Table C-1
Potrero Hills Energy Producers
Construction Criteria Pollutant Emissions

		Construction Emissions[1]			
Source	Activity	ROG	NOx	PM10 (exhaust)	PM2.5 (exhaust)
	Site Work	5.63	47.64	2.06	1.89
	Paving	3.97	29.70	1.53	1.41
	HDPE Installation	0.64	4.04	0.35	0.32
	Concrete (Foundation)	2.36	18.18	1.12	1.03
LFGE Plant	Building Counstruction	4.29	20.19	1.26	1.16
	Pole Installation	3.69	31.85	1.38	1.27
	Trenching	1.20	2.47	0.27	0.24
	Set pull boxes	0.49	2.87	0.27	0.24
	Compaction	0.26	2.94	0.13	0.12
Distribution Line	Conductors	3.51	31.17	1.17	1.08
Maximum Emissions		9.32	79.49	3.44	3.16
Significance Threshold		54	54	82	82
Exceed Threshold		NO	YES	NO	NO

Notes
(1) Results from URBEMIS runs.

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Users\bchen\Desktop\Current Projects\DTE Potrero\DTE PHEP.urb924

Project Name: DTE PHEP

Project Location: Solano County in Bay Area AD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2012 TOTALS (lbs/day unmitigated)	5.63	47.64	20.00	2.06	22.06	4.18	1.89	6.07

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
Time Slice 1/2/2012-1/13/2012 Active Days: 10	**5.63**	**47.64**	**20.00**	**2.06**	**22.06**	**4.18**	**1.89**	**6.07**
Fine Grading 01/01/2012-01/15/2012	5.63	47.64	20.00	2.06	22.06	4.18	1.89	6.07
Fine Grading Dust	0.00	0.00	20.00	0.00	20.00	4.18	0.00	4.18
Fine Grading Off Road Diesel	5.60	47.59	0.00	2.06	2.06	0.00	1.89	1.89
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.03	0.05	0.00	0.00	0.01	0.00	0.00	0.00

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Time Slice 1/16/2012-1/18/2012 Active Days: 3	3.97	29.70	0.11	1.53	1.64	0.04	1.41	1.44
Asphalt 01/16/2012-01/18/2012	2.53	12.45	0.02	0.79	0.81	0.01	0.73	0.73
Paving Off-Gas	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.44	9.92	0.00	0.68	0.68	0.00	0.63	0.63
Paving On Road Diesel	0.21	2.51	0.01	0.11	0.12	0.00	0.10	0.10
Paving Worker Trips	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading 01/16/2012-01/18/2012	1.44	17.25	0.10	0.74	0.83	0.03	0.68	0.71
Fine Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading On Road Diesel	1.44	17.25	0.10	0.74	0.83	0.03	0.68	0.71
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Time Slice 1/19/2012-1/25/2012 Active Days: 5	0.64	4.04	0.00	0.35	0.35	0.00	0.32	0.32
Trenching 01/19/2012-01/25/2012	0.64	4.04	0.00	0.35	0.35	0.00	0.32	0.32
Trenching Off Road Diesel	0.62	4.02	0.00	0.35	0.35	0.00	0.32	0.32
Trenching Worker Trips	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00

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Time Slice 1/26/2012-2/10/2012 Active Days: 12	2.36	18.18	0.02	1.12	1.14	0.01	1.03	1.03
Asphalt 01/26/2012-02/12/2012	2.11	15.13	0.00	0.99	0.99	0.00	0.91	0.91
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.08	15.10	0.00	0.98	0.98	0.00	0.90	0.90
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Worker Trips	0.02	0.04	0.00	0.00	0.01	0.00	0.00	0.00
Mass Grading 01/26/2012-02/12/2012	0.25	3.04	0.02	0.13	0.15	0.01	0.12	0.13
Mass Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Off Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading On Road Diesel	0.25	3.04	0.02	0.13	0.15	0.01	0.12	0.13
Mass Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Time Slice 2/13/2012-8/31/2012 Active Days: 145	4.29	20.19	0.03	1.26	1.29	0.01	1.16	1.17
Building 02/13/2012-09/02/2012	4.29	20.19	0.03	1.26	1.29	0.01	1.16	1.17
Building Off Road Diesel	4.05	18.30	0.00	1.18	1.18	0.00	1.08	1.08
Building Vendor Trips	0.16	1.75	0.01	0.08	0.09	0.00	0.07	0.07
Building Worker Trips	0.09	0.15	0.01	0.01	0.02	0.01	0.01	0.01

