.

A plot of the last column in Table 18-3 is shown in Figure 18-3.

Using the second approach based on droplet size from the cooling tower manufacturer, and the approach by Aull (1999), $PM_{2.5}$ emissions from cooling towers is approximately 20 percent of the total particulate emission. This approach showed that the HECA Project's assumption that $PM_{2.5}$ emissions are 60 percent of the PM_{10} (which was assumed as 100 percent particulates) is far more conservative than the expected value.

Figure 18-2
Particulate Mass Distribution Curve (U.S. EPA)

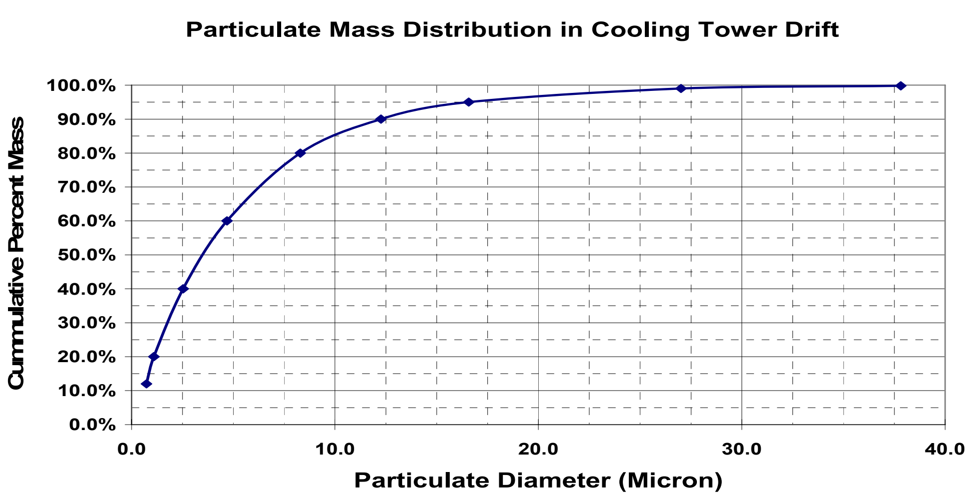


Table 18-3
Cooling Tower Droplet Mass Distribution[1]

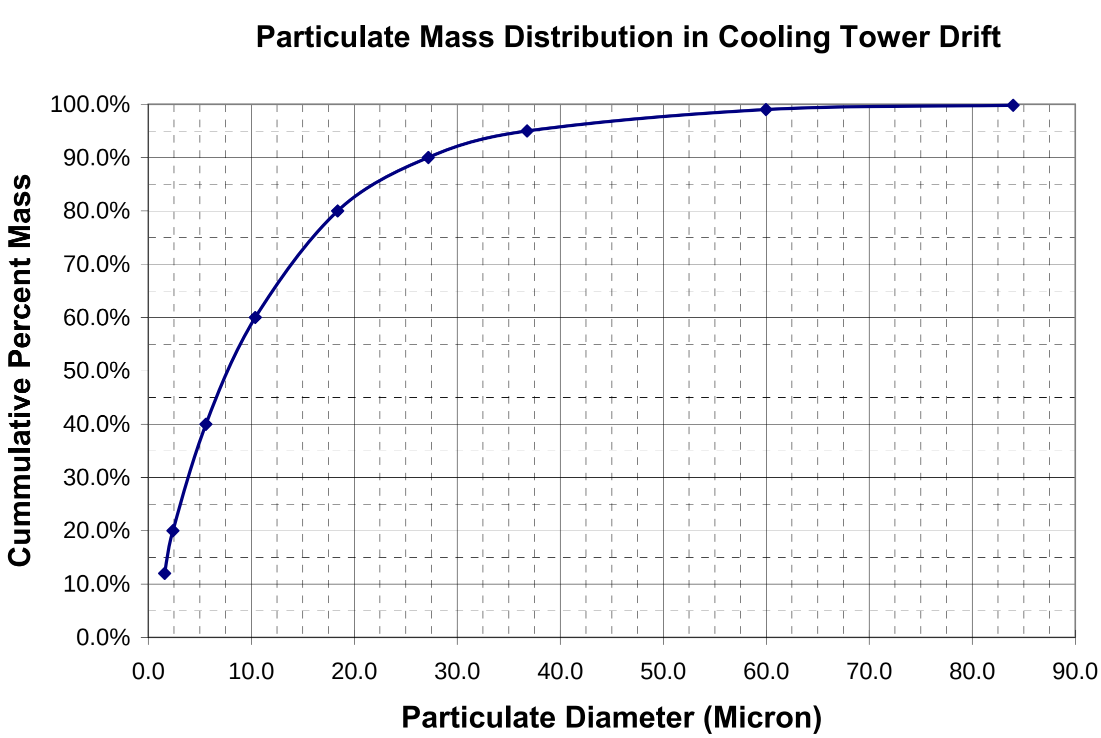
Droplet Size (Microns)[2]	Mass Fraction[2]	PM Diameter (Microns)[1]
525	0.2%	83.97
375	1.0%	59.98
230	5.0%	36.78
170	10.0%	27.19
115	20.0%	18.39
65	40.0%	10.40
35	60.0%	5.60
15	80.0%	2.40
10	88.0%	1.60

Notes:

[1] Correlating particle size at dryness based on the assumption that, shortly after being emitted into ambient air, each water droplet was to evaporate into a single, solid, spherical salt (sodium chloride) particle.

[2] Data provided by Marley for Marley TU10 and TU12 Excel Drift Eliminators. Mass Fraction specifies the fraction of particle with diameter larger than the specified diameter—0.2 percent of the drift will have particle sizes larger than 525 microns.

Figure 18-3 Particulate Mass Distribution Curve



References

Aull, R., 1999. Memorandum from R. Aull, Brentwood Industries, to J. Reisman, Greystone. December 7.

Michelleti, W.C., 2006. "Atmospheric Emissions from Power Plant Cooling Towers." CTI Journal. Vol. 27, No. 1.

Reisman, Joel, and Gordon Frisbie. Calculating Realistic PM_{10} Emissions from Cooling Towers. Greystone Environmental Consultants. *Environmental Progress,* Volume 21, Issue 2.

U.S. EPA, 1998. Chromium Estimate from Comfort Cooling Towers/Background Information for Proposed Standards. Emission Standards Division. EPA-450/3-87-010a.

ATTACHMENT 18-1

TABLE 3-4. EFFECT OF EVAPORATION ON DROPLET SIZE

Original droplet size, µm (mils)	Particle size at dryness, µm (mils)[a]	Droplet size, µm (mils)[b] 80 percent relative humidity	90 percent relative humidity	Solids concentration, ppm[a] 80 percent relative humidity
500 (19.69)	36.0 (1.4)	499.3 (19.66)	499.7 (19.67)	1,004
300 (11.81)	21.6 (0.85)	298.9 (11.77)	299.5 (11.79)	1,007
100 (3.94)	7.2 (0.28)	96.6 (3.80)	98.4 (3.87)	1,109
50 (1.97)	3.6 (0.14)	42.7 (1.68)	46.7 (1.84)	1,605
30 (1.2)	2.2 (0.09)	15.0 (0.59)	24.2 (0.95)	8,000

[a]Assumes total dissolved solids content of droplets is 1,000 µg/ml (0.0624 lb/ft^3) and that the dissolved solids are primarily calcium carbonate (35 percent), magnesium carbonate (48 percent), and sodium carbonate (17 percent). Also assumes that the specific gravity of resulting dry particulate is the same as the weighted average of the specific gravity of the three major components.

[b]Assumes an evaporation time of 3 seconds and 26.7°C (80°F) dry bulb temperature. See Reference 29 for the equation used to calculate the droplet size.

29. Chemical Engineers' Handbook. 3rd Edition. John H. Perry, ed. New York, McGraw-Hill. 1950. p. 806.

Source: USEPA, 1998. Chromium Estimate from Comfort Cooling Towers- Background Information for Proposed Standards – Emission Standards Division. EPA-450/3-87-010a.

Appendix E-5

Offsite Operational Transportation Emissions

Hydrogen Energy California LLC *4/16/2012*
HECA Project

Area	Attainment Status	Emission Source	CO	NOx	PM10	PM2.5	SO2	VOC
			Annual Emission Rates (tons/yr)					
SJVAPCD (San Joaquin Valley)	Ozone Nonattainment - Extreme PM2.5 Nonattainment	Offsite Train	25.39	93.08	1.69	1.64	1.53	5.35
		Offsite Truck	9.96	8.71	2.39	0.72	0.06	0.74
		Offsite Workers Commuting	4.17	0.48	1.05	0.28	0.01	0.13
		Onsite Train	1.09	2.65	0.05	0.05	0.06	0.28
		Onsite Truck	0.63	0.99	0.15	0.05	0.01	0.16
		Total Emission (ton/yr)	**41.23**	**105.90**	**5.33**	**2.74**	**1.67**	**6.65**
		Conformity De minimis (ton/yr)	**100**	**10**	**NA**	**100**	**NA**	**10**
		Less than De minimis?	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**
SCAQMD (South Coast)	Ozone Nonattainment - Extreme PM10 Nonattainment - Serious PM2.5 Nonattainment CO Nonattainment - Serious	Offsite Train	0.00	0.00	0.00	0.00	0.00	0.00
		Offsite Truck	7.80	6.82	1.87	0.56	0.05	0.58
		Total Emission (ton/yr)	**7.80**	**6.82**	**1.87**	**0.56**	**0.05**	**0.58**
		Conformity De minimis (ton/yr)	**100**	**10**	**70**	**100**	**NA**	**10**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
EKAPCD (East Kern County)	Ozone Nonattainment (Former Subpart 1) PM10 Nonattainment - Serious	Offsite Train	12.16	44.57	0.81	0.79	0.73	2.56
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**12.16**	**44.57**	**0.81**	**0.79**	**0.73**	**2.56**
		Conformity De minimis (ton/yr)	**NA**	**100**	**70**	**NA**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
MDAQMD (Mojave Desert)	Ozone Nonattainment - Moderate (San Bernardino County): approximately 75% of the total distance across of MDAQMD PM10 Nonattainment - Moderate (San Bernardino County)	Offsite Train	24.94	70.01	1.66	1.61	1.50	4.02
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**24.94**	**70.01**	**1.66**	**1.61**	**1.50**	**4.02**
		Conformity De minimis (ton/yr)	**NA**	**100**	**100**	**NA**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Sacramento Metro	Ozone Nonattainment - Serious PM10 Nonattainment - Moderate (Sacramento County) PM2.5 Nonattainment	Offsite Train	1.72	6.29	0.11	0.11	0.10	0.36
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**1.72**	**6.29**	**0.11**	**0.11**	**0.10**	**0.36**
		Conformity De minimis (ton/yr)	**NA**	**50**	**100**	**100**	**NA**	**50**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Yuba City-Marysville	Ozone Nonattainment - Former Subpart 1 (Sutter County) PM2.5 Nonattainment	Offsite Train	1.07	3.93	0.07	0.07	0.06	0.23
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**1.07**	**3.93**	**0.07**	**0.07**	**0.06**	**0.23**
		Conformity De minimis (ton/yr)	**NA**	**100**	**NA**	**100**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Chico	Ozone Nonattainment - Former Subpart 1 (Sutter County) PM2.5 Nonattainment	Offsite Train	1.07	3.93	0.07	0.07	0.06	0.23
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**1.07**	**3.93**	**0.07**	**0.07**	**0.06**	**0.23**
		Conformity De minimis (ton/yr)	**NA**	**100**	**NA**	**100**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Arizona	Ozone Nonattainment (Former Subpart 1) (Maricopa Co, Pinal Co) PM10 Nonattainment (Moderate or Serious) (10 counties) PM2.5 Nonattainment (Santa Cruz and Pinal Counties) SO2 Nonattainment (Pinal county) CO Nonattainment (Phoenix and Tucson, AZ. Maricopa and Pima Counties)	Offsite Train	31.16	57.13	3.78	0.20	1.88	3.28
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**31.16**	**57.13**	**3.78**	**0.20**	**1.88**	**3.28**
		Conformity De minimis (ton/yr)	**100**	**100**	**70**	**100**	**100**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

New Mexico	PM10 Nonattainment - Moderate (Dona Ana County) CO Nonattainment - Moderate (Bernalillo County)	Offsite Train	24.15	88.56	1.61	1.56	1.46	5.09
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**24.15**	**88.56**	**1.61**	**1.56**	**1.46**	**5.09**
		Conformity De minimis (ton/yr)	**100**	**NA**	**100**	**NA**	**NA**	**NA**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Notes:
Onsite worker travel and associated emissions are negligible
SJVAPCD - Carbon Monoxide - Not Classified (Bakersfield, CA, Kern County)
MDAQMD - PM2.5 Unclassified/Attainment (Federal), PM2.5 Non-ttainment (State)
MDAQMD - Approximately 75% of the train route (distance) within MDAQMD is ozone nonattainment area while all MDAQMD is PM10 nonattainment area.

Annual Number of Train Cars (incoming/outgoing)

	Coal Cars (incoming)	Liquid Sulfur Cars (outgoing)	Gasification Cars (outgoing)	Ammonia Cars (outgoing)	Urea Cars (outgoing)	UAN Cars (outgoing)	Maximum Total Trains per period
Annual average number of train cars	13034	83	2800	357	1795	1983	20051

		Line-Haul Engine for Product Trains				
	Line-Haul Engine for Coal Train	Liquid Sulfur	Gasification	Ammonia	Urea	UAN
ton-mile/gallon	480	480	480	480	480	480
Train car capacity (ton)	117	100	100	117	117	117
Unloaded train car weight (ton)	25	25	25	25	25	25

480 ton-mile/gallon is based on 2009 *class I rail freight fuel consumption and travel* data (Association of American Railroads, *Railroad Facts*)

	Coal Trains			Liquid Sulfur Product Train			Gasification Solid Product Train		
Area	Miles traveled per Train (mile/engine) - One Way *	Coal Train (ton-miles/year) - Round Trip	Fuel Use for Coal Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip
SJVAPCD	63	137,132,692	285,683	150	1,856,250	3,867	63	26,460,000	55,123
EKAPCD	62	134,955,983	281,148		0	0	83	34,852,294	72,606
MDAQMD (PM10 nonattainment and total distance)	150	326,506,410	680,198		0	0	52	21,847,706	45,514
MDAQMD (Ozone nonattainment)	113	244,879,808	510,148		0	0		0	0
Arizona (PM10 nonattainment and total distance)	364	792,322,222	1,650,613		0	0		0	0
Arizona (PM2.5 nonattainment)	20	43,534,188	90,693		0	0		0	0
Arizona (Ozone nonattainment)	100	217,670,940	453,465		0	0		0	0
Arizona (SO2 and CO nonattainment)	200	435,341,880	906,930		0	0		0	0
New Mexico	155	337,389,957	702,871		0	0		0	0

* Since exact route of coal train was not determined yet, It was assumed that the coal train would travel across the maximum distance of the nonattainment area for all pollutants in Arizona.

	Ammonia Product Train			Urea Product Train			UAN Product Train		
Area	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip
SJVAPCD	264	15,732,256	32,774	287	86,026,410	179,215	264	87,422,359	182,123
Sacramento Metro		0	0	80	23,979,487	49,956		0	0
Yuba City-Marysville		0	0	50	14,987,179	31,222		0	0
Chico		0	0	50	14,987,179	31,222		0	0
Other Area in California and Oregon/Washington		0	0	161	48,258,718	100,535		0	0

	Line-Haul Emission Factors	**CO**	**NOx**	**PM10**	**PM2.5**	**SO2**	**VOC**
	Tier 3 Emission Factor (g/bhp-hr)	1.50	5.50	0.10	0.10	0.09	0.32
	Tier 3 Emission Factor (g/gal)	31.20	114.40	2.08	2.02	1.88	6.57

Annual Emission Rates Using ton-mile/gallon factor

Area		CO	NOx	PM10	PM2.5	SO2	VOC
		Annual Emission Rates (tons/year) all trains					
SJVAPCD (San Joaquin Valley), CA	Line-haul coal engines	9.82	35.99	0.65	0.63	0.59	2.07
	Line-haul liquid sulfur product engines	0.13	0.49	0.01	0.01	0.01	0.03
	Line-haul gasification product engines	1.89	6.95	0.13	0.12	0.11	0.40
	Line-haul ammonia product engines	1.13	4.13	0.08	0.07	0.07	0.24
	Line-haul urea product engines	6.16	22.58	0.41	0.40	0.37	1.30
	Line-haul UAN product engines	6.26	22.95	0.42	0.40	0.38	1.32
	Total Trains (ton/yr)	**25.39**	**93.08**	**1.69**	**1.64**	**1.53**	**5.35**
EKAPCD (East Kern County), CA	Line-haul coal engines	9.66	35.42	0.64	0.62	0.58	2.03
	Line-haul gasification product engines	2.49	9.15	0.17	0.16	0.15	0.53
	Total Trains (ton/yr)	**12.16**	**44.57**	**0.81**	**0.79**	**0.73**	**2.56**
MDAQMD (Mojave Desert), CA	Line-haul coal engines	23.37	64.27	1.56	1.51	1.41	3.69
	Line-haul gasification product engines	1.56	5.73	0.10	0.10	0.09	0.33
	Total Trains (ton/yr)	**24.94**	**70.01**	**1.66**	**1.61**	**1.50**	**4.02**
Sacramento Metro, CA	Line-haul urea product engines	1.72	6.29	0.11	0.11	0.10	0.36
	Total Trains (ton/yr)	**1.72**	**6.29**	**0.11**	**0.11**	**0.10**	**0.36**
Yuba City-Marysville, CA	Line-haul urea product engines	1.07	3.93	0.07	0.07	0.06	0.23
	Total Trains (ton/yr)	**1.07**	**3.93**	**0.07**	**0.07**	**0.06**	**0.23**
Chico, CA	Line-haul urea product engines	1.07	3.93	0.07	0.07	0.06	0.23
	Total Trains (ton/yr)	**1.07**	**3.93**	**0.07**	**0.07**	**0.06**	**0.23**
Other Area in California and	Line-haul urea product engines	3.45	12.67	0.23	0.22	0.21	0.73
Oregon/Washington	**Total Trains (ton/yr)**	**3.45**	**12.67**	**0.23**	**0.22**	**0.21**	**0.73**
Arizona	Line-haul coal engines	31.16	57.13	3.78	0.20	1.88	3.28
	Total Trains (ton/yr)	**31.16**	**57.13**	**3.78**	**0.20**	**1.88**	**3.28**
New Mexico	Line-haul coal engines	24.15	88.56	1.61	1.56	1.46	5.09
	Total Trains (ton/yr)	**24.15**	**88.56**	**1.61**	**1.56**	**1.46**	**5.09**

Emission Factors

40 CFR Part 1033

Table 1 to §1033.101—Line-Haul Locomotive Emission Standards

Year of original manufacture	Tier of standards	Standards (g/bhp-hr)			
		CO	NO_X	PM	HC
1973–1992	Tier 0	5	8	0.22	1
1993–2004	Tier 1	2.2	7.4	0.22	0.55
2005–2011	Tier 2	1.5	5.5	0.10	0.3
2012–2014	Tier 3	1.5	5.5	0.10	0.3
2015 or later	Tier 4	1.5	1.3	0.03	0.14

Reference: 40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards

Emission Factors For all Locomotives			
SOx (3)	CO_2	CH_4 (4)	N_2O (4)
g/gal	g/gal	g/gal	g/gal
1.88	10217	0.80	0.26

Locomotive Application	Conversion Factor (bhp-hr/gal)
Large Line-haul & Passenger	20.8
Small Line-haul	18.2
Switching	15.2

Note:

(1) EPA's Technical Highlights: Emission Factors for Locomotives, 2009 (http://www.epa.gov/nonroad/locomotv/420f09025.pdf).

(2) Line-haul engine emissions of CO, Nox, PM, and HC are based on EPA Tier 3.

(3) Based on 300 ppm sulfur diesel fuel.

(4) CH_4 and N_2O factors are derived from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Stationary Combustion by Sector and Fuel Type).

VOC emissions can be assumed to be equal to 1.053 times the HC emissions

(5) $PM_{2.5}$ Fraction of PM_{10}, = 0.97

(6) No off-site switching or idling was assumed for train transportation.

Summary of Truck Emissions - HECA

4/16/2012

Calculations for Trucks Operation Modeling

Data Supplied By Client							
Parameter	Coke and Coal Trucks (Max @ 50 or 60 mph)	Liquid Sulfur Product Trucks (Max @ 50 or 60 mph)	Gasification Product Trucks (Max @ 50 or 60 mph)	Ammonia Product Trucks (Max @ 50 or 60 mph)	Urea Product Trucks (Max @ 50 or 60 mph)	UAN Sulfur Product Trucks (Max @ 50 or 60 mph)	Equipment and Miscellaneous Trucks (Max @ 50 or 60 mph)
	Running Emissions	Running Emissions					Running Emissions
Distance traveled per truck in SJVAPCD (mi)	104	104	160	80	80	80	80
Distance traveled per truck in SCAQMD (mi)	176	180	0	0	0	0	0
Maximum number of trucks or loads:							
Annual average trucks or loads	15,200	990	2,800	5,010	2,800	9,280	1,818

No off-site idling was assumed for truck transportation.
Distance traveled per truck is based on round-trip.

EMFAC2007 Emission Factors + Fugitive Dust (g/mi) For Truck Model year 2010, Scenario year 2015

Pollutant	Coke and Coal Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Liquid Sulfur Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Gasification Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Ammonia Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Urea Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	UAN Sulfur Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Equipment and Miscellaneous Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)
CO	2.48	2.48	2.48	2.48	2.48	2.48	2.48
NOx	2.17	2.17	2.17	2.17	2.17	2.17	2.17
ROG	0.18	0.18	0.18	0.18	0.18	0.18	0.18
SOx	0.02	0.02	0.02	0.02	0.02	0.02	0.02
PM10 *	0.60	0.60	0.60	0.60	0.60	0.60	0.60
PM2.5 *	0.18	0.18	0.18	0.18	0.18	0.18	0.18

EMFAC2007 is the approved federal model for vehicle combustion emissions
* PM10 and PM2.5 includes fugitive dust factor for paved roads obtained from AP-42 Ch. 13 plus PM factors from EMFAC 2007
PM factors from EMFAC = combustion exhaust + tire wear + break wear
The maximum emission factor from either truck speed at 50 mph or 60 mph was used.
Most California highways have speed limits of 60 or 70 mph and large trucks travel more slowly than the speed limit.

Annual Emission Rates for AERMOD (ton/yr) all trucks

Pollutant	Coke and Coal Trucks (Max @ 50 or 60 mph) Running Emissions	Liquid Sulfur Product Trucks (Max @ 50 or 60 Running Emissions	Gasification Product Trucks (Max @ 50 or 60 Running Emissions	Ammonia Product Trucks (Max @ 50 or 60 mph) Running Emissions	Urea Product Trucks (Max @ 50 or 60 mph) Running Emissions	UAN Sulfur Product Trucks (Max @ 50 or 60 mph) Running Emissions	Equipment and Miscelleneous Trucks (Max Running Emissions	Total Truck Emission Rates (tons/yr)
SJVAPCD (San Joaquin Valley)								
CO	4.32	0.28	1.22	1.10	0.61	2.03	0.40	**9.96**
NOx	3.78	0.25	1.07	0.96	0.54	1.77	0.35	**8.71**
ROG	0.32	0.02	0.09	0.08	0.05	0.15	0.03	**0.74**
SOx	0.03	0.00	0.01	0.01	0.00	0.01	0.00	**0.06**
PM10	1.04	0.07	0.29	0.26	0.15	0.49	0.10	**2.39**
PM2.5	0.31	0.02	0.09	0.08	0.04	0.15	0.03	**0.72**
SCAQMD (South Coast)								
CO	7.31	0.49	0.00	0.00	0.00	0.00	0.00	**7.80**
NOx	6.39	0.43	0.00	0.00	0.00	0.00	0.00	**6.82**
ROG	0.54	0.04	0.00	0.00	0.00	0.00	0.00	**0.58**
SOx	0.05	0.00	0.00	0.00	0.00	0.00	0.00	**0.05**
PM10	1.76	0.12	0.00	0.00	0.00	0.00	0.00	**1.87**
PM2.5	0.53	0.04	0.00	0.00	0.00	0.00	0.00	**0.56**

Summary of Worker Commute Vehicle Emissions - HECA

4/16/2012

Calculations for Worker Commute Vehicle Operation Modeling

OFFSITE - 50 MPH								EF (g/mile)					
Onroad Vehicle	Fuel Type	Vehicle Type	Total Number of Workers per day	Daily Vehicle Count	Round Trip Distance (miles/vehicle/day)	Trips per day	VMT (Annual)	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	TOC
Personal Commuting Vehicles	G/D	LDA/ LDT	200	154	40.0	1	2,246,154	1.6825	0.1930	0.4234	0.1134	3.50E-03	0.0540

Assumptions:

Assumed average distance traveled off site for all employees commuting will be 20 miles

times 2 for return trip = 40 miles

365 days per year

Number of workers per commuter vehicle = 1.3

EMFAC2007 emissions are for fleet mix years 1971-2015 travelling at 50 mph.

Area	Description	CO	NOx	PM10	PM2.5	SO2	VOC
		Annual Emission Rates (tons/year) all worker commute vehicles					
SJVAPCD (San Joaquin Valley), CA	Personal Commuting Vehicles	4.17	0.48	1.05	0.28	0.01	0.13

Fugitive dust on Paved Road - HECA

4/16/2012

AP 42 13.2.1 Paved Roads, updated January 2011

For a daily basis,

E = [k (sL)^0.91 x (W)^1.02](1-P/4N) (2)

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period
W = average weight (tons) of vehicles traveling the road
k = particle size multiplier for particle size range and units of interest
sL = road surface silt loading (g/m^2)

	k
	g/VMT
PM2.5	0.25
PM10	1.00

Table 13.2.1-1
PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Fleet mix on highway

W=	9.1	tons, average
sL=	0.031	g/m2 Default value from URBEMIS 9.2 for Kern County
P=	36	days/year Buttonwillow Station 1940-2011, WRCC

E=

0.09836 g/VMT PM2.5
0.39344 g/VMT PM10

Vehicle weight (tons)		fraction of each vehicle type
1.6	passenger vehicles	0.75
40	large trucks	0.18
9	2-4 axle trucks	0.07

9.1 weighted average for all vehicles (ton)

On I-5 near the Project, 75% of all vehicles are passenger vehicles,
of the remaining vehicle, 73% are 5-axle trucks and the remainder are 2-4 axle trucks.
From information provided by California Department of Transportation for the traffic analysis.

Summary of Transportation Vehicles and Routes

16-Apr-2012

Commodity Handled	Petcoke	Coal	Liquid Sulfur	Gasification	Ammonia	Urea	UAN	Equipment	Miscellaneous
Expected plant operation									
Expected plant operation is 8000 hours / year									
The plant will operate 24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day
The plant will operate 333 days / year	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr
Shipment by trucks	100 %	0 %	75 %	25 %	75 %	25 %	50 %	100 %	100 %
Shipment by train	0 %	100 %	25 %	75 %	25 %	75 %	50 %	0 %	0 %
Production rate									
Required Normal Flow / day	1,140 tons / day	4,580 tons / day	100 tons / day	839 tons / day	500 tons / day	833 tons / day	1,392 tons / day		
Required Normal Flow / year	380,000 tons / yr	1,525,000 tons / yr	33,000 tons / yr	280,000 tons / yr	167,000 tons / yr	280,000 tons / yr	464,000 tons / yr		
Required Maximum Flow day	1,368 tons / day (3)	6,107 tons / day (4)	200 tons / day (5)	1,678 tons / day (6)	1,000 tons / day (6)	1,666 tons / day (6)	2,784 tons / day (6)		
Truck Shipments									
Truck Capacity	25 tons / truck		25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck
Required trucks loads for normal operation / day	46 trucks / day		4 trucks / day	8 trucks / day	15 trucks / day	8 trucks / day	28 trucks / day	2 trucks / day	3 trucks / day
Required trucks loads for normal operation / yr	15,200 truck / yr		990 truck / yr	2,800 truck / yr	5,010 truck / yr	2,800 truck / yr	9,280 truck / yr		
Required trucks loads for maximum operation /day	55 trucks / day		8 trucks / day	17 trucks / day	30 trucks / day	17 trucks / day	56 trucks / day		
Train Shipments									
Railcar Capacity		117 tons / car	100 tons / car	100 tons / car	117 tons / car	117 tons / car	117 tons / car		
Assume a train has 13,000 ton capacity									
Required railcars for normal operation / day		39 cars / day	0.25 cars / day	6 cars / day	1 cars / day	5 cars / day	6 cars / day		
Required railcar loads for normal operation / yr		13,034 cars / yr	83 cars / yr	2,800 cars / yr	357 cars / yr	1,795 cars / yr	1,983 cars / yr		
Required railcars for maximum operation / day		200 cars / day	1 cars / day	16 cars / day	2 cars / day	11 cars / day	12 cars / day		
Basis	- 91% availability - 25% petcoke (heat input) - 25 ton/truck - 7 days/week receiving - 25% excess truck	- 91% availability - 75% coal (heat input) per - 117 tons/car - 100% coal for maximum - Rack sized to handle two	- 91% availability - High sulfur case - 100 - 25 ton/truck - Weekdays only - Can only move up to 25% of	- 91% availability - 75% coal max annual - 100% capable by rail - 25% capable by truck - Maximun is double the daily	- 91% availability - 500 t/d NH3 sales - 75% by truck - Ability to ship 7500 tons ove	- 91% availability - 75% by rail -empty 45 day storage in 10	- 91% availability - 75% by rail -empty 45 day storage in 10		

Summary of Transportation Vehicles and Routes

16-Apr-2012

Traffic route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route
Destination/Origin	Carson Refinery	None	California Sulfur	Various	Various	Various	Various	Various	Various
Address	1801 E Sepulveda, Carson		2509 E Grant Street, Wilmington						
Distance	140 Miles		142 Miles	80 Mile radius	40 mile radius	40 mile radius	40 mile ratius	40 mile ratius	40 mile ratius
Route	Alameda 405 Fwy 5 Fwy Stockdale hwy Morris Road Station Road Station Road		Grant Henry Ford Alameda 405 Fwy 5 Fwy Stockdale hwy Morris Road Station Road	40 mile radius Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	5 fwy Stockdale Hwy Dairy Road	5 fwy Stockdale Hwy Dairy Road
	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route
Destination/Origin	None	Elk Ranch New Mexico	In SJVAPCD	CEMEX, Victorville	Calamco	Oregon/Washington	Calamco	None	None
Address					Port Rd G15, Stockton, CA		Port Rd G15, Stockton, CA		
Distance		794 miles		198 miles	264 miles	628 Miles	264 miles		
Route		Kern County: 132.2 miles (County Line near Boron, CA to north pro Mine to Boron, CA: 662 miles Total Distance: 794.2 miles		SJVR/BNSF	SJVR/UPRR	SJVR/UPRR			

Notes

1) Equipment Maintenance Trucks are considered to be 2% of the total trucks per day for the feed and product operation.
2) Miscellaneous trucks are considered to be 3% of the total trucks per day for the feed and product operation.
3) The maximum flow rate of coke is ratioed up from the normal flow rate at 25% to 30% of feed
4) The maximum flow rate of coal is ratioed up from the normal flow rate at 75% to 100% of feed
5) The maximum flow rate of sulfur is 2 times the normal production
6) The maximum flow rate of these commodities is 2 times the normal production
7) The sources of flow data used in the Production Rate calculation were based on the flow rates provided in "Conference Note: Rail and Truck Traffic - Planning Session" and the "FertilizerProductMovement Update", 01-25-12.

Appendix E-6

Operational Greenhouse Gas Emissions

Appendix E-6
Hydrogen Energy California LLC
HECA Project
Operational Greenhouse Gas Emissions
April 26, 2012

HECA Maximum Annual CO2e Emissions

Source	Permitted CO2e Emissions (tonne/year)
CTG/HRSG Hydrogen-Rich Fuel and PSA Off-gas	269,153
CTG/HRSG Natural Gas	44,772
CO_2 Vent	174,113
SF_6 Circuit breakers	86
Flares	8,257
Thermal Oxidizer	5,946
Emergency generators and fire pump	181
Auxiliary boiler	24,782
Ammonia Synthesis Plant Startup Heater	409
Urea Absorber Vents	116
Nitric Acid Unit	7,426
Fugitives	35
Total CO2e Annual Emissions	**535,278**

Notes:

Maximum permitted emissions include periods of startup and shutdown.

HECA Annual CO2e Emissions for SB1368 Emission Performance Standard

Operating Parameters	Early Operations (Maximum Permitted)	Mature Operations	Expected Mature Syngas Operations
Natural Gas Operation, hours per year	351	351	15
Hydrogen-rich Fuel Operation, hours per year	8,108	8,108	8,108
Intermittent CO_2 Venting, hours per year	504	120	0
Electricity Generated, MWh	2,699,860	2,699,860	2,599,060
Source	**CO2e Emissions (Metric Ton/year)**		
CTG/HRSG Hydrogen-Rich Fuel and PSA Off-gas	269,153	269,153	269,153
CTG/HRSG Natural Gas	44,772	44,772	1,913
CO_2 Vent	174,113	41,456	0
SF_6 Circuit breakers	86	86	86
Flares, thermal oxidizer, emergency engines, aux boiler	0	0	0
Manufacturing Complex	0	0	0
Fugitives	35	35	35
Total CO2e Annual Emissions	**488,160**	**355,502**	**271,187**
CO2e lb/MWh	398.5	290.2	230.0

Notes:

Early operations Maximum permitted emissions include 2 periods of start-up and shut-down, natural gas use in the CTG and 504 hours of CO2 venting.

Mature operations emissions include 2 periods of start-up and shut-down, natural gas use in the CTG and 120 hours of CO2 venting.

During expected mature operation, the CTG and duct burners will fire only hydrogen-rich fuel and PSA off-gas, it includes 2 startups and shutdown (which includes natural gas), but no natural gas backup use and no CO2 venting.

The fugitive CO_2 emissions are from all process areas, therefore overestimate the emissions from the sequestration process.

Power Production

Hydrogen-rich Fuel Operation		
Net Power Exported	267	MW
Fertilizer Production Power	58	MW
Steam Produced by Fertilizer Production	-5	MW
Net Power	**320**	MW
Natural Gas Operation		
Net Power Exported	**300**	MW

SB1368

Emission caclulation

Emissions include annual carbon dioxide emissions from each fuel used in any component directly involved in electricity production associated with the sequestration of the CO2.

Emissions from electricity production come from the CTG/HRSG and coal dryer when burning syngas, PSA off-gas and natural gas and SF6 from Circuit breakers.

Emissions associated with the CO2 sequestration include CO2 vent and fugitives from CO2 preparation for sequestration.

The SB1368 emission calculations do not include emissions associated with the gasification block (flares, thermal oxidizer), fertilizer complex (Ammonia Synthesis Plant Startup Heater, Urea Absorbers, nitric acid unit), auxiliary boiler, emergency generators, fire pump, and vehicles.

MW caclulation

The net electricity production includes the net power exported plus the power used onsite for fertilizer production minus the steam generated from the ammonia production unit.

The net power exported justification is provided in Section 2, Project Description.

Hydrogen Energy California LLC *4/11/2012*
HECA Project

GHG emissions are numerically depicted as metric tons (tonne) of carbon dioxide equivalents (CO_2e). CO_2e represents CO_2 plus the additional warming potential from CH_4 and N_2O. CH_4 and N_2O have 21 and 310 times the warming potential of CO_2, respectively.

Natural Gas GHG Emission Factors

CO_2 =	53.06	kg/MMBtu =	116.98	lb/MMBtu
CH_4 =	0.001	kg/MMBtu =	0.002	lb/MMBtu
N_2O =	0.0001	kg/MMBtu =	0.00022	lb/MMBtu

Diesel GHG Emission Factors

CO_2 =	10.15	kg/gal =	22.38	lb/gal
CH_4 =	0.0004	kg/gal =	0.001	lb/gal
N_2O =	0.0001	kg/gal =	0.0002	lb/gal

CO_2, CH_4, and N_2O emission factors are taken from Appendix C of the California Climate Action Registry (CCAR) General Reporting Protocol Version 3.1 (Jan 2009)

Turbine - Burning Hydrogen-Rich Fuel - released to HRSG and Coal Dryer Stacks

Operating Hours	8108	hr/yr				
Heat Input (HHV)	2,537	MMBtu/hr				
CO_2 =	165,200	tonne/yr				
CH_4 =	291	tonne/yr =	6,116	tonne CO_2e/yr		
N_2O =	2.06	tonne/yr =	638	tonne CO_2e/yr	Total tonne CO_2e/yr =	171,953

Syngas GHG Emission Factors		
CO_2 =	17.7	lb/MMBtu
CH_4 =	0.03	lb/MMBtu

HRSG heat input rate is based Case 5, average ambient temperature and peak load.

Operating hours include startup and shutdown operations

Although N2O emissions are expected to be lower than from the combustion of natural gas, N2O emissions were conservatively estimated using the natural gas emission factor.

Duct burner - Burning Hydrogen-Rich Fuel - released to HRSG and Coal Dryer Stacks

Operating Hours	8000	hr/yr				
Heat Input (HHV)	165	MMBtu/hr				
CO_2 =	10,603	tonne/yr				
CH_4 =	19	tonne/yr =	393	tonne CO_2e/yr		
N_2O =	0.13	tonne/yr =	41	tonne CO_2e/yr	Total tonne CO_2e/yr =	11,036

Syngas GHG Emission Factors		
CO_2 =	17.7	lb/MMBtu
CH_4 =	0.03	lb/MMBtu

Duct burner heat input rate is based Case 5, average ambient temperature and peak load.

Duct burner not operated during turbine startup and shutdown

Although N2O emissions are expected to be lower than from the combustion of natural gas, N2O emissions were conservatively estimated using the natural gas emission factor.

Duct burner - Burning PSA Offgas - released to HRSG and Coal Dryer Stacks

Operating Hours	8,000	hr/yr				
Heat Input (HHV)	149	MMBtu/hr				
CO_2 =	83,053	tonne/yr				
CH_4 =	146	tonne/yr =	3,073	tonne CO_2e/yr		
N_2O =	0.12	tonne/yr =	37	tonne CO_2e/yr	Total tonne CO_2e/yr =	86,163

Syngas GHG Emission Factors		
CO_2 =	153.6	lb/MMBtu
CH_4 =	0.3	lb/MMBtu

Duct burner heat input rate is based Case 5, average ambient temperature and peak load.

Duct burner not operated during turbine startup and shutdown

Although N2O emissions are expected to be lower than from the combustion of natural gas, N2O emissions were conservatively estimated using the natural gas emission factor.

Turbine - Burning Natural Gas - released to HRSG Stack

Operating Hours	351	hr/yr				
Heat Input (HHV)	2,401	MMBtu/hr				
CO_2 =	44,729	tonne/yr				
CH_4 =	0.84	tonne/yr =	18	tonne CO_2e/yr		
N_2O =	0.08	tonne/yr =	26	tonne CO_2e/yr	Total tonne CO_2e/yr =	44,772

HRSG heat input rate is assumed to be the maximum heat input rate firing natural gas. Hours of operation include startup and shutdown.

Auxiliary Boiler

Operating Hours	2,190	hr/yr				
Heat Input	213	MMBtu/hr				
CO_2 =	24,758	tonne/yr				
CH_4 =	0	tonne/yr =	10	tonne CO_2e/yr		
N_2O =	0.05	tonne/yr =	14	tonne CO_2e/yr	Total tonne CO_2e/yr =	24,782

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Emergency Generators (2)

Operating Hours		50	hr/yr			
Heat Input		2,922	Bhp			
CO_2 =	3,341	lb/hr =	76	tonne CO_2/yr		
CH_4 =	0.13	lb/hr =	0.063	tonne CO_2e/yr		
N_2O =	0.03	lb/hr =	0.2315	tonne CO_2e/yr	Total tonne CO_2e/yr* =	152

The following conversions were used to convert from lb/gallon to lb/hp-hour; and then multiplying by the rated horsepower rating: 1 gallon/137,000 Btu; and 7,000 Btu/hp-hour.

* Total tonnes CO_2e per year represent the contributions from both generators.

Fire Water Pump

Operating Hours		100	hr/yr			
Heat Input		556	Bhp			
CO_2 =	636	lb/hr =	29	tonne CO_2/yr		
CH_4 =	0.03	lb/hr =	0.024	tonne CO_2e/yr		
N_2O =	0.01	lb/hr =	0.0881	tonne CO_2e/yr	Total tonne CO_2e/yr =	29

The following conversions were used to convert from lb/gallon to lb/hp-hour; and then multiplying by the rated horsepower rating: 1 gallon/137,000 Btu; and 7,000 Btu/hp-hour.

Gasification Flare

Pilot Operation						
Operating Hours		8,760	hr/yr			
Heat Input		0.5	MMBtu/hr			
CO_2 =	232	tonne/yr				
CH_4 =	0.00	tonne/yr =	0.1	tonne CO_2e/yr		
N_2O =	0.0004	tonne/yr =	0.1	tonne CO_2e/yr	Total tonne CO_2e/yr =	233
Flaring Events						
Total Operation		70,536	MMBtu/yr			
CO_2 =	3,744	tonne/yr				
CH_4 =	0.1	tonne/yr =	1	tonne CO_2e/yr		
N_2O =	0.01	tonne/yr =	2	tonne CO_2e/yr	Total tonne CO_2e/yr =	3,747

GHG emissions from flaring events are conservatively estimated using GHG emission factors for natural gas combustion.

Rectisol Flare

Pilot Operation						
Operating Hours		8,760	hr/yr			
Heat Input		0.3	MMBtu/hr			
CO_2 =	139	tonne/yr				
CH_4 =	0.00	tonne/yr =	0.1	tonne CO_2e/yr		
N_2O =	0.0003	tonne/yr =	0.08	tonne CO_2e/yr	Total tonne CO_2e/yr =	140
Flaring Events						
Operating Hours		40	hr/yr			
Vent gas flow		4542	lb-mole/hr			
CO_2 =	3,627	tonne/yr				
CH_4 =		tonne/yr =		tonne CO_2e/yr		
N_2O =		tonne/yr =		tonne CO_2e/yr	Total tonne CO_2e/yr =	3,627

GHG emissions from flaring event based on 100% carbon content of the gas during startup.

SRU Flare

Pilot Operation						
Operating Hours		8,760	hr/yr			
Heat Input		0.3	MMBtu/hr			
CO_2 =	139	tonne/yr				
CH_4 =	0.00	tonne/yr =	0.1	tonne CO_2e/yr		
N_2O =	0.0003	tonne/yr =	0.08	tonne CO_2e/yr	Total tonne CO_2e/yr =	140
Flaring Events - natural gas assist for acid gas venting during startup						
Operating Hours		40	hr/yr			
Heat Input		36	MMBtu/hr			
Throughput (inerts) - acid gas venting during startup						
CO_2 =		140000	scf/hr			
CO_2 =		16,240	lb/hr			
CO_2 =	371	tonne/yr				
CH_4 =	0.001	tonne/yr =	0.03	tonne CO_2e/yr		
N_2O =	0.00014	tonne/yr =	0.045	tonne CO_2e/yr	Total tonne CO_2e/yr =	371

Throughtput (inerts) provided from design engineers.

Tail Gas Thermal Oxidizer

Process Vent Disposal Emissions						
Operating Hours		8,314	hr/yr			
Heat Input		13	MMBtu/hr			
CO_2 =	5,736	tonne/yr				
CH_4 =	0.11	tonne/yr =	2.3	tonne CO_2e/yr		
N_2O =	0.0108	tonne/yr =	3.4	tonne CO_2e/yr	Total tonne CO_2e/yr =	5,742
SRU Startup Waste Gas Disposal						
Operating Hours		48	hr/yr			
Heat Input		80	MMBtu/hr			
CO_2 =	204	tonne/yr				
CH_4 =	0.004	tonne/yr =	0.08	tonne CO_2e/yr		
N_2O =	0.00038	tonne/yr =	0.119	tonne CO_2e/yr	Total tonne CO_2e/yr =	204

GHG emissions from thermal oxidizer are estimated using GHG emission factors for natural gas combustion for the assist gas.

Intermittent CO_2 Vent

Operating Hours	504	hr/yr		
CO_2 Emission Rate	761,400	lb/hr		
			Total tonne CO_2e/yr =	174,113

Assumes 504 hours per year venting at full rate.

Fugitives

Operating Hours		8,760	hr/yr			
CO_2 =	32.3	tpy	31.37	tonne CO_2e/yr		
CH_4 =	0.19	tpy	3.86	tonne CO_2e/yr		
					Total tonne CO_2e/yr =	35

Detailed emission calculations are provided in Appendix M, Public Health.

Ammonia Synthesis Plant Startup Heater

Operating Hours		140	hr/yr			
Heat Input		55	MMBtu/hr			
CO_2 =	409	tonne/yr				
CH_4 =	0	tonne/yr =	0	tonne CO_2e/yr		
N_2O =	0.00	tonne/yr =	0	tonne CO_2e/yr	Total tonne CO_2e/yr =	409

Urea Absorber Vents

Operating Hours		8,000	hr/yr			
CO_2		32	lb/hour			
CO_2 =	116	tonne/yr				
CH_4 =		tonne/yr =	0	tonne CO_2e/yr		
N_2O =		tonne/yr =	0	tonne CO_2e/yr	Total tonne CO_2e/yr =	116

Emission rate provided by project engineers.

Nitric Acid Unit

Operating Hours		8,000	hr/yr			
N_2O uncontrolled		6.32	lb/ton NHO3			
Production rate		501	ton/day			
N_2O uncontrolled		132	lb/hour			
destruction efficiency		95	%			
N_2O controlled		6.6	lb/hour			
CO_2 =		tonne/yr				
CH_4 =		tonne/yr =	0	tonne CO_2e/yr		
N_2O =	24	tonne/yr =	7,426	tonne CO_2e/yr	Total tonne CO_2e/yr =	7,426

Emission factor and destruction efficiency provided by design engineer.

