DOCKETED

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URS

August 23, 2013

CALIFORNIA ENERGY COMMISSION – DOCKET UNIT
Attn: Docket No. 08-AFC-08A
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512

Re: GHG Emissions for Alternative 2

This spreadsheet contains greenhouse gas (GHG) calculations for the transportation sources in Alternative 2. These calculations were provided in the Amended AFC, and are being provided here based on project refinements discussed in the Updated Emissions and Modeling Report, docketed on May 20, 2013.
Sincerely,

URS Corporation

Dale Shileikis
Project Manager
URS Corporation

Enclosure:
Operational Transportation Greenhouse Gas Emissions - Alternative 2

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Hydrogen Energy California LLC
HECA Project

Operational Transportation Greenhouse Gas Emissions - Alternative 2
August 20, 2013

Hydrogen Energy California LLC *8/20/2013*
HECA Project

Greenhouse Gas Emissions Associated with the Mobile Sources During Project Operations - Alternative 2

Source	Annual CO2e Emissions (tonne/year)
Onsite Trucks	947
Onsite Trains	0
Offsite Workers Commuting	824
Offsite Trucks	24,037
Offsite Trains	37,654
Total CO2e Annual Emissions	**63,462**

Notes:

Onsite worker travel and associated emissions are negligible

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 and Coal Trucks

Number of Truck loads		76,240	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 Fluxant & Product Trucks

Number of Truck loads		58,000	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 =	488	tonne/yr					
CH_4 =	7.86E-04	tonne/yr =	2.E-02	tonne CO_2e/yr			
N_2O =	7.40E-04	tonne/yr =	2.E-01	tonne CO_2e/yr	Total tonne CO_2e/yr =		488

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		2,330	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 =	16	tonne/yr					
CH_4 =	2.61E-05	tonne/yr =	5.E-04	tonne CO_2e/yr			
N_2O =	2.46E-05	tonne/yr =	8.E-03	tonne CO_2e/yr	Total tonne CO_2e/yr =		16

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.

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Offsite Coal Trains

Number of Trains cars per year	13,100	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	1.75E+09	ton-miles/year				
Fuel Use for all Trains - Round Trip	3,650,596	gal/year				

CO_2 =	37,298	tonne/yr				
CH_4 =	2.92	tonne/yr =	61.33	tonne CO_2e/yr		
N_2O =	0.95	tonne/yr =	294.24	tonne CO_2e/yr	Total tonne CO_2e/yr =	37,654

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	61,040	truck per year		$EF\ CO_2$ =	1,671	g/mi
Distance traveled per Truck (Round Trip)	53	miles/ truck		$EF\ CH_4$ =	0.0051	g/mi
Total Annual VMT	3,235,120	miles/ year		$EF\ N_2O$ =	0.0048	g/mi

CO_2 =	5,405	tonne/yr				
CH_4 =	1.65E-02	tonne/yr =	3.E-01	tonne CO_2e/yr		
N_2O =	1.55E-02	tonne/yr =	5.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =	5,410

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 Fluxant Trucks

Number of Trucks	2,360	truck per year		$EF\ CO_2$ =	1,671	g/mi
Distance traveled per Truck (Round Trip)	404	miles/ truck		$EF\ CH_4$ =	0.0051	g/mi
Total Annual VMT	953,440	miles/ year		$EF\ N_2O$ =	0.0048	g/mi

CO_2 =	1,593	tonne/yr				
CH_4 =	4.86E-03	tonne/yr =	1.E-01	tonne CO_2e/yr		
N_2O =	4.58E-03	tonne/yr =	1.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =	1,594

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	1,360	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	386,240	miles/ year		$EF\ N_2O$ =	0.0048	g/mi

CO_2 =	645	tonne/yr				
CH_4 =	1.97E-03	tonne/yr =	4.E-02	tonne CO_2e/yr		
N_2O =	1.85E-03	tonne/yr =	6.E-01	tonne CO_2e/yr	Total tonne CO_2e/yr =	646

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 Gasification Solids Product Trucks

Number of Trucks	12,680	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	2,028,800	miles/ year		EF N_2O =	0.0048	g/mi

CO_2 =	3,389	tonne/yr				
CH_4 =	1.03E-02	tonne/yr =	2.E-01	tonne CO_2e/yr		
N_2O =	9.74E-03	tonne/yr =	3.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =	3,393

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	0	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	0	miles/ year		EF N_2O =	0.0048	g/mi

CO_2 =	0	tonne/yr				
CH_4 =	0.00E+00	tonne/yr =	0.E+00	tonne CO_2e/yr		
N_2O =	0.00E+00	tonne/yr =	0.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =	0

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	22,920	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	1,833,600	miles/ year		EF N_2O =	0.0048	g/mi

CO_2 =	3,063	tonne/yr				
CH_4 =	9.35E-03	tonne/yr =	2.E-01	tonne CO_2e/yr		
N_2O =	8.80E-03	tonne/yr =	3.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =	3,066

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	18,680	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	1,494,400	miles/ year		EF N_2O =	0.0048	g/mi

CO_2 =	2,497	tonne/yr				
CH_4 =	7.62E-03	tonne/yr =	2.E-01	tonne CO_2e/yr		
N_2O =	7.17E-03	tonne/yr =	2.E+00	tonne CO_2e/yr	Total tonne CO_2e/yr =	2,499

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

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Offsite Equipment and Miscellaneous Trucks

Number of Trucks	2,330	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	186,400	miles/ year		EF N_2O =	0.0048	g/mi

CO_2 =	311	tonne/yr				
CH_4 =	9.51E-04	tonne/yr =	2.E-02	tonne CO_2e/yr		
N_2O =	8.95E-04	tonne/yr =	3.E-01	tonne CO_2e/yr	Total tonne CO_2e/yr =	312

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=	**63,462**