Phase Assumptions

Phase: Fine Grading 1/1/2012 - 1/15/2012 - Site Work

Total Acres Disturbed: 4

Maximum Daily Acreage Disturbed: 1

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Crawler Tractors (147 hp) operating at a 0.64 load factor for 10 hours per day

2 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 10 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 10 hours per day

Phase: Fine Grading 1/16/2012 - 1/18/2012 - Paving Delivery Trucks

Total Acres Disturbed: 0

Maximum Daily Acreage Disturbed: 0

Fugitive Dust Level of Detail: Default

0 lbs per acre-day

On Road Truck Travel (VMT): 680

Off-Road Equipment:

Phase: Mass Grading 1/26/2012 - 2/12/2012 - Concrete (foundation) concrete trucks

Total Acres Disturbed: 0

Maximum Daily Acreage Disturbed: 1

Fugitive Dust Level of Detail: Default

0 lbs per acre-day

On Road Truck Travel (VMT): 120

Off-Road Equipment:

Phase: Trenching 1/19/2012 - 1/25/2012 - HDPE Installation

Off-Road Equipment:

1 Plate Compactors (8 hp) operating at a 0.43 load factor for 10 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 10 hours per day

Phase: Paving 1/16/2012 - 1/18/2012 - Paving

Acres to be Paved: 1

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 6 hours per day

Phase: Paving 1/26/2012 - 2/12/2012 - Concrete (foundation)

Acres to be Paved: 0

Off-Road Equipment:

1 Rubber Tired Dozers (100 hp) operating at a 0.59 load factor for 10 hours per day

1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 10 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 10 hours per day

Phase: Building Construction 2/13/2012 - 9/2/2012 - Masonry/Steel Erection/Piping/Electrical/Equipment Installation

Off-Road Equipment:

1 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 10 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 10 hours per day

1 Forklifts (145 hp) operating at a 0.3 load factor for 10 hours per day

2 Generator Sets (49 hp) operating at a 0.74 load factor for 10 hours per day

2 Welders (45 hp) operating at a 0.45 load factor for 10 hours per day

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Users\bchen\Desktop\Current Projects\DTE Potrero\DTE PHEP TL.urb924

Project Name: DTE PHEP transmission line

Project Location: Solano County in Bay Area AD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2011 TOTALS (lbs/day unmitigated)	3.69	31.85	0.08	1.38	1.39	0.03	1.27	1.27

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
Time Slice 11/1/2011-11/9/2011 Active Days: 7	**3.69**	**31.85**	0.01	**1.38**	**1.39**	0.00	**1.27**	**1.27**
Trenching 11/01/2011-11/09/2011	3.69	31.85	0.01	1.38	1.39	0.00	1.27	1.27
Trenching Off Road Diesel	3.65	31.77	0.00	1.37	1.37	0.00	1.26	1.26
Trenching Worker Trips	0.05	0.08	0.01	0.00	0.01	0.00	0.00	0.01