230 kV Circuit Breakers

Number of Circuit Breakers		6				
SF_6 capacity		240	lb/breaker			
Annual Leakage rate		0.5%				
SF_6 =	0.003	tonne/yr =	78	tonne CO_2e/yr	Total tonne CO_2e/yr =	78

SF6 GWP = 23,900 http://www.epa.gov/electricpower-sf6/faq.html)
Sources: SF6 inventory and maximum leakage rates from electrical equipment suppliers

18 kV Circuit Breakers

Number of Circuit Breakers		2				
SF_6 capacity		73	lb/breaker			
Annual Leakage rate		0.5%				
SF_6 =	0.000	tonne/yr =	8	tonne CO_2e/yr	Total tonne CO_2e/yr =	8

SF6 GWP = 23,900 http://www.epa.gov/electricpower-sf6/faq.html)
Sources: SF6 inventory and maximum leakage rates from electrical equipment suppliers

Total tonne CO_2e/yr for Stationary Sources=	**535,278**

Gas Composition for the Syngas and PSA Off-gas

		Greenhouse Gas Fuel Summary and Durations of Major Fuel Consumers											
		Syngas						PSA Off-Gas					
COMPONENTS	MW	mol%	mol*MW (lb/lbmole)	Wt%	MW C	% C	wt%Cmix	mol%	mol*MW (lb/lbmole)	Wt%	MW C	% C	wt%Cmix
CO (CARBON MONOXIDE)	28.01	1.92	0.54	8.48%	12	42.84%	3.63%	9.10	2.55	11.36%	12	42.84%	4.87%
H2 (HYDROGEN)	2.02	83.80	1.69	26.62%	-	0.00%	0.00%	23.78	0.48	2.14%	-	0.00%	0.00%
CO2 (CARBON DIOXIDE)	44.01	1.50	0.66	10.38%	12	27.27%	2.83%	7.09	3.12	13.92%	12	27.27%	3.79%
H2O (WATER)	18.02	-	-	0.00%	-	0.00%	0.00%	-	-	0.00%	-	0.00%	0.00%
CH4 (METHANE)	16.04	1.07	0.17	2.69%	12	74.81%	2.01%	5.03	0.81	3.60%	12	74.81%	2.69%
Ar (ARGON)	39.95	0.13	0.05	0.79%	-	0.00%	0.00%	0.59	0.23	1.04%	-	0.00%	0.00%
N2 (NITROGEN)	28.01	11.58	3.24	51.02%	-	0.00%	0.00%	54.38	15.23	67.90%	-	0.00%	0.00%
H2S (HYDROGEN SULFIDE)	34.08	0.00	0.00	0.00%	-	0.00%	0.00%	0.00	0.00	0.00%	-	0.00%	0.00%
COS (CARBONYL SULFIDE)	60.07	0.00	0.00	0.00%	12	19.98%	0.00%	0.00	0.00	0.00%	12	19.98%	0.00%
CH3OH (METHANOL)	32.03	0.01	0.00	0.03%	12	37.46%	0.01%	0.03	0.01	0.04%	12	37.46%	0.01%
C2H6 (ETHANE)	30.07	-	-	0.00%	24	79.81%	0.00%	-	-	0.00%	24	79.81%	0.00%
C3H8 (PROPANE)	44.10	-	-	0.00%	36	81.63%	0.00%	-	-	0.00%	36	81.63%	0.00%
C4H10 (N-BUTANE)	58.12	-	-	0.00%	48	82.59%	0.00%	-	-	0.00%	48	82.59%	0.00%
C4H10 (ISO-BUTANE)	58.12	-	-	0.00%	48	82.59%	0.00%	-	-	0.00%	48	82.59%	0.00%
C5H12 (N-PENTANE)	72.15	-	-	0.00%	60	83.16%	0.00%	-	-	0.00%	60	83.16%	0.00%
C5H12 (ISO-PENTANE)	72.15	-	-	0.00%	60	83.16%	0.00%	-	-	0.00%	60	83.16%	0.00%
C6+ (HEXANES, ETC)	86.18	-	-	0.00%	72	83.55%	0.00%	-	-	0.00%	72	83.55%	0.00%
NH3 (AMMONIA)	17.04	-	-	0.00%	-	0.00%	0.00%	-	-	0.00%	-	0.00%	0.00%
HCl (HYDROGEN CHLORIDE)	36.48	-	-	0.00%	-	0.00%	0.00%	-	-	0.00%	-	0.00%	0.00%
HCN (HYDROGEN CYANIDE)	27.03	-	-	0.00%	12	44.40%	0.00%	-	-	0.00%	12	44.40%	0.00%
Total		**100.00**	**6.36**	**100.00%**			**8.48%**	**100.00**	**22.43**	**100.00%**			**11.37%**

		Syngas Duration (hr)	Syngas Fuel input HHV (MMBtu/hr)	Syngas fuel consumption (MMscf/hr)	PSA Off-Gas Duration (hr)	PSA Off-Gas Fuel input HHV (MMBtu/hr)	PSA Off-Gas fuel consumption (MMscf/hr)
Gas Turbine	mmBTU/h	8,108	2,536.57	8.79	-	-	
Duct Burner	mmBTU/h	8,000	165.00	0.57	8,000	149.00	0.95
HHV (Btu/scf)		288.6			157.3		
Percentage of destruction of CH4		98.0%			98.0%		
CO2 lb/MMBtu HHV		17.704			153.56		
CH4 lb/MMBtu HHV		0.031			0.27		

		Syngas Hourly Emissions (lb/hr)	Syngas Annual Emissions (ton/yr)	Syngas Annual Emissions (tonnes/yr)	PSA Off-Gas Hourly Emissions (lb/hr)	PSA Off-Gas Annual Emissions (ton/yr)	PSA Off-Gas Annual Emissions (tonnes/yr)
CO2 emissions (lb/hr)	Gas Turbine	44,906	182,050	165,200	22,881	91,524	83,053
CH4 emissions (lb/hr)	Gas Turbine	79	321	291	40	161	146
CO2 emissions (lb/hr)	Duct Burner	2,921	11,684	10,603			
CH4 emissions (lb/hr)	Duct Burner	5	21	19			

Notes:

All Data based on Case 5 Performance Avg Ambient On-Peak

Includes startup and shutdown hours in the turbine operations. Assumed max heating value during SU/SD hours.

No startup or shutdown for duct burners

Greenhouse Gas Emissions Associated with the Mobile Sources During Project Operations

Source	Annual CO2e Emissions (tonne/year)
Onsite Trucks	413
Onsite Trains	291
Offsite Workers Commuting	824
Offsite Trucks	10,866
Offsite Trains	45,226
Total CO2e Annual Emissions	**57,619**

Notes:

Onsite worker travel and associated emissions are negligible

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GHG emissions are numerically depicted as metric tons (tonne) of carbon dioxide equivalents (CO_2e). CO_2e represents CO_2 plus the additional warming potential from CH_4 and N_2O. CH_4 and N_2O have 21 and 310 times the warming potential of CO_2, respectively.

Onsite LHD Gasoline Trucks

Number of Onsite Trucks		10	trucks		EF CO_2 =	1,175	g/mi
Total Annual VMT		10,000	miles/ truck		EF CH_4 =	0.0157	g/mi
					EF N_2O =	0.0101	g/mi
CO_2 =	118	tonne/yr					
CH_4 =	1.57E-03	tonne/yr =	3.E-02	tonne CO_2e/yr			
N_2O =	1.01E-03	tonne/yr =	3.E-01	tonne CO_2e/yr	Total tonne CO_2e/yr =		118

CO2 emissions from EMFAC2007 for fleet year 2010 for light heavy-duty gasoline trucks travelling at 15 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for light gasoline trucks.

Onsite LHD Diesel Trucks

Number of Onsite Trucks		10	trucks		EF CO_2 =	519	g/mi
Total Annual VMT		10,000	miles/ truck		EF CH_4 =	0.001	g/mi
					EF N_2O =	0.0015	g/mi
CO_2 =	52	tonne/yr					
CH_4 =	1.00E-04	tonne/yr =	2.E-03	tonne CO_2e/yr			
N_2O =	1.50E-04	tonne/yr =	5.E-02	tonne CO_2e/yr	Total tonne CO_2e/yr =		52

CO2 emissions from EMFAC2007 for fleet year 2010 for light heavy-duty diesel trucks travelling at 15 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for light diesel trucks.

Onsite Petcoke Trucks

Number of Truck loads		15,200	truck loads		EF CO_2 =	3,165	g/mi
Distrance Travelled Onsite		1.0	mi/ load		EF CH_4 =	0.0051	g/mi
Truck Idle Time		0.08	hr/load		EF N_2O =	0.0048	g/mi
					EF CO_2 =	6,542	g/ idle hr
					EF CH_4 =	0.011	g/ idle hr
					EF N_2O =	0.010	g/ idle hr
CO_2 =	54	tonne/yr					
CH_4 =	8.75E-05	tonne/yr =	2.E-03	tonne CO_2e/yr			
N_2O =	8.23E-05	tonne/yr =	3.E-02	tonne CO_2e/yr	Total tonne CO_2e/yr =		54

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 10 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Onsite Product Trucks

Number of Truck loads		20,880	truck loads		EF CO_2 =	3,165	g/mi
Distrance Travelled Onsite		2.49	mi/ load		EF CH_4 =	0.0051	g/mi
Truck Idle Time		0.08	hr/load		EF N_2O =	0.0048	g/mi
					EF CO_2 =	6,542	g/ idle hr
					EF CH_4 =	0.011	g/ idle hr
					EF N_2O =	0.010	g/ idle hr
CO_2 =	176	tonne/yr					
CH_4 =	2.83E-04	tonne/yr =	6.E-03	tonne CO_2e/yr			
N_2O =	2.66E-04	tonne/yr =	8.E-02	tonne CO_2e/yr	Total tonne CO_2e/yr =		176

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 10 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Onsite Miscellaneous Diesel Trucks

Number of Truck loads		1,818	truck loads		EF CO_2 =	3,165	g/mi
Distrance Travelled Onsite		2.2	mi/ load		EF CH_4 =	0.0051	g/mi
					EF N_2O =	0.0048	g/mi
CO_2 =	13	tonne/yr					
CH_4 =	2.04E-05	tonne/yr =	4.E-04	tonne CO_2e/yr			
N_2O =	1.92E-05	tonne/yr =	6.E-03	tonne CO_2e/yr		Total tonne CO_2e/yr =	13

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 10 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles.

Onsite Switching Engines

Number of engines		1	per year		EF CO_2 =	672	g/bhp-hr
Avg power used onsite		260	hp		EF CH_4 =	0.053	g/bhp-hr
Annual operations		1248	hours/yr		EF N_2O =	0.0171	g/bhp-hr
CO_2 =	218	tonne/yr					
CH_4 =	1.71E-02	tonne/yr =	4.E-01	tonne CO_2e/yr			
N_2O =	5.55E-03	tonne/yr =	2.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	220

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Onsite Coal Trains

Number of Trains		109	per year		EF CO_2 =	491	g/bhp-hr
Number of engines		218	per year		EF CH_4 =	0.038	g/bhp-hr
Avg power used onsite		220	hp		EF N_2O =	0.0125	g/bhp-hr
Time to unload each train		2	hours				
CO_2 =	47	tonne/yr					
CH_4 =	3.69E-03	tonne/yr =	8.E-02	tonne CO_2e/yr			
N_2O =	1.20E-03	tonne/yr =	4.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	48

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Onsite Product Trains

Number of Trains		153	per year		EF CO_2 =	491	g/bhp-hr
Number of engines		153	per year		EF CH_4 =	0.038	g/bhp-hr
Avg power used onsite		150	hp		EF N_2O =	0.0125	g/bhp-hr
Time to unload each train		2	hours				
CO_2 =	23	tonne/yr					
CH_4 =	1.77E-03	tonne/yr =	4.E-02	tonne CO_2e/yr			
N_2O =	5.74E-04	tonne/yr =	2.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	23

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite Coal Trains

Number of Trains cars per year		13,034	per year		EF CO_2 =	10,217	g/gal
Miles Traveled Per Train		794	Miles one way		EF CH_4 =	0.8	g/gal
Rail Freight Fuel Consumption		480	ton-mile/gallon		EF N_2O =	0.26	g/gal
Loaded train car weight		142	ton				
Unloaded train car weight		25	ton				
All Trains - Round Trip		1.73E+09	ton-miles/year				
Fuel Use for all Trains - Round Trip		3,600,461	gal/year				
CO_2 =	36,786	tonne/yr					
CH_4 =	2.88	tonne/yr =	60.49	tonne CO_2e/yr			
N_2O =	0.94	tonne/yr =	290.20	tonne CO_2e/yr		Total tonne CO_2e/yr =	37,137

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite Liquid Sulfur Product Trains

Number of Trains cars per year		83	per year		EF CO_2 =	10,217	g/gal
Miles Traveled Per Train		150	Miles one way		EF CH_4 =	0.8	g/gal
Rail Freight Fuel Consumption		480	ton-mile/gallon		EF N_2O =	0.26	g/gal
Loaded train car weight		125	ton				
Unloaded train car weight		25	ton				
All Trains - Round Trip		1.87E+06	ton-miles/year				
Fuel Use for all Trains - Round Trip		3,890	gal/year				
CO_2 =	39.75	tonne/yr					
CH_4 =	3.11E-03	tonne/yr =	7.E-02	tonne CO_2e/yr			
N_2O =	1.01E-03	tonne/yr =	3.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	40

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite Gasification Solid Product Trains

Number of Trains cars per year		2,800	per year		EF CO_2 =	10,217	g/gal
Miles Traveled Per Train		198	Miles one way		EF CH_4 =	0.8	g/gal
Rail Freight Fuel Consumption		480	ton-mile/gallon		EF N_2O =	0.26	g/gal
Loaded train car weight		125	ton				
Unloaded train car weight		25	ton				
All Trains - Round Trip		8.32E+07	ton-miles/year				
Fuel Use for all Trains - Round Trip		173,244	gal/year				
CO_2 =	1,770	tonne/yr					
CH_4 =	1.39E-01	tonne/yr =	3.E+00	tonne CO_2e/yr			
N_2O =	4.50E-02	tonne/yr =	1.E+01	tonne CO_2e/yr		Total tonne CO_2e/yr =	1,787

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite Ammonia Product Trains

Number of Trains cars per year		357	per year		EF CO_2 =	10,217	g/gal
Miles Traveled Per Train		264	Miles one way		EF CH_4 =	0.8	g/gal
Rail Freight Fuel Consumption		480	ton-mile/gallon		EF N_2O =	0.26	g/gal
Loaded train car weight		142	ton				
Unloaded train car weight		25	ton				
All Trains - Round Trip		1.57E+07	ton-miles/year				
Fuel Use for all Trains - Round Trip		32,789	gal/year				
CO_2 =	335	tonne/yr					
CH_4 =	2.62E-02	tonne/yr =	6.E-01	tonne CO_2e/yr			
N_2O =	8.53E-03	tonne/yr =	3.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	338

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite Urea Product Trains

Number of Trains cars per year		1,795	per year		EF CO_2 =	10,217	g/gal
Miles Traveled Per Train		628	Miles one way		EF CH_4 =	0.8	g/gal
Rail Freight Fuel Consumption		480	ton-mile/gallon		EF N_2O =	0.26	g/gal
Loaded train car weight		142	ton				
Unloaded train car weight		25	ton				
All Trains - Round Trip		1.88E+08	ton-miles/year				
Fuel Use for all Trains - Round Trip		392,179	gal/year				
CO_2 =	4,007	tonne/yr					
CH_4 =	3.14E-01	tonne/yr =	7.E+00	tonne CO_2e/yr			
N_2O =	1.02E-01	tonne/yr =	3.E+01	tonne CO_2e/yr		Total tonne CO_2e/yr =	4,045

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite UAN Product Trains

Number of Trains cars per year		1,983	per year		EF CO_2 =	10,217	g/gal
Miles Traveled Per Train		264	Miles one way		EF CH_4 =	0.8	g/gal
Rail Freight Fuel Consumption		480	ton-mile/gallon		EF N_2O =	0.26	g/gal
Loaded train car weight		142	ton				
Unloaded train car weight		25	ton				
All Trains - Round Trip		8.74E+07	ton-miles/year				
Fuel Use for all Trains - Round Trip		182,132	gal/year				
CO_2 =	1,861	tonne/yr					
CH_4 =	1.46E-01	tonne/yr =	3.E+00	tonne CO_2e/yr			
N_2O =	4.74E-02	tonne/yr =	1.E+01	tonne CO_2e/yr	Total tonne CO_2e/yr =		1,879

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite Petcoke Trucks

Number of Trucks		15,200	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		280	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		4,256,000	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	7,110	tonne/yr					
CH_4 =	2.17E-02	tonne/yr =	5.E-01	tonne CO_2e/yr			
N_2O =	2.04E-02	tonne/yr =	6.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =		7,117

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Liquid Sulfur Product Trucks

Number of Trucks		990	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		284	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		281,160	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	470	tonne/yr					
CH_4 =	1.43E-03	tonne/yr =	3.E-02	tonne CO_2e/yr			
N_2O =	1.35E-03	tonne/yr =	4.E-01	tonne CO_2e/yr	Total tonne CO_2e/yr =		470

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Gasification Solids Product Trucks

Number of Trucks		2,800	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		160	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		448,000	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	748	tonne/yr					
CH_4 =	2.28E-03	tonne/yr =	5.E-02	tonne CO_2e/yr			
N_2O =	2.15E-03	tonne/yr =	7.E-01	tonne CO_2e/yr	Total tonne CO_2e/yr =		749

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

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Offsite Ammonia Product Trucks

Number of Trucks		5,010	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		400,800	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	670	tonne/yr					
CH_4 =	2.04E-03	tonne/yr =	4.E-02	tonne CO_2e/yr			
N_2O =	1.92E-03	tonne/yr =	6.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	670

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Urea Product Trucks

Number of Trucks		2,800	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		224,000	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	374	tonne/yr					
CH_4 =	1.14E-03	tonne/yr =	2.E-02	tonne CO_2e/yr			
N_2O =	1.08E-03	tonne/yr =	3.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	375

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite UAN Product Trucks

Number of Trucks		9,280	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		742,400	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	1,240	tonne/yr					
CH_4 =	3.79E-03	tonne/yr =	8.E-02	tonne CO_2e/yr			
N_2O =	3.56E-03	tonne/yr =	1.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	1,241

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Equipment and Miscellaneous Trucks

Number of Trucks		1,818	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		145,440	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	243	tonne/yr					
CH_4 =	7.42E-04	tonne/yr =	2.E-02	tonne CO_2e/yr			
N_2O =	6.98E-04	tonne/yr =	2.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	243

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

GHG Emissions Summary for Mobile Sources — Emissions Summary

Hydrogen Energy California LLC — *4/11/2012*
HECA Project

Offsite Employee Commute Vehicles

Total Number of Employee	200	employees/day		EF CO_2 =	364	g/mi
Number of Worker per Commuter Vehicle	1.3			EF CH_4 =	0.0159	g/mi
Daily Vehicle Count	154	vehicles/day		EF N_2O =	0.0093	g/mi
Distance traveled per vehicle (Round Trip)	40	miles/ vehicle/ day				
Day of Commute per Month	365	days/yr				
Total Annual VMT	2,246,154	miles/year				

CO_2 =	817	tonne/yr				
CH_4 =	3.57E-02	tonne/yr =	7.E-01	tonne CO_2e/yr		
N_2O =	2.09E-02	tonne/yr =	6.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =	824

CO2 emission factor for CO2 is from EMFAC 2007 (average of light duty automobile and light duty truck) for the vehicle model year fro m1971 to 2015. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for average of gasoline passenger cars, gasoline light trucks, diesel passenger cars, and diesel light truck.

Total tonne CO_2e/yr for Mobile Sources=	**57,619**

Appendix E-7

NO2 1-Hour Regional Analysis

MODELING REPORT FOR

1-HOUR NO_2 NAAQS REGIONAL MODELING

FOR THE HYDROGEN ENERGY CALIFORNIA (HECA) PROJECT

Prepared for:

U.S. Environmental Protection Agency Region IX

San Joaquin Valley Air Pollution Control District

California Energy Commission

Prepared on behalf of:

Hydrogen Energy California LLC

April 2012

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1. INTRODUCTION

On January 22, 2010, the United States Environmental Protection Agency (USEPA) announced a new primary nitrogen dioxide (NO_2) 1-hour National Ambient Air Quality Standard (NAAQS). The standard is attained when the 3-year average of the 98th percentile of the annual distribution of the daily maximum 1-hour concentrations does not exceed 100 parts per billion (ppb). This new standard will apply to the Hydrogen Energy California (HECA) Project.

In February 2010, the USEPA issued *Notice Regarding Modeling for New Hourly NO_2 NAAQS* (USEPA, 2010b). In June 2010, the USEPA issued a compliance guidance document, *Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program* (USEPA, 2010c). These guidance documents include a description of Tier 3 "detailed screening methods" for modeling compliance with the 1-hour NO_2 federal standard.

In preparation for conducting the regional NO_2 modeling analysis described in the guidance document, HECA sought concurrence from USEPA Region IX and from the USEPA Office of Air Quality Planning and Standards (OAQPS) through submittal of a protocol document entitled "*Modeling Protocol for Parameter Selection Specific to the 1 Hour NO_2 NAAQS Regional Modeling for the Hydrogen Energy California (HECA) Project*" dated January 20, 2011 (referred to as the "January 2011 protocol"). The January 2011 protocol proposed source screening methodology and input parameters for the HECA Project's regional NO_2 modeling analysis. The January 2011 protocol document received approval from both USEPA Region IX and the OAQPS on March 11, 2011. This document describes and presents the results of the Tier 3 "detailed screening methods" modeling analysis performed to satisfy the 1-hour NO_2 federal standard.

In March 2011, the USEPA issued an additional guidance document: *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard* (USEPA, 2011). This guidance, hereafter referred to as the "March 2011 USEPA Memo," provided further clarification on uncertainties raised since the earlier USEPA June 2010 modeling guidance document. Because this document was released after the HECA Project's submittal of the January 2011 protocol document, HECA prepared the *Modeling Protocol Supplement for the Hydrogen Energy California (HECA) Project*, February 2012, outlining any variances in modeling techniques from the January 2011 protocol.

1.1 PROJECT DESCRIPTION

Hydrogen Energy California LLC (HECA) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (hereafter referred to as HECA or the Project). The Project will gasify a 75 percent coal and 25 percent petroleum coke (petcoke) fuel blend to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel and used to generate a nominal 300-megawatt (MW) output of low-carbon baseload electricity in a Combined Cycle Power Block, and to produce low-carbon nitrogen-based products in an integrated Manufacturing Complex. Carbon dioxide (CO_2) from the HECA facility will be captured and transported to the adjacent Elk Hills Oil Field (EHOF) for use in enhanced oil recovery (EOR), which results in sequestration (storage) of the CO_2. Occidental of Elk Hills Incorporated (OEHI) will use the CO_2 for EOR at the EHOF.

The HECA Project is approximately 7 miles west of the outermost edge of the city of Bakersfield and 1.5 miles northwest of the unincorporated community of Tupman in western Kern County, California. Figure 1 presents an overview map of the HECA Project location, as well as the locations of regional monitoring stations in relation to the HECA Project. Figure 2 presents close-up aerial images of the HECA Project Site next to the surface meteorological station. The HECA Project is within the San Joaquin Valley Air Basin and is within the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD). The Project area is in attainment for NO_2, and therefore HECA is subject to Prevention of Significant Deterioration (PSD) requirements. Since annual HECA emissions are greater than the NO_2 PSD Significant Emission Rate (SER) of 40 tons/yr, HECA must conduct modeling for compliance with the NO_2 1-hour NAAQS.

This introduction provides a brief description of the HECA Project. Additional details are provided in the AFC Amendment (2012), Section 2.0, Project Description.

2. OVERALL MODELING APPROACH

This section outlines the overall modeling approach that was undertaken by the HECA Project to show compliance with the new 1-hour NO_2 NAAQS. Subsequent sections describe the details of individual parameters that were included in the modeling analysis.

The new 1-hour NO_2 NAAQS is 100 ppb (or 188.68 micrograms per cubic meter [$\mu g/m^3$]). The NAAQS is a statistical standard based on the 3-year average of the annual 98th percentile of the daily maximum 1-hour concentrations.

Modeling was conducted per the techniques described in the HECA January 2011 protocol and February 2012 protocol supplement. In addition HECA conducted the NO_2 1-hour NAAQS analysis incorporating guidance from the March 2011 USEPA Memo, the USEPA June 2010 modeling guidance, CAPCOA *Modeling Compliance of The Federal 1-Hour NO_2 NAAQS*, October 2011, and SJVAPCD *Assessment of Non-Regulatory Option in AERMOD Specifically OLM and PVMRM*, September 2010.

The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) version 12060 was used to estimate the 1-hour ground level concentrations of NO_2. The model has received a scientific peer review. As noted in the USEPA's June 2010 guidance document, AERMOD is the preferred model for dispersion for a wide range of applications.

To address NO_X chemistry, the ozone-limiting method (OLM) plume volume molar ratio method (PVMRM) algorithm was used in AERMOD, which is explained in detail later. The AERMOD model was run using the rural dispersion setting.

The first step of the NO_2 1-hour analysis was to model the HECA sources alone to determine if the multiyear average first high 1-hour concentrations at every receptor within 50 kilometers are less than the interim Significant Impact Level (SIL) of 4 ppb. Modeling showed concentrations greater than or equal to the SIL at receptors out approximately 13 kilometers, which is the Area of Impact (AOI).

Because the Project's impacts exceeded the SIL at several receptors based on this initial impact analysis, a cumulative (or regional) impact assessment was completed to determine whether the project would cause or contribute to any modeled violations of the NAAQS.

The cumulative analysis was completed including emissions from HECA sources, nearby sources, and background concentrations measured at a nearby monitoring station. Only receptors that were shown to have Project impacts greater than or equal to the SIL were included in the cumulative modeling.

Modeled concentrations from HECA and regional emissions sources were added to hourly background monitoring NO_2 data to determine the cumulative average 98th percentile maximum daily 1-hour impacts for all ranks below the 98th percentile until the NAAQS was no longer exceeded. In AERMOD, the design value is calculated as the eighth-highest (98th percentile) daily maximum 1-hour concentration averaged across the 5 modeled years at each receptor.

The MAXDCONT option in AERMOD was run to determine the NO_2 1-hour impact contribution from HECA. The option was run from rank 8 (or the 98th percentile daily maximum value per receptor averaged over 5 years) to rank 20, with a threshold value equal to the NO_2 1-hour NAAQS (188 µg/m^3). The target source group was set to all sources (HECA, regional sources, and background). This setup option continues to examine the concentrations for all ranks until the impacts from all sources are less than the threshold value of 188 µg/m^3. This option was used to determine if there are any exceedances of the NAAQS from all sources and, if an exceedance occurs, to determine whether HECA's contribution is greater than or equal to the SIL at that point in time and space.

If the total regional impacts (i.e., model result plus background) were predicted to be less than the NAAQS, then compliance with the NAAQS was shown. However, if the total regional impacts were predicted to be greater than the NAAQS, then for that hour and receptor, the impact from HECA Project operations sources was compared to the interim SIL. If the predicted impact from just the HECA sources was less than the interim SIL, then it could be concluded that the HECA Project does not contribute to the violation, and thus, compliance with the standard was demonstrated.

2.1 THE PLUME VOLUME MOLAR RATIO METHOD (PVMRM)

The PVMRM algorithm within AERMOD was the OLM used in the modeling analysis. PVMRM accounts for the role of ambient ozone (O_3) in limiting the conversion of emitted NO_X—which occurs mostly in the form of nitrogen oxides (NO)—to NO_2, the pollutant regulated by ambient standards.

The chemistry for PVMRM has been peer-reviewed, as noted by the documents posted on the USEPA's Support Center for Regulatory Air Modeling web site. The posted documents include *Sensitivity Analysis of PVMRM and OLM in AERMOD* (MACTEC, 2004) and *Evaluation of Bias in AERMOD-PVMRM* (MACTEC, 2005). Both documents indicate that the models appear to perform as expected.

The PVMRM algorithm has been demonstrated to be applicable for calculating NO_X chemistry on a theoretical basis. As noted in *Sensitivity Analysis of PVMRM and OLM in AERMOD* (MACTEC, 2004), which was prepared by Roger W. Brode of MACTEC (now with USEPA OAQPS):

> *"Overall the PVMRM option appears to provide a more realistic treatment of the conversion of NO_X to NO_2 as a function of distance downwind from the source than OLM or the other NO_2 screening options (Hanrahan, 1999a; Hanrahan, 1999b). No anomalous behavior of the PVMRM or OLM options was identified as a result of these sensitivity tests."*

Based on this report, the model appears to appropriately account for NO_2 formation and provides a better estimation of the NO_2 impacts, compared to other screening options.

As noted in *Evaluation of Bias in AERMOD-PVMRM* (MACTEC, 2005), which was prepared by Roger W. Brode, PVMRM has been judged to provide unbiased estimates based on criteria that are comparable to, or more rigorous than, evaluations performed for other dispersion models.

The data obtained to conduct the PVMRM run for the HECA Project were: (1) hourly meteorological data, (2) hourly O_3 data, and (3) in-stack NO_2/NO_X ratio. Further refinement of the modeling entailed use of hourly ambient NO_2 data (discussed later). SJVAPCD processed the meteorological, O_3, and NO_2 data following applicable USEPA guidance, as discussed in Section 3. The analysis used NO_2/NO_X in-stack ratios obtained from published references or engineering estimates.

2.2 RECEPTOR DESCRIPTION

USEPA considers most steady-state Gaussian plume models, including AERMOD, to be applicable out to 50 kilometers, but not beyond. Therefore, impacts from the HECA Project operations and nearby sources were examined out to a distance of 50 kilometers from the HECA Project Site in the initial impact analysis. Preliminary modeling with receptors out to 50 kilometers showed that potential impacts from HECA Project operations would generally fall below the interim SIL within 15 kilometers of the HECA Project Site. Although the receptor grid ended at 50 kilometers, large sources located beyond 50 kilometers were included in the nearby source inventory.

The same receptor grid used in the air quality impact analyses presented in the AFC Amendment (2012) was used out to 10 kilometers, with additional receptors out to 50 kilometers. The Project Site is located within the Controlled Area and the property line extends around the outside of the Controlled Area. The receptor grid used in the SIL modeling analysis is as follows:

- 25-meter spacing along the property line and extending from the property line out 100 meters;
- 50-meter spacing from 100 to 250 meters beyond the property line;
- 100-meter spacing from 250 to 500 meters beyond the property line;
- 250-meter spacing from 500 meters to 1 kilometer beyond the property line;
- 500-meter spacing from 1 to 2 kilometers beyond the property line; and
- 1,000-meter spacing from 2 to 50 kilometers beyond the property line.

Terrain heights at receptor grid points were determined from U.S. Geological Survey (USGS) digital national elevation datum (NED) files using AERMAP.

2.3 BUILDING DOWNWASH AND GOOD ENGINEERING PRACTICE STACK HEIGHTS

The effects of building wakes (i.e., downwash) on plumes from the Project's operational sources were evaluated in accordance with USEPA guidance (USEPA, 1985). The USEPA Building Profile Input Program – Prime (BPIP-Prime) (Version 04274) was used to determine data on the buildings on the Project Site that could potentially cause plume downwash effects for different wind directions.

As defined in *Guideline for Determination of Good Engineering Practice Stack Height* (USEPA, 1985), good engineering practice (GEP) is the height necessary to ensure that emissions from a stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, or wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles.

All stacks in the HECA Project will be less than or equal to the GEP default height of 65 meters, except for the coal dryer, the three flares, and the CO_2 vent. The CO_2 vent is not a NO_X emission source; therefore, it was not included in this modeling. The height of the coal dryer stack is 92.9 meters, and the height of all three flare stacks (SRU, Gasification and Rectisol) is 76.2 meters.

BPIP Prime has been run to determine the GEP height for each stack. The output of this model shows that the GEP for the three flares is 65 meters, and for the coal dryer is 223.91 meters. BPIP files are provided with this application.

GEP is calculated based on the following equation:

$$Hg = H + 1.5 * L$$

Where: Hg = GEP stack height (in meters)
H = height of the nearby structure (in meters)
L = lesser dimension of the height or projected width of the nearby structure (in meters)

The largest structure near these stacks is the gasifier building, which is 92.9 meters high, 27.7 meters long, and 83 meters wide. Therefore, L = 87.3 meters, H = 92.9 meters, and Hg = 223.9 meters.

The gasifier building is located at a distance within five times L (436.5 meters) from the coal dryer; therefore, GEP for this source is calculated based on the gasifier building dimensions. The height of the coal dryer is well below the GEP height of 223.9 meters.

The flares are located upwind of the gasification building along its shorter axis, thus L = 27.7 meters and Hg = 134.5 meters. The flares are not within 5 times L (138.5 meters) of the gasification structure or any other structure that is large enough to create downwash for the flares in BPIP Prime. It is important to note that the flares will be built to a height of 76.2 meters for safety from a project engineering perspective. However, a 65 meter stack height, or GEP, was used to calculate effective stack heights for each flare modeling scenario based on the flare's heat release rate during that modeling scenario. The effective stack height is the height of the stack plus the height above the stack where the flare flame ends and a plume can begin. The effective stack parameters were calculated using the SCREEN3 technique, and were input into the AERMOD model (USEPA, 1995b). Therefore, the lower 65 meter stack height was used as the stack height in the calculation of the effective stack heights for the flares, rather than the actual stack height. Appendix E-3, Operational Criteria Pollutant Emissions, of the AFC Amendment (2012), presents the calculation of the effective stack parameters for the flares.

The results of the BPIP-Prime analysis were included in the AERMOD input files to enable downwash effects to be simulated. Input and output files for the BPIP-Prime analyses are included in the electronic files submitted with the AFC Amendment (2012).

2.4 TEMPORAL PAIRING

To estimate the total NO_2 concentration, modeling included HECA sources, nearby sources and background NO_2 data. Background data encompass emission sources not specifically modeled, such as mobile sources.

The 1-hour NO_2 NAAQS was developed for monitoring to allow for the elimination of outlier hours with high monitored concentrations which may not accurately reflect typical conditions near the monitoring station. In order to conduct modeling to comply with this standard, the March 2011 USEPA Memo recommends running AERMOD with the MAXDCONT output option to examine the contribution from the Project emissions to the cumulative impacts at each receptor paired in time and space. AERMOD adds the hourly modeled NO_2 concentrations to the concurrent hourly NO_2 background data, and determines the design value, the eighth-highest (98th percentile) daily maximum 1-hour NO_2 concentration at each receptor averaged across the 5 modeled years.

MAXDCONT was run with the threshold option to output the 8th (design value) through 20th daily maximum 1-hour NO_2 concentrations from all sources including background to ensure the cumulative impact was below the NAAQS. MAXDCONT also presents the contribution from each source at each receptor, paired in time and space if the NAAWS threshold is met. This use of AERMOD and MAXDCONT will provide modeling results that comply with the statistical nature of the NO_2 1-hour NAAQS.

The standard is based on the 98^{th} percentile (eighth-highest) daily maximum 1-hour concentration; as a result, more than one hourly average concentration above the standard on the same day will only result in one concentration greater than the standard for that day. This allows a monitor or model receptor to have 8 hours or more with concentrations greater than the standard on an annual basis, yet to still be considered in compliance as long as there are fewer than 8 days with a daily maximum 1-hour concentration above the standard. The hourly monitoring concentration was greater than or equal to 100 ppb twice during the 5-year data set (2006-2010), but because the standard is based on the eighth-highest daily maximum 1-hour concentration, compliance was able to be shown even with these high outliers.

During the 5-year monitoring period selected for the HECA Project (2006-2010), the NO_2 1-hour monitoring yielded concentrations greater than the standard. The "first tier" assumption (a term defined in the June 2010 USEPA guidance document [USEPA, 2010c]) of adding the overall highest hourly background NO_2 concentration to the model results was not reasonable to apply to the HECA Project. Thus, the additional refinement to the “first tier” approach that HECA has employed is temporal pairing of modeled and monitored values on an hourly basis. Justification for this refinement technique was provided in the January 2011 protocol, and its use was approved by both USEPA Region IX and OAQPS on March 11, 2011.

The approved method of combining the hourly NO_2 monitoring data with the hourly NO_2 impacts predicted from the modeling to show the maximum potential regional NO_2 impacts was employed in this analysis. Temporally pairing monitoring values with meteorological conditions is consistent with language in Appendix W, where monitored background concentrations are used to reflect contribution of regional levels of pollution not explicitly accounted for in the modeled inventory (USEPA, 2011).

The use of 5 years of hourly data will account for fluctuations in the background NO_2 concentrations. The model was run with sources operating at peak emissions, thus ensuring maximum impacts are predicted for every hour. These impacts are combined with the hourly background concentrations; thus when the background concentrations are high, the model predicted concentrations are also high, as modeled impacts are always maximized. Using the hourly temporal pairing technique of combining the modeled and background monitoring concentrations, the HECA regional modeling determines whether the “NO_X emissions increase from the proposed source will have a significant impact at the *point and time* of any violation” (USEPA, 2010c).

An exceptionally inclusive modeling emission inventory clearly represents the majority of emissions that could potentially contribute to the regional impact assessment, and the monitoring concentrations are intended to represent the contribution from minor sources and transportation sources not represented in the modeling inventory (USEPA, 2011). The use of temporal pairing of monitored background concentrations with modeled predicted concentrations on an hourly basis does not under-predict impacts because of numerous conservative assumptions used in the modeling analysis. All conservative assumptions employed in this modeling analysis are outlined in Section 6 of this modeling analysis.

3. BACKGROUND AIR QUALITY AND METEOROLOGICAL DATA

In preparation of demonstrating to show HECA Project operations compliance with the new 1-hour NO_2 NAAQS through modeling, a representative monitoring station with both hourly NO_2 and O_3 ambient monitoring data was chosen, an ambient NO_2/NO_X ratio was calculated, and meteorological data sets were obtained. The following sections provide further detail on those efforts. Additionally, based on information contained in the March 2011 USEPA Memo, the SJVAPCD was contacted and confirmed that the ambient air quality monitoring observation times are based upon the hour-beginning convention, and the meteorological monitoring observations recorded in the files obtained from their website are based upon the hour-ending convention. SJVAPCD prepared and provided the monitoring data to match the meteorological data time stamp format.

3.1 SELECTION OF A REPRESENTATIVE AMBIENT MONITORING STATION

Selection of a representative monitoring station was an important process because hourly O_3 data are used in conjunction with the PVMRM algorithm in AERMOD, and hourly NO_2 data would be used to represent ambient background NO_2 concentrations. The hourly NO_2 data were combined with the hourly NO_2 modeled impacts to estimate regional NO_2 impacts.

Several monitoring stations in Kern County, part of the San Joaquin Valley Air Basin, were considered for the NO_2 and O_3 data; these are shown in Figure 1 and Figures 3 through 5. The monitoring station nearest to the proposed Project Site that measured both pollutants from 2006-2010 is in Shafter, California. Data were processed and provided by the SJVAPCD. The data demonstrated completeness requirements during all quarters (more than 75 percent data capture) for all 5 years, per 40 Code of Federal Regulations Parts 50 and 58, February 9, 2010, Appendix S, 3.2(b) (USEPA, 2010a). The NO_2 and O_3 monitoring data cover the same years as the meteorological data used in the modeling; because both NO_2 and O_3 were obtained from the same monitoring station, they provide a better representation of the chemistry and balance between ambient NO_2 and O_3 concentrations.

The Shafter monitoring station is most representative of the rural location at the HECA Project Site. The Shafter monitoring station is on the roof of the local Department of Motor Vehicles building, which is surrounded by parking lots and near several roadways and a railroad, seen in Figure 3. California State Route 43 is 540 feet to the west of the Shafter monitoring station, and currently has an average daily traffic (ADT) volume of 14,000 trips (Caltrans, 2010). The Shafter monitoring station is 350 feet to the west of the Burlington Northern Santa Fe railroad. Due to the close proximity to State Route 43 and the railroad, the data from this station account for potential impacts from sources related to transportation. Since the HECA Project location is several miles from any major roadway, the Shafter monitoring station is expected to measure significantly more pollution from mobile sources than if a monitor were located next to the completed HECA Project. The ADT volumes at the HECA Project Site for the current year and future year (2017, with and without the Project), for both Alternative 1 (rail transportation) and Alternative 2 (truck transportation) are given in Table 1. The traffic volume near the Shafter monitoring station is currently more than 20 times larger than the volume near the Project Site. In future year 2017, with Project operations, the Shafter monitoring station will have approximately nine times the traffic volume than the traffic volume near the Project Site. Therefore, it is very conservative to represent the background pollution from transportation sources near the HECA Project Site with Shafter monitoring station data, although the Shafter data will represent the transportation emissions in the region appropriately.

The NO_2 and O_3 data used in the regional NO_2 analysis should adequately account for mobile emission sources; thus, the monitoring station chosen is located near mobile sources. Because the 1-hour NO_2 analysis that is being conducted is a regional analysis, it would be inappropriate to use O_3 data from a station heavily influenced by local sources.

Table 1
HECA Project Site Average Daily Traffic Counts

Road Segment	Existing (2012) ADT	2017 ADT without Project Trips	2017 ADT with Project Trips (Alternative 1)	2017 ADT with Project Trips (Alternative 2)
Adohr Road between Dairy and Tupman	273	301	775	787
Tupman Road between Adohr Road and Station Road	128	141	357	357
Dairy Road between Adohr Road and Stockdale Highway	188	206	464	476
Total ADT around Project Site	589	648	1,596	1,620

Source: Caltrans, 2010; HECA, 2012

The monitoring station is not near large industrial sources, but such sources will be accounted for in the regional modeling. Figures 6 and 7 graphically present the hourly and annual emissions (respectively) of stationary sources within 10 kilometers of the Shafter monitoring station. As can be seen, the stationary sources within the city limits are primarily smaller sources. Eight of the 10 sources within 2 kilometers of the Shafter monitoring station are owned and operated by the City of Shafter, and are electrical generators or pumps powered by emergency standby IC engines. The remaining two sources consist of an emergency standby IC engine and a small natural gas-fired heater, both under different ownership. On Figure 6, the larger hourly contributors (i.e., those with hourly emissions estimated at greater than 10 pounds per hour), beginning due west of the monitor and rotating counter-clockwise around the monitoring station are the following: Oasis Holstein Dairy; Vermeer Goedhart Dairy; North of River Sanitary District; Plains LPG Services, L.P.; and Performance Food Group. Comparison of the respective hourly and annual emissions for these facilities implies that the only equipment that operates on a regular (or non-emergency) basis is the equipment at Plains LPG Services, L.P., and, to a lesser extent, Oasis Holstein Dairy. The equipment at the remaining facilities consists largely of smaller sources or sources that do not operate on a regular basis (e.g., standby emergency ICengines). It is important to note that neither the smaller sources (i.e., those with NO_X emissions lower than 48 pounds/day) that are less frequently operated nor sources close to the monitoring station (as presented in Figures 6 and 7) will be included in the PSD modeling performed to assess compliance with the 1-hour NO_2 standard.

A description of the nearby sources included in the NO_2 analysis is provided in Section 4.2, presented in Figure 8, and a listing of the sources included in the modeling analysis is provided in Attachment A of this document.

Examination of the Shafter monitoring station 2006-2010 NO_2 hourly data provided by SJVAPCD showed that the 98th percentile daily maximum 1-hour concentration averaged over the 5 years was 62 ppb, which is below the standard. There were very few hours when the measured background concentration is near or above 100 ppb.

Because the Shafter monitoring station is near mobile sources but no large industrial sources, and is not downwind from an urban area, the data appropriately represent ambient NO_2 and O_3

concentrations expected to be found throughout the rural San Joaquin Valley. Therefore, the Shafter monitoring station was chosen to represent the background NO_2 and O_3 data in the modeling.

Other monitoring stations that were considered for NO_2 and O_3 data are shown in Table 2. These other stations did not meet the following criteria:

1. Meet data completeness requirements;
2. Match the rural land use surface parameters of the proposed Project Site;
3. Show close proximity to the Project Site compared to other monitoring stations; or
4. Monitor NO_2 or O_3 data.

Table 2
Monitoring Stations Considered for Ozone and Nitrogen Dioxide Data, Kern County, San Joaquin Valley Air Basin

Monitoring Station	NO_2 Data Availability Years	O_3 Data Availability Years	Distance from Project Site (Miles)	All Quarters Between 2006-20010 Have 75% Raw Data Capture for NO_2 and O_3?[1]
Shafter-Walker Street	1989-2010	1989-2010	13	Yes
Taft College	Not Available	Not Available	13	Not Applicable
Bakersfield-5558 California Avenue	1994-2010	1994-2010	18	Yes
Maricopa-Stanislaus Street	Not Available	1987-2010	19	Not Applicable
Bakersfield-Golden State Highway	1994-2008	1994-2009	21	No; Station has been shut down. Ozone sampling ended in 2009, and NO_2 sampling ended in early 2010.
Bakersfield-410 E Planz Road	Not Available	Not Available	21	Not Applicable
Oildale - 3311 Manor Street	Not Available	1980 - 2010	28	Not Applicable
Arvin - Bear Mountain Blvd	1989-2008	Not Available	34	Not Applicable
Arvin- Di Giorgio	Not Available	2009 - 2010	39	Not Applicable

Notes:
[1] Raw data per quarter must meet 75 percent data capture, per 40 Code of Federal Regulations Parts 50 and 58, February 9, 2010, Appendix S, 3.2(b).
Data from CARB (2010): http://www.arb.ca.gov/aqmis2/aqdselect.php?tab=specialrpt.

Bakersfield NO_2 and O_3 data were not used. The Bakersfield Golden State Highway station did not meet data completeness requirements. The Bakersfield California Avenue station's suburban location is not representative of the rural HECA Project Site. Figure 1 displays an overview image of the HECA Project Site and locations of several nearby monitoring stations. Close-up aerial images of the HECA Project Site next to the surface meteorological station used in the AERMET files are shown in Figure 2. Finally, zoomed-in locations of the monitoring stations at Shafter, Bakersfield-California Avenue, and Bakersfield-Golden State Highway are presented in Figures 3 through 5, respectively.

3.1.1 Handling of Missing Hourly O_3 & NO_2 Data for Shafter Monitoring Station

To run PVMRM in AERMOD, hourly O_3 data are required. These data cannot have any missing values for the model to function correctly, thus missing data must be filled appropriately. Likewise, NO_2 background data added to modeled NO_2 concentrations must be complete. SJVAPCD used the following convention to fill in missing hours in the raw hourly Shafter NO_2 and O_3 background data.

The maximum raw monitoring value for each hour in each month of the 5 years was obtained. Missing hours were filled with the maximum value that occurred for that hour in that month for all years. This method of handling missing data will not underestimate the missing background O_3 or NO_2 concentrations because the maximum concentration for the given hour was substituted.

3.2 AMBIENT NO_2/NO_X RATIO

The PVMRM algorithm uses the ambient or equilibrium NO_2/NO_X ratio in calculating the predicted NO_2 concentrations. On an hourly basis, the ambient NO_2/NO_X ratio will vary depending on nearby sources, meteorological conditions, and ambient O_3 concentrations. The PVMRM algorithm in AERMOD is not designed to accept hourly ambient NO_2/NO_X ratios; therefore, a regional annual ratio was used in the model.

The highest seasonal average NO_2/NO_X equilibrium ratio from the Shafter NO_2 monitoring station based on hourly data for 2006 through 2010 was 0.83, occurring in the summer (CARB, 2012). However, the modeling analysis presented in this report used a NO_2/NO_X equilibrium ratio of 0.9, which represents the hourly upper bound, as recommended by USEPA Region IX. With this point considered, the use of the default NO_2/NO_X equilibrium ratio of 0.9 in PVMRM is another conservative assumption in the HECA NO_2 modeling analyses, as it will allow more conversion of NO_X to NO_2 than has been observed in ambient data.

3.3 METEOROLOGICAL DATA

Hourly surface data were obtained from the SJVAPCD for the Bakersfield Meadows Field Airport (BFL) meteorological station for the years 2006 through 2010. When using off-site meteorological data, USEPA requires 5 years of the most recent and representative data available. The SJVAPCD hourly surface observation data included meteorological parameters of temperature, dew point, pressure, wind speed, wind direction, cloud cover, and ceiling height. SJVAPCD has prepared a document describing their meteorological processing methodology, “Procedures for Downloading and Processing NCDC Meteorological Data” (SJVAPCD, 2010a), provided in Attachment B.

The BFL station is approximately 20 miles northeast of the HECA Project, as shown in Figure 1. The data meet the USEPA criteria for representativeness, and are suitable based on proximity and terrain similarities between the Project Site and BFL. The terrain immediately surrounding the meteorological station and the HECA Project is rural, as shown in the aerial photographs of Figure 2. Circles with a 1-kilometer radius around the HECA Project Site and the meteorological station show similar terrain, including open fields and semi-developed land use categories. Projected HECA Project structures will create a more developed site at the Project location, producing some developed land use similar to the airport. There are no major geographical features that could influence the meteorological conditions between or near the locations.

The BFL station and the HECA Project Site both lie within the southern portion of the San Joaquin Valley, between the foothills of the Sierra Nevada Mountains to the east, the Diablo Mountain Range to the west, and the Tehachapi mountains to the south. The HECA Project Site will sit at 288 feet above sea level, while the BFL station sits at 489 feet. The climate in the valley is warm and semi-arid, with the wet season occurring between October and April. The Bakersfield 30-year average for normal sky coverage is 189 days of clear skies per year, 80 days of partly cloudy skies, and 92 days of cloudy skies. Summers are clear and dry. The relative humidity is low in the summer and high in the winter, with an average annual relative humidity of 54 percent. Winds in the San Joaquin Valley often flow with the axis of the valley, and thus blow frequently from the northwest. During the summer the northwest sea breezes frequent the Bakersfield area, especially during hot summer periods, which may carry dust and bring thermal instability. As air descends downward over the mountain ranges, it warms and dries out, allowing temperatures in the city and adjacent areas of the southeastern San Joaquin Valley to run warmer than areas farther north. A very strong eastern Chinook wind will often blow through the Tehachapi Pass during the winter months. Frontal passages are also common in winter months throughout the valley (NCDC, 2010; NOAA, 2008).

An annual wind rose based on the 5 years of Bakersfield surface data was provided in Appendix E-1, Seasonal and Annual Wind Roses, of the AFC Amendment (2012). Winds blow predominantly from the northwest, with an average annual speed of 6.5 miles per hour, but winds are often calm. Western Regional Climate Center Bakersfield Meadows Airport temperature data for the years 1940 through 2012 indicate the average annual high and low temperature for this station are 78 degrees Fahrenheit (°F) and 49°F, respectively (WRCC, 2012).

Only two long-term upper air stations exist for the entire state of California that collect enough data for use in air quality modeling. These stations are in Oakland and San Diego. There is an upper air station at Vandenberg Air Force Base in California, but this station has insufficient hourly data for modeling. SJVAPCD chose the Oakland International Airport upper air station for all meteorological data processing. Data were obtained from the National Oceanic and Atmospheric Administration Radiosonde Database for the same years as the surface station data (NOAA, 2010). The Oakland Airport upper air station is approximately 235 miles northwest of the Project Site. Using the Oakland upper air data and the Bakersfield surface data, AERMET creates an hourly vertical wind profile to estimate wind parameters at different plume heights (USEPA, 2004).

The USEPA AERMOD Implementation Guide (USEPA, 2008a) discussed a fairly new tool called AERSURFACE, which may be used to establish realistic and reproducible surface characteristic values around the meteorological surface station (USEPA, 2008b). SJVAPCD used the AERSURFACE program to determine surface characteristics for input into the AERMET processor program for the Bakersfield meteorological data set. AERSURFACE uses USGS National Land Cover Data 1992 archives to determine the Albedo, Bowen ratio, and surface roughness length representative of the surface meteorological station.

For the AERSURFACE input, the USEPA-recommended surface parameter distance of 1 kilometer was used to develop surface roughness values, and a 10-kilometer radius was used for Albedo and Bowen ratios. Figure 2 displays an aerial view of the HECA Project Site and BFL meteorological station site, with a circle 1 kilometer in radius surrounding both locations. The meteorological station is at an airport, does not receive continuous snow cover in the winter, and is not in an arid region. The Bowen ratio calculation is based on comparison of precipitation during the study period to a 30-year climate average. If conditions are within the upper 30^{th} percentile moisture conditions, it is considered wet conditions; the lower 30^{th} percentile represents dry conditions, and the middle 40^{th} percentile represents average conditions.

The HECA Project Site is in close proximity to the BFL meteorological station, so the locations have a similar climate, the land use surrounding each location is comparable, and there are no major geographical features between the HECA site and weather station that could cause a difference between the meteorological conditions at the two locations. Therefore, the meteorological data used in the NO_2 regional modeling analysis from the BFL station are representative.

4. EMISSIONS SOURCES

4.1 HECA PROJECT

The emission scenario used in the NO_2 1-hour SIL and NAAQS cumulative modeling was developed following guidance from the March 2011 USEPA Memo. To minimize emissions, all HECA emissions sources will use best available control technology (BACT).

For this modeling, the CTG/HRSG and coal dryer operate in normal on-peak (Case 1) power mode. Start-up emissions for the CTG/HRSG are limited to 105 hours per year, while shut-down emissions are limited to 18 hours per year. Start-up emissions for the coal dryer are limited to 104 hours per year, with shut-down emissions at 8 hours per year. Annualized maximum 1-hour NO_2 start-up/shut-down emission rates for these two sources are lower than their normal maximum NO_2 1-hour rates; therefore, the maximum normal NO_2 1-hour emission rates for the CTG/HRSG and coal dryer were used.

Similarly, the SRU flare and tail gas thermal oxidizer have maximum impacts during normal operations with pilot and process vent disposal, respectively, rather than during an annualized start-up period. The Rectisol® and gasification flares were included with maximum annualized start-up flaring emission rates, which are higher than their normal emission rate during pilot mode.

The auxiliary boiler and nitric acid unit operations were included at their peak hourly emission rate. The ammonia plant start-up heater also was included with an annualized start-up 1-hour NO_2 emission rate. Finally, all three ancillary diesel engines, including the two emergency diesel generators and firewater pump, were included in the modeling with annualized emission rates. Mobile sources were not included in this modeling scenario.

The emission rates and stack parameters used in these analyses for the HECA sources can be found in Table 3.

Table 3
HECA Source Emission Rates and Stack Parameters
Used in the NO_2 SIL and NAAQS Analyses

Source	Operating Condition Associated with Emission Rate	Stack Height	Temperature	Exit Velocity	Stack Diameter	NO_2 emissions
		(ft)	(°F)	(ft/sec)	(ft)	(lb/hr)
HRSG Stack	Normal On-Peak Emissions (Case 1)	213.00	200.00	53.81	23.00	25.01
Coal Dryer	Normal On-Peak Emissions (Case 1)	305.00	200.00	19.16	16.00	4.37
Tail Gas Thermal Oxidizer Stack	Normal operations	165.00	1200.00	50.93	2.50	3.12
Auxiliary Boiler	Normal operations	80.00	300.00	30.18	4.50	1.28
Rectisol® Flare	Annualized emissions, start-up flaring	217.83	1831.73	65.62	0.87	0.24
Gasification Flare	Annualized emissions, start-up and shut-down flaring	219.63	1831.73	65.62	1.22	0.66
SRU Flare	Normal Operations, Pilot	215.00	1831.73	65.62	0.32	0.04
Nitric Acid Plant Stack	Normal operations	145.00	239.00	17.11	8.00	4.18
Emergency Diesel Generator 1	Annualized emissions	20.00	760.00	221.05	1.20	0.02
Emergency Diesel Generator 2	Annualized emissions	20.00	760.00	221.05	1.20	0.02
Emergency Diesel Firewater Pump	Annualized emissions	20.00	850.00	155.91	0.70	0.02
Ammonia Synthesis Plant Start-up Heater	Annualized emissions	80.00	300.00	18.71	3.50	0.01

Notes:
ft = foot/feet
Lb = pound
Hr = hour
HRSG = heat recovery steam generator
NAAQS = National Ambient Air Quality Standard
NO_2 = nitrogen dioxide
sec = second
SIL = Significant Impact Level
SRU = sulfur recovery unit

4.1.1 NO_2/NO_X In-Stack Ratios for HECA Sources

In stack NO_2/NO_X ratios were determined for all sources in the NO_2 modeling for use in the ozone limiting method PVMRM. For the emergency generators, firewater pump, ammonia start-up heater, and auxiliary boiler, the NO_2/NO_X in-stack ratios were obtained from the SJVAPCD 2010 draft guidance document, *Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM* and the CAPCOA *Modeling Compliance of the Federal 1-hour NO_2 NAAQS*

(Attachment C). For the emergency generators and fire water pump, an in-stack ratio of 0.2 was used from the "IC Engines (Diesel)" category. The ammonia start-up heater used an in-stack ratio of 0.32 from the "Heaters (NG)" category. For the auxiliary boiler, an in-stack ratio of 0.1 was used from the "Boilers (NG)" category.

Limited information is available regarding in-stack NO_2/NO_X ratios for thermal oxidizers and flares. The exhaust from the thermal oxidizer or flares will have very little to no residence time in the stack, so almost no conversion of nitrogen oxide (NO) to NO_2 is expected. For these sources, it was conservatively assumed that 10 percent of the NO_X will be NO_2.

No data exist for the NO_2/NO_X in-stack ratio for turbines burning hydrogen-rich fuel or the associated coal dryer. The turbine vendor expects the NO_2/NO_X in-stack ratio will be similar to turbines that burn natural gas. Based on the in-stack NO_2/NO_X ratio of 0.091 for a natural gas turbine as determined by SJVAPCD guidance, and accounting for the conversion of NO to NO_2 across the oxidation catalyst that could be as high as 20 percent (NO_2/NO_X ratio 0.2), HECA proposes to use the conservative NO_2/NO_X in-stack ratio of 0.3 for all turbine and coal dryer operating conditions. Neither the turbine nor oxidation catalyst vendor could provide written documentation regarding the NO_2/NO_X in-stack ratio, although this ratio was their professional engineering estimate.

Emissions from the nitric acid plant will be cleaned before being discharged to the atmosphere by catalytic decomposition and reduction of both nitrous oxide (N_2O) and NO_X. The N_2O emissions are treated in a tertiary reduction system, in a reducing catalyst that uses high temperature rather than a reducing agent, to convert 95 percent of the remaining N_2O emission to molecular nitrogen (N_2) and nitric oxide (NO). The NO_X emissions (including the NO formed in the N_2O converter) are then reduced in one or more selective catalytic reduction (SCR) units, with injected ammonia as a reducing agent, as is typical for NO_X control in flue gas systems. The nitric acid unit vendor and Project design engineers estimate that approximately 50 percent of the NO converts to NO_2 in the exhaust, therefore an in-stack ratio of 0.5 was used.

4.2 NEARBY SOURCES

Section 8.2 of Appendix W of 40 CFR, Part 51 (the USEPA's *Revision to the Guideline on Air Quality Models* [USEPA, 2005]) refers to background concentrations as "an essential part of the total air quality concentration to be considered in determining source impacts." When a source is not isolated, a multi-source model (i.e., AERMOD) is prescribed to establish the potential impact of nearby sources. In the recommendations subsections for multi-source areas, the following key points are made:

- Contributions from ***nearby sources*** and contributions from ***other sources*** should be determined.

- ***Nearby sources*** are those expected to cause a significant concentration gradient in the vicinity of the source or sources under consideration; the number of such sources is "expected to be small," given the complexities of modeling specific projects (i.e., unique modeling situations, large numbers of variables). It specifically states that the definition is provided merely as guidance and is not intended to alter professional judgment.

- An appropriate model should be employed along with emission input data as shown in Table 8-1 or 8-2 of the USEPA guidelines (USEPA, 2005); any unpermitted sources should be modeled at their maximum physical capacity to emit.

- Only sources that would run simultaneously with the primary source being modeled (i.e., HECA) are to be modeled. As an example: “emergency backup generators that never operate simultaneously with the sources that they back up would not be modeled as nearby sources.”

- Interactions between the primary source and the various nearby sources should be evaluated by examining the areas of maximum impact for each separately, followed by examination of the area of maximum impact where the two are combined, on a “trial and error” basis.

- ***Other sources*** are defined as the “portion of the background attributable to all other sources (e.g., natural sources, minor sources, and distant major sources)” to be determined using prescribed methods.

Other sources that were not accounted for in the background data, such as minor sources and distant major sources, were included in the modeling analysis. For simplicity in discussion, other sources and nearby sources are collectively referred to as “nearby sources.”

4.2.1 Nearby Source Screening and Selection Process

URS requested information on NO_2 emissions sources surrounding the HECA Project Site from the SJVAPCD for the PSD analysis. SJVAPCD provided a list of over 8,500 permitted sources to a distance of approximately 75 kilometers from the center of the HECA Project Site. Upon closer inspection, the NO_X emissions data for approximately 75 percent of these sources contained either no values for the daily or annual emission rates or presented values of zero. For the most part, the zero emissions sources consisted of processes or equipment that would not emit NO_X (e.g., VOC sources, such as gasoline stations, storage tank operations, etc., or particulate matter [PM] sources, such as wood processing, dust control equipment, etc.). The zero emissions sources were further screened for dormant NO_X equipment that was flagged as such in the SJVAPCD’s equipment description (i.e., dormant equipment typically contained the word “DORMANT” in the SJVAPCD’s equipment description). This was also done by searching the zero emissions equipment description for the terms “ENGINE” and/or “TURBINE.” Any engines and/or turbines with zero emissions were labeled as “assumed dormant.”

Furthermore, equipment was analyzed based upon its distance from the HECA Project Site. The fairly large distance between the HECA Project Site centroid and its property fence line (approximately 1.3 miles) resulted in URS extending the radii (or distance) to screen. The following distances were used to evaluate the sources surrounding the HECA Project Site:

- Source distance less than 11.4 miles (18.3 kilometers)

- Source distance greater than or equal to 11.4 miles (18.3 kilometers), and less than or equal to 32.4 miles (52.1 kilometers)
- Source distance greater than 32.4 miles (52.1 kilometers)

After omitting sources for which NO_X emissions were either zero or not provided, URS used a qualitative approach to further refine the sources used in this modeling analysis. This approach was based upon professional judgment and made use of various source metrics or a combination thereof, including, but not limited to the following:

- size (e.g., horsepower [hp], heat input rating, or emissions)
- type of source
- frequency of use (e.g., emergency/standby internal combustion (IC) engine/ emergency fire pump, test operation)
- relative emission rate (Q) divided by source distance from HECA centroid (d), Q/d

and, specifically for IC engines:

- USEPA Tier emission rating
- Emergency or non-emergency IC engine

The use of Q/d was prescribed as a viable screening method for PSD projects in a 1985 letter by the State of North Carolina Department of Natural Resources and Community Development (NCDNRCD) (NCDNRCD, 1985). That particular reference suggested that this simple screening method could be employed to:

> "rapidly and objectively eliminate from the emissions inventory those sources that are beyond the PSD impact area yet within the screening area, but are not likely to have significant interaction with the PSD source."

Two Q/d values labeled Q/D-1 and Q/D-2, with units of tons per year per kilometer (ton/yr/km), were calculated for each source by dividing the respective daily and annual emissions values by its distance from HECA. As expected, the values calculated using daily emissions are more conservative (except in the case of several flagged sources [errant data]); that is, they would cause more sources to be included in the analysis.

A summary of the number of nearby sources included in the modeling analyses that exceed a Q/d threshold of 2, one order of magnitude less than the threshold of 20 used in the NCDNRCD document (NCDNRCD, 1985), is provided in Table 4.

Using professional judgment, a number of facilities (especially oil production/refining operations, cogeneration plants, etc.) were included based upon the fact that they had a significant number of sources or yielded significant emissions, even if they had Q/d values less than the screening threshold presented in Table 4.

As a conservative check on information presented in Table 4, additional effort was made to evaluate a "totalized" facility Q/d, whereby the sum of the Q/d values for a facility's sources

Table 4
Summary of Number of Sources with a Q/D Threshold of 2

Distance	Threshold Value	No. of Sources Included, Using ONLY Q/d Calc	
		Q/D-1 ([ton/yr]/km) (based on daily emissions)	Q/D-2 ([ton/yr]/km) (based on annual emissions)
< 11.4 mi (18.3 km)	2	33	22
≥ 11.4 mi (18.3 km) and ≤ 32.4 mi (52.1 km)	2	90	39
> 32.4 mi (52.1 km)	2	3	0

Notes:
< = less than
> = greater than
≤ = less than or equal to
≥ = greater than or equal to
mi = mile
km = kilometer
[ton/yr]/km = tons per year per kilometer

(those sources with NO_X emission rates greater than 2 pounds per hour [or 48 pounds per day]) was compared to the Q/d threshold of 2 used above. No such cases were found; therefore, no additional facilities were included based upon totalized facility emissions.

Smaller co-located sources within the lesser 10-mile radius were also more likely to be included than those at greater distances.

The result of adding the various co-located sources, the sources found at fairly large facilities (even those below threshold values), removal of intermittent sources, plus all the other factors resulted in the modeled source count presented in Table 5.

Table 5
Sources Included in the 1-hour NO_2 PSD Analysis

Distance Range	Total
< 11.4 mi (18.3 km)	108
≥ 11.4 mi (18.3 km) and ≤ 32.4 mi (52.1 km)	257
> 32.4 mi (52.1 km)	6
Total	371

Notes:
< = less than
> = greater than
≤ = less than or equal to
≥ = greater than or equal to
mi = mile
km = kilometer
NO2 = nitrogen dioxide
PSD = Prevention of Significant Deterioration

The source counts above are based upon professional judgment, while also taking into account the sources with a Q/D-1 or Q/D-2 greater than or equal to 2; in addition, small sources that could not have a significant impact were removed. Small sources (co-located or not) with a daily emission rate less than or equal to 48 pounds per day (equates to 2 pounds per hour) were omitted from the source list due to their limited size. Emergency/standby engines at nearby facilities were not included based on the March 2011 USEPA Memo modeling guidance. However, 78 IC engines powering compressors, 13 IC engines for agricultural pumping, and 3 IC engines used to start gas turbines were included for the regional modeling analysis.

The number of sources discussed above may differ from that discussed in the January 2011 modeling protocol; such reasons for removing sources may include, but are not limited to, the following:

1. duplicative/backup sources;
2. additional information provided for a given source;
3. omitting emergency engines at nearby facilities from the modeling inventory; and
4. if a source closer to HECA does not result in a significant concentration gradient, a similar source farther from HECA may be eliminated.

Several source data handling assumptions were used as follows:

- Multiple Flares: If SJVAPCD information showed that a facility has more than one (1) flare or emergency flare in its permitted inventory, then at least one of any duplicate flares (i.e., flares of equivalent heat input capacity that result in equivalent pseudo-stack parameters, as discussed later) or the most conservative flare was used; professional judgment was used to estimate the conservativeness of stack parameters in combination with the emission rates provided by the SJVAPCD;
- Sources immediately adjacent to the Shafter monitoring station that are already included in the background data were excluded from the analysis.

All nearby sources included in the NO_2 analysis were modeled using their maximum hourly emission rate. The maximum hourly emission rates were estimated by dividing each source's maximum permitted daily emissions (as provided by SJVAPCD) by 24 hours. The modeling analysis includes all nearby sources operating simultaneously with maximum emissions; this is an extremely conservative assumption and is guaranteed to overestimate potential impacts from these sources during actual HECA Project operations. The SJVAPCD provided nearby source list of over 8,000 sources, which is presented electronically with the modeling files. The list of the modeled nearby sources with stack parameters is provided in Attachment A.

Figure 8 presents the hourly emissions from nearby sources included in the modeling analysis. Sources located at the same facility have been combined in order to simplify the plot. The largest facilities within 10 kilometers of the HECA Project are OEHI (IC engines and heaters) and Elk Hills Power (turbine). The largest contributors (greater than 100 pounds per hour) are several cogeneration plants (Sycamore Cogeneration Co. and Kern River Cogeneration Co.) and oil and gas facilities (Aera Energy, LLC and Chevron, USA Inc.) located greater than

30 kilometers from the HECA Project Site. A complete list of all sources is included as Attachment A and in the modeling files presented electronically with this submittal.

4.2.2 Nearby Source Emissions and Stack Parameters

The emissions for the nearby sources included in the modeling analysis are tabulated in Attachment A. A collective sum of approximately 1.5 tons of NO_2 per hour is assumed to be emitted by all nearby sources, running continuously with the modeled HECA emissions.

Stack parameters for the nearby sources included in the analysis were either provided by SJVAPCD or derived from similar equipment based on professional judgment. URS filed a Public Records Request with the SJVAPCD in early-November 2009 for permit-related information from 25 facilities within approximately 10 miles of the HECA Project Site. The request included the following document types: permit applications, emissions inventory statements, AB2588 "Hot Spots" Information, engineering evaluations, and determinations of compliance. Furthermore, the request called for documents that included a summary of modeling files, including information on stack parameters and source coordinates. In late November 2009, URS received two DVDs of information for the 25 facilities. A very large number of PDF files were provided on the disks for each facility; however, review of each PDF file proved overwhelming and instead only the larger files were perused for useful information. The most useful information was typically a source test, air toxics inventory, or engineering evaluation; however, few such documents were found. As stack parameter information was found for particular sources, such information was applied to other sources based upon their similarity in size and/or orientation.

If adequate source information was not provided to approximate source parameters (e.g., a flare without a heat input rating), parameters for a similar source with a similar emission rate at the same facility or similar facility were used. Similarly, if stack parameters could not be readily found in information provided by the SJVAPCD via a literature search or via internet searches, then reasonable stack parameters for similar equipment were used, or approximate values were used based upon the professional judgment of a URS technical staff member.

Pertinent source information provided by the SJVAPCD included locations (as UTM coordinates), emission rates, equipment descriptions, facility number, permitted source number, etc. Due to the size of the modeled area and number of sources, the accuracy of facility locations provided by the SJVAPCD was not questioned, nor investigated.

In parallel with the request for information from SJVAPCD, Occidental of Elk Hills, Inc. (OEHI) was approached independently. OEHI is located fairly close to the HECA project and consists of a very large number of sources. The following information received for approximately two-thirds of the sources at OEHI proved useful in the modeling analysis:

- source coordinates
- stack temperature
- stack height
- stack diameter
- base elevation

- exhaust stack temperature
- equipment status (active/dormant/emergency)
- equipment make, model and permit number

Coordinates for the remaining one-third of OEHI sources were estimated; stack parameters for those same sources (and stack flow rates or velocities for the above two-thirds) were estimated based upon professional judgment and/or research of parameters for similar equipment.

One type of regional NO_X source found in great numbers and densities in oil field applications was a gas- and/or vapor-fired steam generator (most common size was 62.5 MMBtu/hr). Source parameters for these steam generators, including stack height, stack diameter, exhaust stack temperature, and a stack flow rate and/or velocity, were found in a Human Health Risk Assessment (HRA) produced by the SJVAPCD for a document entitled "Notice of Preliminary Decision - ATC/Cert of Conformity," addressed to Chevron USA and dated 12-8-10. The HRA was dated 10-29-10 and addressed 62.5 MMBtu/hr steam generators specifically.

In general, SJVAPCD-provided UTM coordinates were identical for all sources at a given facility (with the same facility ID). This resulted in a considerable amount of co-located sources being input to the modeling. In some instances, all of which are noted appropriately, the SJVAPCD-provided coordinates were adjusted using aerial imaging software, the facility footprint (where appropriate), and professional judgment to distribute sources across a larger area. Such was the case for several apparent oil fields (e.g., Aera Energy LLC [Facility ID No. 1135]; Chevron USA, Inc. [Facility ID No. 1141]) that consisted of the steam generator equipment previously mentioned and/or combined cycle gas turbines equipment providing both electricity and steam. The coordinates of selected sources at OEHI [Facility ID Nos. 382, 2234]) were also adjusted where facility information was not provided; this facility included a wide variety of equipment.

Notes pertaining to the source of input information (e.g., emissions rates or stack parameters used) for all nearby sources included in modeling are tabulated in Attachment A.

4.2.2.1 Nearby Source NO_2/NO_X In-Stack Ratios

NO_2/NO_X in-stack ratios were obtained from the SJVAPCD 2010 draft guidance documents, *Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM* and the updated Recommended In-Stack NO_2/NO_X Ratios (Attachment C), and Master List of NO_2/NO_X ratios from EPA Region 10, which is provided electronically with the modeling files in the submittal of the AFC Amendment (2012). Table 6 contains a listing of the NO_2/NO_X in-stack ratios used for the various combinations of nearby source types and fuels.

As seen in Table 6, the NO_2/NO_X in-stack ratio for the nearby sources was chosen by equipment and fuel type, as provided from SJVAPCD guidance, and USEPA Region 10 for large gas turbines. Where good information regarding a particular type of source was not available, a high ratio was used. In-stack ratios used for each nearby source are provided with the modeling source input parameters in Attachment A.

Table 6
NO_2 / NO_X In-stack Ratios Used in Modeling

Source Type	Fuel	In-stack Ratio Used	
Boilers/Steam generators	biomass, NG, vapor	0.1	
Turbines (including cogeneration, simple-/ combined-cycle, and gas compressor applications)	NG	0.1032 0.17	(small turbines) (large turbines)
Emergency turbine	diesel	0.1	
Other cogeneration sources	solid fuel, multi-fuel	0.1	
Process heaters/dryers	NG, vapor	0.32 / 0.1	(heaters or both) / (dryers)
IC engines (including those acting as gas turbine starters or powering pumps)	diesel	0.2	
	NG	0.1	
IC engines (acting as compressors)	diesel	0.2	
	NG	0.6	
Ovens	NG	0.32	

Notes:
NO_2 = nitrogen dioxide
NO_X = nitrogen oxide
NG = natural gas

5. MODELING RESULTS

Because NO_2 impacts from HECA sources exceeded the 1-hour SIL, a cumulative impact assessment was completed to determine whether the Project would cause or contribute to a modeled violation of the NAAQS. HECA sources were combined with nearby sources and modeled in AERMOD with PVMRM, and hourly NO_2 ambient background concentrations were added to the hourly model predictions. Section 5.1 presents the results from HECA sources alone compared with the 1-hour NO_2 SIL, and defines the area of impact receptors to be subsequently used in the regional analysis. Section 5.2 presents results from the regional analysis, which presents the HECA sources, nearby sources, and background modeled design value in comparison to the NAAQS.

5.1 RESULTS FOR SIL AND AREA OF IMPACT FROM HECA SOURCES

Screening modeling determined whether HECA operational impacts had the potential to cause or contribute to a violation of the NAAQS, comparing the modeled maximum first high concentration averaged over 5 years to the NO_2 1-hour Class II interim SIL of 4 ppb. Only permitted stationary sources were included in the modeling analyses.

The modeled NO_2 concentration from HECA was predicted to be 24 µg/m^3, compared with the interim NO_2 1-hour SIL of 7.55 µg/m^3 (4 ppb) for Class II areas. This NO_2 1-hour concentration is the maximum first high concentration averaged over 5 years. In this initial impact analysis, approximately 2,500 receptors exceeded the NO_2 1-hour SIL within 15 kilometers of the site, and were used as the HECA area of impact for the refined modeling analysis.

5.2 RESULTS FOR CUMULATIVE MODELING ANALYSIS

The MAXDCONT option in AERMOD was run to determine the NO_2 1-hour impact contribution from HECA. The option was run from rank 8 (or, the 98th percentile daily maximum value per receptor averaged over 5 years) to rank 20, with a threshold value equal to the NO_2 1-hour NAAQS (188 µg/m^3). The target source group was set to all sources (HECA, regional sources, and background). This setup option continues to examine the concentrations for all ranks until the impacts from all sources are less than the threshold value of 188 µg/m^3. This option was used to obtain any exceedances of the NAAQS from all sources and, if an exceedance occurs, whether or not HECA's contribution is greater than or equal to the SIL at that point in time and space. HECA stationary sources were modeled using the higher of their normal operating emission rate or an annualized intermittent operation emission rate.

The maximum modeled 5-year average 8th high (98th percentile) 1-hour daily concentration (design value) at any receptor was 126 µg/m^3, which complies with the 1-hour NO_2 NAAQS of 188 µg/m^3. The total predicted design value includes HECA sources, nearby regional sources and background measured concentrations of NO_2.

The regional modeling analysis showed that no concentrations were predicted to be greater than the NAAQS. Therefore, HECA does not cause or significantly contribute to a violation of the NO_2 1-hour NAAQS.

6. CONSERVATISM IN THE MODELING ANALYSIS

Following the USEPA modeling guidance documents resulted in the inclusion of many conservative assumptions within the modeling analysis. The conservative data assumptions used as input to the modeling analysis are outlined below:

1. Emissions from the nearby sources were input at maximum potential to emit out as far as 75 kilometers. For most sources the maximum permitted emission rates are significantly higher than their actual emission rates, and thus the modeling over-predicts the impacts from these sources.

2. Simultaneous operation of HECA sources and nearby sources, all with maximum hourly permitted emission rates, for all hours of the 5-year meteorological data set.

3. For NO_2/NO_X in-stack ratios, a high ratio was used where good information regarding a particular type of source was not available.

4. The hourly upper bound NO_2/NO_X equilibrium ratio of 0.9 was used, and this value is higher than the maximum seasonal hourly ratio of 0.83.

5. Hourly NO_2 background data from the Shafter monitoring station are used as a surrogate for emissions from transportation sources near the HECA Project, although they will also contain contributions from sources near the monitoring station.

6. The traffic volume near the Shafter monitoring station is expected to be approximately nine times larger than the traffic volume near the HECA when operation starts. The NO_2 data from the Shafter monitoring station represents significantly more vehicular emissions than are expected near HECA.

7. HECA has purchased Emission Reduction Credits (ERC) to cover the total HECA Project annual NO_X emissions at a 1.5-to-1 ratio. No credit has been taken for these emission reductions in the modeling analysis.

The use of so many conservative inputs into the model have the effect of removing accuracy from the analysis and analyzing a situation that could never be observed in reality, thereby grossly overestimating the potential impact from HECA Project operations and nearby sources.

7. CONCLUSION

The HECA Project is a revolutionary power and manufacturing facility and one of the first projects in USEPA Region IX that is faced with showing compliance with the new, statistically based 1-hour NO_2 NAAQS. Although USEPA has created guidance documents for conducting modeling to show compliance with the new standard, many aspects of conducting a regional analysis are still controversial between different permitting agencies. HECA has been in constant contact with USEPA Region IX and SJVAPCD, seeking additional modeling guidance in order to show compliance with the new 1-hour NO_2 NAAQS. This analysis was based on techniques agreed to with USEPA Region IX, OAQPS, and SJVAPCD.

The modeling results compiled and presented in the report clearly show that the HECA Project, combined with nearby sources to a distance of 75 kilometers, conservative ambient air quality background values, and a number of other of other conservative assumptions, would comply with the 1-hour NO_2 NAAQS.

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Appendix E-8

Commissioning Scenario Emissions and Modeling Results

HECA Emissions for all Commissioning Scenarios

	Maximum Hourly Emission Rates (lb/hr)				
Case 1	SO2	Nox	CO	VOC	PM10
One Diesel Generator	0.0	3.2	16.7	1.9	0.5
Power CT	0	0	0	0	1.1
Total	**0.03**	**3.2**	**16.7**	**1.9**	**1.6**

Case A	SO2	Nox	CO	VOC	PM10
Power Block CT	0	0	0	0	1.1
CTG @ 20% No Controls	2.1	67.1	2270	65	15
Total	**2.1**	**67.1**	**2270**	**65**	**16.1**

Case B	SO2	Nox	CO	VOC	PM10
Power Block CT	0	0	0	0	1.1
CTG @ 80% No Controls	4.8	391.2	344.5	3.8	15
Total	**4.8**	**391.2**	**344.5**	**3.8**	**16.1**

Case A2	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
Flare Unshifted	4.1	140	4000	0	0
(NG) Coal Drying	0.3	4.5	44.2	1.9	0.9
(NG) HRSG 80%	4.7	34.1	26	5.9	15
Tail Gas Oxidizer	2.2	22.3	18.6	0.6	0.7
No CO2 Venting					
Total	**11.2**	**201.0**	**4088.8**	**8.4**	**19.8**

Case B2	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
Flare Shifted	4.1	140.0	740.0	0.0	0.0
(NG) Coal Drying	0.3	4.53	44.22	1.9	0.9
(NG) HRSG 80%	4.7	34.1	26	5.9	15
Tail Gas Oxidizer	42.7	22.3	18.6	0.6	0.7
No CO2 Venting					
Total	**51.8**	**201.0**	**828.8**	**8.4**	**19.8**

Case C2	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
H2 Rich Gas Flare	4.1	140.0	740.0	0.0	0.0
(NG) Coal Drying	0.3	4.53	44.22	1.9	0.9
(NG) HRSG 80%	4.7	34.1	26	5.9	15
Tail Gas Oxidizer (Normal Operation)	2.0	3.1	2.6	0.1	0.1
CO2 Vent	0	0	246	5.5	0
Total	**11.1**	**181.8**	**1058.8**	**13.4**	**19.2**

Case D2	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
H2 Rich Gas Flare	3.6	123.8	654.2	0.0	0.0
PSA Off-Gas Flare	0.5	16.2	85.8	0.0	0.0
(NG) Coal Drying	0.3	4.53	44.22	1.9	0.9
(NG) HRSG 80%	4.7	34.1	26	5.9	15
Tail Gas Oxidizer (Normal Operation)	2.0	3.1	2.6	0.1	0.1
No CO2 Venting					
Total	**11.1**	**181.8**	**812.8**	**7.9**	**19.2**

Case E2	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
H2 Rich Gas Flare	1.0	35.0	185.0	0.0	0.0
Coal Drying (H2)	0.9	17.6	21.4	0.6	1.4
HRSG (40% H2)	2.4	66.6	81	4.6	15
Tail Gas Oxidizer (Normal Operation)	2.0	3.1	2.6	0.1	0.1
CO2 Vent	0	0	246	5.5	0
Total	**6.3**	**122.3**	**536.0**	**10.8**	**19.7**

Case A3	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
H2 Purified Flare	0.0	79.9	0.0	0.0	0.0
Coal Drying (Normal)	0.9	4.4	3.2	0.6	1.4
HRSG (normal)	4.1	25	18.3	3.5	15
Tail Gas Oxidizer (Normal Operation)	2.0	3.1	2.6	0.1	0.1
CO2 Vent (blend to CO2 purification)	0	0	103.4	0	0
Total	**7.0**	**112.4**	**127.5**	**4.2**	**19.7**

Case B3	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
H2 Rich Gas Flare	0.0	79.9	0.0	0.0	0.0
Coal Drying (Normal)	0.9	4.4	3.2	0.6	1.4
HRSG (normal)	4.1	25	18.3	3.5	15
Tail Gas Oxidizer (Normal Operation)	2.0	3.1	2.6	0.1	0.1
CO2 Vent (high purity)	0	0	103.4	0	0
Ammon S/U Heater	0.1	0.5	1.5	0.2	0.2
Total	**7.1**	**112.9**	**129.0**	**4.3**	**19.9**

Case C3	SO2	Nox	CO	VOC	PM10
Power CT	0	0	0	0	1.1
ASU CT	0	0	0	0	0.2
Process CT	0	0	0	0	1.9
Coal Drying	0.9	4.4	3.2	0.6	1.4
HRSG (normal)	4.1	25	18.3	3.5	15
Tail Gas Oxidizer (Normal Operation)	2.0	3.1	2.6	0.1	0.1
Nitric Acid Nox Abator	0.0	60.0	0.0	0.0	0.2
Total	**7.0**	**92.5**	**24.1**	**4.2**	**19.9**

Flare Stack Parameters for Commissioning Modeling Scenarios

Parameter	Gasification Flare (unshifted) Case A2	Gasification Flare (shifted) Case B2	Gasification Flare (H2 Rich) Case C2	Gasification Flare (H2 Rich gas, PSA Off-Gas Flare) Case D2	Gasification Flare (H2 Rich Gas) Case E2	Gasification Flare (H2 Purified) Case A3 and B3
Heat release rate for flare+pilot, (10^6 Btu/hr HHV)	2000	2000	2,000	2,000	500	1142
H = Total Heat release rate (cal/s)	1.40E+08	1.40E+08	1.40E+08	1.40E+08	3.50E+07	7.99E+07
Fb = Buoyancy flux	2.32E+03	2.32E+03	2.32E+03	2.32E+03	5.81E+02	1.33E+03
Q_H = sensible heat release rate	6.30E+07	6.30E+07	6.30E+07	6.30E+07	1.57E+07	3.60E+07
Actual Stack height (m)	76.2	76.2	76.2	76.2	76.2	76.2
GEP stack height for modeling (m)	65	65	65	65	65	65
AERMOD Input parameters						
He = Effective stack height (m) as calculated in SCREEN3	100.71	100.71	100.71	100.71	83.41	92.32
T = Stack temperature (K)	1273	1273	1273	1273	1273	1273
v = Exit velocity (m/s)	20	20	20	20	20	20
d = effective stack diameter (m)	7.842	7.842	7.842	7.842	3.921	5.926

Flare stack parameters are based on calculated using the SCREEN3 technique
Fb = Buoyancy flux = 1.66 x 10-5 x H
QH = sensible heat release rate = 0.45 x H
He = Effective stack height (m) = Hs + 4.56E-03 * H^0.478
BTU/hr to cal/sec 0.06999882

HECA Modeling Results for all Commissioning Scenarios

Modeling Scenario	Pollutant	Averaging Period	Maximum Estimated Impact (mg/m^3)	Background[1] (mg/m^3)	Monitoring Station Description[1]	Total Predicted Concentration (mg/m^3)	Most Stringent Standard (mg/m^3)[2]
Case 1	CO	1-hour	144.64	4,581	a	4725.64	23,000
		8-hour	46.38	2,485	a	2531.38	10,000
	SO_2	1-hour	0.26	42	d	42.26	655
		24-hour	0.03	13	d	13.03	105
	NO_2[3]	1-hour	24.94	140	b	164.94	339
	PM_{10}	24-hour	0.95	264	c	264.55	50
Case A	CO	1-hour	1975.17	4,581	a	6556.17	23,000
		8-hour	801.25	2,485	a	3286.25	10,000
Case B	SO_2	1-hour	4.18	42	d	46.18	655
		24-hour	0.85	13	d	13.85	105
	NO_2[3]	1-hour	149.73	140	b	289.73	339
Case A2	CO	1-hour	565.85	4,581	a	5146.85	23,000
		8-hour	147.91	2,485	a	2632.91	10,000
	SO_2	1-hour	4.18	42	d	46.18	655
		24-hour	0.85	13	d	13.85	105
	NO_2[3]	1-hour	38.36	140	b	178.36	339
	PM_{10}	24-hour	3.40	264	c	267.00	50
Case B2	SO_2	1-hour	97.43	42	d	139.43	655
		3-hour	37.51	26	d	63.51	1,300
		24-hour	7.48	13	d	20.48	105
	NO_2[3]	1-hour	38.36	140	b	178.36	339
Case C2	CO	1-hour	1097.41	4,581	a	5678.41	23,000
		8-hour	178.21	2,485	a	2663.21	10,000
Case D2	NO_2[3]	1-hour	23.43	140	b	163.43	339
Case E2	CO	1-hour	914.50	4,581	a	5495.50	23,000
		8-hour	146.67	2,485	a	2631.67	10,000
	NO_2[3]	1-hour	66.76	140	b	206.76	339
Case B3	CO	1-hour	384.78	4,581	a	4965.78	23,000
		8-hour	61.38	2,485	a	2546.38	10,000
	SO_2	1-hour	5.53	42	d	47.53	655
		24-hour	0.92	13	d	13.92	105
	NO_2[3]	1-hour	23.23	140	b	163.23	339
Case C3	NO_2[3]	1-hour	128.32	140	b	268.32	339
	PM_{10}	24-hour	3.51	264	c	267.11	50

Source: HECA Project 2012

Notes:

1. Background Concentrations are maximum concentrations from the last 3 years of available EPA AirData and/or CARB data at the following stations
   - a) Bakersfield Golden State Highway Monitoring Station, Maximum Concentration 2007-2009
   - b) Shafter Monitoring Station, Maximum Concentration 2009-2011
   - c) Bakersfield California Avenue Monitoring Station, Maximum Concentration 2008-2010
   - d) Fresno 1st Street Monitoring Station Maximum Concentrations, 2007-2009 for 3-hour SO_2, 2009-2011 for 1-hour and 24 -hour SO2
2. Although there is a NAAQS for SO2 and NO2 1-hour impacts from commissioning activities are only be compared to the CAAQS due to the infrequent nature of the commissioning activities.
3. NO_2 modeling for commissioning was conducted with the PVMRM algorithm.

CO = carbon monoxide

NO_2 = nitrogen dioxide

PM_{10} = particulate matter less than 10 microns in diameter

SO_2 = sulfur dioxide

µg/m^3 = micrograms per cubic meter

Appendix E-9

Fumigation Modeling Results

SCREEN3 Fumigation Modeling

Nocturnal Fumigation - Inversion Break-up Fumigation

Max model scenario from crit pollutants modeling		**Max Conc X/Q (ug/m^3/g/s)**	**Distance to max (m)**	
NO2 1hr HRSG and coal dryer in startup 40% NG mode, TO startup, nitric acid plant on	HRSG max impact no fumigation simple terrain	0.9827	1,100	NO2 1hr HRSG Startup 40% NG mode Max Impact Scenario
	HRSG inversion Break-up Fumigation max impact	0.9865	18,896	
	Coal Dryer max impact no fumigation simple terrain	4.1410	900	NO2 1hr Coal Dryer Startup 40% NG mode Max Impact Scenario
	Coal Dryer Inversion Break-up Fumigation max impact	2.0100	10,783	
	TAIL TO max impact no fumigation simple terrain	6.5320	700	NO2 1hr Tail Gas Thermal Oxidizer Startup Max Impact Scenario
	TAIL TO Inversion Break-up Fumigation max impact	6.2710	4,785	
	Nitric Acid Plant max impact no fumigation simple terrain	6.2610	713	NO2 1hr Nitric Acid Plant
	Nitric Acid Plant max impact no fumigation simple terrain	6.3410	4,787	
SO2 1hr HRSG startup 80% natural gas mode, coal dryer normal emissions mix, TO startup	HRSG no fumigation simple terrain	0.9783	1,100	SO2 1hr HRSG Startup 80% NG mode Max Impact Scenario
	HRSG inversion Break-up Fumigation max impact	0.9620	19,252	
	Coal Dryer max impact no fumigation simple terrain	2.6240	1,000	SO2 1hr Coal Dryer Normal Ops mode
	Coal Dryer Break-up Fumigation max impact	1.5430	13,219	
	TAIL TO max impact no fumigation simple terrain	6.5320	700	SO2 1hr Tail Gas Thermal Oxidizer Startup Max Impact Scenario
	TAIL TO Inversion Break-up Fumigation max impact	6.2710	4,785	
CO 1hr HRSG shutdown 20% load NG mode, no coal dryer, TO normal process vent	HRSG max impact no fumigation simple terrain	0.9777	1,100	CO 1hr HRSG Shutdown 20% NG mode Max Impact Scenario
	HRSG inversion Break-up Fumigation max impact	0.9590	19,298	
	TAIL TO max impact no fumigation simple terrain	6.5320	700	CO 1hr Tail Gas Thermal Oxidizer normal process vent
	TAIL TO Inversion Break-up Fumigation max impact	6.2710	4,785	

Since the peak impacts occur at different locations the peak concentrations predicted from fumigation of all together sources will be greatly overpredicted.

NO2 1 hr	Emission Rate (g/s)	Xf = 1 hour fumigation conc (ug/m3)	X1 = 1 hour no fumigation conc (ug/m3)	Predicted conc for averaging time (ug/m3)	Background conc (ug/m3)	Total model + background conc (ug/m3)	
HRSG startup	13.5064	**13.324**	13.273	13.32			
COAL DRYER startup	1.9064	3.832	7.894	7.89			
TAIL_TO startup	2.8123	17.636	18.370	18.37			**NO OLM**
NITRIC ACID PLANT	0.5260	**3.336**	3.294	3.34			
				42.92	140	183	
SO2 1 hr							
HRSG Startup natural gas mode	0.5984	0.576	0.585	0.59			
COAL DRYER normal operations mode	0.1180	0.182	0.310	0.31			
TAIL_TO startup	0.2726	1.709	1.780	1.78			
				2.68	42	45	
CO 1 hr							
HRSG Shutdown 20% CTG load on NG no Coal Dryer	285.9802	274.255	279.603	279.60			
TAIL_TO normal process vent	0.3276	2.054	2.140	2.14			
				281.74	4581	4863	

for **2** cases the Xf is more than X1, therefore fumigation must be considered

Scenarios match worst case criteria pollutant modeling

Assumptions
Average annual temp: 63.4 F daily average Buttonwillow, WRCC AFC Table 5.1-2
Flat terrain only
No downwash
Add max impacts from all sources regardless of location, conservative
Distance to nearest fenceline:
HRSG: 454 m
Coal Dryer: 514 m
Thermal Oxidizer: 618 m
Nitric Acid Plant: 713 m
Closest receptor for each source are the distances above, plus receptors out to 10 km with receptor spacing every 100 m from fenceline receptor to 3 km, and every 500 m from 3 km to 10 km.

Appendix E-10

Offset Package

HECA EMISSION REDUCTION CREDIT PACKAGE SUMMARY

Section 4.5.3 of San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 2201 requires a project with operational emissions of nonattainment pollutants and precursors above specific thresholds to provide offsets as mitigation for net emissions increases resulting from the Project, unless otherwise exempt from the offset requirement. Applicable thresholds are 10 tons per year (tpy) of nitrogen oxide (NO_X) or volatile organic compounds (VOC), 100 tpy of carbon monoxide (CO), 14.6 tpy of particulate matter less than 10 microns in diameter (PM_{10}), 100 tpy of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and 27.375 tpy of sulfur oxides (SO_X). In the case of the Project, offsets will not be required for CO per Section 4.6.1 of SJVAPCD Rule 2201, "Emission Offsets shall not be required for the following: Increases in carbon monoxide in attainment areas if the applicant demonstrates to the satisfaction of the APCO, that the Ambient Air Quality Standards are not violated in the areas to be affected, and such emissions will be consistent with Reasonable Further Progress, and will not cause or contribute to a violation of Ambient Air Quality Standards." Modeling results presented in Section 5.1, Air Quality, of the Application for Certification (AFC) Amendment provide this demonstration for carbon monoxide. Thus, CO offsets are not proposed.

Emissions of $PM_{2.5}$ are less than the SJVAPCD offset threshold; therefore, emissions reduction credits (ERCs) are not required for $PM_{2.5}$.

To demonstrate compliance with SJVAPCD rules, the Project is required to provide emission offsets in the form of ERCs equal to increases in gross emissions of NO_X, SO_X, PM_{10}, and VOCs that will result from the operation of the Project, minus the specified thresholds. As discussed below, the Project proposes to further mitigate emissions of these pollutants beyond applicable offset requirements by offsetting the full amount of the Project net emission increase.

SJVAPCD Rule 2201 Section 4.8 specifies distance ratios that must be applied in determining the quantity of ERCs to be provided for a new source. If the location of the offsetting emission reduction is less than 15 miles from the new source, the ratio for a major source is 1.3 to 1. If the location of the offsetting emission reduction is 15 miles or more from the new source, the applicable offset ratio is 1.5 to 1. In the case of the Project, the VOC ERCs procured resulted from an emission reduction less than 15 miles from the Project Site, and a factor of 1.3 was applied. For all other pollutants for which offsets are required, the location of the emission reduction resulting in the ERC is greater than 15 miles from the Project Site, and a factor of 1.5 was applied.