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Time Slice 11/10/2011-11/22/2011 Active Days: 9	1.20	2.47	0.00	0.27	0.27	0.00	0.24	0.24
Trenching 11/10/2011-11/22/2011	1.20	2.47	0.00	0.27	0.27	0.00	0.24	0.24
Trenching Off Road Diesel	1.19	2.45	0.00	0.26	0.26	0.00	0.24	0.24
Trenching Worker Trips	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Time Slice 11/23/2011-11/25/2011 Active Days: 3	0.49	2.87	0.00	0.27	0.27	0.00	0.24	0.25
Fine Grading 11/23/2011-11/25/2011	0.49	2.87	0.00	0.27	0.27	0.00	0.24	0.25
Fine Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.48	2.86	0.00	0.27	0.27	0.00	0.24	0.24
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Time Slice 11/28/2011-11/30/2011 Active Days: 3	0.26	2.94	0.02	0.13	0.14	0.01	0.12	0.12
Asphalt 11/28/2011-11/30/2011	0.26	2.94	0.02	0.13	0.14	0.01	0.12	0.12
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.14	0.00	0.01	0.01	0.00	0.00	0.00
Paving On Road Diesel	0.23	2.79	0.01	0.12	0.13	0.00	0.11	0.12
Paving Worker Trips	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Time Slice 12/1/2011-12/6/2011 Active Days: 4	3.51	31.17	**0.08**	1.17	1.25	**0.03**	1.08	1.10
Building 12/01/2011-12/06/2011	3.51	31.17	0.08	1.17	1.25	0.03	1.08	1.10
Building Off Road Diesel	2.69	24.34	0.00	0.87	0.87	0.00	0.80	0.80
Building Vendor Trips	0.58	6.43	0.04	0.28	0.33	0.01	0.26	0.27
Building Worker Trips	0.23	0.40	0.04	0.02	0.06	0.01	0.02	0.03

Phase Assumptions

Phase: Fine Grading 11/23/2011 - 11/25/2011 - Set pull boxes

Total Acres Disturbed: 4

Maximum Daily Acreage Disturbed: 0

Fugitive Dust Level of Detail: Default

0 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Cranes (100 hp) operating at a 0.43 load factor for 10 hours per day

Phase: Trenching 11/1/2011 - 11/9/2011 - Erect/Backfill holes

Off-Road Equipment:

1 Bore/Drill Rigs (291 hp) operating at a 0.75 load factor for 2 hours per day

2 Cranes (399 hp) operating at a 0.43 load factor for 2 hours per day

2 Off Highway Trucks (350 hp) operating at a 0.57 load factor for 10 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 10 hours per day

Phase: Trenching 11/10/2011 - 11/22/2011 - Chain trenching

Off-Road Equipment:

1 Trenchers (40 hp) operating at a 0.75 load factor for 8 hours per day

Phase: Paving 11/28/2011 - 11/30/2011 - Compaction

Acres to be Paved: 1

Off-Road Equipment:

1 Plate Compactors (8 hp) operating at a 0.43 load factor for 10 hours per day

Phase: Building Construction 12/1/2011 - 12/6/2011 - Conductors

Off-Road Equipment:

2 Off Highway Trucks (479 hp) operating at a 0.57 load factor for 8 hours per day

Table C-2
Potrero Hills Energy Producers
GHG Emissions for Construction Activities

Diesel	Fuel Use Factor (kg/gal)[1]	GWP
CO2	10.2	1
CH4	0.00144	21
N2O	0.00026	310

			Construction (Metric Tons)			
Source	**Activity**	**CO2 tons[2]**	**CO2**	**CH4**	**N2O**	**CO2e**
	Site Work	23	21	3.0E-03	5.4E-04	21.31
	Paving	6	6	7.9E-04	1.4E-04	5.68
	HDPE Installation	1	1	1.5E-04	2.8E-05	1.10
	Concrete (Foundation)	12	11	1.5E-03	2.8E-04	11.04
	Building Counstruction	195	177	2.5E-02	4.5E-03	179.23
LFGE Plant	Subtotal	238	216	3.0E-02	5.5E-03	218.35
	Pole Installation	15	13	1.9E-03	3.4E-04	13.46
	Trenching	1	1	1.4E-04	2.6E-05	1.04
	Setting pull boxes	0.39	0.35	5.0E-05	9.0E-06	0.36
	Compaction	0.66	0.60	8.5E-05	1.5E-05	0.61
	Conductors	10	9	1.3E-03	2.3E-04	9.28
Distribution Line	Subtotal	27	24	3.5E-03	6.2E-04	24.74
Total		265	240	3.4E-02	6.1E-03	243.08

Notes
(1) Emission factors for diesel fuel use based on CCAR Protocol
(2) From URBEMIS runs, reported in english tons.