The Project will use SO_X ERCs to offset PM_{10} emissions on an inter-pollutant basis. The SJVAPCD has developed an inter-pollutant trading ratio for SO_X to PM_{10} of 1:1 and concluded that this is protective of managing regional particulate matter impacts and progress towards attainment.

Based on operational emissions data presented in Section 5.1, Air Quality, and applying the appropriate ratios, the calculation of offsets is presented in Table E-10-1. HECA has procured sufficient ERCs to satisfy these offset requirements. The ERCs that have been procured are detailed in Table E-10-2.

Table E-10-1. Emission Reduction Credits Determination

	NO_X	SO_X[2]	PM_{10}	$PM_{2.5}$[3,4]	CO	VOC[5]
Gross Emissions, lb/yr [1]	327,400	58,780	180,700	160,340	550,380	70,800
SJVAPCD Requirements						
Offset Threshold Levels per Section 4.5.3 of DR2201, lb/yr	20,000	54,750	29,200	200,000	200,000	20,000
Required ERCs, lb/yr	307,400	4,030	151,500	-39,660	350,380	50,800
Offsets Triggered?	yes	yes	yes	no	no[6]	yes
Offset Ratio (1:X)	1.5	1.5	1.5	NA	NA	1.3
Required ERCs, lb/yr	461,100	6,045	227,250	0	0	66,040
ERCs in Possession, lb/yr	522,400	266,000	0	0	0	77,498
Inter-pollutant offset, lb/yr	–	-236,000	236,000	–	–	–
ERCs Surplus/(Needed), lb/yr	61,300	23,955	8,750	–	–	11,458
Additional Mitigation						
Required ERCs, lb/yr	327,400	58,780	180,700	0	0	70,800
ERCs in Possession, lb/yr	522,400	266,000	0	0	0	77,498
Inter-pollutant offset, lb/yr	–	-192,000	192,000	–	–	–
ERCs Surplus/(Needed), lb/yr	195,000	15,220	11,300	–	–	6,698

1 = Gross emissions include emissions from the exempt emergency generators and fire pumps; therefore, for SJVAPCD, less ERCs would be required.

2 = Ratio of 1:1 used to apply SO_x certificates to PM_{10} emissions

3 = Major Source of $PM_{2.5}$ is defined as 100TPY as of July 15, 2008

4 = Federal and SJVAPCD NSR offset trigger for $PM_{2.5}$ emissions is 100 TPY.

5 = Ratio of 1:1.3 used for VOCs, because source of VOC ERCs is within 15 miles of HECA project

6 = per Section 4.6.1 of DR2201, "Emission Offsets shall not be required for the following: Increases in carbon monoxide in attainment areas if the applicant demonstrates to the satisfaction of the APCO, that the Ambient Air Quality Standards are not violated in the areas to be affected, and such emissions will be consistent with Reasonable Further Progress, and will not cause or contribute to a violation of Ambient Air Quality Standards."

Table E-10-2. ERCs Procured by HECA

Source	Address	Method of Reduction	ERC Certificate Number	Pollutant	lbs/yr
Big West of California, LLC	6500 Refinery Ave, Bakersfield, CA Section: NE27, Township: 29S, Range: 27E	Shutdown of Catalytic Cracker, Fluid Cocker, and CO Boiler	S-3273-2	NO_X	482,000
	6451 Rosedale Hwy, Area I, Bakersfield, CA Section: NE27, Township: 29S, Range: 27E	Shutdown of Tail Gas Incinerator, 2007027A	S-3275-5	SO_X	168,000
Aer Glan Energy LLC	20807 Stockdale Hwy, Bakersfield, CA Section: NE06, Township: 30S, Range: 26E	Shutdown of Entire Stationary Source	S-3605-1	VOC	31,748
			S-3557-1	VOC	45,750
G.I.C. Financial Services, Inc.	11535 E Mountain View Ave., Kingsburg, CA	Install Selective Catalytic Reduction, SCR, and Scrubber and convert from fuel oil to natural gas	C-1058-2	NO_X	40,400
			C-1058-5	SO_X	98,000

Appendix E-11

Criteria Pollutant BACT Analysis

BEST AVAILABLE CONTROL TECHNOLOGY (BACT) ANALYSIS
HYDROGEN ENERGY CALIFORNIA PROJECT
KERN COUNTY, CALIFORNIA

Prepared For:

San Joaquin Valley Air Pollution Control District
California Energy Commission
U.S. Environmental Protection Agency Region IX

Prepared on behalf of

Hydrogen Energy California LLC

April 2012

URS

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1.0 APPLICABLE REGULATIONS

Federal requirements pertaining to control of pollutants subject to PSD review (i.e., attainment pollutants) were promulgated by the U.S. Environmental Protection Agency (USEPA) in 40 Code of Federal Regulations (CFR) 42.21 (j). This regulation defines Best Available Control Technology (BACT) as emission limits "based on the maximum degree of reduction for each pollutant." BACT determinations are made on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs.

Federal requirements pertaining to control of non-attainment pollutants, or Lowest Achievable Emission Rate (LAER), were promulgated by USEPA under 40 CFR 51.165 (a). This regulation defines LAER as the emissions limit based on either (1) the most stringent emission rate contained in a State Implementation Plan (SIP), unless the [source] demonstrates the rate is not achievable; or (2) the most stringent emissions limitation that is achieved in practice. The federal LAER does not consider the cost impacts of control.

BACT must be applied to any new or modified source resulting in an emissions increase exceeding any San Joaquin Valley Air Pollution Control District (SJVAPCD) BACT threshold. SJVAPCD Rule 2201 requires HECA to apply BACT to any source that has an increase in emissions of oxides of nitrogen (NO_X), volatile organic compounds (VOC), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter equal to or less than 10 microns in diameter (PM_{10}) (criteria pollutants) in excess of 2.0 pounds per highest day. BACT for the applicable pollutants was determined by reviewing the SJVAPCD BACT Guidelines Manual, the South Coast Air Quality Management District BACT Guidelines Manual, the most recent Compilation of California BACT Determinations, CAPCOA (2nd Ed., November 1993), and USEPA's BACT/LAER Clearinghouse.

This analysis provides a BACT review for the proposed HECA Project emission sources of NO_X, CO, VOC, PM_{10} and SO_2.

The Combined Cycle Power Block will generate approximately 405 megawatts (MW) of gross power and will provide a nominal 300 MW of low-carbon baseload electricity to the grid during operations. The basis for the emissions-related analyses is annual average operation at a design capacity of approximately 405 MW of gross power. The Manufacturing Complex is designed for annual production of approximately 1 million tons of nitrogen-based product. The proposed Project as currently configured will involve the following major processes and emission units that require BACT review for the above-mentioned criteria pollutants:

- One hydrogen-rich fuel and/or natural gas–fired Combustion Turbine Generator (CTG) with Heat Recovery Steam Generator (HRSG) and one Steam Turbine-Generator (STG)
- One Multi-cell, Mechanical-draft Cooling Tower for the Combined-Cycle Power Block
- One Multi-cell, Mechanical-draft Cooling Tower for the Air Separation Unit
- One Multi-cell, Mechanical-draft Cooling Tower for the Gasification Block
- One Auxiliary Boiler
- Solid Feedstock Receiving and Handling System

- Gasification Block, including an Elevated Gasification Flare
- Coal Dryer
- Sulfur Recovery System (Tail Gas Thermal Oxidizer and two elevated flares with natural gas assist)
- Two Emergency, Diesel-Engine Generators
- One Diesel-Engine Fire-water Pump
- One carbon dioxide (CO_2) vent stack
- Ammonia Synthesis Unit preheater
- Urea Unit – Absorber Stacks and Pastillation Unit
- Nitric Acid Unit
- Ammonium Nitrate Unit
- Fugitive emissions

Section 2 of the CEC AFC Amendment provides a complete description of the Project indicating the layout of the major components within the site, and general discussion of the Project components.

2.0 BACT REVIEW PROCESS

BACT is defined in the PSD regulations as:

> *"... an emission limitation based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source ... which [is determined to be achievable], on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs" [40 CFR 52.21(b)(12)].*

In a December 1, 1987 memorandum from the USEPA Assistant Administrator for Air and Radiation, the agency provided guidance on the "top-down" methodology for determining BACT. The "top-down" process involves the identification of all applicable control technologies according to control effectiveness. Evaluation begins with the "top," or most stringent, control alternative. If the most stringent option is shown to be technically or economically infeasible, or if environmental impacts are severe enough to preclude its use, then it is eliminated from consideration, and the next most stringent control technology is similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by technical or economic considerations, energy impacts, or environmental impacts. The top control alternative that is not eliminated in this process becomes the proposed BACT basis.

This top-down BACT analysis process can be considered to contain five basic steps, described below (from the USEPA's Draft New Source Review Workshop Manual, 1990).[1]

Step 1. Identify all available control technologies with practical potential for application to the specific emission unit for the regulated pollutant under evaluation.

[1] "New Source Review Workshop Manual," DRAFT October 1990, USEPA Office of Air Quality Planning and Standards

Step 2. Eliminate all technically infeasible control technologies.

Step 3. Rank remaining control technologies by control effectiveness and tabulate a control hierarchy.

Step 4. Evaluate most effective controls and document results.

Step 5. Select BACT, which will be the most effective practical option not rejected, based on economic, environmental, and/or energy impacts.

Formal use of these steps is not always necessary. However, the USEPA has consistently interpreted the statutory and regulatory BACT definitions as containing two core requirements, which USEPA believes must be met by any BACT determination, irrespective of whether it is conducted in a "top-down" manner. First, the BACT analysis must include consideration of the most stringent available technologies, i.e., those that provide the "maximum degree of emissions reduction."

Second, any decision to require a lesser degree of emissions reduction must be justified by an objective analysis of "energy, environmental, and economic impacts" contained in the record of the permit decisions.

Additionally, the minimum control efficiency to be considered in a BACT analysis must result in an emission rate no less stringent than the applicable New Source Performance Standard (NSPS) emission rate, if any NSPS standard for that pollutant is applicable to the source.

This BACT analysis was conducted in a manner consistent with this stepwise approach. Control options for potential reductions in criteria pollution emissions were identified for each source. These options were identified by researching the USEPA database known as the RACT/BACT/LAER/ Clearinghouse (RBLC), drawing upon previous environmental permitting experience for similar units and surveying available literature. Available controls that are judged to be technically feasible are further evaluated based on an analysis of economic, environmental, and energy impacts.

Assessing the technical feasibility of emission control alternatives is discussed in USEPA's draft "New Source Review Workshop Manual." Using terminology from this manual, if a control technology has been "demonstrated" successfully for the type of emission unit under review, then it would normally be considered technically feasible. For an undemonstrated technology, "availability" and "applicability" determine technical feasibility. An available technology is one that is commercially available, meaning that it has advanced through the following steps:

- Concept stage;
- Research and patenting;
- Bench-scale or laboratory testing;
- Pilot-scale testing;
- Licensing and commercial demonstration; and
- Commercial sales.

Suitability for consideration as a BACT measure involves not only commercial availability (as evidenced by past or expected near-term deployment on the same or similar type of emission unit), but also involves consideration of the physical and chemical characteristics of the gas stream to be controlled. A control method applicable to one emission unit may not be applicable to a similar unit, depending on differences in the gas streams' physical and chemical characteristics.

For this BACT analysis, the available control options were identified by querying the USEPA RBLC and by consulting available literature on control options for integrated gasification combined cycle (IGCC) and for nitrogen-based product sources. The analysis also involves review of currently permitted and operating IGCC and nitrogen-based products facilities.

3.0 PROJECT SOURCES SUBJECT TO BACT ANALYSIS

HECA will consist of several facility blocks/systems representing sources of regulated air pollutants that are addressed in this BACT analysis. These main "systems" are essentially the IGCC process, hydrogen production and power generation, and the Manufacturing Complex. To evaluate possible emission control technologies for the IGCC process, it is first important to understand the unique IGCC process and the supporting ancillary plant processes; additional descriptions of other permitted IGCC are provided in Section 5.0 for comparison. Section 6.0 describes the proposed BACT for each source. More detailed process descriptions for the various processes that make up the HECA Project are included in Chapter 2.0 the CEC AFC Amendment. The proposed BACT controls and associated emission rates for each emission unit are summarized in Table 3-1.

HECA includes a source unique to power generation facilities operating at this time – a CTG equipped to combust synthesis gas (syngas). It is important to emphasize that BACT for this source is based on the "best of class" in current diffusion combustor-based syngas fired gas turbine technology. The emissions profile contained in this application for this source is as good as or better than other syngas IGCC permitted to date, as discussed later in this section. However, the IGCC BACT level emissions should not be compared to the NGCC gas turbine technology using dry low-NO_X burner technology emission levels.

Table 3-1
Proposed BACT for Project

<table>
<tr><th>Pollutant</th><th>Technology</th><th>Emission Limit</th></tr>
<tr><td colspan="3">CTG/HRSG Combustion Turbine (excluding Startup/Shutdown conditions)</td></tr>
<tr><td rowspan="2">NO_X</td><td rowspan="2">Diluent Injection, Selective Catalytic Reduction (SCR), Limited operation on natural gas</td><td>2.5 ppm NO_X at 15% O_2 on hydrogen-rich fuel, 3-hour average</td></tr>
<tr><td>4 ppm NO_X at 15% O_2 on natural gas fuel, 3-hour average</td></tr>
<tr><td rowspan="2">CO</td><td rowspan="2">Good Combustion Practice (GCP), CO Catalyst, Limited operation on natural gas</td><td>3 ppm CO at 15% O_2 on hydrogen-rich fuel, 3-hour average</td></tr>
<tr><td>5 ppm CO at 15% O_2 on natural gas fuel, 3-hour average</td></tr>
</table>

Table 3-1
Proposed BACT for Project

Pollutant	Technology	Emission Limit
PM/PM_{10}	GCP, Gas Cleanup, Gaseous Fuels, pipeline quality natural gas	15 lb/hr on hydrogen-rich fuel and natural gas fuel
SO_2	Hydrogen-rich Gas cleanup, pipeline quality natural gas	≤ 2 ppmv total sulfur in hydrogen-rich syngas, ≤ 10 ppmv total sulfur in PSA off-gas
		≤ 0.75 grain/100 SCF (12.65 ppm for natural gas)
VOC	CO Catalyst, Limited operation on natural gas	1 ppm VOC at 15% O_2 on hydrogen-rich fuel, 3-hour average
		2 ppm VOC at 15% O_2 on natural gas fuel, 3-hour average
NH_3	SCR	5 ppm NH_3 slip on hydrogen-rich fuel and natural gas fuel
Coal Dryer		
PM/PM_{10}	Baghouse	0.001 grain/scf outlet dust loading
Cooling Towers		
PM/PM_{10}	High Efficiency Drift Eliminators, Total Dissolved Solids (TDS) limit in circulating water, and Good Operating Practice	0.0005 % drift as percent of the circulating water
Auxiliary Boiler, Natural Gas 213 MMBTU/hr		
NO_X	Low-NO_X burner and SCR	5 ppm NO_X at 3% O_2
CO	GCP, annual tune-up	50 ppmvd at 3% O_2
PM/PM_{10}	GCP, PUC grade natural gas fuel	0.005 lb/MMBtu heat input
SO_2		0.00285 lb/MMBtu (12.65 ppm for natural gas)
VOC		0.004 lb/MMBtu heat input
NH_3	SCR	5 ppm NH_3 slip natural gas fuel
Emergency Diesel Engines (2 Emergency Generators; 2,922 hp each)		
NO_X	Certified EPA Tier 4 diesel engine, combustion controls, restricted operating hours, Low Sulfur Diesel fuel	0.5 g/bhp/hr
CO		2.6 g/bhp/hr
PM/PM_{10}		0.07 g/bhp/hr
SO_2		Very Low Sulfur Diesel fuel (15 ppmw or less)
VOC		0.3 g/bhp/hr

Table 3-2
Proposed BACT for Project (Continued)

Pollutant	Technology	Emission Limit
Emergency Diesel Engine (Fire Pump; 565 hp)		
NO_X	Certified EPA Tier 4 diesel engine, combustion controls, restricted operating hours, Low Sulfur Diesel fuel	1.5 g/bhp/hr
CO		2.60 g/bhp/hr
PM/PM_{10}		0.015 g/bhp/hr
SO_2		Very Low Sulfur Diesel fuel (15 ppmw or less)
VOC		0.14 g/bhp/hr

Table 3-2
Proposed BACT for Project (Continued)

Pollutant	Technology	Emission Limit
Gasification Flare		
NO_X, CO, PM/PM_{10}, SO_2	GCP, gaseous fuel only, Gas cleanup/Limit on reduced sulfur in hydrogen-rich fuel	
VOC	GCP, gaseous fuel only, flare gas recovery system for non-emergency releases, VOC destruction of ≥ 98.5%	
Rectisol® Flare		
NO_X, CO, PM/PM_{10}, SO_2	GCP, gaseous fuel only, flare gas recovery system for non-emergency releases, gas cleanup/limit on reduced sulfur in syngas	
VOC	GCP, gaseous fuel only, flare gas recovery system for non-emergency releases, VOC destruction of ≥ 98.5%	
SRU Flare (Sulfur Recovery System)		
NO_X, CO, PM/PM_{10}	GCP, gaseous fuel only, flare gas recovery system for non-emergency releases	
SO_2	Caustic Scrubber	
VOC	GCP, gaseous fuel only, flare gas recovery system for non-emergency releases, VOC destruction of ≥ 98.5%	
Thermal Oxidizer (Sulfur Recovery System) (excluding Startup/Shutdown conditions)		
NO_X	GCP	0.24 lb/MMBtu
CO		0.20 lb/MMBtu
PM/PM_{10}		0.0076 lb/MMBtu
SO_2	GCP, Gas cleanup to ≤ 10 ppmw H_2S	2 lb/hr process vent gas
VOC	GCP	0.0055 lb/MMBtu
CO_2 Vent		
CO	Gas Cleanup, restricted operating hours	1,000 ppmv
VOC		40 ppmv
H_2S	Acid Gas Removal	10 ppmv
Feedstock		
PM/PM_{10}	Dust Collector, adequate moisture to prevent visible emissions in excess of 5% opacity	0.005 grain/scf outlet dust loading
Ammonia Plant Heater, Natural Gas 55 MMBtu/hr		
NO_X	Low-NO_X burner, limited operation	9 ppm NO_X at 3% O_2
CO	GCP, annual tune-up	50 ppmvd at 3% O_2
PM/PM_{10}	GCP, PUC grade natural gas fuel	0.005 lb/MMBtu heat input
SO_2		0.00285 lb/MMBtu (12.65 ppm for natural gas)
VOC		0.004 lb/MMBtu heat input
Urea HP Absorber		
NH_3	Wet scrubber	11.1 lb/hr
Urea LP Absorber		
NH_3	Wet scrubber	2.0 lb/hr
Urea Pastillation		
PM/PM_{10}	Baghouse	0.001 grain/dscf
Nitric Acid Plant		

Table 3-2
Proposed BACT for Project (Continued)

Pollutant	Technology	Emission Limit
NO_X	SCR	0.2 lb/ton (15 ppmv in vent gas)
NH_3	SCR	5 ppm NH_3 slip
Ammonium Nitrate Plant		
PM/PM_{10}	Wet scrubber	0.2 lb/hr
Fugitives		
VOC	LDAR, leak detection for valves and connectors with VOC > 100 ppmv above background, and for pumps and compressor seals with VOC > 500 ppmv above background	Varies

Source: HECA Project.

Notes:
BACT = best available control technology
CO = carbon monoxide
CPUC = California Public Utility Commission
CTG = combustion turbine generator
FGR = flue gas recirculation
GCP = good combustion practice
LDAR = leak detection and repair
MMBtu = million British thermal units
NH_3 = ammonia
NO_X = nitrogen dioxide
O_2 = oxygen
PM/PM_{10} = particulate matter/particulate matter less than 10 microns
ppm = parts per million
ppmvd = parts per million volumetric dry
SCF = standard cubic feet
SCR = selective catalytic reduction
SO_2 = sulfur dioxide
VOC = volatile organic compound

4.0 CONSIDERATION OF ALTERNATIVE GENERATING TECHNOLOGY

This section addresses recent guidance relating to the need for consideration of alternative electrical generating technologies for the proposed Project, as part of the BACT analysis. Compared to pulverized coal (PC)-fired boilers and circulating fluidized bed (CFB) boilers, the proposed IGCC process is the very lowest emitting solid fuel-based electricity generating technology available, and selection of a completely different solid fuel-based generating technology would not result in lower emissions. Later portions of this BACT analysis address the specific controls that are proposed to minimize the emissions from the proposed IGCC process. In addition, Section 5.0 provides descriptions of other permitted IGCC facilities for more in-depth comparison.

The first step in a BACT determination process is to identify all available control technologies that could potentially be used to minimize the emissions of the source and pollutant under evaluation. The most common control technologies considered in a BACT analysis are add-on control measures and inherent process characteristics that minimize generation of pollutants, in addition to process or work practice modifications to improve the emissions performance of a proposed Project. These types of process modifications/measures, when applicable, are properly considered in a BACT analysis.

In contrast, consideration of alternatives that would involve completely "redefining the design" of the proposed process are not required to be considered (1990 Draft New Source Review Workshop Manual, Section IV.A.3). Alternative generating processes, such as natural-gas–fired combined-cycle plants, represent a completely different family of power generation plant designs from IGCC. Although there are certain types of components in common, such as cooling towers and steam-driven turbine generators, the technical basis for a gas-fired plant differs markedly from that of an IGCC facility.

Because CFB or PC boilers or a natural-gas–fired electrical generating plant would be a completely different process, and represent "redefining the design" compared to IGCC, it is reasonable to conclude that the USEPA would not require that the BACT analysis for HECA compare these different technologies. This point was reinforced in a December 13, 2005 letter from Stephen Page, Director of the USEPA's OAQPS, to E3 Consulting, LLC regarding BACT requirements for proposed coal-fired power plant projects. In that letter, the USEPA clarified that a BACT analysis need not consider an alternative "which would wholly replace the proposed facility with a different type of facility." Some specific cases regarding alternative design and project definitions are discussed below in Section 4.1. The decisions in these cases provide additional clarity for excluding alternative technologies that redefine the source from BACT procedures for this Project. Section 4.2 gives more details regarding the HECA source and purpose, providing further justification for excluding alternative technologies from this BACT analysis.

4.1 Case Studies for Alternative Technology Methodology and Applicability to HECA Project

Desert Rock Energy Company LLC proposed to build a 1,500 MW coal-fired electric generating facility in New Mexico. USEPA Region 9 issued a final PSD permit on July 31, 2008, which was appealed by four different parties. On September 24, 2009, the U.S. Environmental Appeals Board issued a remand, both granting the Region's request for a voluntary remand, as well as remanding for BACT review to consider IGCC technology as an alternative process/control technology. (*In re: Desert Rock Energy Company, LLC, PSD Appeal Nos. 08-03 et al. (September 24, 2009) ["Desert Rock."])*

The Desert Rock decision stated that "the Region abused its discretion in declining to consider IGCC as a potential control technology in step 1 of its BACT analysis for the facility. Although the Region has broad discretion in determining whether imposition of a control technology would "redefine the source," the Board concludes that, based on the administrative record for this case, the Region's analysis is inadequate for two reasons. First, the Region did not provide a rational explanation of why IGCC would redefine the source, especially when the applicant itself had indicated in its initial application that IGCC was a technology that could be considered for the facility (i.e., could satisfy its business purpose), thereby suggesting that IGCC would not redefine the source. Second, the Region failed to adequately explain its conclusion in light of previously issued federal permits at similar facilities in which IGCC *had* been considered as a BACT step 1 production process and had not been considered a "redefinition of the source."

The Desert Rock project's failure to consider IGCC as an alternate technology is not directly relevant to the HECA Project's BACT analysis, because HECA is already proposing an IGCC, and has in fact, proposed to go even further than a traditional IGCC. Traditional IGCCs burn syngas containing large quantities of both hydrogen and CO. In contrast, HECA is achieving similar or lower criteria emissions while significantly reducing greenhouse gas (GHG) emissions by the removal and sequestration of the carbon pre-combustion, and burning a hydrogen-rich syngas instead. [Note: GHG BACT is addressed in a separate GHG BACT document, and is only mentioned here as part of the alternative technology discussion.]

Nevertheless, the Desert Rock decision is instructive in that it provides a framework for determining if a particular technology "redefines the source". Specifically, the Board articulated the proper test to be used to answer that question. As the Board explained, the permit applicant initially "defines the proposed facility's end, object, aim, or purpose— that is the facility's basic design…." The inquiry, however, does not end there. The permit issuer should take a "hard look" at the applicant's determination in order to discern which design elements are inherent for the applicant's purpose and which design elements "may be changed to achieve pollutant emissions reductions without disrupting the applicant's basic business purpose for the proposed facility," while keeping in mind that BACT, in most cases, should not be applied to regulate the applicant's purpose or objective for the proposed facility."

In a sense, HECA is adhering to the Desert Rock decision by proposing an IGCC-based plant with coal and petcoke as feedstock, rather than a conventional coal boiler. In addition, the

Project goes even further than traditional IGCC, which burn the syngas containing both hydrogen and CO. HECA will remove the majority of the carbon (present in the syngas as CO or CO_2) and will fuel the combustion turbine with a hydrogen-rich syngas which drastically reduces CO_2 emissions.

USEPA issued similar guidance regarding what needs to be included in a BACT analysis in their December 15, 2009 response to objections raised by petitioners to the Cash Creek Generation LLC project in Kentucky, and objected to the permit issued by the Kentucky Department of Air Quality (KY DAQ) for a 770 MW IGCC plant proposed for Cash Creek, Kentucky (*In the Matter of Cash Creek Generation, LLC, Henderson, Kentucky*, Petition Nos. IV-2008-1 and IV-2008-2 ["*Cash Creek*"]). One of the reasons for objection was that KY DAQ did not adequately justify their lack of consideration of the use of natural gas as an alternative in the BACT analysis. USEPA pointed out that a BACT analysis should normally consider the use of "clean fuels" unless such an option is not "available" or would fundamentally redefine the design of the source. The USEPA maintained that KY DAQ did not provide sufficient justification and a reasoned basis as to why the use of natural gas would "redefine the source." In this decision, USEPA references and repeats the same analytical framework described above in the Desert Rock decision (i.e., evaluate proposed facility purpose and evaluate which design elements are inherent to that purpose).

The USEPA specifically stated that they were not indicating the proposed emission limits did not represent BACT, "only that the present permit record does not provide a sufficient rationale to demonstrate the adequacy of the BACT determinations for this facility."

This aspect of the Cash Creek situation is somewhat analogous to HECA's. In both cases, the applicant is proposing use of solid feedstocks and syngas fuels, and the USEPA has questioned the possible need to consider natural gas as an alternative. However, the USEPA very clearly states that its objection to the Cash Creek permit does not indicate that the use of natural gas is BACT. The USEPA states in the *Cash Creek* decision (emphasis added):

> "EPA's conclusion here… should in no way be interpreted as EPA expressing a policy preference for construction of natural-gas fired facilities over IGCC facilities to generate electricity. EPA supports the development and use of a broad range of technologies across the energy sector including those that will enable the sustainable use of coal. **The deployment of lGCC technology is one of the important technologies and a positive strategy to reduce emissions from coal-fired electricity generation. Technology that enables the United States to use its appreciable reserves of coal in an environmentally sustainable manner is critical to achieving the goals of the PSD program and maintaining compliance with the NAAQS by reducing conventional air pollutants**...This Order should not be interpreted to establish or imply an EPA position that PSD permitting authorities should conclude, under all circumstances, that BACT for a proposed electricity generating unit is firing such a unit with natural gas" (*Cash Creek*, pg. 9).

Another relevant Environmental Appeals Board (EAB) decision worth noting is *Prairie State* (*In re Prairie State Generating Company*, PSD Appeal No. 05-05 [August 24, 2006) "*Prairie State*]). EAB concluded in the *Prairie State* decision that the basic design of the proposed power plant at issue there was to generate electricity using solely coal originating from a coal mine at which the power plant was to be located (i.e., mine-mouth plant). Given this basic design, the EAB stated that requiring the applicant and the state permit agency to consider the use of *another source of coal*—specifically, low-sulfur western coal—in the BACT analysis for the plant would constitute redesigning the source.

This Prairie State decision shows that where there is a legitimate business purpose to using a particular fuel source, use of another cleaner fuel source is not necessarily required to be considered if the alternative fuel would be incompatible with the basic design and purpose of the proposed facility.

To summarize, in these recent USEPA decisions, the following analytical framework is provided to evaluate whether an option may be excluded from a BACT analysis because it redefines the proposed source:

- First, the permitting authority should determine from the particular record how the permit applicant defines the proposed facility's end, object, aim, or purpose (the "basic" or "fundamental" design of the facility).
- The next step is for the permitting authority to take a "hard look" at the applicant's purpose to discern which design elements are inherent for the applicant's purpose and which design elements may be changed to achieve pollutant emissions reductions without disrupting the applicant's basic business purpose for the proposed facility.
- As part of the latter step, the permitting authority should keep in mind that BACT, in most cases, should not be applied to regulate the applicant's purpose or objective for the proposed facility.

4.2 Purpose and Design of HECA as Applied to BACT Alternative Technology Methodologies

The purpose of the Project is not merely the generation of electricity. As identified in other areas of the application, the three key interrelated elements of the Project design and purpose can be summarized as follows:

- Use of solid carbon feedstocks (petcoke and/or coal) to produce low-emission electricity;
- Generation of hydrogen for low-carbon electricity and nitrogen-based products in an integrated Manufacturing Complex; and
- Capture of CO_2 for reduced GHG emissions and transporting CO_2 for use in enhanced oil recovery (EOR).

The design and purpose of the Project is outlined below and presented in detail in the AFC Amendment (2012).

The Project will gasify a 75 percent coal and 25 percent petroleum coke (petcoke) fuel blend to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, which will be used to generate low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR).

The products and power produced by the Project have a lower carbon footprint than similar products. This low-carbon footprint is accomplished by capturing more than 90 percent of the CO_2 in the syngas and transporting CO_2 for use in EOR, which results in simultaneous sequestration (storage) of the CO_2 in a secure geologic formation. CO_2 will be transported for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). As discussed below, the OEHI EOR project will be separately permitted by OEHI through the Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR). The EOR process results in sequestration (storage) of the CO_2.

Project GHG emissions (e.g., CO_2) will be reduced through carbon capture and CO_2 EOR resulting in simultaneous sequestration.

The Project is owned by SCS Energy California LLC, with the prime objective of producing hydrogen for low-carbon polygeneration.

In addition, the Project has been selected as part of the Clean Coal Power Initiative (CCPI), a cost-shared collaboration between the federal government and private industry to increase investment in low-emission coal technology by demonstrating advanced coal-based power generation technologies prior to commercial deployment.

DOE's purpose, aim, and goal in supporting the Project, as stated on the above referenced website, is: "to accelerate the development of advanced coal technologies with carbon capture and storage at commercial-scale. These projects will help to enable commercial deployment to ensure the United States has clean, reliable, and affordable electricity and power."

DOE's relevant stated goals for this cost sharing program are to:

- make progress toward a target CO_2 capture efficiency of 90 percent;
- make progress toward a capture and sequestration goal of less than 10 percent increase in the cost of electricity for gasification systems; and
- capture and sequester or put to beneficial use an amount of CO_2 emissions in excess of the minimum of 300,000 tons per year required by Clean Coal Power Initiative.

This evaluation predominantly presents how a change to natural gas fuel would be considered "redefining the design of the source" in the context of the source's "design" being its "purpose". The next few paragraphs discuss the actual physical/engineering design of the source (i.e., equipment types, processes, etc.) that would require "redesigning" to accommodate a change to natural gas as the primary fuel or feedstock.

A production process is typically defined in terms of its physical and chemical unit operations used to produce the desired product from a specified set of raw materials. The specified raw materials of the IGCC process are solid carbon feedstocks such as petcoke and coal. Many of the unit operations and processes that have been designed for HECA are specific to the use of coal/ petcoke feedstocks, and to the removal of sulfur and CO_2 from the syngas, and the production of nitrogen-based products from the hydrogen-rich syngas. Use of natural gas as a feed stock would require substantial re-design of the facility due to these processes. These include:

- Solid fuel handling systems and baghouses
- Gasifier
- Sour shift/gas cooling
- Mercury removal
- Acid gas removal
- Sulfur Recovery Unit and Tail Gas Treating Unit
- SRU, Gasification and Rectisol® Flares
- Air Separation Unit
- CO_2 Absorption and Compression
- CO_2 Pipeline (3.4 miles)
- Nitrogen-based product from syngas.

In addition, the combustion turbine used in this Project has been specifically designed by Mitsubishi to fire hydrogen-rich fuel. While it is capable of firing natural gas, different turbines/ burners would be used if natural gas were the primary fuel.

Based on the criteria previously discussed, and the general stated purposes of the Project, the following paragraphs analyze the various Project elements with an emphasis on their necessity and inherent inclusion in the basic Project design/purpose.

As detailed previously, there are three key interrelated elements of the Project design and purpose. Each of these elements is critical to the objectives of the Project and the design of the source. These are legitimate business goals, and are important to the Project sponsors. They are not incidental, but rather essential Project preferences. These goals preclude the use of natural gas, or the construction of a natural-gas combined cycle power plant as an alternative. Further discussion of these points is provided in the following paragraphs.

Coal and petcoke, a by-product of petroleum refining, are the raw materials integral to the process. They are historically cheaper (per British thermal unit) and more widely available in the United States than natural gas. The purpose of the Project is to use these traditional solid raw materials/fuels, which are readily-available, and demonstrate the generation of clean, low-carbon electricity and nitrogen based products. Although the electricity generation is an important revenue stream that helps support the economic justification for the Project, the goals of the Project will clearly not be achieved if the electricity is generated by the use of natural gas or other non-solid fuel. Likewise the use of natural gas would not qualify for funding or meet the objectives of DOE’s Clean Coal Power Initiative.

Second, the Project intends to generate hydrogen for the production of electricity and nitrogen-based products. Hydrogen is one of the cleanest, purest fuels that can be combusted to generate electricity, especially in regards to GHG emissions. However, hydrogen use for this purpose has not yet been demonstrated in a large-scale application. This Project is revolutionary in the advancement of clean fuel production and electricity generation, as well as reduction of GHGs through low-carbon fuels. The Project will take the revolutionary step of producing clean gaseous hydrogen-rich fuel from some of the most abundant solid fuel resources in the U.S.: petcoke and coal. This hydrogen-rich fuel will be used for both the generation of electricity and production of nitrogen-based products. The production of hydrogen is a key element of the Project.

Third, the Project will demonstrate the capture of over 90 percent of the carbon from the fuel, prior to combustion in the turbines or use in the Manufacturing Complex. The simple combustion of natural gas for electricity generation would not achieve this goal. Likewise, the "gasification" of natural gas would be superfluous. The power generation portion of the Project, which uses syngas with the majority of the carbon removed prior to combustion, results in CO_2 emissions of approximately 400 pounds per megawatt hour (lb/MWh). This is less than half of the CO_2 emissions from a typical natural gas-fired simple cycle combustion turbine of 1,100 lb/MWh and easily complies with U.S. and California's stringent GHG emissions performance standard (EPS) for electricity generation of 1,000 and 1,100 lb/MWh, respectively. The CO_2 that is captured from the syngas will be used for sequestration and EOR in the Elk Hills Oil Field in San Joaquin Valley, California. This sequestration step is significant as a demonstration for the DOE funding, as well as integral to the financial objectives of the Project. The use of EOR to recover local petroleum reserves increases the United States' energy independence.

For all the above reasons, it is clear that the use of natural gas as the primary fuel to the combustion turbine, as the feedstock to the gasification process or raw material for production of nitrogen-based products would not achieve the inherent business purposes of the Project. Hydrogen generated from solid fuels with advanced pollution controls has great promise as a clean source of electricity and nitrogen based products. However, it has not yet been used or demonstrated in large scale application. The Project is an important first step in the advancement of clean fuel production and electricity generation, as well as reduction of GHGs through the use of low-carbon fuels. It is vital to the Project's goals, and to the DOE Clean Coal Project demonstration, that solid petcoke/coal feeds be used to demonstrate that these abundant resources can be used in an environmentally-sensitive manner to generate low-carbon electricity and capture and sequester carbon dioxide to reduce impacts of GHGs, along with the production of nitrogen-based products from a low carbon fuel. The use of natural gas would simply not fulfill these business, project and national energy program purposes and would constitute a substantial redesign of the source.

5.0 OTHER PERMITTED IGCC PROJECTS

The available control options were identified by querying the RBLC database and by consulting available literature on control options for IGCC. Applications and/or permits from a number of other IGCC facilities that have completed the New Source Review process were also reviewed to provide additional reference material for this BACT analysis. A brief summary of the other recently permitted IGCC plants in the United States and their emissions limits is presented in this section. Recently permitted IGCC facilities that will be used for comparison in this BACT analysis are:

- Duke Energy, Edwardsport Generating Station
- Christian County Generation (formerly ERORA Group), Taylorville Energy Center
- ERORA Group, Cash Creek Generation Station
- Hyperion Energy Center
- Mississippi Power Company, Kemper IGCC Facility
- Summit Power TCEP, IGCC Power Plant

The air permits, BACT analyses, and additional literature were reviewed for each of these recently permitted IGCC facilities. Each facility is discussed briefly below. The facilities that were subject to BACT determinations are listed as such.

Duke Energy, Edwardsport Generating Station: Duke Energy Indiana, owner of Edwardsport Generating Station, obtained approval, via Indiana Department of Environmental Management Significant Modification Title V Permit, to install an IGCC facility in Knox County, Indiana. The Title V Significant Modification Permit was issued in January 2008. The Edwardsport Generating Station is expected to start commercial operation in 2012. The 630 MW (net) IGCC plant will replace four older, less efficient generating units capable of generating approximately 160 MW at the Edwardsport site. The Edwardsport Generating Station is expected to use coal as feedstock, and SCR as add-on control to minimize NO_X emissions from the plant. The SCR system is being installed on a trial basis to investigate technical feasibility for effective operation in recognition of technical uncertainties posed by SO_2 residuals, ammonia slip, and potential inorganic precipitants. The SCR system is not required to demonstrate compliance with federal or state statutes.

Christian County Generation – Taylorville Energy Center: Christian County Generation LLC is developing the Taylorville Energy Center, a 630 MW IGCC facility to be located in Christian County, southern Illinois. Taylorville Energy Center obtained a draft Illinois Environmental Protection Agency air permit. Final public comments were due December 31, 2011; a final permit has not yet been issued. Commercial operation is expected to start in 2014. Taylorville Energy Center proposed to use Siemens gasification technology and local coals (Illinois coal) as the feedstock. The Taylorville Energy Center will use a Rectisol® acid gas removal (AGR) system, for syngas cleanup followed by a Methanation Unit in the gasification process to produce Substitute Natural Gas (SNG), which has virtually the same composition as natural gas. Since the SNG is essentially the same as natural gas, the combustion turbine is designed to operate on natural gas. BACT for NO_X will be dry low-NO_X (DLN) burners and SCR.

***ERORA Group – Cash Creek Generation Station**:* The ERORA Group is developing the Cash Creek Generation Station IGCC facility, to be located near Owensboro, Henderson County, Kentucky. Cash Creek Generation Station obtained a final Kentucky DAQ air permit in January 2008 and is expected to start commercial operation in 2012. The 630 MW IGCC proposes to use GE Energy gasification technology and local coals (Kentucky coal) as the feedstock. Cash Creek Generation Station will use Selexol® AGR systems, as well as SCR. Because the proposed facility site is in an ozone attainment area, SCR is not required for BACT purposes. ERORA is using SCR to minimize NO_X emissions from the plant, but not as BACT. This will allow them to minimize the cost to acquire NO_X allowances from the market. ERORA notes that in order to increase the chance that the SCR system will work in this unproven application on coal-derived syngas, higher sulfur removal, by using Selexol® instead of methyldiethanol-amine (MDEA), will be required.

Hyperion Energy Center: The South Dakota Department of Environmental and Natural Resources issued a PSD permit for the Hyperion Energy Facility on August 20, 2009, and a revised PSD permit in September 2011. The facility will consist of a greenfield petroleum refinery and an IGCC plant, to be located in Union County, South Dakota. The IGCC plant will use petroleum coke as primary feedstock, and is designed to provide the refinery with up to 450 million cubic feet per day of hydrogen, 200 MW of electricity, and 2.4 million pounds of steam per hour. The application did not specify the type of combustion turbine to be used.

The co-located refinery will not be able to make enough petroleum coke to supply the IGCC, so additional fuel will be imported to make up the energy shortfall. Hyperion was permitted for two mutually exclusive configurations for the power plant. The first configuration is termed the "maximum coke design case," and will use imported solid fuels (coke and/or coal) to meet the energy needs. In this configuration, the combustion turbines will be fired with syngas, and the heat recovery steam generators will be fired with both syngas and tail gas from the plant's pressure swing absorber (PSA) process (which is part of its process for generating hydrogen for use by the refinery processes) and ultra-low sulfur distillate as a backup fuel.

The second configuration is termed the "natural gas design case." In this configuration the turbines will be fired with natural gas as the primary fuel and ultra-low sulfur distillate as a backup fuel. The heat recovery steam generators will be fired with natural gas and PSA tail gas. This configuration (using no syngas fuel in the turbine) is fundamentally different than HECA's proposed turbine operation. Therefore, we have not used this configuration in our comparison, but instead focused our comparison on the Hyperion "maximum coke design case," which is more similar to HECA's.

For SO_2 and particulate, the permitted Hyperion IGCC BACT control technology is syngas sulfur cleanup by physical absorption (Rectisol®). For NO_X the use of low-NO_X duct burners, diluent injection, and SCR was determined to be BACT for the maximum coke design case. For CO and VOCs, the use of oxidation catalyst and good combustion practice was selected as BACT. These are the same control technologies proposed as BACT by HECA. It should be noted that some of the pollutant limits for this facility are based on long-term (24-hour and 365-day) rolling averages.

Mississippi Power Company, Kemper IGCC Facility: The Mississippi Department of Environmental Quality issued a final PSD permit for the Kemper IGCC Facility on March 9, 2010. Commercial operation is expected to start in 2014. The facility will be located in Kemper County, Mississippi. The primary fuel for the proposed facility will be syngas derived from lignite coal. Natural gas will be used as a secondary fuel. The facility will use Siemens 5000F turbines, and generate a nominal 582 net MW of electric power.

For NO_X, BACT was determined to be the use of good combustion and operating practices for a diffusion flame combustion turbine when using syngas. BACT when using natural gas was determined to be the use of steam or water injection in conjunction with the use of SCR. (Note: SCR was not required when firing syngas because of the project's use of lignite coal and an oxygen-blown gasifier. When using syngas, the permit allows ammonia to not be added to the SCR, allowing the exhaust gas to pass through the system without forming ammonium sulfates.) For CO and VOC, the use of good combustion practice was selected as BACT. (Note: oxidation catalyst was not required.) For SO_2, use of the Selexol® AGR system was determined to be BACT. For particulate, BACT was determined to be the use of clean fuels and good combustion practices. The Kemper permit does not require as stringent emissions controls as those proposed by HECA.

Summit Texas Clean Energy, LLC (Summit) TCEP, IGCC Power Plant: The Texas Commission on Environmental Quality issued a final PSD permit for Summit's Texas Clean Energy Project (TCEP) IGCC Facility on December 28, 2010. Commercial operation is expected to start in 2015. The facility will be located in Odessa, Ector County, Texas. The primary fuel for the proposed facility will be syngas derived from coal. Natural gas will be used as a secondary fuel. The facility will use Siemens gasifiers fueling a single Siemens 5000F turbine and one steam turbine, and will generate a nominal 400 net MW of electric power.

For NO_X, combustion control diluent injection and SCR was determined to be BACT. When firing on syngas, diluent injection will provide combustion control; when firing on natural gas, steam injection will provide combustion control. For CO and VOC, the use of good combustion practice was selected as BACT. For SO_2, use of the clean, low sulfur fuel was determined to be BACT. For particulate, BACT was determined to be the use of clean fuels and good combustion practices. It should be noted that some of the NO_X limits for this facility (for both syngas and natural gas) are based on 30-day rolling averages.

6.0 SOURCE-SPECIFIC BACT ANALYSIS

The following BACT analysis evaluates control technologies applicable to each of the criteria pollutants that would be emitted from the HECA Project to determine appropriate BACT emission limits. This BACT analysis is based on the current state of IGCC and nitrogen-based product production technology, energy and environmental factors, current expected economics, energy, and technical feasibility.

6.1 CTG/HRSG BACT Analysis

The following is the BACT analysis for the proposed combustion turbine. The proposed combustion turbine will be a Mitsubishi Heavy Industries (MHI) 501 GAC® model turbine with a gross capacity of approximately 405 MW. The MHI 501 GAC® is a new turbine model designed to optimally use hydrogen-rich fuel and natural gas as a backup fuel, and includes changes to the fuel system, combustion system, and hot gas path. The use of hydrogen-rich fuel requires the use of a diffusion-type combustor, because the high concentration of hydrogen precludes the use of DLN combustor technology.

The air permits, BACT analyses, and additional literature for each of the recently permitted IGCC facilities discussed in the last section were reviewed. Table 6-1 summarizes the criteria pollutant emission levels permitted for the combustion turbine units at each facility. This table also shows the proposed BACT limits for the HECA Project as a comparison.

6.1.1 Nitrogen Oxides BACT Analysis for the CTG/HRSG

The criteria pollutant NO_X is primarily formed in combustion processes via the reaction of elemental nitrogen and oxygen in the combustion air (thermal NO_X), and the oxidation of nitrogen contained in the fuel (fuel NO_X). The hydrogen-rich fuel produced in the Project contains negligible amounts of fuel-bound nitrogen; therefore, it is expected that essentially all NO_X emissions from the CTG/HRSG will originate as thermal NO_X.

The rate of formation of thermal NO_X in a combustion turbine is a function of residence time, oxygen radicals, and peak flame temperature. Front-end NO_X control techniques are aimed at controlling one or more of these variables during combustion. Examples include dry low-NO_X combustors, flue gas recirculation, and diluent injection (steam, water, or nitrogen). These technologies are considered to be commercially available pollution prevention techniques. It is necessary to recognize the fundamental differences between natural-gas-fired and hydrogen-rich fuel-fired combustion turbines in evaluating these techniques. Compared to natural gas and substitute natural gas (SNG), hydrogen-rich fuel has a much higher hydrogen content (natural gas is often over 90 percent methane), and a much lower heating value (about 250 Btu/scf for hydrogen-rich fuel vs. 1,000 Btu/scf for natural gas). HECA will be fired primarily on hydrogen-rich fuel. The other power plants used for comparison in this analysis are fired on syngas. Plants firing SNG will be discussed, but are not comparable to HECA.

1. Identify Control Technologies

The following NO_X control technologies were evaluated for the proposed CTG/HRSG:

Combustion Process Controls

- Dry Low-NO_X Burner
- Diluent Injection

Post-Combustion Controls

- SCONO$_X$™
- Selective Non-Catalytic Reduction (SNCR)
- Selective Catalytic Reduction (SCR)

Table 6-1
Permitted Criteria Pollutant BACT Limits for Combined-Cycle Combustion Turbine

Facility	HECA	Cash Creek Generation Station	Edwardsport Generating Station	Taylorville Energy Center	Hyperion Energy Center	Kemper County IGCC Project	Summit TCEP
Location	Kern County, CA	Henderson County, KY	Knox County, IN	Christian County, IL	Union County, SD	Kemper County, MS	Ector County, TX
Permit Date	Not Yet Permitted	January 2008	June 2007	Public Comment Period on Draft PSD Permit Ended December 31, 2011	September 2011	March 2010	December 2010
Fuel	Hydrogen-based syngas ----- Natural Gas backup	Coal-derived Syngas ----- Natural Gas backup	Coal-derived Syngas ----- Natural Gas backup	Substitute Natural Gas (SNG) and Natural Gas	Petroleum coke-derived Syngas with PSA Tail gas *or* Natural Gas with PSA Tail gas[a] ----- Ultra Low Sulfur Distillate (ULSD) backup	Lignite coal-derived Syngas ----- Natural Gas backup	Coal-derived Syngas ----- Natural Gas backup
MW (net)	405	630	630	630 (net)	280[b]	582	400
Turbine	MHI 501 GAC®	GE 7FB	GE 7FB	Siemens MHI 501GAC® CT	Not Specified	Siemens 5000F	Siemens 5000F
NO_X	2.5 ppmc (0.011 lb/MMBtu) on hydrogen-rich fuel, 3-hr rolling average; 4.0 ppmc (0.015 lb/MMBtu) on Natural Gas, 3-hr rolling average	5 ppmc (0.0331 lb/MMBtu) on Syngas; 0.0246 lb/MMBtu on Natural Gas	0.027 lb/MMBtu on Syngas; 0.018 lb/MMBtu on Natural Gas	2.0 ppmc on SNG or Natural Gas	3.0 ppmc (0.018 lb/MMBtu) on Syngas/PSA Tailgas; 2.0 ppmc (0.012 lb/MMBtu) on Natural Gas/PSA Tailgas; 6.0 ppmc on ULSD	0.061 lb/MMBtu on Syngas (LHV); 0.015 lb/MMBtu on Natural Gas (LHV)	15 ppmc on Syngas or Natural Gas, 1-hr average; 3.5 ppmc (0.014 lb/MMBtu) on Syngas, 30-day rolling average; 2.5 ppmc (0.009 lb/MMBtu) on Natural Gas, 30-day rolling average
SO_2	≤ 2 ppmv in undiluted hydrogen-rich fuel; and ≤ 10 ppmv in PSA off-gas (0.0002 lb/MMBtu); 0.75 grains/100 scf of total sulfur on Natural Gas (0.002 lb/MMBtu)	3.8 ppmc (0.0158 lb/MMBtu) on Syngas; 0.0006 lb/MMBtu on Natural Gas	0.0138 lb/MMBtu on Syngas; 0.0006 lb/MMBtu on Natural Gas	0.25 grains/100 scf sulfur in SNG or Natural Gas	1.0 ppmv sulfur in Syngas, 0.5 ppmv in PSA Tail gas (0.0005 lb/MMBtu on Syngas/PSA Tail gas); 9 ppmv sulfur in Natural Gas; 15.0 ppmw sulfur in ULSD (0.0015 lb/MMBtu)	0.004 lb/MMBtu on Syngas; 1.9 lb/hr on Natural Gas	10 ppmv sulfur in Syngas (0.006 lb/MMBtu); 2 grains/100 dscf in Natural Gas (0.006 lb/MMBtu)
CO	3 ppmc (0.008 lb/MMBtu) on hydrogen-rich fuel; 5 ppmc (0.011 lb/MMBtu) on Natural Gas	0.0485 lb/MMBtu on Syngas; 0.0449 lb/MMBtu on Natural Gas	0.0441 lb/MMBtu on Syngas; 0.0421 lb/MMBtu on Natural Gas	4.3 ppmc on SNG or Natural Gas	3.0 ppmv on Syngas/PSA Tailgas/ULSD; 3.0 ppmv on Natural Gas/PSA Tailgas/ULSD	0.031 lb/MMBtu on Syngas (LHV); 0.063 lb/MMBtu on Natural Gas (LHV)	10 ppmc (0.02 lb/MMBtu) on Syngas; 10 ppmc (0.02 lb/MMBtu) on Natural Gas
PM_{10}	15 lb/hr (0.008 lb/MMBtu) on hydrogen-rich fuel or Natural Gas	76 lb/hr[c] on Syngas; 57 lb/hr[c] on Natural Gas	63 lb/hr[c] on Syngas; 29 lb/hr[c] on Natural Gas	0.0065 lb/MMBtu on SNG or Natural Gas	36.9 lb/hr (0.022 lb/MMBtu) on Syngas/PSA Tailgas; 18.4 lb/hr (0.011 lb/MMBtu) on Natural Gas/PSA Tailgas; 36.9 lb/hr (0.022 lb/MMBtu) on ULSD	36 lb/hr[c] on Syngas; 0.01 lb/MMBtu on Natural Gas (LHV)	0.008 lb/MMBtu on Syngas or Natural Gas
VOC	1 ppmc (0.0015 lb/MMBtu) on hydrogen-rich fuel; 2 ppmc (0.003 lb/MMBtu) on Natural Gas	NA	0.0016 lb/MMBtu on Syngas; 0.0016 lb/MMBtu on Natural Gas	0.0013 lb/MMBtu on SNG or Natural Gas	0.0017 lb/MMBtu on Syngas or Natural Gas	0.005 lb/MMBtu on Syngas (LHV); 0.008 lb/MMBtu on Natural Gas (LHV)	1 ppmc (0.0012 lb/MMBtu) on Syngas; 1 ppmc (0.0012 lb/MMBtu) on Natural Gas

Notes:

[a] Hyperion turbines are designed to operate in one of 2 configurations. Option 1 is a turbine designed to burn petcoke-derived syngas with PSA tail gas fired only in the duct burner. Option 2 is a natural gas-fired turbine with PSA tail gas fired only in the duct burner. These two options are mutually exclusive turbine configuration, one or the other will be selected, not a combination of the two.
[b] Hyperion gas turbines are not defined in permit, except for a fuel input rate of 1,677 MMBtu/hr (each turbine). The MW size for each of these is prorated from the HECA turbine (405 MW and approximately 2,400 MMBtu/hr (HHV)), for an individual turbine size of 280 MW.
[c] PM_{10} lb/hr limits have been prorated to HECA-sized turbine in MW for comparison purposes. This is only done in cases where no other limits (such as lb/MMBtu) are provided.

dscf = dry standard cubic foot
HHV = higher heating value
lb/hr = pounds per hour
lb/MMBtu = pounds per million British thermal units
LHV = lower heating value
MW = megawatt
ppmc = parts per million by volume, dry basis, corrected to 15 percent O_2
ppmv = parts per million by volume
scf = standard cubic foot

2. *Evaluate Technical Feasibilities*

- Dry Low-NO_X Combustor

  DLN combustor technology has been successfully demonstrated to reduce thermal NO_X formation from natural-gas combustion turbines. This is done by designing the combustors to control both the stoichiometry and temperature of combustion by tuning the fuel and air locally within each individual combustor's flame envelope. Combustor design includes features that regulate the aerodynamic distribution and mixing of the fuel and air. A lean, pre-mixed combustor design mixes the fuel and air prior to combustion. This results in a homogeneous air/fuel mixture, which minimizes localized fuel-rich pockets that produce elevated combustion temperatures and higher NO_X emissions. A lean fuel-to-air ratio approaching the lean flammability limit is maintained, and the excess air serves as a heat sink to lower the combustion temperature, which in turn lowers thermal NO_X formation. A pilot flame is used to maintain combustion stability in this fuel-lean environment.

  Hydrogen-rich fuel differs from natural gas in heating value, gas composition, and flammability characteristics. Available DLN combustor technologies are designed for natural gas (methane-based) fuels and will not operate on the hydrogen-rich fuel (CO-based) used by an IGCC combustion turbine. DLN combustors are not technically feasible for this application due to the potential for explosion hazard in the combustion section due primarily to the high hydrogen content of the fuel. No manufacturer currently makes DLN combustors that can be used for a combustion turbine fueled by syngas or other fuels containing significant hydrogen. Thus, DLN combustor is not a technically feasible control option for this unit. [Note that the Hyperion Energy Center has DLN for NO_X BACT for their natural gas design case only. This technology is not combined with the diffusion burner technology (and diluent injection) for the Syngas design case. Therefore, the use of DLN at Hyperion is not comparable to the HECA facility.]

  The more recently constructed natural gas combustion turbines use the latest technology dry low nitrogen oxide (DLN) combustors, which are typically guaranteed to achieve 9 to 15 ppm NO_X in the turbine exhaust gas when operating with natural gas. The MHI combustion turbine proposed for the HECA Project must use a diffusion combustor, because a DLN or other low-NO_X combustor has not yet been developed for hydrogen-rich fuel, due to its high flame front speed and broad range of combustibility. During periods when hydrogen-rich fuel is unavailable and during start up/shut downs, the HECA Project will fire natural gas for very limited periods as a backup fuel. The natural gas must be fired through the same diffusion burner because the MHI turbine does not have the option of a separate natural gas DLN combustor. Thus, the use of DLN combustor is not a technically feasible control option for this unit.

- Diluent Injection

  Higher peak flame temperature during combustion may increase thermodynamic efficiency, but it also increases the formation of thermal NO_X. The injection of an inert diluent such as atomized water, steam, or nitrogen into the high-temperature region of a combustor flame serves to inhibit thermal NO_X formation by reducing the peak flame temperature.

For the Project's CTG/HRSG, nitrogen is used as a diluent that reduces thermal NO_X produced when hydrogen-rich gas is combusted. Steam is used as a diluent when natural gas is combusted. This method effectively lowers the fuel heat content, and consequently, the combustion temperature, thereby reducing NO_X emissions.

[redacted] The higher emission rate from combustion of natural gas is caused by the difference in combustion characteristics of natural gas compared to the hydrogen-rich fuel.

A secondary benefit of diluent injection is that it will increase the mass flow of the exhaust. Therefore, the power output per unit of fuel input also increases.

Diluent injection represents an inherently lower-emitting process for IGCC units, and is a technically feasible control technology. Diluent injection (steam for natural gas and nitrogen for hydrogen-rich fuel) is proposed as the baseline case for the CGT/HRSG combustion turbine NO_X BACT analysis. This NO_X control technology and emission level has also been determined as BACT for all other recent IGCC permits. This NO_X diluent injection control technology has been commercially demonstrated on syngas turbines.

- $SCONO_X$™

  The $SCONO_X$™ system is an add-on control device that reduces emissions of multiple pollutants. $SCONO_X$™ uses a single catalyst for the reduction of CO, VOC, and NO_X, which are converted to CO_2, water (H_2O), and nitrogen (N_2).

  All installations of the technology have been on small natural gas facilities, and have experienced performance issues. The fact that $SCONO_X$™ has not been applied to large-scale natural gas combustion turbines creates concerns regarding the timing, feasibility, and cost-effectiveness of necessary design improvements. $SCONO_X$™ has also not been applied to syngas (or hydrogen-rich fuel).

  In evaluating technical feasibility for large IGCC projects, the additional concerns are:

  – $SCONO_X$™ uses a series of dampers to re-route air streams to regenerate the catalyst. The HECA Project is significantly larger than the facilities where $SCONO_X$™ has been used. This would require a significant redesign of the damper system, which raises feasibility concerns regarding reliable mechanical operation of the larger and more numerous dampers that would be required for application to the HECA CTG/HRSG.

– SCONO$_X$™ would not be expected to achieve lower guaranteed NO$_X$ levels than SCR, and, for reasons described above, it has even greater feasibility concerns with respect to application on IGCC turbines than those for SCR.

For the above reasons, SCONO$_X$™ is considered technically infeasible for this unit.

- Selective Non-Catalytic Reduction

  Selective non-catalytic reduction is a post-combustion NO_X control technology in which a reagent (NH_3 or urea) is injected into the exhaust gases to react chemically with NO_X to form elemental nitrogen and water without the use of a catalyst. The success of this process in reducing NO_X emissions is highly dependent on the ability to achieve uniform mixing of the reagent into the flue gas, which must occur within a narrow flue gas temperature zone (typically from 1,700 to 2,000 degrees Fahrenheit [°F]).

  The consequences of operating outside the optimum temperature range are severe. Above the upper end of the temperature range, the reagent will be converted to NO_X. Below the lower end of the temperature range, the reagent will not react with the NO_X resulting in very high NH_3 slip concentrations (NH_3 discharge from the stack).

  This technology is occasionally used in conventional fired heaters or boilers upstream of any HRSG or heat recovery unit. SNCR has never been applied in IGCC service, primarily because there are no flue gas locations within the combustion turbine or upstream of the HRSG with the optimal requisite temperature and residence time characteristics to facilitate the SNCR flue gas reactions. Therefore, SNCR is not technically feasible for this unit.

- Selective Catalytic Reduction

  Selective Catalytic Reduction (SCR) is a technology that achieves post-combustion reduction of NO_X from flue gas within a catalytic reactor. The SCR process involves the injection of NH_3 into the exhaust gas stream upstream of a specialized catalyst module to promote the conversion of NO_X to molecular nitrogen. SCR is a common control technology for use on natural gas–fired combustion turbines.

  In the SCR process, NH_3, usually diluted with air or steam, is injected through a grid system into the exhaust gas upstream of the catalyst bed. On the catalyst surface, the NH_3 reacts with NO_X to form molecular nitrogen and water. The basic reactions are:

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$$

$$8NH_3 + 6NO_2 \rightarrow 7N_2 + 12H_2O$$

  The Project selected SCR and diluent injection technology to control NO_X emissions from the CTG/HRSG unit. The SCR system reduces nitrogen oxide emissions from the HRSG stack gases by up to about 92 percent when firing hydrogen-rich fuel. Anhydrous ammonia is injected into the stack gases upstream of a catalytic system that converts nitrogen oxide and ammonia to nitrogen and water.

It is anticipated that this combination of control processes will achieve a NO_X emission limit of 2.5 ppmvd at 15 percent oxygen, based on a 3-hour rolling average, when firing hydrogen-rich fuel, or 4 ppmvd at 15 percent oxygen, based on a 3-hour rolling average, when firing natural gas.

The HECA Project has been designed to use steam injection and SCR for NO_X control when in natural gas service. A comparison with other recent IGCCs using SCR indicate that 4 ppm is an appropriate emission stack concentration for natural gas operation using a diffusion burner. (Note that the Hyperion Project's BACT limit for NO_X on natural gas is slightly lower than this, but uses DLN technology that is not available with syngas-fired turbines. Also, the Summit Project, when combusting natural gas, has a significantly higher short-term NO_X limit of 15 ppm, but a slightly lower long-term [30-day] rolling average limit; this is not comparable to the short-term limit proposed for HECA.) To provide the high level of confidence necessary to meet a 4 ppm permit limit, the HECA Project will plan to achieve very high conversion efficiency in the SCR. Therefore, the HECA LLC believes that the proposed 4 ppm NO_X level is an appropriate BACT level for the HECA Project when burning natural gas and is consistent with other recently permitted IGCCs.

These emission limitations for both hydrogen-rich fuel and natural gas represent a removal efficiency that is better than the approved emissions for recently permitted IGCC units. HRSG vendors confirm the feasibility of achieving these NO_X levels.

3. Rank Control Technologies

Among the control technologies considered in the previous subsection, only one was determined to be both technically feasible and commercially demonstrated at a cost level acceptable as a BACT option. Specifically, the feasible option is diluent injection upstream of the combustion zone.

Although there is no commercial demonstration of SCR performance for an IGCC plant using coal or petcoke feedstock, SCR technology has been proposed as emission limits for many recently permitted IGCC projects; therefore, SCR is determined to be technically feasible. The HECA HRSG vendor confirm that the SCR catalyst will be able to achieve combined NO_X reduction to 2.5 ppmvd at 15 percent oxygen, based on a 3-hour rolling average, when firing hydrogen-rich fuel, and 4 ppmvd at 15 percent oxygen, based on a 3-hour rolling average, when firing natural gas.

4. Evaluate Control Options

The next step in a BACT analysis is to evaluate the feasible control technology. Based on the evaluation in the previous step, the only feasible technologies suitable for establishment of BACT limits are diluent injection and SCR. The principal environmental consideration with respect to implementation of SCR is that, while it will reduce NO_X emissions, it will add NH_3 emissions associated with use of NH_3 as the reagent chemical. A portion of the unreacted NH_3 passes through the catalyst and is emitted from the stack. This is called ammonia slip, and the magnitude of these emissions depends on the catalyst activity and the degree of NO_X control desired. For the Project, the concentration of ammonia slip is limited to 5 ppmvd at 15 percent oxygen.

Table 6-2 shows the typical NO_X BACT determination (when firing hydrogen-rich fuel and natural gas, respectively) and control technology for other recently permitted IGCC projects, in comparison with HECA's proposed NO_X BACT for the CTG/HRSG.

As shown in Table 6-2, the BACT limitation for NO_X emissions from HECA CTG/HRSG is more stringent than the historic BACT determination for other recently permitted IGCC projects.

NSPS 40 CFR 60 Subpart Da is considered as the BACT "floor" for this source category. As shown above, the BACT emission limit proposed for HECA is significantly lower than the applicable NSPS Subpart Da limit of 0.5 lb/MMBtu heat input for gaseous fuel. The proposed NO_X reduction technology is also more stringent than the NSPS Subparts Da recommended minimum reduction efficiency of 25 percent.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. As has been explained, for this application of hydrogen-rich fuel-fired combustion turbine within an IGCC facility, diluent injection in the combustion turbine and SCR installation as post-combustion NO_X control are the appropriate control techniques for setting BACT-based emission limits. The BACT selection described above is strongly supported by recent precedents for similar IGCC projects.

The proposed BACT limits based on this technology are 2.5 ppmvd NO_X at 15 percent O_2 for hydrogen-rich–fuel firing, and 4 ppmvd NO_X at 15 percent O_2 for natural-gas firing.

6.1.2 Carbon Monoxide BACT Analysis for the CTG/HRSG

CO is a product of incomplete combustion. Control of CO is typically accomplished by providing adequate fuel residence time and high temperature in the combustion zone to ensure complete combustion. However, these same control factors can increase NO_X emissions. Conversely, lower NO_X emission rates achieved through flame temperature control (by diluent injection) can increase CO emissions for natural gas and un-shifted syngas. Thus, a compromise must be established whereby the flame temperature reduction is set to achieve the lowest NO_X emission rate possible while keeping CO emissions to an acceptable level. However, CO emissions are inherently low for hydrogen-rich fuels that contain very little reduced carbon and are less affected by the conventional trade-off between CO and NO_X.

Table 6-2
NO_X BACT Emission Limit Comparison

Facility	State	MW	Turbine	NO_X BACT Technology	Emission Limit on Syngas		Emission Limit on Natural Gas	
					ppmc	lb/MMBtu	ppmc	lb/MMBtu
HECA	CA	405	MHI 501 GAC®	SCR	2.5	0.011	4	0.015
Cash Creek Generation Station	KY	630	GE 7FB	SCR	5	0.0331	--	0.0246
Edwardsport Generating Station	IN	630	GE 7FB	SCR operated in trial mode	--	0.027[a]	--	0.018[a]
Taylorville Energy Center	IL	630 (net)	Siemens MHI 501GAC® CT; SNG fuel	DLN[b], SCR (SNG and natural gas)	2[b]	--	2	--
Hyperion Energy Center	SD	280	Not specified	Diluent Injection and SCR (syngas option) DLN and SCR (natural gas option)[c],	3[d]	0.018	2[e]	0.012
Kemper County IGCC Project	MS	582	Siemens 5000F	GCP and diffusion flame combustion (syngas); Steam/ Water Inject and SCR (natural gas)	--	0.061	--	0.015
Summit TCEP	TX	400	Siemens 5000F	Diluent Injection and SCR	15[f] 3.5[g]	0.014[g]	15[f] 2.5[g]	0.009[g]

Notes:

[a] Calculated from mass emissions rate of 57 lb/hr on hydrogen-rich fuel and 38 lb/hr on natural gas.

[b] DLN technology is feasible for substitute natural gas (SNG) – fired turbine. Emission limits are for SNG firing only.

[c] For the syngas Option 1, diluent injection and SCR are proposed. DLN control will only be included if Option 2 is chosen, which is a natural gas-fired turbine with PSA tail gas fired only in the duct burner. These two options are mutually exclusive turbine configuration, one or the other will be selected, not a combination of the two.

[d] The DLN technology is not applied for this limit, as the technology is not feasible for a syngas-fired turbine.

[e] Emission limit for separate natural gas turbine option using DLN and SCR (see footnote c).

[f] Emission limit based on 1-hour averaging time.

[g] Emission limit based on 30-day averaging time.

DLN = dry low-NO_X burners
GCP = good combustion practice
MMBtu = million British thermal units
MW = megawatt
ppmc = parts per million by volume, dry basis, corrected to 15 percent O_2
SCR = selective catalytic reduction

1. Identify Control Technologies

The following CO control technologies were evaluated for the proposed CTG/HRSG:

Combustion Process Controls

- Good Combustion Practices (GCPs)

Post-Combustion Controls

- $SCONO_X$™
- Oxidation Catalyst

2. Evaluate Technical Feasibilities

Good Combustion Practices

Good combustion practices include the use of operational and design elements that optimize the amount and distribution of excess air in the combustion zone to ensure optimum complete combustion. [redacted]

This technology has been determined to be BACT for CO emissions in other operational or recently permitted IGCC projects.

- $SCONO_X$™

  The $SCONO_X$ system was evaluated in the NO_X BACT analysis, and determined to be not technically feasible for this unit.

- Oxidation Catalysts

  Catalytic oxidation is a post-combustion control technology that uses a catalyst to oxidize CO into CO_2. Other operational or recently permitted IGCC projects determined GCPs as the only feasible BACT for CO emissions, with the exception of the Hyperion Energy that is proposing use of an oxidation catalyst to reduce CO emissions to 3 ppm. HECA anticipates CO conversions greater than 90 percent are attainable across the CO catalyst, thus HECA proposed CO emission limits of 3.0 ppmvd at 15 percent O_2 while firing hydrogen-rich fuel, and 5.0 ppmvd CO at 15 percent O_2 while firing natural gas.

3. Rank Control Technologies

Oxidation catalyst is the only technically feasible CO control technology identified in addition to Good Combustion Practices.

4. Evaluate Control Options

GCP is considered the baseline and only feasible and commercially demonstrated CO control technology for IGCC combustion turbines. GCP has been selected as BACT for other recent IGCC permits. The Hyperion Energy Center is the only IGCC project to propose use of oxidation catalysts to control CO. In comparison to other operational or recently permitted IGCC projects, this emission limitation represents a removal efficiency that is lower than the emission achieved in practice at currently operating IGCC turbines, and the lowest proposed emission limits for proposed syngas-fired units, including other proposed IGCC turbines.

Table 6-3 shows the typical CO BACT determination (when firing hydrogen-rich fuel and natural gas) and control technology for other recently permitted IGCC projects, in comparison with HECA's proposed CO BACT for the CTG/HRSG.

Table 6-3
CO BACT Emission Limit Comparison

Facility	State	MW	Turbine	CO BACT Technology	Emission Limit on Syngas		Emission Limit on Natural Gas	
					ppmc	lb/MMBtu	ppmc	lb/MMBtu
HECA	CA	405	MHI 501 GAC®	Oxidation catalyst and GCP	3	0.008	5	0.011
Cash Creek Generation Station	KY	630	GE 7FB	GCP	--	0.0485	--	0.0449
Edwardsport Generating Station	IN	630	GE 7FB	GCP	--	0.0441[a]	--	0.0421[a]
Taylorville Energy Center	IL	630 (net)	Siemens MHI 501GAC® CT; SNG fuel	GCP	4.3[b]	--	4.3	--
Hyperion Energy Center	SD	280	Not specified	Oxidation catalyst and GCP	3	--	3[c]	--
Kemper County IGCC Project	MS	582	Siemens 5000F	GCP	--	0.031	--	0.063
Summit TCEP	TX	400	Siemens 5000F	GCP	10	0.02	10	0.02

Notes:
[a] Calculated from mass emissions rate of 93 lb/hr on hydrogen-rich fuel and 88.7 lb/hr on natural gas.
[b] Emission limit for substitute natural gas (SNG) – fired turbine; turbines are set up for natural-gas type of firing only.
[c] Emission limit for separate natural gas turbine option set up with CO catalyst and GCP specifically for natural gas use. The natural gas turbine option is a mutually exclusive turbine configuration from the syngas Option 1, only one turbine configuration will be selected, not a combination of the two.

GCP = good combustion practice
lb/MMBtu = pound per million British thermal units
MW = megawatt
ppmc = parts per million by volume, dry basis, corrected to 15 percent O_2.

As shown in Table 6-3, the BACT limitation for CO emissions from HECA CTG/HRSG is more stringent than most of the historic BACT determination for other recently permitted IGCC units. This emission limitation represents a removal efficiency that is better than the emission achieved in practice at currently operating IGCC turbines, and equals the lowest proposed emission limits for recently permitted IGCC turbines. The proposed CO emission limit for backup natural gas firing is lower than other similarly operated units. It is slightly higher than the limits proposed for Taylorville and Hyperion; turbines at both of these facilities are designed specifically for natural gas firing as the primary fuel, not as a backup, as is the case for HECA.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. As explained, GCPs and oxidation catalyst are the appropriate control technique for setting BACT-based emission limits.

HECA proposed the CO BACT-based limit of 3.0 ppmvd at 15 percent O_2 while firing hydrogen-rich fuel, and 5.0 ppmvd CO at 15 percent O_2 while firing natural gas during non-start-up operation, using GCPs and an oxidation catalyst.

6.1.3 Particulate Matter Emissions BACT Analysis for the CTG/HRSG

Particulate matter emissions from gas-fired combustion sources consist of inert contaminants in gaseous fuel, sulfates from fuel sulfur, ammonia compounds for the SCR reagent, dust drawn in from the ambient air that passes through the combustion turbine inlet air filters, and particles of carbon and hydrocarbons resulting from incomplete combustion. Low ash content and high combustion efficiency exhibit correspondingly low particulate matter emissions for hydrogen-rich fuel.

1. Identify Control Technologies

The following particulate matter control technologies were evaluated for the proposed CTG/ HRSG:

Pre-Combustion Controls

- Gas Cleanup (for hydrogen-rich fuel)

Combustion Process Controls

- Good Combustion Practices

Post-Combustion Controls

- Baghouse
- Electrostatic Precipitation

2. Evaluate Technical Feasibilities

In a typical solid fuel combustion process, fuel particulate matter is removed by post-combustion processes such as fabric filters or electrostatic precipitators. However, in an IGCC plant, particulate matter could damage the turbine, so particulate matter is removed prior to combustion. Post-combustion controls, such as electrostatic precipitators (ESPs) or baghouses, have never been applied to commercial combustion turbines burning gaseous fuels. Therefore, the use of ESPs and baghouses are considered technically infeasible control technology.

In the absence of add-on controls, the most effective control method demonstrated for gas-fired combustion turbines is the use of low-ash fuel, such as natural gas or hydrogen-rich fuel and GCPs. Therefore, it is necessary to use pre-combustion controls such as particulate removal as an integral part of the gasification process, in addition to GCPs.

The use of clean hydrogen-rich fuel and good combustion control is proposed as BACT for PM/ PM_{10} control in the proposed HECA CTG/HRSG. These operational controls will limit filterable plus condensable PM/PM_{10} emissions to 15 lb/hr when operating on hydrogen-rich fuel or natural gas.

3. Rank Control Technologies

The use of clean fuels with low potential particulate emissions from optimum gas cleanup processes and GCPs were identified as the only technically feasible particulate emissions control technologies applicable to the proposed combustion turbines.

4. Evaluate Control Options

The USEPA has indicated that particulate matter control devices are not typically installed on combustion turbines and that the cost of installing a particulate matter control device is prohibitive. When the NSPS for Stationary Gas Turbines (40 CFR 60 Subpart GG) was promulgated in 1979, the USEPA acknowledged, "Particulate emissions from stationary gas turbines are minimal." Similarly, the recently revised Subpart GG NSPS (2004) did not impose a particulate emission standard. Therefore, performance standards for particulate matter control of stationary gas turbines have not been proposed or promulgated at a federal level.

Table 6-4 shows the typical PM BACT determination (when firing hydrogen-rich fuel and natural gas) and control technology for other recently permitted IGCC projects, in comparison with HECA's proposed PM BACT for the CTG/HRSG.

Based on the evaluation in the previous step, GCPs and optimum gas cleanup are considered as technically feasible PM/PM_{10} control technologies that are suitable for establishment of BACT limits. As shown in Table 6-4, HECA emission limitation represents a removal efficiency that is cleaner in comparison to other operational or recently permitted IGCC units. Therefore, the BACT limitation for PM emissions from HECA CTG/HRSG is more stringent than the historic BACT determination for other recently permitted IGCC units.

Table 6-4
PM BACT Emission Limit Comparison

Facility	State	MW	Turbine	PM_{10} BACT Technology	Emission Limit on Syngas	Emission Limit on Natural Gas
					lb/hr	lb/hr
HECA	CA	405	MHI 501 GAC®	Gas Cleanup and GCP	15 (0.008 lb/ MMBtu)	15 (0.008 lb/ MMBtu)
Cash Creek Generation Station	KY	630	GE 7FB	Gas Cleanup and GCP	76[a]	57[a]
Edwardsport Generating Station	IN	630	GE 7FB	Gas Cleanup and GCP	63[a]	29 [a]
Taylorville Energy Center	IL	630 (net)	Siemens MHI 501GAC® CT; SNG fuel	GCP	0.0065 lb/ MMBtu[b]	0.0065 lb/ MMBtu
Hyperion Energy Center	SD	280	Not specified	AGR, Rectisol®	36.9 (0.022 lb/ MMBtu)	18.4 (0.011 lb/ MMBtu)[c]
Kemper County IGCC Project	MS	582	Siemens 5000F	Clean fuels and GCP	36[a]	0.01 lb/MMBtu
Summit TCEP	TX	400	Siemens 5000F	Clean fuels and GCP	0.008 lb/MMBtu	0.008 lb/ MMBtu

Notes:

[a] Emission limits have been prorated to HECA-sized turbine in MW for comparison purposes. This is only done in cases where no other limits (such as lb/MMBtu) are provided.
[b] Emission limit using substitute natural gas (SNG); turbines are set up for natural-gas type firing only.
[c] Emission limit for separate natural gas turbine option specifically for natural gas use.

AGR = acid gas removal
lb/MMBtu = pound per million British thermal unit
MW = megawatt
PM_{10} = particulate matter 10 microns in diameter or less

NSPS 40 CFR 60 Subpart Da is considered as the BACT "floor" for this source category. The BACT emission limits proposed in Table 6-4 are equivalent to 0.006 lb/MMBtu on hydrogen-rich fuel, and 0.006 lb/MMBtu on natural gas. These emission limits are significantly lower than the applicable NSPS Subpart Da limit of 0.03 lb/MMBtu heat input derived from the combustion of solid, liquid, or gaseous fuel.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. As explained, GCPs and optimum gas cleanup are the appropriate control technique for setting BACT-based emission limits. The use of optimum gas cleanup to produce clean fuels with low potential particulate emissions and GCPs were selected as LAER for particulate emissions from the proposed combustion turbines. The following emission limit resulting from the implementation of these technologies is proposed for each combustion turbine.

HECA proposed the PM BACT-based limit of 15 lb/hr while firing hydrogen-rich fuel or natural gas, during non-start-up operation, using GCPs and optimum gas cleanup.

6.1.4 Sulfur Dioxide and Sulfuric Acid Mist BACT Analysis for the CTG/HRSG

Sulfur dioxide emissions from any combustion process are largely defined by the sulfur content of the fuel being combusted and the rate of the fuel usage. The combustion of hydrogen-rich fuel in the combustion turbines creates primarily SO_2 and small amounts of sulfite (SO_3) by the oxidation of the fuel sulfur. The SO_3 can react with the moisture in the exhaust to form sulfuric acid mist, or H_2SO_4. Emissions of these sulfur species can be controlled, either by limiting the sulfur content of the fuel (pre-combustion control), or by scrubbing the SO_2 from the exhaust gas (post-combustion control).

1. Identify Control Technologies

The following sulfur dioxide and sulfuric acid mist control technologies were evaluated for the proposed CTG/HRSG when operating on hydrogen-rich fuel:

Pre-Combustion Controls

- Chemical Absorption Acid Gas Removal (AGR), e.g., methyldiethanol-amine (MDEA)
- Physical Absorption Acid Gas Removal, e.g., Selexol®, Rectisol®

Post-Combustion Controls

- Flue Gas Desulfurization

The sulfur dioxide BACT for the proposed CTG/HRSG when operating on natural gas is PUC-grade natural gas fuel with less than 0.75 grain/100 scf sulfur content.

2. Evaluate Technical Feasibilities

- Acid Gas Removal

  In the gasification process, sulfur in the petcoke or coal feedstock converts primarily to hydrogen sulfide (H_2S). Solvent-based acid gas cleanup is commonly used for "gas sweetening" processes in petroleum refinery fuel gas or tail gas treating units, where H_2S in the process gas is removed before use as a fuel. The removed H_2S is recovered either as elemental sulfur in a Sulfur Recovery Unit (e.g., using a Claus process).

In a chemical absorption process, acid gases in the sour syngas are removed by chemical reactions with a solvent that is subsequently separated from the gas and regenerated. The chemical absorption occurs in amine-based systems that use solvents such as MDEA. Amine solvents chemically bond with the H_2S. The H_2S can be easily liberated with low-level heat in a stripper to regenerate the solvent. However, amine-based systems such as MDEA are not effective at removing COS and have not demonstrated the deep total sulfur removal levels required by the Project.

Lower levels of sulfur removal are possible using physical absorption AGR systems. Physical absorption methods, including Selexol® and Rectisol®, use solvents that dissolve acid gases under pressure. Selexol® or Rectisol® are normally applied when low syngas sulfur levels are required for SCR. Solubility of an acid gas is proportional to its partial pressure and is independent of the concentrations of other dissolved gases in the solvent. Consequently, increased operating pressure in an absorption column facilitates separation and removal of an acid gas like H_2S. The dissolved acid gas can then be removed from the solvent, which is regenerated by depressurization in a stripper.

To selectively remove H_2S and CO_2, two absorption and regeneration columns or two-stage process are required. In general, H_2S is selectively removed in the first column by a lean solvent that has been deeply stripped with steam, while CO_2 is removed from the now H_2S-free gas in the second absorber. The second-stage solvent can be regenerated if very deep CO_2 removal is required. If only bulk CO_2 removal is required, then the flashed gas containing the bulk of the CO, can be vented, and the second regenerator duty can be substantially lowered or totally eliminated.

- Flue Gas Desulfurization

Flue gas desulfurization (FGD) is a post-combustion SO_2 control technology that reacts an alkaline with SO_2 in the exhaust gas. Typical FGD processes operate by contacting the exhaust gas downstream of the combustion zone with an alkaline slurry or solution that absorbs and subsequently reacts with the acidic SO_2. FGD technologies may be wet, semi-dry, or dry, based on the state of the reagent as it is injected or pumped into the absorber vessel. Also, the reagent may be regenerable (where it is treated and reused) or non-regenerable (all waste streams are de-watered and either discarded or sold). Wet, calcium-based processes that use lime (CaO) or limestone ($CaCO_3$) as the alkaline reagent are the most common FGD systems in PC unit applications. After the exhaust gas has been scrubbed, it is passed through a mist eliminator and discharged through a stack.

Flue gas desulfurization systems are commonly employed in conventional PC plants, where the concentration of oxidized sulfur species in the exhaust is relatively high. If properly designed and operated, FGD technology can reliably achieve more than 95 percent sulfur removal. However, FGD cannot provide as high a level of control as the pre-combustion AGR systems. In addition, FGD has the environmental drawbacks of substantial water usage and the need to dispose of a solid byproduct (the scrubber sludge). The solid by-product requires the installation of a significant number of ancillary support systems to accommodate treatment, handling, and disposal. Given these disadvantages and the fact that FGD could not achieve the high removal efficiencies associated with AGR, even though FGD is not technically infeasible, it is not considered to be a reasonable technical option for IGCC. Therefore FGD will not be considered further in this BACT analysis

3. Rank Control Technologies

Both chemical and physical absorption methods for AGR are considered feasible for an IGCC, and can achieve control of the sulfur in syngas up to 99 percent or better. Both of these systems are further considered in the BACT analysis.

4. Evaluate Control Options

Physical absorption AGR systems (including Selexol® and Rectisol®) are considered as feasible sulfur dioxide and sulfuric acid mist control technology for the proposed CTG/HRSG turbine. Selexol® has been selected as BACT for several of the recent IGCC permits. Rectisol® was selected for Taylorville Energy Center and the Hyperion Energy Project and has also been widely used in gasification projects in the chemical industry where both deep sulfur removal and CO_2 removal are required. Both Rectisol® and Selexol® are considered viable alternatives to MDEA. However, the Project selected Rectisol® because there are more units operating at similar capacities and similar conditions to those required for the Project, making Rectisol® the more proven alternative.

Table 6-5 shows the typical SO_2 BACT determination (when firing hydrogen-rich fuel and natural gas, respectively) and control technology for other recently permitted IGCC projects, in comparison with HECA's proposed SO_2 BACT for the CTG/HRSG.

As shown in Table 6-5, the BACT limitation for SO_2 emissions from HECA CTG/HRSG when firing hydrogen-rich fuel is similar to the historic BACT determination for other recently permitted IGCC units. This emission limitation represents a removal efficiency that is better than the emission achieved in practice at currently operating IGCC units, and similar to the proposed emission limits compared to recently permitted IGCC units.

NSPS 40 CFR 60 Subpart Da is considered as the BACT "floor" for this source category. The proposed SO_2 emission limits are significantly lower than the applicable NSPS Subpart Da limit of 180 nanograms per joule (1.4 lb/MWh) or 95 percent reduction on a 30-day rolling average.

When firing natural gas, SO_2 emission from CTG/HRSG is slightly higher than other recently permitted IGCC units. The SO_2 BACT for the proposed CTG/HRSG when operating on natural gas is PUC-grade natural gas fuel with less than 0.75 grain/100 scf sulfur content.

Table 6-5
SO_2 BACT Emission Limit Comparison

Facility	State	MW	Turbine	SO_2 BACT Technology	Emission Limit on Syngas		Emission Limit on Natural Gas	
					ppm	lb/MMBtu	ppm	lb/MMBtu
HECA	CA	405	MHI 501 GAC®	AGR, Rectisol®	≤ 2 ppm Sulfur in undiluted Hydrogen-rich fuel ≤ 10 ppm Sulfur in PSA off-gas	0.0002	0.75 grains/ 100 scf	0.002
Cash Creek Generation Station	KY	630	GE 7FB	AGR, Selexol®	3.8[a]	0.0158		0.0006
Edwardsport Generating Station	IN	630	GE 7FB	AGR, Selexol®		0.0138[b]		0.0006[b]
Taylorville Energy Center	IL	630 (net)	Siemens MHI 501GAC® CT; SNG fuel	AGR, Rectisol®	0.25 grains/ 100 scf in SNG	--	0.25 grains/ 100 scf	--
Hyperion Energy Center	SD	280	Not specified	AGR, Rectisol®	1 ppmv Sulfur in syngas[c]; 0.5 ppmv in PSA off-gas	0.0005[c]	9 ppmv	--
Kemper County IGCC Project	MS	582	Siemens 5000F	AGR, Selexol®	--	0.004		1.9 lb/hr
Summit TCEP	TX	400	Siemens 5000F	Low Sulfur fuel	10 ppmv Sulfur in Syngas	0.006	2 grains/ 100 dscf	0.006

Notes:
[a] Parts per million by volume, dry basis, corrected to 15 percent O_2.
[b] Calculated from mass emissions rate of 2.9 lb/hr on hydrogen-rich fuel and 1.30 lb/hr on natural gas.
[c] Emission limit based on 24-hr rolling average.

AGR = acid gas removal
dscf = dry standard cubic foot
lb/MMBtu = pounds per million British thermal units
MW = megawatt
ppm = parts per million
ppmv = parts per million by volume
scf = standard cubic foot
SNG = substitute natural gas

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. HECA selected Rectisol® as syngas cleanup control technology to remove sulfur dioxide from the hydrogen-rich fuel stream entering the CTG/HRSG. The reduction efficiency of Rectisol® is above the NSPS floor requirement, and the overall performance of this technology is more stringent than the historic BACT determination for other recently permitted IGCC units. The following emission limit resulting from the implementation of these technologies is proposed for each combustion turbine.

HECA proposed the SO_2 BACT-based limit of ≤ 2 ppmv sulfur in undiluted hydrogen-rich syngas, ≤ 10 ppmv sulfur in PSA off-gas using an AGR system (Rectisol®) and ≤0.75 grains/ 100 scf of natural gas sulfur content using PUC-grade natural gas. These levels will meet the SJVAPCD BACT guideline 7.2.6 for sulfur recovery plants.

6.1.5 Volatile Organic Compounds BACT Analysis for the CTG/HRSG

VOCs are a product of incomplete combustion of the organic components in the hydrogen-rich fuel. Hydrogen-rich fuel contains very low concentrations of VOC; therefore, emissions of VOC are inherently very low. Reduction of VOC emissions is accomplished by providing adequate fuel residence time and a high temperature in the combustion zone to ensure complete combustion. A survey of the RBLC database indicated that good combustion control and burning clean gas fuel are the VOC control technologies primarily determined to be BACT. The advantage of IGCC technology is the fact that the combustion turbine operates on hydrogen-rich fuel, which contains a very low organic content, and yields very low levels of uncombusted VOC emissions.

1. Identify Control Technologies

The following VOC control technologies were evaluated for the proposed CTG/HRSG:

Combustion Process Controls

- Good Combustion Practices

Post-Combustion Controls

- $SCONO_X$™
- Oxidation Catalyst

2. Evaluate Technical Feasibilities

- Good Combustion Practices

  GCPs include the use of operational and design elements that optimize the amount and distribution of excess air in the combustion zone to ensure optimum complete combustion.

This technology has been determined to be BACT for VOC emissions in other operational or recently permitted IGCC projects.

- $SCONO_X$™

  The $SCONO_X$ system was evaluated in the NO_X BACT analysis, and determined to be not technically feasible for this unit.

- Oxidation Catalysts

  Catalytic oxidation is a post-combustion control technology that uses a catalyst to oxidize VOC. The catalyst beds that functions to reduce CO emissions can also be effective in reducing VOC emissions. Such systems typically achieve a maximum VOC removal efficiency of up to 50 percent, while providing control for CO.

  Other operational or recently permitted IGCC projects determined GCPs as the only feasible BACT for VOC emissions, with the exception of the Hyperion Energy that is proposing use of an oxidation catalyst to reduce VOC emissions. The turbine exhaust will achieve VOC emission levels of 1.0 ppmvd VOC (at 15 percent oxygen) when firing hydrogen-rich fuel, and 2.0 ppmvd VOC (at 15 percent oxygen) when operating on natural gas.

3. Rank Control Technologies

Oxidation catalyst is the only technically feasible VOC control technology identified in addition to GCPs.

4. Evaluate Control Options

GCPs are considered the baseline and the only commercially demonstrated VOC control technology for IGCC combustion turbines. GCP has been selected as BACT for all other recent IGCC permits, with the exception of the Hyperion Energy, that is proposing use of an oxidation catalyst. In comparison to other operational or recently permitted IGCC projects, this emission limitation represents a removal efficiency that is lower than the emissions achieved in practice at currently operating IGCC units, and the lowest proposed emission limits for proposed turbines combusting syngas.

Table 6-6 shows the typical VOC BACT determination (when firing hydrogen-rich fuel and natural gas, respectively) and control technology for other recently permitted IGCC projects, in comparison with HECA's proposed VOC BACT for the CTG/HRSG.

As shown in Table 6-6, the BACT limitation for VOC emissions from HECA CTG/HRSG is comparable to the historic BACT determination for other recently permitted IGCC turbines when firing syngas. This emission limitation represents a removal efficiency that is as good as the emissions proposed in recently permitted syngas turbines.

Table 6-6
VOC BACT Emission Limit Comparison

Facility	State	MW	Turbine	VOC BACT Technology	Emission Limit on Syngas		Emission Limit on Natural Gas	
					ppmc	lb/MMBtu	ppmc	lb/MMBtu
HECA	CA	405	MHI 501 GAC®	Oxidation catalyst and GCP	1	0.0015	2	0.003
Cash Creek Generation Station	KY	630	GE 7FB	GCP	--	N/A	--	N/A
Edwardsport Generating Station	IN	630	GE 7FB	GCP	--	0.0016[a]	--	0.0016[a]
Taylorville Energy Center	IL	630 (net)	Siemens MHI 501GAC® CT; SNG fuel	GCP	--	0.0013[b]	--	0.0013
Hyperion Energy Center	SD	280	Not specified	Oxidation catalyst and GCP	--	0.0017	--	0.0017[c]
Kemper County IGCC Project	MS	582	Siemens 5000F	GCP	--	0.005	--	0.008
Summit TCEP	TX	400	Siemens 5000F	GCP	1	0.0012	1	0.0012

Notes:
[a] Calculated from mass emissions rate of 3.3 lb/hr on hydrogen-rich fuel and natural gas.
[b] Emission limit using substitute natural gas (SNG); turbines are set up for natural-gas type of firing only.
[c] Emission limit for separate natural gas turbine option set up with CO catalyst and GCP specifically for natural gas use. The natural gas turbine option is a mutually exclusive turbine configuration from the syngas Option 1, only one turbine configuration will be selected, not a combination of the two.

GCP = good combustion practice
lb/MMBtu = pound per million British thermal units
MW = megawatt
ppmc = parts per million by volume, dry basis, corrected to 15 percent O_2.
VOC = volatile organic compound

The proposed VOC emission limit for backup natural gas firing is comparable to other similarly operated units, although it is slightly higher than the limits proposed for Taylorville and Hyperion; turbines at both of these facilities are designed specifically for natural gas firing as the primary fuel, not as a backup, as is the case for HECA. The Summit Project, when combusting natural gas, has a slightly lower long-term average limit than HECA is proposing, although this is not comparable to the short-term limit proposed for HECA.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. As explained, GCPs and oxidation catalyst are the appropriate control technique for setting BACT-based emission limits.

HECA proposes the VOC BACT-based limit of 1.0 ppmvd at 15 percent O_2 while firing hydrogen-rich fuel, and 2.0 ppmvd VOC at 15 percent O_2 while firing natural gas during non-start-up operation, using GCPs and oxidation catalyst.

6.1.6 Startup and Shutdown BACT Analysis for the CTG/HRSG

The proposed turbine is a MHI 501 GAC® model turbine with a gross capacity of approximately 405 MW, operating in a combined cycle mode and discharging its exhaust gases through a HRSG. The MHI 501 GAC® turbine is a new turbine model designed for optimum performance on both hydrogen-rich fuel and natural gas and includes changes to the fuel system, combustion system and hot gas path to accommodate this combination of fuels.