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Users\bchen\Desktop\Current Projects\DTE Potrero\DTE PHEP.urb924

Project Name: DTE PHEP

Project Location: Solano County in Bay Area AD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	CO2
2012 TOTALS (tons/year unmitigated)	238.03

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	CO2
2012	238.03
Fine Grading 01/01/2012-01/15/2012	23.23
Fine Grading Dust	0.00
Fine Grading Off Road Diesel	22.72
Fine Grading On Road Diesel	0.00
Fine Grading Worker Trips	0.51

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Asphalt 01/16/2012-01/18/2012	2.08
Paving Off-Gas	0.00
Paving Off Road Diesel	1.41
Paving On Road Diesel	0.60
Paving Worker Trips	0.08
Fine Grading 01/16/2012-01/18/2012	4.11
Fine Grading Dust	0.00
Fine Grading Off Road Diesel	0.00
Fine Grading On Road Diesel	4.11
Fine Grading Worker Trips	0.00
Trenching 01/19/2012-01/25/2012	1.20
Trenching Off Road Diesel	1.07
Trenching Worker Trips	0.13
Asphalt 01/26/2012-02/12/2012	9.13
Paving Off-Gas	0.00
Paving Off Road Diesel	8.67
Paving On Road Diesel	0.00
Paving Worker Trips	0.46
Mass Grading 01/26/2012-02/12/2012	2.90
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	0.00
Mass Grading On Road Diesel	2.90
Mass Grading Worker Trips	0.00

Building 02/13/2012-09/02/2012	195.39
Building Off Road Diesel	147.02
Building Vendor Trips	26.10
Building Worker Trips	22.27

Phase Assumptions

Phase: Fine Grading 1/1/2012 - 1/15/2012 - Site Work

Total Acres Disturbed: 4

Maximum Daily Acreage Disturbed: 1

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Crawler Tractors (147 hp) operating at a 0.64 load factor for 10 hours per day

2 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 10 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 10 hours per day

Phase: Fine Grading 1/16/2012 - 1/18/2012 - Paving Delivery Trucks

Total Acres Disturbed: 0

Maximum Daily Acreage Disturbed: 0

Fugitive Dust Level of Detail: Default

0 lbs per acre-day

On Road Truck Travel (VMT): 680

Off-Road Equipment:

Phase: Mass Grading 1/26/2012 - 2/12/2012 - Concrete (foundation) concrete trucks

Total Acres Disturbed: 0

Maximum Daily Acreage Disturbed: 1

Fugitive Dust Level of Detail: Default

0 lbs per acre-day

On Road Truck Travel (VMT): 120

Off-Road Equipment:

Phase: Trenching 1/19/2012 - 1/25/2012 - HDPE Installation

Off-Road Equipment:

1 Plate Compactors (8 hp) operating at a 0.43 load factor for 10 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 10 hours per day

Phase: Paving 1/16/2012 - 1/18/2012 - Paving

Acres to be Paved: 1

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 6 hours per day

Phase: Paving 1/26/2012 - 2/12/2012 - Concrete (foundation)

Acres to be Paved: 0

Off-Road Equipment:

1 Rubber Tired Dozers (100 hp) operating at a 0.59 load factor for 10 hours per day

1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 10 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 10 hours per day

Phase: Building Construction 2/13/2012 - 9/2/2012 - Masonry/Steel Erection/Piping/Electrical/Equipment Installation

Off-Road Equipment:

1 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 10 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 10 hours per day

1 Forklifts (145 hp) operating at a 0.3 load factor for 10 hours per day

2 Generator Sets (49 hp) operating at a 0.74 load factor for 10 hours per day

2 Welders (45 hp) operating at a 0.45 load factor for 10 hours per day

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Users\bchen\Desktop\Current Projects\DTE Potrero\DTE PHEP TL.urb924

Project Name: DTE PHEP transmission line

Project Location: Solano County in Bay Area AD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	CO2
2011 TOTALS (tons/year unmitigated)	26.97

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	CO2

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2011	26.97
Trenching 11/01/2011-11/09/2011	14.67
Trenching Off Road Diesel	14.14
Trenching Worker Trips	0.54
Trenching 11/10/2011-11/22/2011	1.13
Trenching Off Road Diesel	1.01
Trenching Worker Trips	0.12
Fine Grading 11/23/2011-11/25/2011	0.39
Fine Grading Dust	0.00
Fine Grading Off Road Diesel	0.35
Fine Grading On Road Diesel	0.00
Fine Grading Worker Trips	0.04
Asphalt 11/28/2011-11/30/2011	0.66
Paving Off-Gas	0.00
Paving Off Road Diesel	0.03
Paving On Road Diesel	0.60
Paving Worker Trips	0.04
Building 12/01/2011-12/06/2011	10.12
Building Off Road Diesel	6.24
Building Vendor Trips	2.38
Building Worker Trips	1.50