According to the turbine manufacturer, the emissions of all criteria pollutants except SO_2 and PM_{10} will be slightly higher during turbine start up. This is in part due to lower control effectiveness of the SCR and Oxidation Catalyst control systems until the exhaust gases reach optimal operating temperatures. This is also due to the slightly lower combustion efficiency of gas turbines at low loads, particularly during cold starts. Consequently, the most effective consideration for minimizing emissions due to start up and shutdown events is to minimize the frequency and duration of these events.

HECA is being designed and permitted as a base-load electrical generating facility. In keeping with this mode of operation, frequent start ups and shut downs of the combustion turbine and HRSG will not be required. In contrast, a NGCC plant may frequently be turned off during periods of low demand (e.g., overnight). The time required for gasifier start up does not allow overnight shut downs (and would also result in some flaring during each event). The Project proposed maximum annual start-up and shut-down duration of 314 hours per year for the entire facility and 123 hours per year for the CTG/HRSG. This limit would allow 2 starts per year for HECA, as compared to a typical NGCC plant that may be allowed up to 250 starts per year.

The estimated annual criteria pollutant emissions for the CTG/HRSG operating scenario, including start-up/shut-down emissions and maximum permitted natural gas backup operation, are presented below in Table 6-7.

Table 6-7
Maximum Annual Emissions from the CTG/HRSG

Pollutant	Startup and Shutdown Emissions (ton/yr)	CTG/HRSG Emissions Hydrogen-Rich Fuel (tons/yr)	CTG/HRSG Emissions Natural Gas (tons/yr)	Maximum Total CTG/HRSG Emissions (tons/yr)
NO_X	4.3	99.6	5.7	109.7
CO	15.7	72.8	4.4	92.9
VOC	0.5	13.9	1.0	15.3
PM_{10}	0.8	51.3	2.5	54.6
SO_2	0.1	16.2	0.8	17.1
NH_3	0.0	73.6	2.6	76.3

The start-up and shut-down emissions basis included in the above annual emissions estimate are based on the 2 start ups and 2 shut downs per year. The emissions from these events represent a very small percentage of the overall Project emissions. For example, NO_X emissions from start up and shut down of this base-load turbine would be approximately 4 percent of the total annual turbine emissions. VOC, PM, and SO_2 emissions vary from approximately 1 to 3 percent of the annual turbine emissions. CO emissions are somewhat larger, but still represent less than 20 percent of the annual emissions. This sharply contrasts with single-cycle peaking turbine permits, where start-up emissions can represent the majority of a facility's permitted emissions for certain pollutants.

The following sections provide a stepwise evaluation of control technologies considered for BACT for the proposed CTG/HRSG.

1. Identify Control Technologies

A review of the RBLC database for large combustion turbines in the last 10 years identified only a few combustion turbine entries that specifically discuss start-up or shut-down emissions. Only two of these entries listed the emissions control method determined to represent BACT for start-up emissions, as shown below.

RBLC ID:	LA-0224
+Corporate/Company Name:	SOUTHWEST ELECTRIC POWER COMPANY (SWEPCO)
+Facility Name:	ARSENAL HILL POWER PLANT
Facility State:	LA
+Control Method Description:	**COMPLETE EVENTS AS QUICKLY AS POSSIBLE ACCORDING TO MANUFACTURE'S RECOMMENDED PROCEDURES**

RBLC ID:	IN-0115
+Corporate/Company Name:	MIRANT SUGAR CREEK, LLC
+Facility Name:	MIRANT SUGAR CREEK, LLC
Facility State:	IN
+Control Method Description:	**DRY LOW-NOX BURNERS, GOOD COMBUSTION PRACTICES, NATURAL GAS.**

None of the combustion turbines with start-up and shut-down entries in the RBLC are in IGCC service. Nevertheless, their identified start-up and shut-down BACT listings are helpful references for possible emission control ideas.

Because precedents established in the permits of similar projects can be relevant in determining BACT, the permits for several recent IGCC projects were also reviewed. The following three examples summarize the relevant control strategies identified in other IGCC permits.

Hyperion Energy Center IGCC – Requirement for startup and shutdowns as referenced from this PSD permit are as follows; "…the owner or operator shall use good work and maintenance practices and manufacturers' recommendations to minimize emissions during, and the frequency and duration of, startup, shutdown, and malfunction events for those units and pollutants that are not using a continuous emissions monitoring system to demonstrate compliance. The owner or operator shall develop and implement a startup, shutdown, and malfunction plan…."

Duke Edwardsport IGCC – "Emissions from startups and shutdowns of the power block of the IGCC plant shall not exceed the established annual and 24-hour average limits determined on a monthly basis, using the appropriate emission factors and number of specific startup and shutdown events per month."

Cash Creek IGCC – "…at all times, including periods of startup, shutdown and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Division which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source."

Based on the above review, and also including the "fast-start" and "opflex" technologies mentioned by USEPA, the following start-up/shut-down (SU/SD) control technologies were evaluated for the proposed CTG/HRSG:

Combustion Process Controls

1) Fast Start and OpFlex Technology

2) Several aspects of Good Air Pollution Control Work Practices (i.e., Complete events as quickly as possible following manufactures recommendation and or Startup, Shutdown or Malfunction Plans)

2. Evaluate Technical Feasibilities

Fast Start and OpFlex Technology

The proposed combustion turbine, the MHI 501 GAC®, is designed to run as a combined-cycle turbine specifically for IGCC applications. The "fast start" or "opflex" technologies are technologies that suppliers such as GE offer for their combustion turbines. The technology consists of specialized control software that allows a slightly more rapid start up and slightly lower turndown level on turbines. The concept is to bring the CTG into emissions compliance quicker during the start-up of a NGCC. This approach minimizes the higher emission rates associated with lower load operation, while providing adequate temperature control of the steam entering the steam turbine generator (STG). Plants that are currently using this system or are slated to employee it use DLN combustion technology. Furthermore, these facilities are generally in peaking service, where there are numerous hot and cold starts per year.

The GE OpFlex(TM) system has limited field operating experience in NGCC facilities and no experience in a facility designed to operate on hydrogen fuel. The differences between NGCC and hydrogen fueled IGCC facilities are substantial. Although the GE OpFlex(TM) is an innovative technology that has been successfully applied for NGCC operation, it has not been proven for application in a hydrogen fueled facility like HECA. For this reason, and because the HECA Project is a base-loaded facility with start-up emissions that are a relatively small portion of the total CTG/HRSG emissions, additional BACT for start up and shut down should not be required.

Good Air Pollution Control Work Practices

Good air pollution control work practices are feasible for the Project. The proposed CTG for the HECA Project is designed to minimize the frequency and duration of start-up and shut-down events by using the following work practices, operating controls, and design elements:

- Baseload Power Generation Project (inherent design feature)
- Use of fuel dilution, SCR and CO catalyst systems during start up and shut down when operating conditions are amenable to their effective use.
- Follow manufacturer's recommendations to minimize the duration and emissions during start up.

The Project will be operated as a base-load power generating unit. Unlike peak-load generation, base-load power generation entails continuous operation and power generation during all seasons that is normally interrupted only for maintenance or unexpected outages. The applicant is proposing a maximum of only two start ups annually to allow for repairs and/or maintenance activities. In contrast, a peak-load plant may operate only several hours per day (during periods of peak electrical demand).

Another operating control/design element of the Project that inherently minimizes the emissions associated with start-up and shut-down events from the CTG/HRSG is the use of fuel dilution, SCR and CO catalyst systems. The primary purpose of these emissions controls is to control emissions during operations. However, they will provide some benefit during start up and shut down as well. For example, the SCR and CO catalyst systems will be in the direct path of the exhaust flow throughout the start-up and shut-down processes. As described in the permit application, the oxidation catalyst will be in service and functioning to provide emissions control as soon as the CTG/HRSG operating temperature rises to a sufficient level. Meaningful control of CO emissions by the oxidation catalyst should begin as the temperature approaches about 400 ºF. The SCR catalyst system will be in the exhaust gas flow path throughout start ups, but will become effective for NO_X control when both the temperature is sufficient (about 450 to 500 ºF) to activate the ammonia injection system. Injection of ammonia prematurely will cause excessive ammonia slip. HECA plans to begin injection of ammonia as soon as the exhaust gas operating conditions are amenable to its effective use, following manufacturers' recommendations.

In addition to the above aspects, HECA will follow manufacturers' recommendations and good work practices to minimize the numbers and durations of start ups and shut downs and, hence the emissions associated with non-routine operation.

3. Rank Control Technologies

Among the potentially available controls, the only feasible and commercially demonstrated control technology for IGCC combustion turbines start up and shutdown is the use of good air pollution control practices to minimize emissions during start up and shutdown.

4. Evaluate Control Options

The only feasible and commercially demonstrated control technology for IGCC combustion turbines start up and shut down is the use of good air pollution control practices to minimize emissions during start up and shut down.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps and review of determinations for turbine start ups and shut downs of other IGCC projects. As a result of these considerations, BACT for the HECA Project's turbine start-up and shut-down emissions is proposed as follows:

1. HECA shall operate the CTG/HRSG using good work practices and following manufacturers' recommendations to minimize emissions during, and the duration of, start-up and shut-down events.

2. CTG/HRSG exhaust will be routed through the SCR system and the oxidation catalyst system at all times including periods of start up and shut down. Ammonia

shall be added to the SCR system when operating conditions are amenable to its effective use.

3. HECA shall monitor and maintain records of each start-up and shut-down event including the duration of the event.

4. HECA shall include the emissions during periods of start up and shut down, along with routine emissions, in determining compliance with the long-term annual emission rates which were used in the permit modeling demonstration.

6.2 Coal Dryer BACT Analysis

The MHI gasifier is a completely enclosed process with only one emission point: the coal dryer. This system uses dry feed in an oxygen-blown gasifier to generate the raw syngas. This syngas is further treated in the downstream units to produce the hydrogen used for the combined cycle unit fuel as well as feed for the Manufacturing Complex. This technology has no start-up emissions directly from the gasifier. Waste gases from gasifier warming, start up, and shut down are routed to the one of the flares for safe disposal (which are discussed in later sections of this analysis).

The coal (feedstock) dryer removes moisture from the solid feed to ensure proper grinding and injection into the gasifier. The coal dryer is the only emission point associated with the gasifier system. The heat source for the dryer is a slipstream of HRSG fluegas. This slipstream is obtained just downstream of the catalytic emission controls (SCR and CO catalysts described above) and is ducted to the coal dryer adjacent to the gasifier. The coal dryer is a totally enclosed vessel that contacts the hot flue gas with the coal/petcoke feed material as it enters the grinder. After drying the solid feed, the flue gas is routed to the coal dryer vent stack. The vented gas will contain the moisture removed from the feed, the residual emissions from the HRSG emission controls, and particulate fines entrained from the solid feed. Baghouse fabric filtration will be provided on this vent stream to reduce the particulate emissions to less than 0.001 grain/dscf.

Because the HRSG fluegas has already undergone emission controls for NO_X, CO and VOC, only BACT for PM is reviewed, as emissions of PM are primarily due to the particulate fines entrained from the solid feed in the flue gas, as a consequence of the direct-contact drying process. Even though it is expected that most of these entrained particles are larger than PM_{10}, the controls discussed below apply to PM_{10} and $PM_{2.5}$ as well. An RBLC search for coal dryers identified three units; two of these have baghouses as BACT and one has a fabric filter (essentially the same technology as a baghouse). Baghouses (fabric filtration) are considered to be the only applicable control technology for PM/PM_{10} from coal dryers. The BACT limits cited for the three units range from 0.01 to 0.015 gr/dscf for filterable PM. The baghouse selected for the HECA coal dryer is designed to limit PM emissions to 0.001 gr/dscf. Therefore, HECA proposes this baghouse efficiency as the BACT for the coal dryer vent.

6.3 Cooling Towers Particulate Emissions BACT Analysis

There will be three cooling towers proposed for the Project: two cooling towers, the process cooling tower and the Air Separation Unit (ASU) cooling tower, are associated with the gasification process and Manufacturing Complex, and the third cooling tower, the power block cooling tower, is used by the power block. Compared to similar sized combined cycle power plants, the power block cooling duty is somewhat greater due to the heat integration with gasification resulting in the generation of additional steam for power production in the steam turbine and therefore requires additional cooling to condense this steam from the gasification block. Each tower has a separate cooling water basin, pumps, and piping system, and operates independently. The cooling water will circulate through a mechanical draft-cooling tower that uses electric motor-driven fans to move the air into contact with the flow of the cooling water. The heat removed in the condenser will be discharged by heating the air, and through evaporation of some of the cooling water.

The power block cooling tower is designed for an approximate capacity of 95,500 gallons per minute (gpm) of water, the process cooling tower design circulation rate is 162,582 gpm, and the ASU cooling tower design circulation rate is 44,876 gpm.

All cooling towers are supplied with high-efficiency drift eliminators designed to reduce the maximum drift; that is, the fine mist of water droplets entrained in the warm air leaving the cooling tower, to less than 0.0005 percent of the circulating water flow. Circulating water could range in total dissolved solids (TDS) depending on makeup-water quality and tower operation. Therefore, PM_{10} emissions would vary proportionately.

For cooling water makeup uses, HECA will use local brackish groundwater that has been determined by the local water district to be impaired and not suitable for agricultural or drinking use without extensive treatment because of its high TDS content. These impaired groundwater sources are found in various locations within the BVWSD Buttonwillow Service Area. According to the BVWSD, the impaired groundwater is considered objectionable by local agricultural users because it is unsuitable for good crop yield or crop diversification. As such, this water currently poses a negative impact on agriculture. Elevated TDS in groundwater has prompted the BVWSD to develop the Brackish Groundwater Remediation Project. This program includes extraction of groundwater in elevated TDS areas. HECA's use of this poor quality groundwater for the proposed Project's process water needs will remove significant TDS from the groundwater aquifer and is consistent with the BVWSD groundwater remediation plan. The maximum cycled-up cooling water TDS for the process and power block cooling tower will be 9,000 ppmw and 2,000 ppmw for the ASU cooling tower.[2]

Wet (evaporative) cooling towers emit aqueous aerosol "drift" particles that evaporate to leave crystallized solid particles that are considered PM_{10} emissions. The proposed control technology for PM_{10} is high-efficiency drift eliminators to capture drift aerosols upstream of the vent point.

[2] The cooling equipment in the ASU requires significantly lower dissolved solids in the circulating water than the rest of the plant.

1. Identify Control Technologies

The following particulate matter control technologies were evaluated for the proposed cooling towers:

Potential Cooling Tower Control Technology

- Air Cooled Condenser (ACC) Technology
- Drift Elimination System with limited TDS level

2. Evaluate Technical Feasibilities

- Air Cooled Condenser Technology

Although most power plants and other industrial processes are cooled by use of non-contact cooling water, some use air cooling systems which directly reject heat to the air. Air cooled plants employ high-flow forced draft fans to blow air across a system of finned tubes in the condenser through which the steam (or process fluid needing cooling) passes. The heat from the process is simply transferred to the ambient air directly.

The major benefit of air cooled systems is that they reduce a power plant's water usage (versus a water-cooled plant which has evaporative losses). Consequently, they are commonly considered for projects located in areas without adequate water supplies. In the case of HECA, there is a plentiful supply of suitable water available. Likewise, to a very small degree, they can avoid particulate emissions from the wet cooling tower. However, a major disadvantage of air cooled systems is that they consume a lot of power because of the large fans required. In a hot climate, the ambient air temperature (i.e., 40ºC) can severely limit the cooling potential compared with wet/evaporative cooling systems which would benefit from a cooler wet bulb temperature (i.e., 20ºC) which defines the potential for a wet system. In a power plant application, this results in a loss of efficiency (decreased power output), which increases plant costs and results in greater emissions of GHGs and criteria pollutants per kilowatt-hour from the power generator.

Additionally, air is not a particularly efficient heat transfer medium. Therefore, air cooled systems require a much larger cooling plant which is mechanically more complex. A 2009 U.S. DOE study stated that air cooled systems are three to four times more expensive than a recirculating wet cooling system.

- Drift Elimination System with limited TDS level

High-efficiency drift eliminators and limits on TDS concentrations in the circulating water are the techniques that set the basis for cooling tower BACT emission limits. The efficiency of drift eliminator designs is characterized by the percentage of the circulating water flow rate that is lost to drift. The drift eliminators to be used on the proposed cooling tower will be designed such that the drift rate is less than 0.0005 percent of the circulating water.

There is no PM_{10} BACT guideline for mechanical draft cooling towers in the SJVAPCD. However, the use of high-efficiency drift-eliminating media to de-entrain aerosol droplets from the air flow exiting the wetted-media tower is a commercially proven technique to reduce PM_{10} emissions. Compared to "conventional" drift eliminators, advanced drift eliminators reduce the PM_{10} emission rate by more than 90 percent.

In addition to the use of high-efficiency drift eliminators, management of the tower water balance to control the concentration of dissolved solids in the cooling water can also reduce particulate emissions. Dissolved solids accumulate in the cooling water due to increasing concentrations of dissolved solids in the make-up water as the circulating water evaporates; and secondarily, to the addition of anti-corrosion, anti-biocide additives.

3. Rank Control Technologies

For the control of PM from the cooling towers the following technologies in order of emission control effectiveness are:

- Air Cooled Condenser Technology
- Drift Elimination System with limited TDS level

4. Evaluate Control Options

- Air Cooled Condenser Technology

Cost effectiveness analysis

A cost effectiveness analysis was conducted for the previous configuration of the HECA Project to determine if ACC would be cost effect to control PM emissions. The study examined the power cooling tower, although the operational capacity of this cooling tower has changed, the relative cost per ton of controlled PM is expected to remain similar. Below is the previous discussion.

The Water Minimization Study conducted by Fluor engineers and documented in Appendix X of the AFC (May 2009) provides a comparison of the performance and cost impact of using an ACC versus a water cooled condenser (WCC) for the power block of the Project. The performance and cost effectiveness analyses for an ACC system were conducted on the power block for the Project because this system represented the majority of the cooling load compared to the rest of the Project. The cost-effectiveness based on the increased capital costs/capital recovery for using an ACC system for the other cooling loads proposed in the Project would be comparable to those for the power block.

The HECA Water Minimization Study considered the total installed capital cost of an ACC system compared to the proposed WCC system for the steam turbine generator power block. Using the WCC as a "Base Case," the additional installed capital cost required for an ACC is estimated at approximately $37 million dollars.

The Cost-Effectiveness of using an ACC system can be calculating by dividing the total annualized cost by the amount of particulate matter emission reduction achieved using this type of system. Total annualized cost is calculated by annualizing the capital cost (capital recovery) and including other direct annual costs (labor, maintenance, utilities) and other indirect annual costs (property taxes, insurance, administrative charges, and overhead). However, to conservatively illustrate the poor cost-effectiveness for using an ACC to control particulate matter for the power block, the following calculation includes only the capital recovery component in the total annualized cost. Assuming a 7 percent interest and 20-year life the Capital Recovery Factor (CRF) is 0.0944. This results in a total annualized cost of $3.5 million dollars per year. The total particulate matter emissions from the power block cooling tower were estimated to be 16.4 tons per year. This results in a cost-effectiveness of greater than $213,900/ton of PM controlled based solely on the capital recovery costs, using techniques from the USEPA Cost Control Manual (USEPA, 2002). This cost would be even higher if the increased energy needs of the ACC were included (as discussed below). HECA believes that this high cost per ton of PM for using an ACC is cost prohibitive for the Project.

The "power output" of the steam turbine generator is partially dependent on the temperature of the coolant delivered to the surface condenser. The use of an ACC design will have warmer coolant temperature (ambient air) versus a water cooled design. Consequently, an ACC results in a slightly lower steam turbine generator output. Additionally, the electricity usage for running the fans for an air cooled system is higher than needed for a WCC. Compared to a WCC design, this decreased power output and increase parasitic power consumption would decrease the net electrical generation of an ACC design for the power block by approximately 8.4 MW. This increased electrical consumption/decreased output significantly would increase the annual operating costs for the air cooled system. Even conservatively valued at 8 cents per kilowatt hour, this is equivalent to an additional annual electrical cost of $5.6 million dollars per year. This cost alone is significantly higher than the annualized capital recovery cost shown above. If this cost was included with the above capital recovery component of annualized cost, it would confirm the high cost per ton of PM controlled to use ACC, and further support that an ACC system is cost prohibitive for the Project.

Due to the decreased performance of the steam turbine generator coupled with the cost-prohibitive economic analysis described above results in the ACC system being rejected as an economically feasible control technology for particulate matter emissions from the Project.

- Drift Elimination System with limited TDS level

The highest control efficiency to reduce the PM_{10} emission from the proposed cooling towers involves the instillation of drift eliminators and adoption of TDS limit for the circulating water. Development of increasingly effective de-entrainment structures has resulted in equipment vendors' claims that a cooling tower may be specified to achieve drift release no higher than 0.0005 percent of the circulating water rate for the HECA Project. This level of reduction has been approved in other recently permitted IGCC projects.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps.

Process cooling with an ACC system was rejected as an economically feasible control technology for particulate matter emissions from the Project. Thus, a drift elimination system is selected as BACT for the proposed cooling towers. The proposed cooling tower will be designed with a high-efficiency drift elimination system to minimize potential drift and particulate emissions, achieving a maximum drift of 0.0005 percent of the circulating water. This measure, along with a limit on the circulating water TDS, is considered to be the BACT option for particulate emissions from the cooling towers.

6.4 Auxiliary Boiler BACT Analysis

The auxiliary boiler will provide steam to facilitate CTG start up, and for other industrial purposes. The auxiliary boiler will be designed to burn pipeline-quality natural gas at the design maximum fuel flow rate of 213 MMBtu/hr (HHV). During operation, the auxiliary boiler may be kept in warm standby (steam sparged, no firing) or cold standby (no firing), and will not have emissions. The boiler will produce a maximum of about 150,000 pounds per hour of steam.

Pollutant emissions from natural gas boiler units include NO_X, PM_{10}, CO, SO_2, and VOCs. The auxiliary boiler emissions are based on 2,190 hours of operation per year. The applicant is proposing proper boiler design and operation, low-NO_X combustors with Flue Gas Recirculation (FGR), Selective Catalytic Reduction (SCR) and use of natural gas to be the BACT for the auxiliary boiler. This emission limitation is proposed to meet the SJVAPCD BACT Guidelines for greater than 20.0 MMBtu/hr natural-gas–fired boiler (base-loaded or with small load swings).

1. Identify Control Technologies

The following criteria pollutant emissions control technologies were evaluated for the proposed auxiliary boilers:

Potential Auxiliary Boiler Control Technology

For NO_X emission controls

- Low-NO_X combustor
- Low-NO_X combustor with Flue Gas Recirculation
- Selective Catalytic Reduction
- Selective Non-Catalytic Reduction

For CO emission controls

- Good Combustion Practices
- CO Oxidation Catalysts

6.4.1 Nitrogen Oxides BACT Analysis for the Auxiliary Boiler

2. Evaluate Technical Feasibilities

- Low-NO_X Combustors

  Low-NO_X combustors reduce thermal NO_X formation by regulating the distribution and mixing of fuel and air to control the stoichiometry and temperature of combustion. Historically, low-NO_X combustors have been selected as BACT for natural-gas–fired auxiliary boilers. Therefore, low-NO_X combustor technology is technically feasible for the proposed auxiliary boiler.

- Low-NO_X Combustors with Flue Gas Recirculation

  FGR reduces boiler NO_X emissions by recirculating a portion of the flue gas into the main combustion chamber. The increase in gas flow within the combustion chamber reduces the peak combustion temperature and oxygen in the combustion air/flue gas mixture, thereby reducing the formation of thermal NO_X. The application of FGR is typically in combination with low-NO_X combustor technology and has been selected as BACT for some auxiliary boiler processes. Therefore, FGR is considered technically feasible for the proposed auxiliary boiler.

- Selective Catalytic Reduction

  SCR is a technology that achieves post-combustion reduction of NO_X from flue gas within a catalytic reactor. The SCR process involves the injection of NH_3 into the exhaust gas stream upstream of a specialized catalyst module to promote the conversion of NO_X to molecular nitrogen. SCR technology has been most commonly applied to pulverized coal–generating units and to natural gas–fired combustion turbines.

- Selective Non-Catalytic Reduction

  Selective non-catalytic reduction is a post-combustion NO_X control technology in which a reagent (NH_3 or urea) is injected into the exhaust gases to react chemically with NO_X to form elemental nitrogen and water without the use of a catalyst. The success of this process in reducing NO_X emissions is highly dependent on the ability to achieve uniform mixing of the reagent into the flue gas, which must occur within a narrow flue gas temperature zone (typically from 1,700°F to 2,000°F).

  The consequences of operating outside the optimum temperature range are severe. Above the upper end of the temperature range, the reagent will be converted to NO_X. Below the lower end of the temperature range, the reagent will not react with the $NO_{X,}$ resulting in very high NH_3 slip concentrations (NH_3 discharge from the stack).

  Although there are expected to be technical difficulties with SNCR, due to the lack of flue gas locations within the process with the optimal requisite temperature and residence time characteristics to facilitate the SNCR flue gas reactions, the RBLC shows SNCR applied in only two boiler units greater than 100 MMBtu/hr. The control cited in both of these examples is 60 percent.

3. Rank Control Technologies

The RBLC examples for low-NO_X combustors combined with either FGR or SCR give efficiencies of up to 95 percent with FGR and efficiencies of up to 97 percent with SCR. Both of these technologies have reported control efficiencies that are significantly greater than that for SNCR. Low-NO_X combustors and SCR have recently been selected as BACT for other projects, and report slightly greater control than low-NO_X combustors with FGR. The expected emission rate for the HECA auxiliary boiler operating with low-NO_X combustors and FGR is 9 ppm NO_X at 3 percent O_2, while the expected emission rate with low-NO_X combustors and SCR is 5 ppm NO_X at 3 percent O_2.

4. Select Control Technology

Low-NO_X combustor technology and flue gas recirculation have historically been selected as BACT for natural-gas–fired auxiliary boilers. These technologies are commonly used in combination to reduce NO_X emissions in other recently permitted IGCC projects. However, the HECA auxiliary boiler is expected to have more NO_X control by using SCR instead of FGR, as mentioned above. Therefore, the proposed auxiliary boiler will be designed with a Low-NO_X combustor technology and SCR, achieving a maximum NO_X emission concentration of 5 ppm NO_X at 3 percent O_2 on natural gas fuel.

6.4.2 Carbon Monoxide BACT Analysis for the Auxiliary Boiler

An inadequate degree of fuel mixing, lack of available oxygen, or low temperatures in the combustion zone are common causes of incomplete combustion that results in CO emissions. Fuel quality and good combustion practices can limit CO emissions. Good combustion practice has commonly been determined as BACT for natural gas–fired auxiliary boilers. Post-combustion control technologies using catalytic reduction have also been employed in some processes to reduce CO and VOC emissions.

2. Evaluate Technical Feasibilities

Good Combustion Practices

GCPs include the use of operational and design elements that optimize the amount and distribution of excess air in the combustion zone to ensure complete combustion. Good combustion practice has historically been determined as BACT for CO and VOC emissions from auxiliary boilers, and is a technically feasible control strategy for the proposed auxiliary boiler.

Oxidation Catalyst

Catalytic oxidation is a post-combustion control technology that uses a catalyst to oxidize CO and VOC into CO_2 or H_2O. The technology has most commonly been applied to natural gas–fired combustion turbines. No examples were identified where oxidation catalyst technology has been applied to an auxiliary boiler. Because of the low potential CO and VOC emission without an oxidation catalyst and the limited use of the proposed auxiliary boiler, the use of catalytic oxidation technology is determined to be infeasible.

3. Rank Control Technologies

Good combustion practice is the only feasible control strategy identified, and has historically been selected as BACT for CO emissions from the auxiliary boiler.

4. Select Control Technology

The use of good combustion practices has been selected as BACT for potential CO emission from the proposed auxiliary boiler. Boiler vendor information indicates that a CO worst-case hourly emission for the proposed auxiliary boiler is 50 ppmvd at 3 percent O_2.

6.4.3 Particulate Emissions, Sulfur Oxides, Volatile Organic Compounds BACT Analysis for the Auxiliary Boiler

For these pollutants, the commercially available control measures that are identified in the most stringent BACT determinations are use of low-sulfur, PUC natural gas, and GCP. Based on SJVAPCD BACT Guidelines for > 20.0 MMBtu/hr Natural Gas–Fired Boiler (base-loaded or with small load swings), add-on controls were not implemented to achieve BACT limits for these pollutants.

Boiler vendor information indicates that the worst-case hourly emissions for this unit with these technologies would be 0.00285 lb SO_2/MMBtu; 0.004 lb VOC/MMBtu; and 0.005 lb PM_{10}/ MMBtu. These rates, or corresponding lb/hour emission rates, are proposed as BACT limits for the auxiliary boiler emission unit.

6.5 Diesel Engines BACT Analysis

The Project will include two 2,922 HP standby diesel generators and one 556 HP, standby firewater pump. HECA proposed to apply the SJVAPCD BACT Guidelines for Emergency Diesel I.C. Engine = or > 400 hp as the BACT for the standby diesel generator engines, and SJVAPCD BACT Guidelines for Emergency Diesel I.C. Engine Driving a Fire Pump as the BACT for the standby firewater pump engine. The BACT emission limits will be achieved by the following control effort.

- Low Sulfur Fuel Selection

  The diesel engines will exclusively combust ultra-low sulfur diesel fuel. SO_2 emissions were estimated using ultra-low sulfur diesel fuel containing 15 ppm sulfur.

- Clean Combustion Process Selection

  The engines will meet USEPA interim Tier 4 emissions standards.

  Standby diesel generator engine: 0.3 g/bhp-hr NMHC; 0.5 g/bhp-hr NO_X; 2.6 g/bhp-hr CO; 0.07 g/bhp-hr PM

  Standby firewater pump engine: 0.14 g/bhp-hr NMHC; 1.5 g/bhp-hr NO_X; 2.6 g/bhp-hr CO; 0.015 g/bhp-hr PM

- Restricted Operating Hours

  The standby diesel generators will operate less than 50 hours per year per engine for non-emergency purposes such as: routine testing, maintenance, and inspection purposes. The fire pump will operate than less than 100 hours per year per engine for non-emergency purposes.

6.5.1 BACT Analysis for the Standby Diesel Generators

The achieved-in-practice or contained in the SIP BACT guideline for NO_X is certified emissions of 6.9 g/bhp-hr or less. The proposed control of using engines that meet USEPA interim Tier 4 emissions standards for 2011 and newer model equipment will meet this BACT limit with 0.5 g/bhp-hr NO_X. Although it is technically feasible to install add-on NO_X control, this option is cost prohibitive due to the emergency nature of the engine operations.

The achieved-in-practice or contained in the SIP BACT guideline for CO is 2.0 g/bhp-hr. The vendor emission factor for the diesel engines guaranteed 0.29 g/bhp-hr of CO emission. This emission limit is substantially below the required BACT limit. Although it is feasible to install a CO oxidation catalyst to further reduce CO emissions from the engines, the cost for oxidation catalyst for CO control will be prohibitive, given the low number of routine operating hours per year of the engines.

The achieved-in-practice or contained in the SIP BACT guideline for PM_{10} is 0.1 gram/bhp-hr (if TBACT is triggered) or 0.4 g/bhp-hr (if TBACT is not triggered). The proposed control of using engines that meet USEPA interim Tier 4 emissions standards will meet this BACT limit with 0.07 g/bhp-hr PM.

The achieved-in-practice or contained in the SIP BACT guideline for sulfur oxides is low-sulfur diesel fuel (500 ppmw sulfur or less) or Very Low-Sulfur Diesel fuel (15 ppmw sulfur or less). The standby diesel generator engines will exclusively combust ultra-low sulfur diesel fuel. SO_2 emissions were estimated using ultra-low sulfur diesel fuel containing 15 ppm sulfur.

There is no numerical emission limit achieved in practice or contained in the SIP BACT guideline for VOC. The proposed control of using engines that meet USEPA interim Tier 4 emissions standards for 2011 and newer model equipment proposed a BACT limit with 0.3 g/bhp-hr VOC for this unit.

6.5.2 BACT Analysis for the Firewater Pump Diesel Engine

The achieved-in-practice or contained in the SIP BACT guideline for NO_X is certified emissions of 6.9 g/bhp-hr or less. The proposed control of using engines that meet USEPA interim Tier 4 emissions standards will meet this BACT limit with 1.5 g/bhp-hr NO_X. Although it is technically feasible to install add-on NO_X control, this option is cost prohibitive due to the emergency nature of the fire/water pump engine operations.

There is no numerical emission limit achieved in practice or contained in the SIP BACT guideline for CO. The proposed control of using engines that meet USEPA interim Tier 4 emissions standards proposed a BACT limit with 2.6 g/bhp-hr CO for this unit. Although it is feasible to install a CO oxidation catalyst to further reduce CO emissions from the engines, the cost for an oxidation catalyst for CO control will be prohibitive, given the low number of routine operating hours per year of the fire water pump.

The achieved-in-practice or contained in the SIP BACT guideline for PM_{10} is 0.1 grams/bhp-hr (if TBACT is triggered) or 0.4 grams/bhp-hr (if TBACT is not triggered). The proposed control of using engines that meet USEPA interim Tier 4 emissions standards will meet this BACT limit with 0.015 g/bhp-hr PM.

The achieved-in-practice or contained in the SIP BACT guideline for sulfur oxides is low-sulfur diesel fuel (500 ppmw sulfur or less) or ultra-low sulfur diesel fuel (15 ppmw sulfur or less). The firewater-pump diesel engine will exclusively combust ultra-low sulfur diesel fuel. SO_2 emissions were estimated using ultra-low sulfur diesel fuel containing 15 ppm sulfur.

No numerical emission limit is achieved in practice or contained in the SIP BACT guideline for VOC. The proposed control of using engines that meet USEPA interim Tier 4 emissions standards for 2011 and newer model equipment proposed a BACT limit with 0.14 g/bhp-hr VOC for this unit.

6.6 Gasification Flare BACT Analysis

The gasification block will be provided with a relief system and associated gasification flare to safely dispose of gasifier streams during start up, shut down, and unplanned upsets or emergency events, syngas during AGR start up, hydrogen-rich gas during short-term emergency combustion turbine outages, or other various streams within the Project during other unplanned upsets or equipment failures. Syngas sent to the flare during normal planned flaring events is filtered, water-scrubbed and further treated in the AGR Unit to remove regulated contaminants prior to flaring.

Two flare-control technologies were evaluated for the proposed facility: an elevated flare, and an enclosed ground flare. Elevated flare technology uses a stack to vent combustible process gases to a combustor located at the top, resulting in an open flame at the stack discharge. Elevated flares provide for greater dispersion of heat and combustion products than ground flares. Elevated flares are the most common technology used by refinery, steel, and chemical industries, and are used by operational and recently permitted IGCC projects.

Compared to an elevated flare, an enclosed ground flare offers better CO destruction. However, enclosed ground flares pose potentially decreased dispersion of combustion gases and increased reliability concerns and have never been installed on any IGCC plants and so are considered unproven technology in this application with an associated risk. Elevated flares are used extensively with IGCC applications and therefore, the gasification block will be designed with an elevated flare to safely dispose of gasifier start-up gases, hydrogen-rich fuel during AGR start up, hydrogen-rich gas during short-term emergency combustion turbine outages, or other various streams within the Project during other unplanned upsets or equipment failures.

The flare, when in operation, will emit criteria pollutants that are products of combustion. However, the chemical compositions of the predominant gaseous fuels that would be flared; i.e., syngas and natural gas, result in low emissions of PM_{10}, SO_2, and VOC. For the syngas case, there is very little unoxidized carbon in the fuel, which limits the formation of particulate matter during combustion even below the rate for natural gas. Formation of SO_2 is limited by not intentionally flaring untreated syngas and the inherently low sulfur content of treated syngas and pipeline natural gas.

1. Identify Control Technologies

The following control technologies were evaluated for the proposed gasification flare:

- Clean pilot fuel (Natural gas) and Good Combustion Practices
- Low-NO_X Combustor
- Add-On Controls
- Limited Operation

2. Evaluate Technical Feasibilities

- Clean pilot fuel (Natural Gas) and Good Combustion Practices

  A certain level of flame temperature control can be exercised for the gasification flare by implementing fuel/air ratio control. Flare BACT options that have been achieved in practice in California (e.g., CAPCOA BACT Clearinghouse) indicate a natural gas pilot and "proper burner management and monitoring" are used to control the emissions of CO, VOCs and NO_X.

- Low-NO_X Combustor

  Low-NO_X combustor and ultralow-NO_X combustor technology alter air-to-fuel ratio in the combustion zone by staging the introduction of the air to promote a "lean-premixed" flame. This results in lower combustion temperatures and reduced NO_X formation. Such designs are not available for elevated flares that do not have a confined combustion zone, which would allow staged introduction of fuel and air streams. Therefore, this control technology is not feasible for the proposed gasification flare.

- Add-On Controls

  The gasification block flare is not a candidate for add-on abatement systems. It is generally recognized in the chemical process industries that adoption of add-on control can impede the ability of a flare to respond to unexpected upset conditions. Therefore, this control technology is not feasible for the proposed gasification flare.

- Limited Operations

  The gasification flare planned operation will be limited to gasifier start ups and shut downs, which occurs at most twice a year.

For plant safety, the flare must provide a "fail-safe" that is available regardless of the functioning of pollution control devices.

3. Rank Control Technologies

The use of natural gas as pilot fuel, good combustion practices and limited operation were identified as the only technically feasible criteria pollutant emissions control technologies applicable to the proposed gasification flare.

4. Evaluate Control Options

As determined in the last section, the use of natural gas as pilot fuel, good combustion practices and limited operation are the only feasible control strategy identified. Based on review of SJVAPCD BACT guideline, there is no BACT determination source category for flare that supports the gasification process.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. As has been explained, use of natural gas as pilot fuel, good combustion practices and limited operation are selected as BACT for the proposed gasification flare. The measure, along with natural gas pilot and processes flare gas for non-emergency operation are considered to be the best available control option for criteria pollutant emissions from the gasification flare. The proposed criteria pollutant emissions for the gasification flare are summarized in Table 6-8.

Table 6-8
Gasification Flare Total Criteria Pollutant Emissions

Pollutant	Emissions		
	Pilot (ton/yr)	Start-Up/ Shut-Down (ton/yr)	Total (ton/yr)
NO_X	0.263	2.91	3.17
CO	0.175	18.28	18.46
VOC	0.003	0.01	0.01
SO_2	0.004	0.02	0.02
PM_{10}	0.007	0.03	0.03

Notes:
CO = carbon monoxide
NO_X = oxides of nitrogen
PM_{10} = particulate matter 10 microns in diameter or less
SO_2 = sulfur dioxide
VOC = volatile organic compound

6.7 Sulfur Recovery System BACT Analysis

The sulfur recovery system is designed to process acid gas streams from the AGR system and IGCC process into an elemental sulfur product. Sulfur is removed from the processing facility through a sulfur complex which consists of a Claus unit (thermal stage) plus catalytic converters otherwise known as the SRU. The SRU is a totally enclosed process with no discharges. The tail gas stream from the SRU is composed mostly of carbon dioxide, water vapor, and sulfur vapor with trace amounts of H_2S and SO_2. The tail gas is routed to the Tail Gas Treating Unit (TGTU) where the tail gas is catalytically hydrogenated, compressed, and completely recycled to the Shift Unit.

The proposed sulfur process facility consists of one 100 percent SRU, and one TGTU. HECA proposed the integral use of two elevated flares, a caustic scrubber, and a thermal oxidizer as control devices to provide for the safe and efficient destruction of combustible gas streams. These control devices are primarily used intermittently during short-term periods of start up, shut down, and malfunction operations.

1. Identify Control Technologies

The following control technologies were evaluated for the proposed Sulfur Recovery System:

- Thermal Oxidizer
- Flare
- Caustic Scrubber
- Limited Operation

2. Evaluate Control Technologies

- Thermal Oxidizer

  In the thermal oxidizer, the TGTU tail gas and other oxidizing streams are subjected to a high temperature and a sufficient residence time to cause an essentially complete destruction of reduced sulfur compounds such as H_2S. The thermal oxidizer uses natural gas to reach the necessary operating temperature for optimal thermal destruction. The thermal oxidizer also controls emissions from various systems during operations, including the sulfur pit vent. A continuous natural gas pilot will be in service on both controls. The flare and thermal oxidizer are the only control technologies identified that are capable of controlling the variable potential gas streams associated with the sulfur recovery process and the start up, shut down, and malfunction of the integrated IGCC systems.

Good thermal oxidizer design includes optimization of parameters that maintain efficiency, such as temperature, residence time, and the mixing of gas streams in the combustion zone. The proposed thermal oxidizer will use natural gas for preheating and to facilitate the combustion of process gases in the thermal oxidizer. Implementation of these elements into the design and operation of the thermal oxidizer, in combination with the use of a natural-gas pilot flame, will support a thermal oxidizer control technology that minimizes incomplete combustion, which directly correlates to potential criteria pollutant emissions.

- Flare

Emissions from the IGCC gas cleanup process cannot be directed to certain control systems and/or the combustion turbines during start-up and shut-down operations, or during operational malfunctions. Directly venting these emissions could result in very high concentrations of SO_2, CO, VOCs, NO_X, and/or H_2SO_4 being released. In this case, two elevated flares are selected to accommodate the variability inherent in these operations: Sulfur Recovery Unit Flare, and Rectisol® Flare.

The SRU Flare will be used to safely dispose of gas streams containing sulfur during start up and shut down, and gas streams containing sulfur during unplanned upsets or emergency events. Acid gas derived from the AGR, gasification unit, and Sour Water Stripper overhead is normally routed to the SRU for recovery as elemental sulfur. During cold plant start up of the gasifiers, AGR, and Shift units, these acid-gas streams will be diverted to the SRU Flare Header for a short time. To reduce the emissions of sulfur compounds to the environment during SRU or TGTU shutdown, the acid gas is routed to the Emergency Caustic Scrubber, where the sulfur compounds are absorbed with caustic solution. After scrubbing, the gas is then routed to the elevated SRU Flare Stack. It is expected that a maximum of 40 hours per year of flaring for this purpose would be required by this flare.

The Rectisol® flare may be used for off-specification carbon dioxide during gasifier start-up or shut-down events. It is expected that a maximum of 40 hours per year of flaring for this purpose would be required by this flare.

Enclosed ground flares have the potential to minimize flame appearance and provide a setting for monitoring post-combustion gas streams. However, they have not been proven for the proposed facility because of reliability concerns.

Elevated flares are used extensively with IGCC applications and therefore, are considered proven technology. The SRU will be designed with an elevated flare.

- Caustic Scrubber

  During cold plant start up of the gasification block, acid-gas streams will be diverted to a caustic scrubber prior to being directed to the elevated flare for a short time. The caustic scrubber removes H_2S from the acid gas stream with an anticipated scrubbing efficiency of at least 99.6 percent sulfur removal.

3. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. As discussed, the use of flares, thermal oxidizer, and caustic scrubber are the proposed technologies designed to control criteria pollutant emissions from the sulfur recovery system, in addition to an efficient IGCC process design. These technologies complement one another, and may operate in combination with each other. In addition, limited planned operation of each will control emissions.

Including the proposed control system to provide for the safe and efficient destruction of combustible sulfur-rich acid-gas streams, the emissions from the sulfur recovery system are categorized into three emission sources of tail gas thermal oxidizer, SRU flare and Rectisol® flare (elevated flares with natural gas assist). Each emission source has its own emission control measure to reduce its criteria pollutant emissions. The proposed criteria pollutant emissions for the sulfur recovery system are summarized in Table 6-9. HECA has selected all of the control technologies that were evaluated for the Sulfur Recovery System, and proposes these as BACT for the Project.

Table 6-9
Sulfur Recovery System Emissions

Pollutant	Thermal Oxidizer Emissions (lb/MMBtu, HHV)	SRU Flare Emissions			Rectisol® Flare Emissions		
		Pilot (ton/yr)	Start-Up/ Shut-Down (ton/yr)	Total (ton/yr)	Pilot (ton/yr)	Start-Up/ Shut-Down (ton/yr)	Total (ton/yr)
NO_X	0.24	0.158	0.09	0.24	0.158	1.03	1.19
CO	0.2	0.105	0.06	0.16	0.105	0.69	0.79
VOC	0.006	0.002	0.00	0.00	0.002	0.01	0.01
SO_2	See Below	0.003	0.37	0.37	0.003	0.30	0.30
PM_{10}	0.008	0.004	0.00	0.01	0.004	0.03	0.03

Assume an allowance of 2 lb/hr SO_2 emission to account for sulfur in the various vent streams, plus fuel.

Notes:

CO = carbon monoxide
NO_X = oxides of nitrogen
PM_{10} = particulate matter 10 microns in diameter or less
SO_2 = sulfur dioxide
VOC = volatile organic compound

6.8 CO_2 Vent BACT Analysis

The Project will produce electricity while substantially reducing GHG emissions by capturing CO_2. At least 90 percent of the carbon in the raw syngas will be captured in a high-purity carbon dioxide stream during steady-state operation. The high-purity CO_2 will be compressed and transported by pipeline to the EHOF for injection into deep underground hydrocarbon reservoirs for CO_2 EOR.

A CO_2 vent stack will allow for infrequent venting of produced CO_2 from the AGR and TGTU when the CO_2 injection system is unavailable, unable to export, or other upset condition. The CO_2 vent will enable HECA to operate, rather than be disabled, by brief periods of gasifier shutdown and subsequent gasifier restart. The CO_2 vent exhaust stream will be nearly all CO_2, with small amounts of CO, VOC, and H_2S.

Due to the infrequent nature of the venting event, the option of using add-on control technology is cost prohibitive for this emission point. In order to reduce the impact of this infrequent venting event, good engineering practice stack height, limited venting duration, and vent gas concentration limits are selected as BACT for this source.

HECA proposed a maximum of 504 hours of venting duration for this unit. The pollutant concentrations in the vent gas are limited to 1,000 ppm for CO, 40 ppm for VOCs, and 10 ppm for H_2S to reduce the overall impact of the venting event.

Good Engineering Practice Stack Height

The USEPA provides specific guidance for determining the Good Engineering Practice (GEP) stack height and for determining whether building downwash will occur in the *Guidance for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations*). GEP is defined as "the height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, and wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles."

The GEP definition is based on the observed phenomenon of atmospheric flow in the immediate vicinity of a structure. It identifies the minimum stack height at which significant adverse aerodynamics (downwash) are avoided. The USEPA GEP stack height regulations specify that the GEP stack height is calculated in the following manner:

$$H_{GEP} = H_B + 1.5L$$

where:

H_B = the height of adjacent or nearby structures; and

L = the lesser dimension (height or projected width) of the adjacent or nearby structures.

The regulations also specify that the creditable stack height for modeling purposes is either the GEP stack height as calculated, or a *de minimis* height of 65 meters.

A 260-foot stack height was chosen to satisfy HECA's inherently safe design practices to minimize ground-level CO_2 concentrations in the event of a CO_2 vent under very low wind speeds.

6.9 Material Handling System BACT Analysis

Particulate matter emissions are associated with the material handling of with the feedstock (petcoke and coal), and dry product (urea and gasification solids). The conveyance and preparation processes related to the feedstock and products have a potential to emit particulate matter. The following is the BACT analysis for the proposed material handling system at HECA.

6.9.1 Particulate Matter BACT Analysis for the Material Handling System

Because the feedstock preparation processes will be within an enclosed conveyor system, a forced air dust collection system is the most appropriate and common control technology for particulate matter emission control from the emission points. The material handling system will consist of the following activities, all with associated baghouses:

- Truck/Train feedstock unloading
- Petcoke/coal crushing building and transfer towers
- Urea transfer towers
- Urea unloading buildings
- Gasification solids transfer tower and load-out

HECA selected dust collection systems consisting of baghouses as BACT to control particulate emissions from the aforementioned emission points. The baghouses associated with the material handling at HECA will have a maximum dust collector PM emission rate based on expected supplier guarantee of 0.001 grain/scf outlet dust loading.

A dust collection system using baghouses has been proposed as BACT in other operating and recently permitted IGCC projects. The proposed emission limitation represents a removal efficiency that is comparable or lower with the emissions achieved in practice at currently operating IGCC units, and the lowest recently permitted IGCC units.

6.10 Manufacturing Complex BACT Analysis

The BACT analysis for the Manufacturing Complex is broken down by emission units. Nitrogen-based product production at HECA consists of: an ammonia synthesis unit, where the only emission source is an ammonia plant start-up heater (combustion emissions); a urea unit (scrubber emissions); a urea pastillation unit (particulate matter emissions); and a Urea Ammonium Nitrate (UAN) Unit, consisting of a nitric acid unit and an ammonium nitrate unit as emission sources. BACT for the material handling processes for the Manufacturing Complex are addressed in Section 6.9. The RBLC was examined for similar sources. Most of the facilities listed in the RBLC are different from the HECA Manufacturing Complex; however, there are many similar components. Thus many of the proposed BACT levels are not compared to those from existing facilities unless similar source units had process operations (such as unit inputs and outputs) that were comparable to HECA.

6.10.1 Ammonia Synthesis Unit

The high-purity hydrogen stream, from the Pressure Swing Adsorption (PSA) Unit, and nitrogen, from the ASU, are combined in an exothermic ammonia synthesis reaction that takes place at high temperature and high pressure across an iron-based catalyst. There is a large degree of heat integration within the Ammonia Synthesis Unit, and the substantial heat of reaction is recovered and used to generate steam. Cold liquid ammonia is stored in a tank at atmospheric pressure.

There are no normal operating emissions from the ammonia synthesis unit. However, a start-up heater (natural gas-fired) is used to heat the catalyst during a cold start of the unit. A 55 MMBtu/hr natural gas–fired start-up heater is provided in the ammonia synthesis unit to raise the catalyst-bed temperatures during initial plant commissioning or during start up after a long period of plant shutdown.

The annual heat input for this heater is not expected to exceed 7,700 MMBtu (HHV), which is equivalent to approximately 140 hours of operation at full capacity.

The heater will use a low-NO_X burner to control emissions to 9 ppm. The heater will only combust natural gas, therefore the potential for SO_2, VOC, and PM emissions is minimized. Good combustion practices will optimize the performance of the heater, thereby minimizing the emissions of CO. The proposed BACT emission rates for the ammonia synthesis start-up heater are presented in Table 6-10. Therefore, BACT for the heater was determined to be a low-NO_X burner, GCP, natural gas fuel, and restricted operating hours.

Table 6-10
Ammonia Synthesis Startup Heater Emissions

Pollutant	Emission Limit
NO_X	0.011 lb/MMBtu, HHV – 9 ppmvd (3% O_2)
CO	0.037 lb/MMBtu, HHV – 50 ppmvd (3% O_2)
PM_{10}	0.005 lb/MMBtu, HHV
SO_2	0.002 lb/MMBtu, HHV (12.65 ppm)
VOC	0.004 lb/MMBtu, HHV

Notes:
CO = carbon monoxide
NO_X = oxides of nitrogen
PM_{10} = particulate matter 10 microns in diameter or less
SO_2 = sulfur dioxide
VOC = volatile organic compound

6.10.2 Urea Unit – High and Low Pressure Absorbers

The purified and compressed carbon dioxide and the liquid ammonia are reacted in the Urea Unit to create a concentrated urea solution, which is pumped to the Urea Pastillation Unit. Lower-concentration urea solution is produced as a feedstock to the urea ammonia nitrate (UAN) Solution Plant. Vacuum evaporator/separator systems are used to produce the required urea solutions.

The off-gases from the urea synthesis process, consisting of inerts present in the CO_2 feed, process air and unreacted ammonia are cleaned before being vented in the high-pressure (HP) scrubber, which operates at an elevated pressure. The off-gases are scrubbed first with process water, and second with clean cold water. In this way, nearly all of the ammonia is scrubbed from the gas.

Low pressure off-gases are cleaned in the low-pressure (LP) scrubber, which operates at close to atmospheric pressure. Here, the off-gas is scrubbed with clean cold water to reduce the ammonia content in the vent.

The only emissions associated with the HP and LP Absorbers are ammonia, which are reduced by the wet scrubbers. HECA proposes BACT for the HP and LP Absorbers to be wet scrubbers.

6.10.3 Urea Unit- Pastillation

The pastillation process is used to convert the urea melt into high-quality pastilles. This process is enclosed with a hood, passed through a baghouse then vented. Limited ammonia and urea dust, which is classified as PM_{10}, are emitted from this source.

The only BACT level grain loading provided was 0.0960 gr/dscf. The RBLC shows no listings for ammonia emissions or control.

The vent from the urea pastillation building is treated with a baghouse filter in order to reduce the particulate loading in the atmospheric vent. The HECA granulation process PM/PM_{10} emissions are expected to have a grain loading of 0.001 gr/dscf with use of a baghouse, and is therefore considered BACT.

HECA proposes BACT for the Urea Pastillation Unit to be a baghouse with a grain loading of 0.001 gr/dscf.

6.10.4 Nitric Acid Unit

Nitric acid production is a three-step process consisting of ammonia oxidation, nitric oxide (NO) oxidation and absorption. Tail gas from the absorber column will be cleaned before being discharged by catalytic decomposition and reduction of both nitrous oxide (N_2O) and NO_X.

1. Identify Control Technologies

The following NO_X control technologies were evaluated for the proposed Nitric Acid Unit:

- Extended Absorption with Selective Non-Catalytic Reduction (SNCR)
- Selective Catalytic Reduction (SCR)

2. Evaluate Technical Feasibilities

- Extended Absorption with Selective Non-Catalytic Reduction

  Extended absorption reduces NO_X emissions by increasing absorption efficiency and is achieved by either installing a single large tower, extending the height of an existing absorption tower, or by adding a second tower in series with the existing tower.

  Selective non-catalytic reduction is a NO_X control technology in which a reagent (NH_3 or urea) is injected into the flue gases to react chemically with NO_X to form elemental nitrogen and water without the use of a catalyst. The success of this process in reducing NO_X emissions is highly dependent on the ability to achieve uniform mixing of the reagent into the flue gas, which must occur within a narrow flue gas temperature zone (typically from 1,700°F to 2,000°F). The consequences of operating outside the optimum temperature range are severe. Above the upper end of the temperature range, the reagent will be converted to NO_X. Below the lower end of the temperature range, the reagent will not react with the NO_X, resulting in very high NH_3 slip concentrations (NH_3 discharge from the stack).

  Although there are expected to be technical difficulties with Extended Absorption with SNCR, due to the lack of flue gas locations within the process with the optimal requisite temperature and residence time characteristics to facilitate the SNCR flue gas reactions and the need for larger or additional absorption towers, the RBLC shows Extended Absorption with SNCR was applied at one nitric acid plant. The control cited was 1.6 lb/ton of nitric acid produced.

- Selective Catalytic Reduction

  SCR is a technology that achieves reduction of NO_X from flue gas within a catalytic reactor. The SCR process involves the injection of NH_3 into the exhaust gas stream upstream of a specialized catalyst module to promote the conversion of NO_X to molecular nitrogen.

  A RBLC review identified that SCR technology has been applied to a number of nitric acid plants lowering NO_X emissions as low as 0.524 lb/ton of nitric acid produced.

3. Rank Control Technologies

The RBLC review provided examples of NO_X control with SCR and Extended Absorption with SNCR, neither is identified as providing more control of NO_X.

4. Evaluate Control Options

The next step in a BACT analysis is to evaluate the feasible control technology. Based on the evaluation in the previous step, the technology with the maximum control is SCR.

The N_2O emissions are treated in a tertiary reduction system, based on its location at the end of the tail gas heat recovery system. Primary and secondary reduction occurs in the nitric acid unit equipment without any catalysis simply by the high process temperature. In the tertiary reduction, a reducing catalyst that uses high temperature rather than a reducing agent, converts 95 percent of the remaining N_2O emission to molecular nitrogen (N_2) and nitric oxide (NO). The NO_X emissions (including the NO formed in the N_2O converter) are then reduced in one or more selective catalytic reduction (SCR) units, with injected ammonia as a reducing agent, as is typical for NO_X control in flue gas systems. Total NO_X emissions from this unit will not exceed 0.2 lb/ton of dry nitric acid or 15 ppmv NO_X.

This is far below the NSPS of 3 lb/ton, the proposed NSPS of 0.50 lb/ton, and also well below other limits cited in the RBLC, which range from 0.52 to 3.0 lb/ton, using NSCR or SCR. The levels of control vary for each of these control types; neither is identified as providing more control of NO_X. Injection of hydrogen peroxide is also listed as BACT for one source, with a NO_X limit of 0.6 lb/ton HNO_3. Because the expected NO_X emission level for the HECA nitric acid unit is well below these values, it is considered that BACT is the application of SCR for control of NO_X emissions from the nitric acid unit.

Only one source in the RBLC noted a limit for NH_3 emissions due to ammonia slip. This source had a BACT limit of 10 ppmv. The HECA nitric acid plant will have an emission limit of 5 ppm for NH_3 due to slip from the SCR unit and proposes this as the BACT level.

5. Select Control Technology

The final step in the top-down BACT analysis process is to select BACT based on the results of the previous steps. For the nitric acid unit at HECA, SCR to control NO_X emission limits is considered BACT. HECA proposes the SCR to control NO_X on the nitric acid unit to 0.2 lb/ton of dry nitric acid and an emission limit of 5 ppm for NH_3 due to slip from the SCR unit.

6.10.5 Ammonium Nitrate Unit

The ammonia and nitric acid are the feedstocks to the ammonium nitrate unit, which makes the ammonium nitrate solution. The ammonium nitrate unit vent stream contains water vapor and residual ammonium nitrate solution mist that is not removed by the demisting system. If this vent stream with mist is emitted directly, the mist droplets would evaporate and result in PM emissions. These particulate emissions are substantially reduced by routing the vent stream to a water scrubbing system before discharge. This vent scrubber condenses the vapor into condensate which then absorbs the previously entrained mist droplets. The condensate stream is either recycled to the neutralizer or mixed with cooling tower blowdown for treatment and disposal. For this plant, a near total condensing vent scrubbing system will be used and the scrubber vent particulate emissions will be less than 0.2 lb/hr. Review of the RBLC for ammonium nitrate plants show wet scrubber use in all systems.

HECA proposes BACT for the ammonium nitrate unit to be a wet scrubber with PM/PM_{10} emissions limited to 0.2 lb/hr.

6.11 Fugitive Emissions BACT Analysis

Fugitive emissions of VOC, CO, NH_3, H_2S, and trace HAPs and GHGs may occur in some areas of the facility due to leaking process equipment. Fugitive emissions are associated with the Gasification Block and the Manufacturing Complex. A leak detection and repair (LDAR) program will be implemented in select process areas to maximize emission reductions. LDAR is the primary established method for controlling fugitive emissions from various pieces of equipment, such as valves and seals, and is considered BACT. As determined by SJVAPCD, LDAR will be employed at a minimum to valves and connectors at HECA where VOC > 100 ppmv above background, and to pumps and compressor seals at HECA where VOC > 500 ppmv above background. HECA intends to apply LDAR to additional process areas beyond the SJVAPCD recommendation.

HECA proposes LDAR on select process areas as BACT to control fugitive emissions.

7.0 REFERENCES

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Appendix E-12

Operational Transportation Emissions for Alternative 2

Hydrogen Energy California LLC *4/18/2012*
HECA Project

Area	Attainment Status	Emission Source	CO	NOx	PM10	PM2.5	SO2	VOC
			Annual Emission Rates (tons/yr)					
SJVAPCD (San Joaquin Valley)	Ozone Nonattainment - Extreme PM2.5 Nonattainment	Offsite Train	10.91	39.99	0.73	0.71	0.66	2.30
		Offsite Truck	22.37	19.56	5.37	1.62	0.14	1.65
		Offsite Workers Commuting	4.17	0.48	1.05	0.28	0.01	0.13
		Onsite Train	0.00	0.00	0.00	0.00	0.00	0.00
		Onsite Truck	1.42	2.76	0.28	0.09	0.01	0.41
		Total Emission (ton/yr)	**38.86**	**62.79**	**7.43**	**2.70**	**0.82**	**4.50**
		Conformity De minimis (ton/yr)	**100**	**10**	**NA**	**100**	**NA**	**10**
		Less than De minimis?	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**
SCAQMD (South Coast)	Ozone Nonattainment - Extreme PM10 Nonattainment - Serious PM2.5 Nonattainment CO Nonattainment - Serious	Offsite Train	0.00	0.00	0.00	0.00	0.00	0.00
		Offsite Truck	7.96	6.96	1.91	0.58	0.05	0.59
		Total Emission (ton/yr)	**7.96**	**6.96**	**1.91**	**0.58**	**0.05**	**0.59**
		Conformity De minimis (ton/yr)	**100**	**10**	**70**	**100**	**NA**	**10**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
EKAPCD (East Kern County)	Ozone Nonattainment (Former Subpart 1) PM10 Nonattainment - Serious	Offsite Train	9.66	35.42	0.64	0.62	0.58	2.03
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**9.66**	**35.42**	**0.64**	**0.62**	**0.58**	**2.03**
		Conformity De minimis (ton/yr)	**NA**	**100**	**70**	**NA**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
MDAQMD (Mojave Desert)	Ozone Nonattainment - Moderate (San Bernardino County): approximately 75% of the total distance across of MDAQMD PM10 Nonattainment - Moderate (San Bernardino County)	Offsite Train	23.37	64.27	1.56	1.51	1.41	3.69
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**23.37**	**64.27**	**1.56**	**1.51**	**1.41**	**3.69**
		Conformity De minimis (ton/yr)	**NA**	**100**	**100**	**NA**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Sacramento Metro	Ozone Nonattainment - Serious PM10 Nonattainment - Moderate (Sacramento County) PM2.5 Nonattainment	Offsite Train	0.00	0.00	0.00	0.00	0.00	0.00
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
		Conformity De minimis (ton/yr)	**NA**	**50**	**100**	**100**	**NA**	**50**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Yuba City-Marysville	Ozone Nonattainment - Former Subpart 1 (Sutter County) PM2.5 Nonattainment	Offsite Train	0.00	0.00	0.00	0.00	0.00	0.00
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
		Conformity De minimis (ton/yr)	**NA**	**100**	**NA**	**100**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Chico	Ozone Nonattainment - Former Subpart 1 (Sutter County) PM2.5 Nonattainment	Offsite Train	0.00	0.00	0.00	0.00	0.00	0.00
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
		Conformity De minimis (ton/yr)	**NA**	**100**	**NA**	**100**	**NA**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Summary of Offsite Transportation Emissions — Emissions Summary

Hydrogen Energy California LLC
HECA Project

4/18/2012

Area	Attainment Status	Emission Source	CO	NOx	PM10	PM2.5	SO2	VOC
			Annual Emission Rates (tons/yr)					
Arizona	Ozone Nonattainment (Former Subpart 1) (Maricopa Co, Pinal Co) PM10 Nonattainment (Moderate or Serious) (10 counties) PM2.5 Nonattainment (Santa Cruz and Pinal Counties) SO2 Nonattainment (Pinal county) CO Nonattainment (Phoenix and Tucson, AZ. Maricopa and Pima Counties)	Offsite Train	31.16	57.13	3.78	0.20	1.88	3.28
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**31.16**	**57.13**	**3.78**	**0.20**	**1.88**	**3.28**
		Conformity De minimis (ton/yr)	**100**	**100**	**70**	**100**	**100**	**100**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Area	Attainment Status	Emission Source	CO	NOx	PM10	PM2.5	SO2	VOC
New Mexico	PM10 Nonattainment - Moderate (Dona Ana County) CO Nonattainment - Moderate (Bernalillo County)	Offsite Train	24.15	88.56	1.61	1.56	1.46	5.09
		Offsite Truck	0.00	0.00	0.00	0.00	0.00	0.00
		Total Emission (ton/yr)	**24.15**	**88.56**	**1.61**	**1.56**	**1.46**	**5.09**
		Conformity De minimis (ton/yr)	**100**	**NA**	**100**	**NA**	**NA**	**NA**
		Less than De minimis?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Notes:
Onsite worker travel and associated emissions are negligible
SJVAPCD - Carbon Monoxide - Not Classified (Bakersfield, CA, Kern County)
MDAQMD - PM2.5 Unclassified/Attainment (Federal), PM2.5 Non-attainment (State)
MDAQMD - Approximately 75% of the train route (distance) within MDAQMD is ozone nonattainment area while all MDAQMD is PM10 nonattainment area.

Summary of Offsite Operations Train Emissions - HECA

Emissions Summary

4/18/2012

Annual Number of Train Cars (incoming/outgoing)

	Coal Cars (incoming)	**Liquid Sulfur Cars (outgoing)**	**Gasification Cars (outgoing)**	**Ammonia Cars (outgoing)**	**Urea Cars (outgoing)**	**UAN Cars (outgoing)**	**Maximum Total Trains per period**
Annual average number of train cars	13034	0	0	0	0	0	13034

		Line-Haul Engine for Product Trains				
	Line-Haul Engine for Coal Train	Liquid Sulfur	Gasification	Ammonia	Urea	UAN
ton-mile/gallon	480	480	480	480	480	480
Train car capacity (ton)	117	100	100	117	117	117
Unloaded train car weight (ton)	25	25	25	25	25	25

480 ton-mile/gallon is based on 2009 *class I rail freight fuel consumption and travel* data (Association of American Railroads, *Railroad Facts*)

	Coal Trains			Liquid Sulfur Product Train			Gasification Solid Product Train		
Area	Miles traveled per Train (mile/engine) - One Way *	Coal Train (ton-miles/year) - Round Trip	Fuel Use for Coal Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip
SJVAPCD	70	152,369,658	317,426	0	0	0	0	0	0
EKAPCD	62	134,955,983	281,148		0	0	0	0	0
MDAQMD (PM10 nonattainment and total distance)	150	326,506,410	680,198		0	0	0	0	0
MDAQMD (Ozone nonattainment)	113	244,879,808	510,148		0	0		0	0
Arizona (PM10 nonattainment and total distance)	364	792,322,222	1,650,613		0	0		0	0
Arizona (PM2.5 nonattainment)	20	43,534,188	90,693		0	0		0	0
Arizona (Ozone nonattainment)	100	217,670,940	453,465		0	0		0	0
Arizona (SO2 and CO nonattainment)	200	435,341,880	906,930		0	0		0	0
New Mexico	155	337,389,957	702,871		0	0		0	0

* Since exact route of coal train was not determined yet, It was assumed that the coal train would travel across the maximum distance of the nonattainment area for all pollutants in Arizona.

	Ammonia Product Train			Urea Product Train			UAN Product Train		
Area	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip	Miles traveled per Train (mile/engine) - One Way	Product Train (ton-miles/year) - Round Trip	Fuel Use for Product Train (gal/year) - Round Trip
SJVAPCD	0	0	0	0	0	0	0	0	0
Sacramento Metro		0	0	80	0	0		0	0
Yuba City-Marysville		0	0	50	0	0		0	0
Chico		0	0	50	0	0		0	0
Other Area in California and Oregon/Washington		0	0	-180	0	0		0	0

	Line-Haul Emission Factors	**CO**	**NOx**	**PM10**	**PM2.5**	**SO2**	**VOC**
	Tier 3 Emission Factor (g/bhp-hr)	1.50	5.50	0.10	0.10	0.09	0.32
	Tier 3 Emission Factor (g/gal)	31.20	114.40	2.08	2.02	1.88	6.57

Annual Emission Rates Using ton-mile/gallon factor

Area		CO	NOx	PM10	PM2.5	SO2	VOC
		Annual Emission Rates (tons/year) all trains					
SJVAPCD (San Joaquin Valley), CA	Line-haul coal engines	10.91	39.99	0.73	0.71	0.66	2.30
	Line-haul liquid sulfur product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Line-haul gasification product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Line-haul ammonia product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Line-haul urea product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Line-haul UAN product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Total Trains (ton/yr)	**10.91**	**39.99**	**0.73**	**0.71**	**0.66**	**2.30**
EKAPCD (East Kern County), CA	Line-haul coal engines	9.66	35.42	0.64	0.62	0.58	2.03
	Line-haul gasification product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Total Trains (ton/yr)	**9.66**	**35.42**	**0.64**	**0.62**	**0.58**	**2.03**
MDAQMD (Mojave Desert), CA	Line-haul coal engines	23.37	64.27	1.56	1.51	1.41	3.69
	Line-haul gasification product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Total Trains (ton/yr)	**23.37**	**64.27**	**1.56**	**1.51**	**1.41**	**3.69**
Sacramento Metro, CA	Line-haul urea product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Total Trains (ton/yr)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Yuba City-Marysville, CA	Line-haul urea product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Total Trains (ton/yr)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Chico, CA	Line-haul urea product engines	0.00	0.00	0.00	0.00	0.00	0.00
	Total Trains (ton/yr)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Other Area in California and	Line-haul urea product engines	0.00	0.00	0.00	0.00	0.00	0.00
Oregon/Washington	**Total Trains (ton/yr)**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Arizona	Line-haul coal engines	31.16	57.13	3.78	0.20	1.88	3.28
	Total Trains (ton/yr)	**31.16**	**57.13**	**3.78**	**0.20**	**1.88**	**3.28**
New Mexico	Line-haul coal engines	24.15	88.56	1.61	1.56	1.46	5.09
	Total Trains (ton/yr)	**24.15**	**88.56**	**1.61**	**1.56**	**1.46**	**5.09**

Emission Factors

40 CFR Part 1033

Table 1 to §1033.101—Line-Haul Locomotive Emission Standards

		Standards (g/bhp-hr)			
Year of original manufacture	**Tier of standards**	**CO**	**NO_X**	**PM**	**HC**
1973–1992	Tier 0	5	8	0.22	1
1993–2004	Tier 1	2.2	7.4	0.22	0.55
2005–2011	Tier 2	1.5	5.5	0.10	0.3
2012–2014	Tier 3	1.5	5.5	0.10	0.3
2015 or later	Tier 4	1.5	1.3	0.03	0.14

Reference: 40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards

Emission Factors For all Locomotives			
SOx (3)	**CO_2**	**CH_4 (4)**	**N_2O (4)**
g/gal	g/gal	g/gal	g/gal
1.88	10217	0.80	0.26

Locomotive Application	Conversion Factor (bhp-hr/gal)
Large Line-haul & Passenger	20.8
Small Line-haul	18.2
Switching	15.2

Note:

(1) EPA's Technical Highlights: Emission Factors for Locomotives, 2009 (http://www.epa.gov/nonroad/locomotv/420f09025.pdf).

(2) Line-haul engine emissions of CO, Nox, PM, and HC are based on EPA Tier 3.

(3) Based on 300 ppm sulfur diesel fuel.

(4) CH_4 and N_2O factors are derived from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Stationary Combustion by Sector and Fuel Type).

VOC emissions can be assumed to be equal to 1.053 times the HC emissions

(5) $PM_{2.5}$ Fraction of PM_{10}, = 0.97

(6) No off-site switching or idling was assumed for train transportation.

Summary of Truck Emissions - HECA

4/18/2012

Calculations for Trucks Operation Modeling

Data Supplied By Client								
Parameter	Coke Trucks (Max @ 50 or 60 mph)	Coal Trucks (Max @ 50 or 60 mph)	Liquid Sulfur Product Trucks (Max @ 50 or 60 mph)	Gasification Product Trucks (Max @ 50 or 60 mph)	Ammonia Product Trucks (Max @ 50 or 60 mph)	Urea Product Trucks (Max @ 50 or 60 mph)	UAN Sulfur Product Trucks (Max @ 50 or 60 mph)	Equipment and Miscellaneous Trucks (Max @ 50 or 60 mph)
	Running Emissions	Running Emissions	Running Emissions	Running Emissions	Running Emissions	Running Emissions	Running Emissions	Running Emissions
Distance traveled per truck in SJVAPCD (mi)	104	26.5	104	160	80	80	80	80
Distance traveled per truck in SCAQMD (mi)	176	0	180	0	0	0	0	0
Maximum number of trucks or loads:								
Annual average trucks or loads	15,200	61,000	1,320	11,200	6,680	11,200	18,560	1,818

No off-site idling was assumed for truck transportation.
Distance traveled per truck is based on round-trip.

EMFAC2007 Emission Factors + Fugitive Dust (g/mi) For Truck Model year 2010, Scenario year 2015

Pollutant	Coke Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Coal Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Liquid Sulfur Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Gasification Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Ammonia Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Urea Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	UAN Sulfur Product Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)	Equipment and Miscelleneous Trucks (Max @ 50 or 60 mph) Running Emissions (g/mile/trk)
CO	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
NOx	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17
ROG	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
SOx	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
PM10 *	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
PM2.5 *	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18

EMFAC2007 is the approved federal model for vehicle combustion emissions
* PM10 and PM2.5 includes fugitive dust factor for paved roads obtained from AP-42 Ch. 13 plus PM factors from EMFAC 2007
PM factors from EMFAC = combustion exhaust + tire wear + break wear
The maximum emission factor from either truck speed at 50 mph or 60 mph was used.
Most California highways have speed limits of 60 or 70 mph and large trucks travel more slowly than the speed limit.

Annual Emission Rates for AERMOD (ton/yr) all trucks

Pollutant	Coke Trucks (Max @ 50 or 60 mph) Running Emissions	Coal Trucks (Max @ 50 or 60 mph) Running Emissions	Liquid Sulfur Product Trucks (Max @ 50 or 60 Running Emissions	Gasification Product Trucks (Max @ 50 or 60 mph) Running Emissions	Ammonia Product Trucks (Max @ 50 or 60 mph) Running Emissions	Urea Product Trucks (Max @ 50 or 60 mph) Running Emissions	UAN Sulfur Product Trucks (Max @ 50 or 60 mph) Running Emissions	Equipment and Miscelleneous Trucks (Max Running Emissions	Total Truck Emission Rates (tons/yr)
SJVAPCD (San Joaquin Valley)									
CO	4.32	4.42	0.38	4.90	1.46	2.45	4.06	0.40	**22.37**
NOx	3.78	3.86	0.33	4.28	1.28	2.14	3.55	0.35	**19.56**
ROG	0.32	0.33	0.03	0.36	0.11	0.18	0.30	0.03	**1.65**
SOx	0.03	0.03	0.00	0.03	0.01	0.02	0.03	0.00	**0.14**
PM10	1.04	1.06	0.09	1.18	0.35	0.59	0.97	0.10	**5.37**
PM2.5	0.31	0.32	0.03	0.35	0.11	0.18	0.29	0.03	**1.62**
SCAQMD (South Coast)									
CO	7.31	0.00	0.65	0.00	0.00	0.00	0.00	0.00	**7.96**
NOx	6.39	0.00	0.57	0.00	0.00	0.00	0.00	0.00	**6.96**
ROG	0.54	0.00	0.05	0.00	0.00	0.00	0.00	0.00	**0.59**
SOx	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.05**
PM10	1.76	0.00	0.16	0.00	0.00	0.00	0.00	0.00	**1.91**
PM2.5	0.53	0.00	0.05	0.00	0.00	0.00	0.00	0.00	**0.58**

Calculations for Worker Commute Vehicle Operation Modeling

OFFSITE - 50 MPH								EF (g/mile)					
Onroad Vehicle	Fuel Type	Vehicle Type	Total Number of Workers per day	Daily Vehicle Count	Round Trip Distance (miles/vehicle/day)	Trips per day	VMT (Annual)	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	TOC
Personal Commuting Vehicles	G/D	LDA/ LDT	200	154	40.0	1	2,246,154	1.6825	0.1930	0.4234	0.1134	3.50E-03	0.0540

Assumptions:

Assumed average distance traveled off site for all employees commuting will be 20 miles

times 2 for return trip = 40 miles

365 days per year

Number of workers per commuter vehicle = 1.3

EMFAC2007 emissions are for fleet mix years 1971-2015 travelling at 50 mph.

Area	Description	Annual Emission Rates (tons/year) all worker commute vehicles					
		CO	NOx	PM10	PM2.5	SO2	VOC
SJVAPCD (San Joaquin Valley), CA	Personal Commuting Vehicles	4.17	0.48	1.05	0.28	0.01	0.13

AP 42 13.2.1 Paved Roads, updated January 2011

For a daily basis,
E = [k (sL)^0.91 x (W)^1.02](1-P/4N) (2)

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period
W = average weight (tons) of vehicles traveling the road
k = particle size multiplier for particle size range and units of interest
sL = road surface silt loading (g/m^2)

Table 13.2.1-1
PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

	k
	g/VMT
PM2.5	0.25
PM10	1.00

Fleet mix on highway

W=	9.1	tons, average	
sL=	0.031	g/m2	Default value from URBEMIS 9.2 for Kern County
P=	36	days/year Buttonwillow Station 1940-2011, WRCC	

E=

0.09836	g/VMT PM2.5
0.39344	g/VMT PM10

Vehicle weight (tons)		fraction of each vehicle type
1.6	passenger vehicles	0.75
40	large trucks	0.18
9	2-4 axle trucks	0.07

9.1 weighted average for all vehicles (ton)

On I-5 near the Project, 75% of all vehicles are passenger vehicles,
of the remaining vehicle, 73% are 5-axle trucks and the remainder are 2-4 axle trucks.
From information provided by California Department of Transportation for the traffic analysis.

Commodity Handled	Petcoke	Coal	Liquid Sulfur	Gasification	Ammonia	Urea	UAN	Equipment	Miscellaneous
Expected plant operation									
Expected plant operation is 8000 hours / year									
The plant will operate 24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day	24 hours / day
The plant will operate 333 days / year	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr	333 days / yr
Shipment by trucks	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Shipment by train	0 %	100 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Production rate									
Required Normal Flow / day	1,140 tons / day	4,580 tons / day	100 tons / day	839 tons / day	500 tons / day	833 tons / day	1,392 tons / day		
Required Normal Flow / year	380,000 tons / yr	1,525,000 tons / yr	33,000 tons / yr	280,000 tons / yr	167,000 tons / yr	280,000 tons / yr	464,000 tons / yr		
Required Maximum Flow day	1,368 tons / day (3)	6,107 tons / day (4)	200 tons / day (5)	1,678 tons / day (6)	1,000 tons / day (6)	1,666 tons / day (6)	2,784 tons / day (6)		
Truck Shipments									
Truck Capacity	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck	25 tons / truck
Required trucks loads for normal operation / day	46 trucks / day	183 trucks / day	4 trucks / day	34 trucks / day	20 trucks / day	33 trucks / day	56 trucks / day	2 trucks / day	3 trucks / day
Required trucks loads for normal operation / yr	15,200 truck / yr	61,000 truck / yr	1,320 truck / yr	11,200 truck / yr	6,680 truck / yr	11,200 truck / yr	18,560 truck / yr		
Required trucks loads for maximum operation /day	55 trucks / day	244 trucks / day	8 trucks / day	67 trucks / day	40 trucks / day	67 trucks / day	111 trucks / day		
Train Shipments									
Railcar Capacity		117 tons / car	100 tons / car	100 tons / car	117 tons / car	117 tons / car	117 tons / car		
Assume a train has 13,000 ton capacity									
Required railcars for normal operation / day		39 cars / day	0 cars / day	0 cars / day	0 cars / day	0 cars / day	0 cars / day		
Required railcar loads for normal operation / yr		13,034 cars / yr	0 cars / yr	0 cars / yr	0 cars / yr	0 cars / yr	0 cars / yr		
Required railcars for maximum operation / day		200 cars / day	0 cars / day	0 cars / day	0 cars / day	0 cars / day	0 cars / day		
Basis	- 91% availability - 25% petcoke (heat input) - 25 ton/truck - 7 days/week receiving - 25% excess truck	- 91% availability - 75% coal (heat input) per year - 117 tons/car - 100% coal for maximum - Rack sized to handle two trains/day	- 91% availability - High sulfur case - 100 - 25 ton/truck - Weekdays only	- 91% availability - 75% coal max annual - Maximum is double the daily average rate	- 91% availability - 500 t/d NH3 sales - Ability to ship 7500 tons over 10 days (75% of tank plus some production)	- 91% availability -empty 45 day storage in 10 days	- 91% availability -empty 45 day storage in 10 days		
Traffic route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route	Truck Route
Destination/Origin	Carson Refinery	Wasco rail terminal to site	California Sulfur	Various	Various	Various	Various	Various	Various
Address	1801 E Sepulveda, Carson		2509 E Grant Street, Wilmington						
Distance	140 miles	26.5 miles	142 miles	80 mile radius	40 mile radius	40 mile radius	40 mile radius	40 mile ratius	40 mile ratius
Route	Alameda 405 Fwy 5 Fwy Stockdale hwy Morris Road Station Road		Grant Henry Ford Alameda 405 Fwy 5 Fwy Stockdale hwy Morris Road Station Road	40 mile radius Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	Station Road Morris Road Stockdale Hywy 5 Fwy	5 fwy Stockdale Hwy Dairy Road	5 fwy Stockdale Hwy Dairy Road
	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route	Rail Route
Destination/Origin	None	Elk Ranch New Mexico	None	None	None	None	None	None	None
Address									
Distance		801 miles							
Route		Kern County: 139.2 miles (County Line near Boron, CA to north property line of plant) Mine to Boron, CA: 662 miles Total Distance: 801.2 miles							

Notes
1) Equipment Maintenance Trucks are considered to be 2% of the total trucks per day for the feed and product operation.
2) Miscellaneous trucks are considered to be 3% of the total trucks per day for the feed and product operation.
3) The maximum flow rate of coke is ratioed up from the normal flow rate at 25% to 30% of feed
4) The maximum flow rate of coal is ratioed up from the normal flow rate at 75% to 100% of feed
5) The maximum flow rate of sulfur is 2 times the normal production
6) The maximum flow rate of these commodities is 2 times the normal production
7) The sources of flow data used in the Production Rate calculation were based on the flow rates provided in "Conference Note: Rail and Truck Traffic - Planning Session" and the "FertilizerProductMovement Update", 01-25-12.

Calculations for Trucks Operation Modeling

Data Supplied By Client					
Parameter	Petcoke and Coal Trucks		Product Trucks		Miscellaneous Trucks
	Running Emissions	Idling Emissions	Running Emissions	Idling Emissions	Running Emissions
Distance Traveled (mi)*	0.96		2.49		2.20
Per Truck Idle Time (hr)		0.083		0.083	
Maximum number of trucks or loads:					
1-hr	30	30	30	30	5
3-hr	90	90	89	89	5
8-hr	239	239	237	237	5
24-hr	299	299	296	296	5
Annual average trucks or loads	76,200	76,200	48,960	48,960	1,818

EMFAC2007 Emission Factors + Fugitive Dust (g/mi or g/idle-hour) For Truck Model year 2010

	Coke and Coal Trucks		Product Trucks		Miscellaneous Trucks
Pollutant	Running Emissions (g/mile/trk)	Idling Emissions (g/idle-hour/trk)	Running Emissions (g/mile/trk)	Idling Emissions (g/idle-hour/trk)	Running Emissions (g/mile/trk)
CO	3.03	43.69	3.03	43.69	3.03
NOx	5.43	122.65	5.43	122.65	5.43
ROG	1.39	7.74	1.39	7.74	1.39
SOx	0.03	0.06	0.03	0.06	0.03
PM10 *	0.92	0.11	0.92	0.11	0.92
PM2.5 *	0.29	0.10	0.29	0.10	0.29

EMFAC2007 is the approved federal model for vehicle combustion emissions
* PM10 and PM2.5 includes fugitive dust factor for paved roads obtained from AP-42 Ch. 13 plus PM factors from EMFAC 2007
PM factors from EMFAC = combustion exhaust + tire wear + break wear
EMFAC emissions are for fleet year 2010 travelling at 10 mph.

1-hr Emission Rates for AERMOD (g/s) all trucks

	Coke and Coal Trucks		Product Trucks		Miscellaneous Trucks
Pollutant	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions
CO	2.407E-02	3.027E-02	6.196E-02	2.997E-02	1.010E-02
NOx	4.314E-02	8.496E-02	1.111E-01	8.415E-02	1.810E-02
ROG	1.103E-02	5.365E-03	2.840E-02	5.313E-03	4.629E-03
SOx	2.385E-04	4.295E-05	6.139E-04	4.254E-05	1.000E-04
PM10	7.289E-03	7.897E-05	1.876E-02	7.822E-05	3.058E-03
PM2.5	2.325E-03	7.205E-05	5.985E-03	7.135E-05	9.754E-04

3-hr Emission Rates for AERMOD (g/s) all trucks

	Coke and Coal Trucks		Product Trucks		Miscellaneous Trucks
Pollutant	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions
CO	2.407E-02	3.027E-02	6.196E-02	2.997E-02	1.010E-02
NOx	4.314E-02	8.496E-02	1.111E-01	8.415E-02	1.810E-02
ROG	1.103E-02	5.365E-03	2.840E-02	5.313E-03	4.629E-03
SOx	2.385E-04	4.295E-05	6.139E-04	4.254E-05	1.000E-04
PM10	7.289E-03	7.897E-05	1.876E-02	7.822E-05	3.058E-03
PM2.5	2.325E-03	7.205E-05	5.985E-03	7.135E-05	9.754E-04

8-hour Emission Rates for AERMOD (g/s) all trucks

	Coke and Coal Trucks		Product Trucks		Miscellaneous Trucks
Pollutant	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions	Idling Emissions (at each Idle Point)	Running Emissions
CO	2.407E-02	3.027E-02	6.196E-02	2.997E-02	1.010E-02
NOx	4.314E-02	8.496E-02	1.111E-01	8.415E-02	1.810E-02
ROG	1.103E-02	5.365E-03	2.840E-02	5.313E-03	4.629E-03
SOx	2.385E-04	4.295E-05	6.139E-04	4.254E-05	1.000E-04
PM10	7.289E-03	7.897E-05	1.876E-02	7.822E-05	3.058E-03
PM2.5	2.325E-03	7.205E-05	5.985E-03	7.135E-05	9.754E-04

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24-hour Emission Rates for AERMOD (g/s) all trucks

Pollutant	Coke and Coal Trucks: Running Emissions	Coke and Coal Trucks: Idling Emissions (at each Idle Point)	Product Trucks: Running Emissions	Product Trucks: Idling Emissions (at each Idle Point)	Miscellaneous Trucks: Running Emissions
CO	1.003E-02	1.261E-02	2.582E-02	1.249E-02	1.010E-02
NOx	1.798E-02	3.540E-02	4.627E-02	3.506E-02	1.810E-02
ROG	4.598E-03	2.235E-03	1.183E-02	0.000E+00	4.629E-03
SOx	9.937E-05	1.790E-05	2.558E-04	1.772E-05	1.000E-04
PM10	3.037E-03	3.291E-05	7.818E-03	3.259E-05	3.058E-03
PM2.5	9.688E-04	3.002E-05	2.494E-03	2.973E-05	9.754E-04

Annual Emission Rates for AERMOD (g/s) all trucks

Pollutant	Coke and Coal Trucks: Running Emissions	Coke and Coal Trucks: Idling Emissions (at each Idle Point)	Product Trucks: Running Emissions	Product Trucks: Idling Emissions (at each Idle Point)	Miscellaneous Trucks: Running Emissions	TOTAL (g/s)	TOTAL (tpy)
CO	6.997E-03	8.797E-03	1.168E-02	5.652E-03	3.839E-04	3.35E-02	1.17E+00
NOx	1.254E-02	2.470E-02	2.094E-02	1.587E-02	6.880E-04	7.47E-02	2.60E+00
ROG	3.207E-03	1.559E-03	5.356E-03	1.002E-03	1.760E-04	1.13E-02	3.93E-01
SOx	6.932E-05	1.248E-05	1.158E-04	8.021E-06	3.803E-06	2.09E-04	7.28E-03
PM10	2.119E-03	2.295E-05	3.538E-03	1.475E-05	1.162E-04	5.81E-03	2.02E-01
PM2.5	6.758E-04	2.094E-05	1.129E-03	1.346E-05	3.708E-05	1.88E-03	6.52E-02

Volume, Line Sources

Guidance for Air Dispersion Modeling, SJVAPCD, 2007 and Section 1.2.2 of Volume II of ISC User's Guide			
2.3.2 Oyo=12W/2.15			
Truck Traveling vol src		Truck Idling pt src	
6	ft Release height	12.6	ft Release height
12	ft Width	0.1	m diam
66.98	ft init horz dim Syo	51.71	m/s vel
5.58	ft init vert dim Szo	366	K Temp
		199.134	F Temp

Volume, Stand Alone

Guidance for Air Dispersion Modeling, SJVAPCD, 2007	
2.3.2 + modelers judgement + ISC guidance	
Truck Traveling vol src	
6	ft Release height
12	ft Width
2.79	ft init horz dim Syo
5.58	ft init vert dim Szo

Transportation Information			**Notes**
- Onsite Vehicle =	20	trucks	- Information Provided By Applicant
- Vehicle year=	2010		- Information Provided By Applicant
- Maximum annual mileage =	10,000	miles/truck-year	- All routine vehicular traffic is anticipated to travel exclusively on paved roads
			- Assumed 15 mph average speed within HECA facility

Calculations for Trucks Operation Modeling per Truck

	Onsite O&M Trucks
Mileage	
1-hr	1
3-hr	3
8-hr	9
24-hr	27
Annual average trucks or loads	10000

EMFAC2007 Emission Factors (g/mi) For Truck Model year 2010

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	0.229	0.920
NOx	0.064	0.672
ROG	0.014	0.085
SOx	0.011	0.005
PM10 *	0.167	0.176
PM2.5 *	0.054	0.062

EMFAC2007 is the approved federal model for vehicle combustion emissions
* PM10 and PM2.5 includes fugitive dust factor for paved roads obtained from AP-42 Ch. 13 plus PM factors from EMFAC 2007
PM factors from EMFAC = combustion exhaust + tire wear + break wear
EMFAC emissions are for fleet year 2010 travelling at 15 mph.

1-hr Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

3-hr Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

8-hour Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

24-hour Emission Rates for AERMOD (g/s) all trucks

	AERMOD	
Pollutant	**Gas LHDT1**	**Diesel LHDT2**
CO	1.45E-03	5.83E-03
NOx	4.06E-04	4.26E-03
ROG	8.88E-05	5.39E-04
SOx	6.98E-05	3.17E-05
PM10	1.06E-03	1.11E-03
PM2.5	3.40E-04	3.91E-04

Annual Emission Rates for AERMOD (g/s) all trucks

	AERMOD			
Pollutant	**Gas LHDT1**	**Diesel LHDT2**	**TOTAL (g/s)**	**TOTAL (tpy)**
CO	1.45E-03	5.83E-03	7.29E-03	0.253
NOx	4.06E-04	4.26E-03	4.67E-03	0.162
ROG	8.88E-05	5.39E-04	6.28E-04	0.022
SOx	6.98E-05	3.17E-05	1.01E-04	0.004
PM10	1.06E-03	1.11E-03	2.17E-03	0.076
PM2.5	3.40E-04	3.91E-04	7.32E-04	0.025

Fugitive Dust on Paved Road

4/18/2012

AP 42 13.2.1 Paved Roads, updated January 2011

For a daily basis,
E = [k (sL)^0.91 x (W)^1.02](1-P/4N) (2)

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period
W = average weight (tons) of vehicles traveling the road
k = particle size multiplier for particle size range and units of interest
sL = road surface silt loading (g/m^2)

	k
	g/VMT
PM2.5	0.25
PM10	1.00

Table 13.2.1-1
PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Large Trucks

			Empty truck	full truck	Load Capacity
W=	17.5	tons, average	5	30	25 tons
sL=	0.031	g/m2 Default value from URBEMIS 9.2 for Kern County			
P=	36	days/year Buttonwillow Station 1940-2011, WRCC			

E=
0.19149 g/VMT PM2.5 large delivery trucks
0.76594 g/VMT PM10 large delivery trucks

Operation and Maintenance Vehicles

W= 3 tons
sL= 0.031 g/m2 Default value from URBEMIS 9.2 for Kern County
P= 36 days/year Buttonwillow Station 1940-2011, WRCC

E=
0.03169 g/VMT PM2.5 large delivery trucks
0.12675 g/VMT PM10 large delivery trucks
#vol sources= 10

Fertilizer Product + Sulfur Product trucks + Gas Solids trucks + Misc trucks

218 max trucks/day for Ammonia + Urea + UAN 24 hrs/day
8 max trucks/day for Sulfur
67 max trucks/day gas solids
3 miscellaneous truck along this path
296 Total product trucks max/day

4000 meters, approximate length of road for product trucks: eastern fenceline to southern fenceline to middle loop and back out the opposite way
2.49 miles

0.47593 grams PM2.5/truck/day	141.064 g PM2.5/day for all product trucks	5.8777 g PM2.5/hr
1.90373 grams PM10/truck/day	564.257 g PM10/day for all product trucks	23.5107 g PM10/hr

volume source in model
73 8.0516E-02 g PM2.5/hr/volume source
3.2206E-01 g PM10/hr/volume source

Coke + coal feedstock trucks

299 max feedstock trucks/day

1539 meters, approximate length of road loop to truck feedstock unloading facility on east side
0.96 miles

0.18312 grams PM2.5/truck/day	54.800 g PM2.5/day for all product trucks	2.2833 g PM2.5/hr
0.73246 grams PM10/truck/day	219.201 g PM10/day for all product trucks	9.1334 g PM10/hr

volume source in model
34 6.7157E-02 g PM2.5/hr/volume source
2.6863E-01 g PM10/hr/volume source

Fugitive Dust on Paved Road

4/18/2012

Miscellaneous Delivery Trucks

5 max trucks/day

3540 meters, approximate length of road from end of product truck south road, along southern fenceline, north toward main site, to parking lot and back
2.20 miles

0.421 grams PM2.5/truck/day	2.299 g PM2.5/day for all product trucks	0.0958 g PM2.5/hr
1.685 grams PM10/truck/day	9.196 g PM10/day for all product trucks	0.3832 g PM10/hr

# volume source in model	
5	1.9158E-02 g PM2.5/hr/volume source
	7.6631E-02 g PM10/hr/volume source

GHG Emissions Summary for Mobile Sources — Emissions Summary

Hydrogen Energy California LLC — *4/18/2012*
HECA Project

GHG emissions are numerically depicted as metric tons (tonne) of carbon dioxide equivalents (CO_2e). CO_2e represents CO_2 plus the additional warming potential from CH_4 and N_2O. CH_4 and N_2O have 21 and 310 times the warming potential of CO_2, respectively.

Onsite LHD Gasoline Trucks

Number of Onsite Trucks		10	trucks		EF CO_2 =	1,175	g/mi
Total Annual VMT		10,000	miles/ truck		EF CH_4 =	0.0157	g/mi
					EF N_2O =	0.0101	g/mi
CO_2 =	118	tonne/yr					
CH_4 =	1.57E-03	tonne/yr =	3.E-02	tonne CO_2e/yr			
N_2O =	1.01E-03	tonne/yr =	3.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	118

CO2 emissions from EMFAC2007 for fleet year 2010 for light heavy-duty gasoline trucks travelling at 15 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for light gasoline trucks.

Onsite LHD Diesel Trucks

Number of Onsite Trucks		10	trucks		EF CO_2 =	519	g/mi
Total Annual VMT		10,000	miles/ truck		EF CH_4 =	0.001	g/mi
					EF N_2O =	0.0015	g/mi
CO_2 =	52	tonne/yr					
CH_4 =	1.00E-04	tonne/yr =	2.E-03	tonne CO_2e/yr			
N_2O =	1.50E-04	tonne/yr =	5.E-02	tonne CO_2e/yr		Total tonne CO_2e/yr =	52

CO2 emissions from EMFAC2007 for fleet year 2010 for light heavy-duty diesel trucks travelling at 15 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for light diesel trucks.

Onsite Petcoke & Coal Trucks

Number of Truck loads		76,200	truck loads		EF CO_2 =	3,165	g/mi
Distrance Travelled Onsite		1.0	mi/ load		EF CH_4 =	0.0051	g/mi
Truck Idle Time		0.08	hr/load		EF N_2O =	0.0048	g/mi
					EF CO_2 =	6,542	g/ idle hr
					EF CH_4 =	0.011	g/ idle hr
					EF N_2O =	0.010	g/ idle hr
CO_2 =	272	tonne/yr					
CH_4 =	4.39E-04	tonne/yr =	9.E-03	tonne CO_2e/yr			
N_2O =	4.13E-04	tonne/yr =	1.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	272

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 10 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Onsite Product Trucks

Number of Truck loads		48,960	truck loads		EF CO_2 =	3,165	g/mi
Distrance Travelled Onsite		2.49	mi/ load		EF CH_4 =	0.0051	g/mi
Truck Idle Time		0.08	hr/load		EF N_2O =	0.0048	g/mi
					EF CO_2 =	6,542	g/ idle hr
					EF CH_4 =	0.011	g/ idle hr
					EF N_2O =	0.010	g/ idle hr
CO_2 =	412	tonne/yr					
CH_4 =	6.64E-04	tonne/yr =	1.E-02	tonne CO_2e/yr			
N_2O =	6.25E-04	tonne/yr =	2.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	412

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 10 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Onsite Miscellaneous Diesel Trucks

Number of Truck loads		1,818	truck loads		EF CO_2 =	3,165	g/mi
Distrance Travelled Onsite		2.2	mi/ load		EF CH_4 =	0.0051	g/mi
					EF N_2O =	0.0048	g/mi
CO_2 =	13	tonne/yr					
CH_4 =	2.04E-05	tonne/yr =	4.E-04	tonne CO_2e/yr			
N_2O =	1.92E-05	tonne/yr =	6.E-03	tonne CO_2e/yr		Total tonne CO_2e/yr =	13

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 10 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles.

Offsite Coal Trains

Number of Train cars per year		13,034	per year		EF CO_2 =	10,217	g/gal
Miles Traveled Per Train		801	Miles one way		EF CH_4 =	0.8	g/gal
Rail Freight Fuel Consumption		480	ton-mile/gallon		EF N_2O =	0.26	g/gal
Loaded train car weight		142	ton				
Unloaded train car weight		25	ton				
All Trains - Round Trip		1.74E+09	ton-miles/year				
Fuel Use for all Trains - Round Trip		3,632,203	gal/year				
CO_2 =	37,110	tonne/yr					
CH_4 =	2.91	tonne/yr =	61.02	tonne CO_2e/yr			
N_2O =	0.94	tonne/yr =	292.76	tonne CO_2e/yr		Total tonne CO_2e/yr =	37,464

New engines will meet Tier 3 emissions (40 CFR Part 1033, EPA Switch and Line-haul Locomotive Emission Standards). CH4 and N2O factors are from California Climate Action Registry General Reporting Protocol Version 3.1 (January 2009), Table C.6 (Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles) for locomotives.

Offsite Coal Trucks

Number of Trucks		61,000	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		26.5	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		1,616,500	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	2,701	tonne/yr					
CH_4 =	8.24E-03	tonne/yr =	2.E-01	tonne CO_2e/yr			
N_2O =	7.76E-03	tonne/yr =	2.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	2,703

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Petcoke Trucks

Number of Trucks		15,200	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		280	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		4,256,000	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	7,110	tonne/yr					
CH_4 =	2.17E-02	tonne/yr =	5.E-01	tonne CO_2e/yr			
N_2O =	2.04E-02	tonne/yr =	6.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	7,117

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Liquid Sulfur Product Trucks

Number of Trucks		1,320	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		284	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		374,880	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	626	tonne/yr					
CH_4 =	1.91E-03	tonne/yr =	4.E-02	tonne CO_2e/yr			
N_2O =	1.80E-03	tonne/yr =	6.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	627

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Gasification Solids Product Trucks

Number of Trucks		11,200	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		160	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		1,792,000	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	2,994	tonne/yr					
CH_4 =	9.14E-03	tonne/yr =	2.E-01	tonne CO_2e/yr			
N_2O =	8.60E-03	tonne/yr =	3.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	2,997

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Ammonia Product Trucks

Number of Trucks		6,680	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		534,400	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	893	tonne/yr					
CH_4 =	2.73E-03	tonne/yr =	6.E-02	tonne CO_2e/yr			
N_2O =	2.57E-03	tonne/yr =	8.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	894

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Urea Product Trucks

Number of Trucks		11,200	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		896,000	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	1,497	tonne/yr					
CH_4 =	4.57E-03	tonne/yr =	1.E-01	tonne CO_2e/yr			
N_2O =	4.30E-03	tonne/yr =	1.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	1,498

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

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Offsite UAN Product Trucks

Number of Trucks		18,560	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		1,484,800	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	2,481	tonne/yr					
CH_4 =	7.57E-03	tonne/yr =	2.E-01	tonne CO_2e/yr			
N_2O =	7.13E-03	tonne/yr =	2.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	2,483

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Equipment and Miscellaneous Trucks

Number of Trucks		1,818	truck per year		EF CO_2 =	1,671	g/mi
Distance traveled per Truck (Round Trip)		80	miles/ truck		EF CH_4 =	0.0051	g/mi
Total Annual VMT		145,440	miles/ year		EF N_2O =	0.0048	g/mi
CO_2 =	243	tonne/yr					
CH_4 =	7.42E-04	tonne/yr =	2.E-02	tonne CO_2e/yr			
N_2O =	6.98E-04	tonne/yr =	2.E-01	tonne CO_2e/yr		Total tonne CO_2e/yr =	243

CO2 emissions from EMFAC2007 for fleet year 2010 heavy-heavy duty diesel trucks travelling at 50 mph. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for diesel heavy duty vehicles. Idling emission Factor for N2O and CH4 were extrapolated based on the ratio of CO2 emission factor for running vs idling.

Offsite Employee Commute Vehicles

Total Number of Employee		200	employees/day		EF CO_2 =	364	g/mi
Number of Worker per Commuter Vehicle		1.3			EF CH_4 =	0.0159	g/mi
Daily Vehicle Count		154	vehicles/day		EF N_2O =	0.0093	g/mi
Distance traveled per vehicle (Round Trip)		40	miles/ vehicle/ day				
Day of Commute per Month		365	days/yr				
Total Annual VMT		2,246,154	miles/year				
CO_2 =	817	tonne/yr					
CH_4 =	3.57E-02	tonne/yr =	7.E-01	tonne CO_2e/yr			
N_2O =	2.09E-02	tonne/yr =	6.E+00	tonne CO_2e/yr		Total tonne CO_2e/yr =	824

CO2 emission factor for CO2 is from EMFAC 2007 (average of light duty automobile and light duty truck) for the vehicle model year fro m1971 to 2015. Running emission Factor for N2O and CH4 is based on Table C.4, California Climate Action Registry General Reporting Protocol Version 3.1, Jan 2009 for average of gasoline passenger cars, gasoline light trucks, diesel passenger cars, and diesel light truck.

Total tonne CO_2e/yr for Mobile Sources=	**57,717**

GHG Emissions Summary for Mobile Sources

Hydrogen Energy California LLC *4/18/2012*
HECA Project

Greenhouse Gas Emissions Associated with the Mobile Sources During Project Operations

Source	Annual CO2e Emissions (tonne/year)
Onsite Trucks	867
Offsite Workers Commuting	824
Offsite Trucks	18,562
Offsite Trains	37,464
Total CO2e Annual Emissions	**57,717**

Notes:

Onsite worker travel and associated emissions are negligible

Appendix E-13

CO_2 Vent Study

CO_2 VENT STUDY

The PHAST (Process Hazard Analysis Software Tool; by DNV) dispersion model was used to evaluate the potential for CO_2 venting to affect workers in the plant. This CO_2 venting occurs only during the Rectisol Unit startup or abnormal operating conditions when the off-taker, pipeline, or CO_2 compressor can not take the CO_2 product gas. The vent gas is released through the Scrubber outlet which is located on the Methanol Wash Column at 260 feet above grade. Work platforms are located on the Gasifier structure about 330 feet south-west from the CO_2 vent and 260 feet above grade. This location is the closest in proximity to the release location and the results of the modeling were evaluated at that location.

The Immediately Dangerous to Life and Health (IDLH) value is used as a threshold of unacceptable exposure to plant personnel. It is based on a healthy individual's ability to tolerate exposure to the specified limit for 30 minutes without irreversible health effects. The IDLH for CO_2 is 40,000 ppm.

The Clean Air Act states that the final offsite consequence analysis endpoints for an accidental release should be based on an Emergency Response Planning Guide (ERPG) value of 2 (ERPG-2). Currently an ERPG-2 value has not been established for CO_2. Therefore, the OSHA 8-hour TWA value for CO_2 (5000 ppm) is used as a substitute and conservative limit.

The tables below summarize the stability class, wind speeds, and vent gas rates used in the analysis.

Weather Stability Classes

Stability Class	Condition	Wind Speed
A	Extremely Unstable	3 m/s
B	Moderately Unstable	5 m/s
D	Stable	5 m/s
F	Calm	1.0 m/s

CO_2 Vent Gas Properties

% of Full Flow Rate	100%	50%	25%	10%
Flow lb/hr	761,400	380,700	190350	76140
Volumetric flow, acf/s	1831	916	458	183
Stack Velocity, ft/sec	190	95	48	19
Vent CO_2 Temp, Deg F	65	65	65	65

None of the dispersion plumes reach ground level within or outside the plant. Only the Class F stability full flow vent release plume has the potential to be near the gasification platform; however, it remains elevated above 300 feet. Due to the predicted proximity of the CO_2 plume, administrative controls are recommended during startup and abnormal operations to limit access to the gasifier platform. Also, it is recommended that CO_2 detectors (with alarms) be installed at the gasifier platform along with air packs for emergency use. An alarm that activates when CO_2 is venting would alert operators of a potential toxic threat. The healthy onsite worker who is trained to respond to a siren or horn upon the detection of a high CO_2 level can escape or seek shelter within the 30 minute period associated with the IDLH 40,000 ppm toxicity level. Only the Class F full vent release plume extends beyond the plant boundary; however, it remains elevated. The offsite public is not affected by the CO_2 vent release. The results of the PHAST model dispersion study are graphically shown on the attached elevation views of vent plume concentration contours for the various combinations of meteorology and venting rates.

Attachment A
Dispersion Plumes

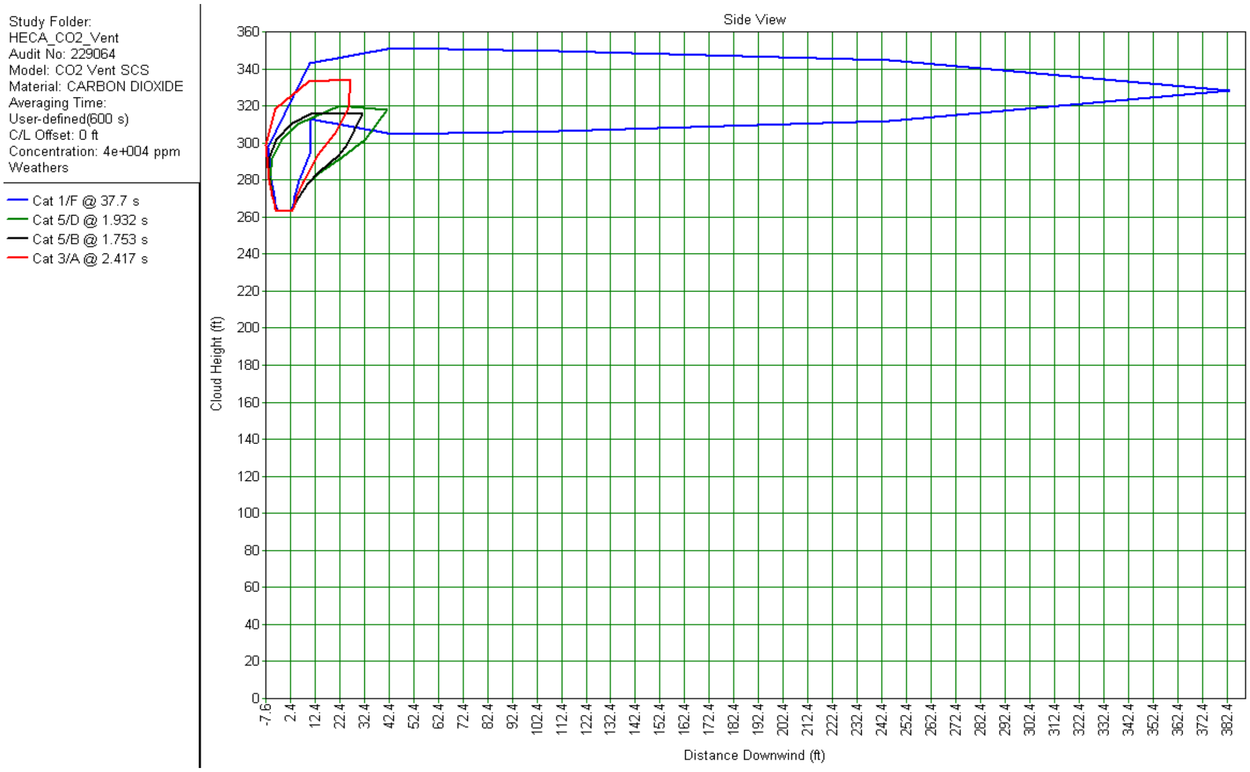


Figure 1a: Dispersion of a CO_2 release from the Vent; 100% Flow (40,000 ppm contour)

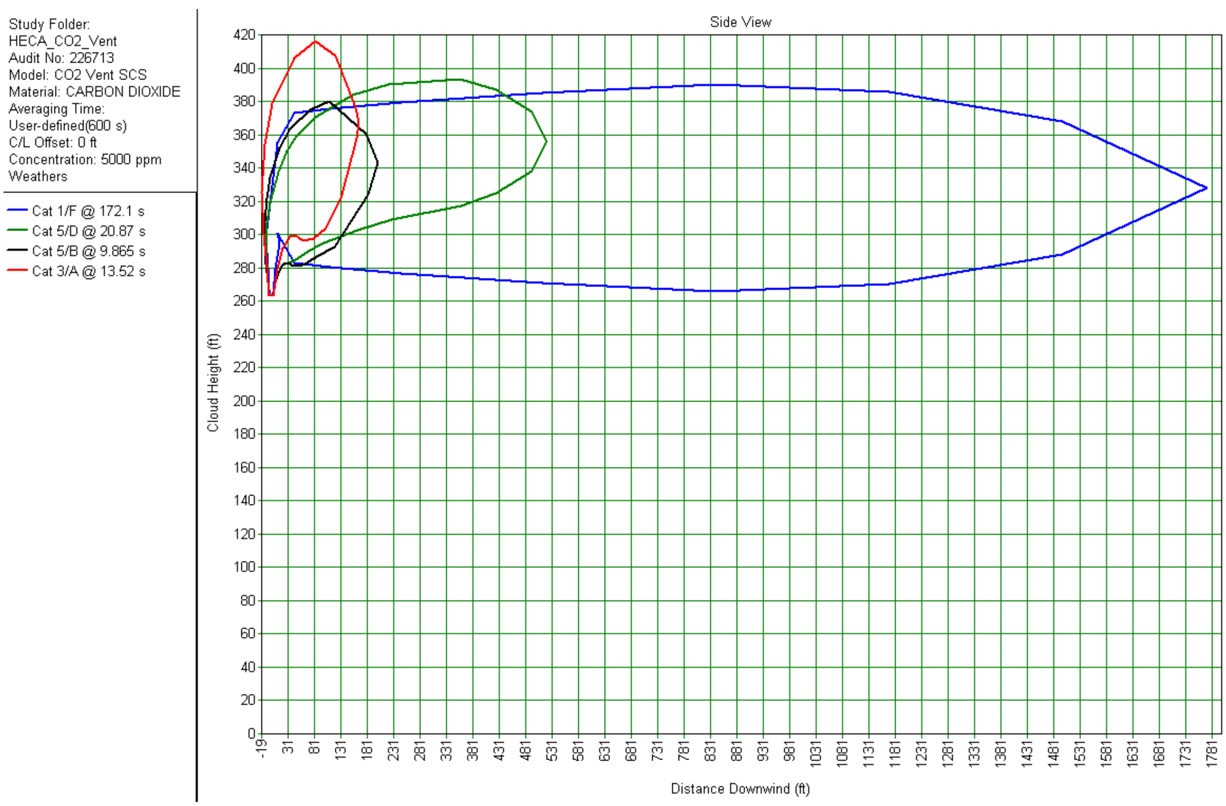


Figure 1b: Dispersion of a CO_2 release from the Vent; 100% Flow (5,000 ppm contour)

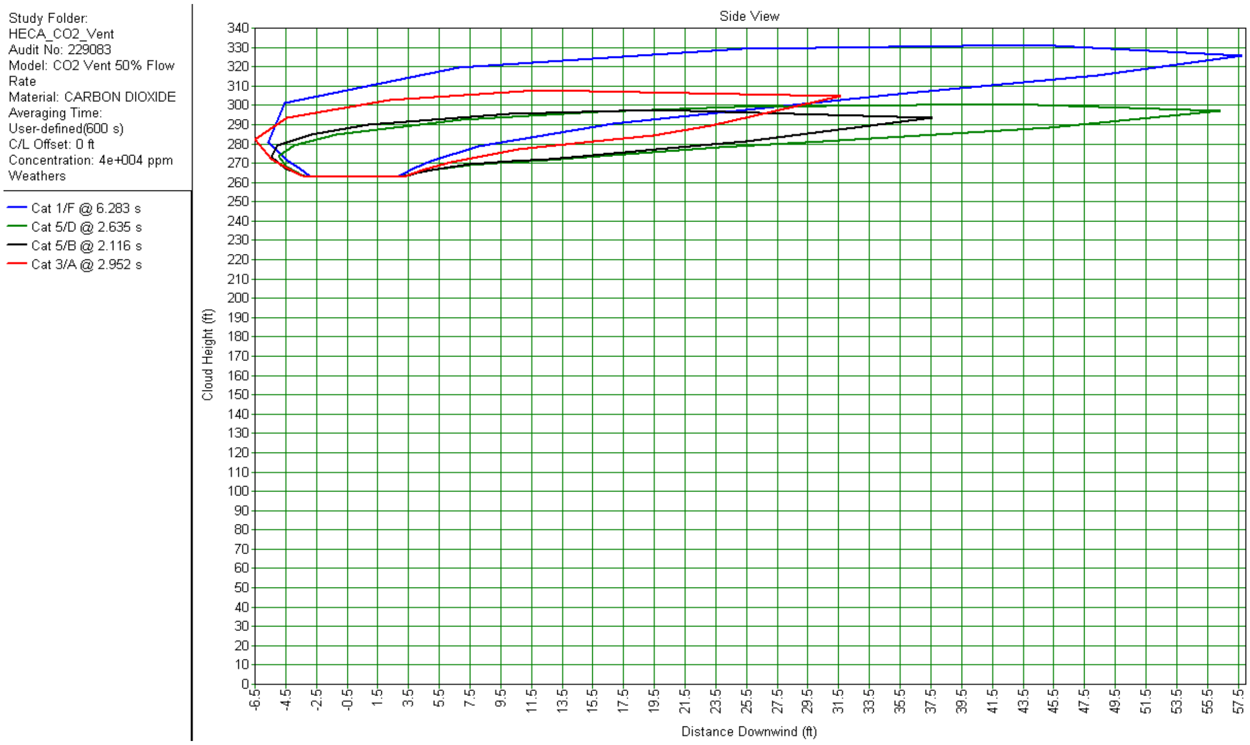


Figure 2a: Dispersion of a CO_2 release from the Vent; 50% Flow (40,000 ppm contour)

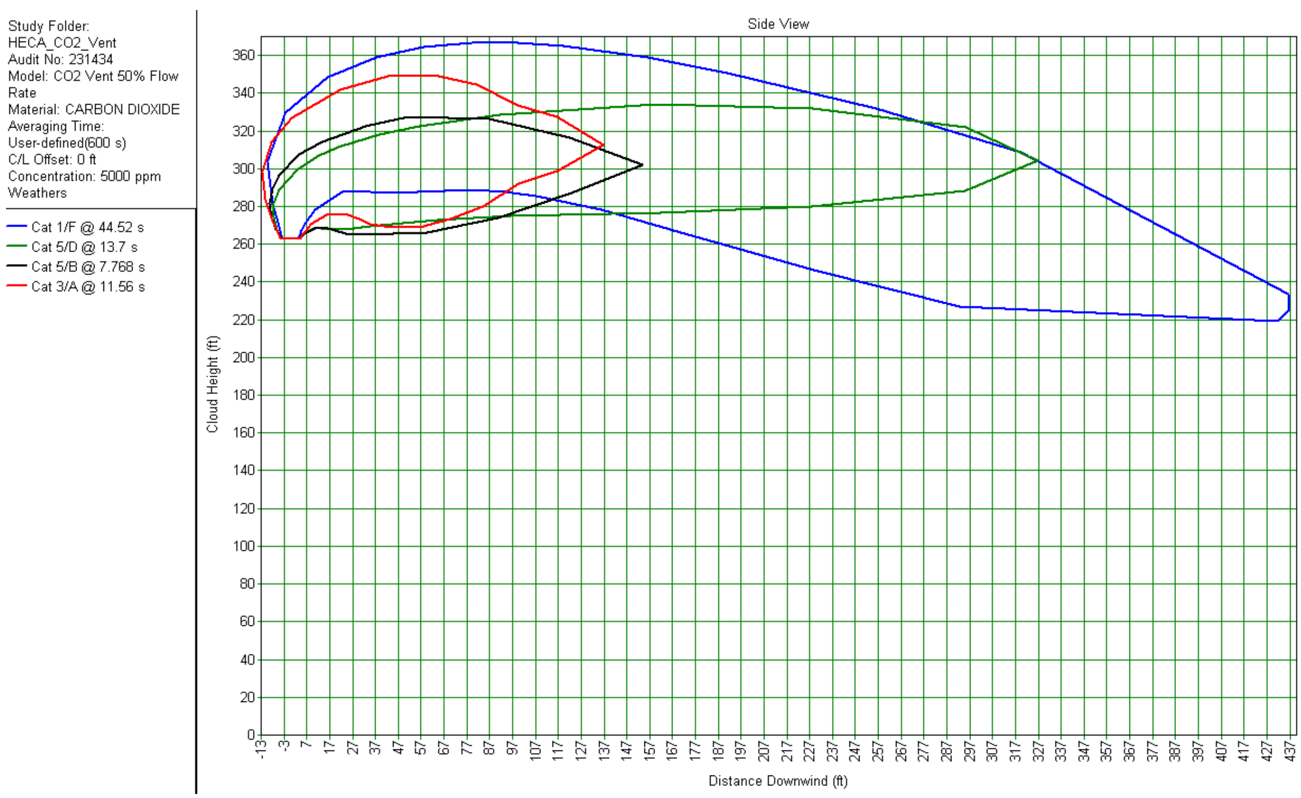


Figure 2b: Dispersion of a CO_2 release from the Vent; 50% Flow (5,000 ppm contour)

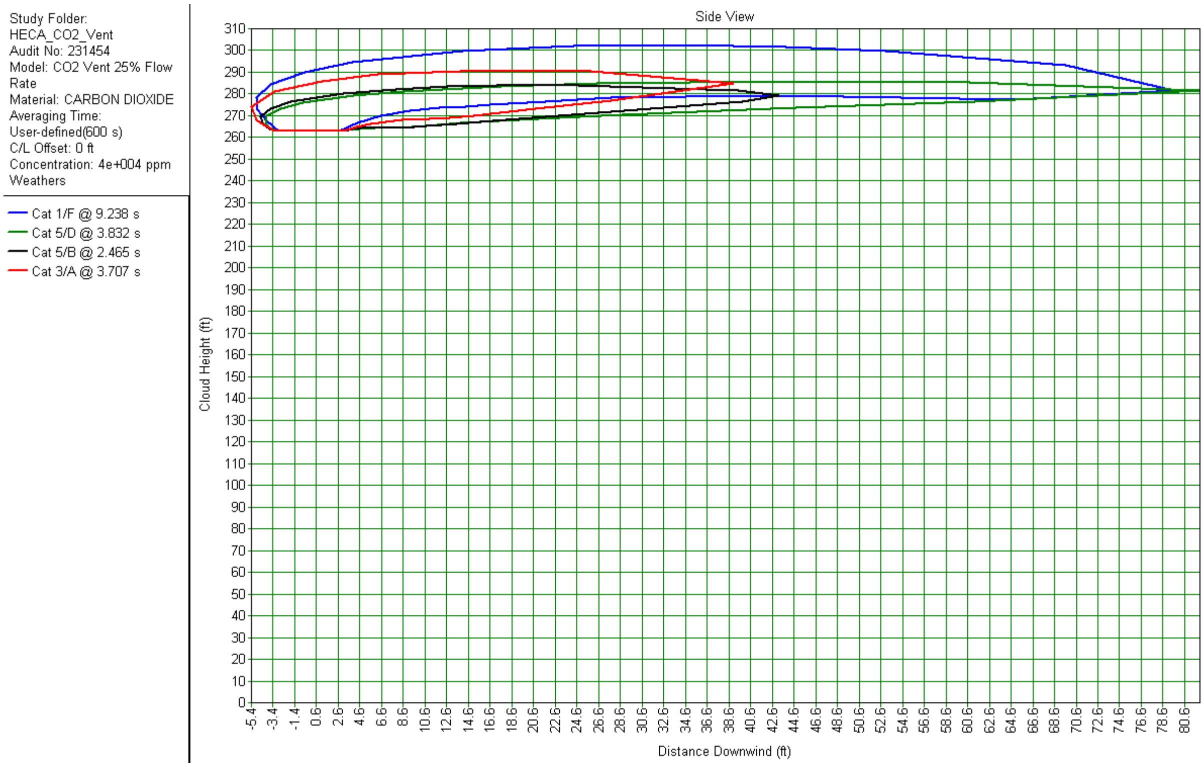


Figure 3a: Dispersion of a CO_2 release from the Vent; 25% Flow (40,000 ppm contour)

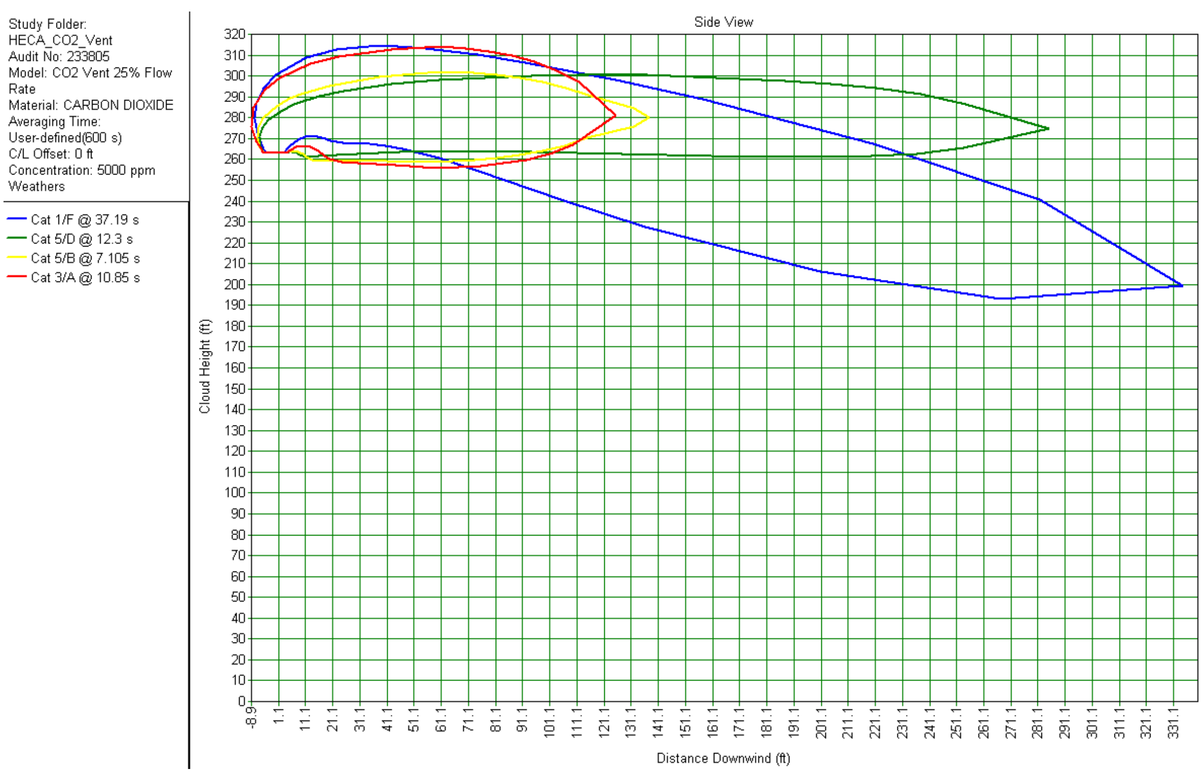


Figure 3b: Dispersion of a CO_2 release from the Vent; 25% Flow (5,000 ppm contour)

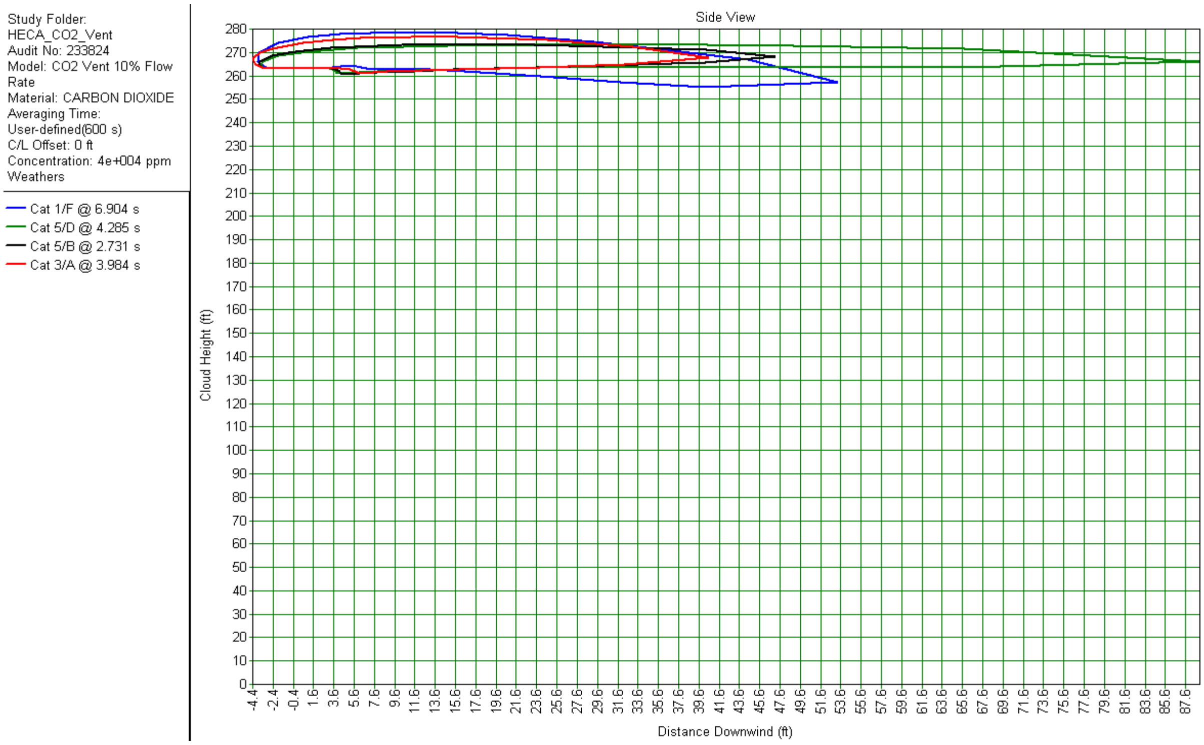


Figure 4a: Dispersion of a CO_2 release from the Vent; 10% Flow (40,000 ppm contour)

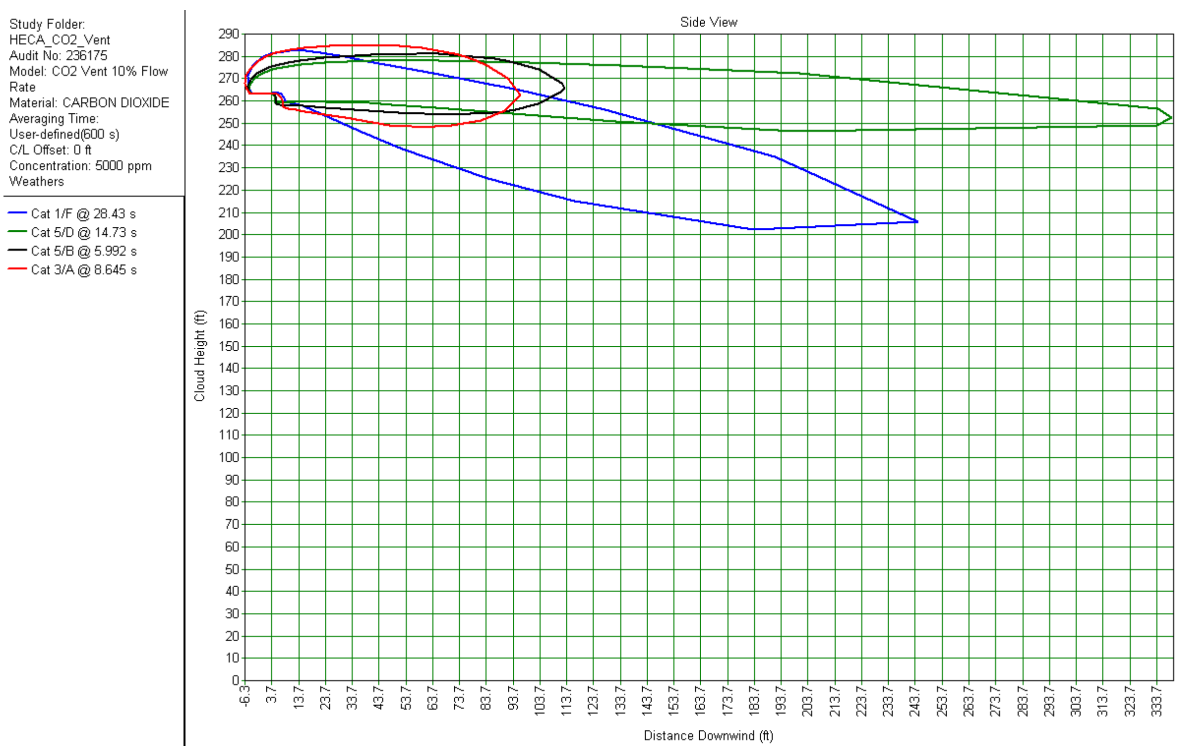


Figure 4b: Dispersion of a CO_2 release from the Vent; 10% Flow (5,000 ppm contour)

Appendix E-14

List of Projects from Response to DR 32

BACKGROUND

The AFC, page 5.1-70, indicates that the results of a cumulative impacts analysis will be provided under separate cover and that Appendix J provides a list of projects located within 6 miles of the site from the SJVAPCD. However, staff's review indicates that Appendix J contains a list of projects from Kern County and not stationary source projects from the SJVAPCD. Staff needs the applicant to obtain the project list from the SJVAPCD and complete the cumulative impacts analysis.

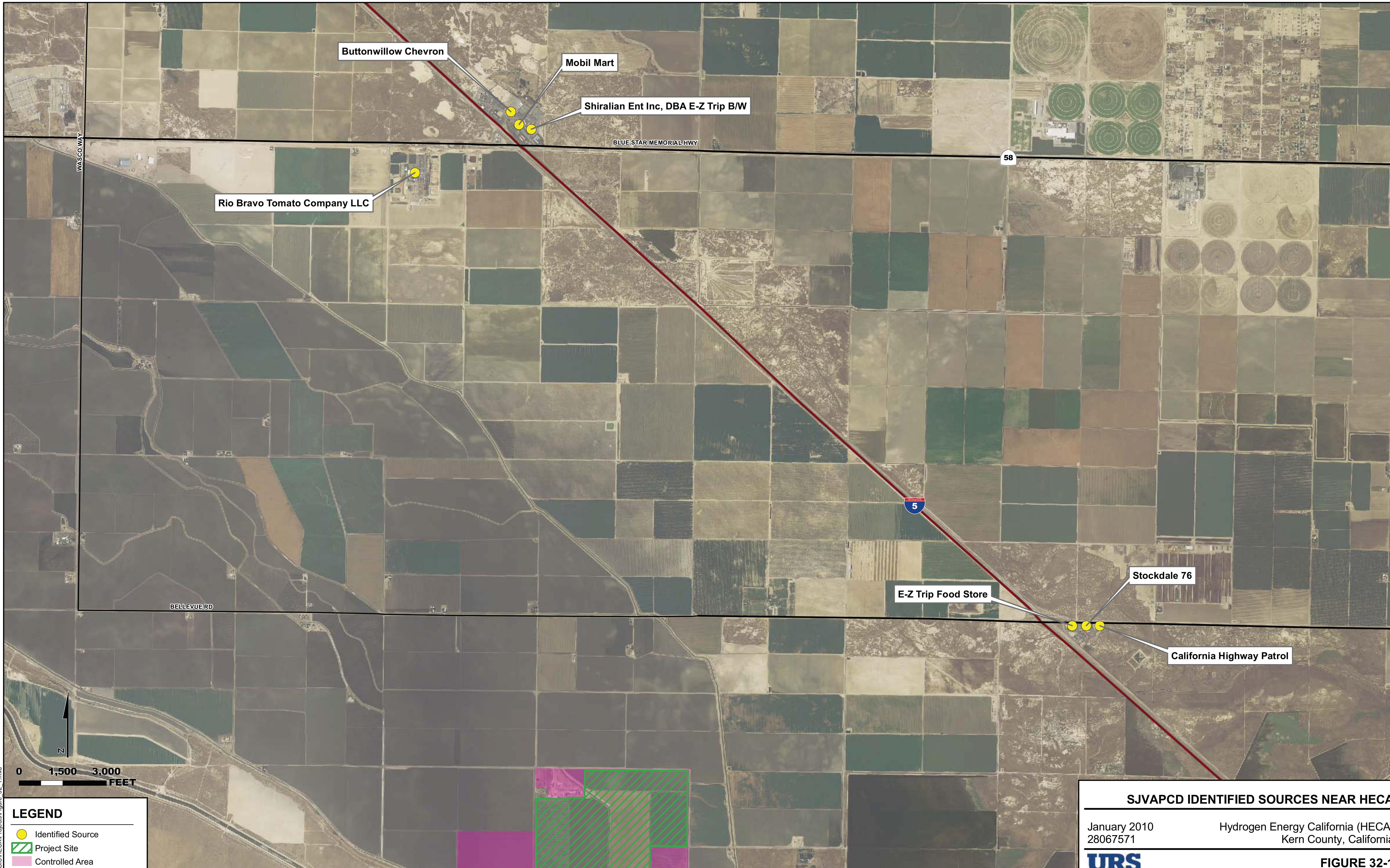
DATA REQUEST

32. Please provide a list from the SJVAPCD of large stationary source projects with permitted emissions, for projects with greater than 5 tons of permitted emissions of any single criteria pollutant, located within six miles of the project site that have been recently permitted, but did not start operation prior to 2009, or are in the process of being permitted.

RESPONSE

A public records request was submitted to the SJVAPCD requesting the list of sources meeting the criteria specified in this data request; a copy of that request is included as Attachment 32-1. SJVAPCD responded with a list of sources, a copy of which is included as Attachment 32-2. There are no sources on the list that meet all of the criteria for inclusion specified in this data request. Specifically, all sources on the list emit less than 5 tons per year of any single criteria pollutant. Therefore, there are no sources to be included in the cumulative impacts modeling requested in Data Request 33. For information purposes only, all the sources from the SJVAPCD list are located and identified on Figure 32-1.

FIGURE 32-1



SJVAPCD IDENTIFIED SOURCES NEAR HECA

January 2010
28067571

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 32-1

ATTACHMENT 32-1
PUBLIC RECORDS REQUEST SUBMITTED TO
THE SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT

San Joaquin Valley
Air Pollution Control District
1990 E. Gettysburg Avenue, Fresno, CA 93726-0244
(559) 230-6000 www.Valleyair.org

Public Records Requests
Phone (559) 230-6000
Fax (559) 230-6061

Office Use Only
CONTROL NUMBER

PUBLIC RECORDS REQUEST FORM

ATTENTION REQUESTOR: To expedite your request for District records, please fill out this form completely. Identify specifically the type of records you are requesting. Please limit your request to one facility or one site address for each request form filed, and three requests items per form. Additional forms or pages can be used if requesting information for more than one facility or for records not identified on this form. Requests should reasonably describe identifiable records prepared, owned, used, or retained by the District. Staff is available to assist you in identifying those records in the District's possession. The District is not required by law to create a new record or list from an existing record. By submission of this form I hereby agree to reimburse the SJVUAPCD for the direct cost of duplicating the requested records in accordance with Gov. Code Sec. 6253(b).

REQUESTOR INFORMATION

NAME: Mark Strehlow DATE: Oct 26, 2009

COMPANY: URS Corporation, on behalf of Hydrogen Energy International LLC

MAILING ADDRESS: 1333 Broadway Suite 800

CITY: Oakland STATE: CA ZIP CODE: 94612

PHONE # 510 874 3055 FAX # E-MAIL: Mark_Strehlow@URSCorp.com

DOCUMENTS REQUESTED *(3 Items per form)*

- ☐ Permit Application(s)
- ☐ Permit(s) to Operate (PTO)
- ☐ Authorities to Construct (ATC)
- ☐ Engineering Evaluation(s)
- ☐ Emissions Inventory Statement(s)
- ☐ Health Risk Assessment(s)
- ☐ Site Inspection Report(s)
- ☐ Source Test Report(s)
- ☐ Air Monitoring Data
- ☐ Complaints
- ☐ Notice(s) of Violation (NOV)
- ☐ Notice(s) to Comply (NTC)
- ☐ All Records/General File Review
- ☐ Toxic Sources within 1/4 mi School Review
- ☐ Asbestos Notification(s)/Record(s)
- ☐ AB2588 "Hot Spots" Information
- ☑ Other (*Describe below or on additional pages*):

Please provide a list of large stationary source projects with permitted emissions, for projects with greater than 5 tons of permitted emissions of any single criteria pollutant, located within 6 miles of HECA project site that have been recently permitted, but did not start operation prior to 2009, or are in the process of being permitted. In addition, please provide any emissions inventory applicable to the former Port Organics operation on the proposed HECA property regardless of any minimum criteria pollutant emission rate.

DATE OF DOCUMENTS REQUESTED: From: To:

REQUESTED FACILITY INFORMATION *(If Applicable)*

FACILITY NAME: Hydrogen Energy California (HECA) FACILITY I.D. NO. *(if known)*

FACILITY ADDRESS: Section 10 of Township 30 South, Range 24 East in Kern County

CITY: STATE: CA ZIP CODE:

METHOD OF DELIVERY (Check all that apply)

- ☐ Pick Up
- ☐ U.S. Mail
- ☐ FAX (Maximum 30 Pages)
- ☐ CD/DVD
- ☑ Email (Maximum 5 MB)
- ☑ Other
- ☐ Inspection of records only, no copies required (District will contact you to setup an appointment for inspection)

☐ I request that the SJVUAPCD contact me prior to completing the requested records if the cost exceeds $

ATTACHMENT 32-2
LIST OF EMISSIONS SOURCES PROVIDED BY
THE SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT

ATC Within 6 Miles

APPs Received Between 1/1/2009 and 12/31/2009

All Sources less than 5 Tons

Region S

Facility ID 1456

Distance To Location 5641.616

Degrees 26.37063

Facility Name E-Z TRIP FOOD STORE

Facility Type GASOLINE DISPENSING

	Received	Type	Status	Description
VOC	1/14/2009	ATC	FINAL	installation of Healy EVR Phase II

Facility ID 2002

Distance To Location 5527.26

Degrees 26.96527

Facility Name STOCKDALE 76

Facility Type GASOLINE DISPENSING

	Received	Type	Status	Description
VOC	10/5/2009	ATC	PR-INCO	installation of Phase II EVR and new dispensers

Facility ID 2187

Distance To Location 7835.253

Degrees 353.6736

Facility Name SHIRALIAN ENT INC, DBA E-Z TRIP-B/W

Facility Type GASOLINE DISPENSING

	Received	Type	Status	Description
VOC	1/14/2009	ATC	FINAL	installation of Healy EVR Phase II

Facility ID *2346*

Facility Name CALIFORNIA HIGHWAY PATROL

Facility Type POLICE PROTECTION

Distance To Location 5773.069

Degrees 25.67612

	Received	Type	Status	Description
VOC	3/16/2009	ATC	FINAL	modify GDF/remove Phase II, per Rule 4622 ORVR exemption

Facility ID *2797*

Facility Name BUTTONWILLOW CHEVRON

Facility Type GASOLINE DISPENSING

Distance To Location 7835.387

Degrees 353.6724

	Received	Type	Status	Description
	8/5/2009	ATC	FINAL	Veeder Root Phase II Upgrade with ISD
VOC	3/17/2009	ATC	FINAL	installation of six new dispensers
	1/20/2009	ATC	FINAL	VST Phase II upgrade with Veeder Root vapor filter and without ISD

Facility ID *3043*

Facility Name MOBIL MART

Facility Type GASOLINE DISPENSING

Distance To Location 7818.377

Degrees 353.4922

	Received	Type	Status	Description
VOC	3/30/2009	ATC	FINAL	Vapor polisher upgrade

Facility ID *3550*

Distance To Location 7865.64

Facility Name RIO BRAVO TOMATO COMPANY LLC

Facility Type TOMATO PROCESSING

Degrees 344.3918

NOx
3.5 Tons/year

Received	Type	Status	Description
3/30/2009	PEER	FINAL	PEER: ONE (1) BOILER