Phase Assumptions

Phase: Fine Grading 11/23/2011 - 11/25/2011 - Set pull boxes

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Total Acres Disturbed: 4

Maximum Daily Acreage Disturbed: 0

Fugitive Dust Level of Detail: Default

0 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Cranes (100 hp) operating at a 0.43 load factor for 10 hours per day

Phase: Trenching 11/1/2011 - 11/9/2011 - Erect/Backfill holes

Off-Road Equipment:

1 Bore/Drill Rigs (291 hp) operating at a 0.75 load factor for 2 hours per day

2 Cranes (399 hp) operating at a 0.43 load factor for 2 hours per day

2 Off Highway Trucks (350 hp) operating at a 0.57 load factor for 10 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 10 hours per day

Phase: Trenching 11/10/2011 - 11/22/2011 - Chain trenching

Off-Road Equipment:

1 Trenchers (40 hp) operating at a 0.75 load factor for 8 hours per day

Phase: Paving 11/28/2011 - 11/30/2011 - Compaction

Acres to be Paved: 1

Off-Road Equipment:

1 Plate Compactors (8 hp) operating at a 0.43 load factor for 10 hours per day

Phase: Building Construction 12/1/2011 - 12/6/2011 - Conductors

Off-Road Equipment:

2 Off Highway Trucks (479 hp) operating at a 0.57 load factor for 8 hours per day

Table C-3
Potrero Hills Energy Producers
Operational Emissions
Scenario: Project as proposed

Process	Daily Emissions (lbs/day)				Annual Emissions (tpy)			
	ROG	NOx	PM10	PM2.5	ROG	NOx	PM10	PM2.5
Generator	114	425	51	51	21	78	9	9
Flare	0.27	2	6	6	0.05	0.35	1	1
Offsets	-114	-427	0	0	-21	-78	0	0
Baseline	0.48	65	16	16	0.09	12	3	3
Difference	-0.48	-65	41	41	-0.09	-12	7	7
Significance Threshold	54	54	82	54	10	10	15	10
Exceed?	NO	NO	NO	NO	NO	NO	NO	NO

Notes:

(1) Results based on attached calculations

(2) Baseline estimated from various landfill sources (see following table)

(3) BAAQMD Regulation 2-2-302 will require offsets for all NOx and POC emission increases at the PHEP facility (POC and ROG include the same set of compounds), because the PHEP facility will emit more than 10 tons/year each of NOx and POC. The emission reduction credits (ERC) that will be used to offset the NOx and ROG emission increases must be supplied for the entire cumulative emission increase (CEI) at the PHEP site at a ratio of at least 1.0 tons/year of ERC per 1.0 tons/year of CEI.

Table C-4
Potrero Hills Energy Producers
Operational Emissions
Scenario: Project with SCR

Process	Daily Emissions (lbs/day)				Annual Emissions (tpy)			
	ROG	NOx	PM10	PM2.5	ROG	NOx	PM10	PM2.5
Generator	114	107	51	51	21	19	9	9
Flare	0.27	2	6	6	0.05	0.35	1	1
Offsets	-114	-109	0	0	-21	-19	0	0
Baseline	0.48	65	16	16	0.09	12	3	3
Difference	-0.48	-65	41	41	-0.09	-12	7	7
Significance Threshold	54	54	82	54	10	10	15	10
Exceed?	NO	NO	NO	NO	NO	NO	NO	NO

Notes:

(1) Results based on attached calculations

(2) Baseline estimated from various landfill sources (see following table)

(3) BAAQMD Regulation 2-2-302 will require offsets for all NOx and POC emission increases at the PHEP facility (POC and ROG include the same set of compounds), because the PHEP facility will emit more than 10 tons/year each of NOx and POC. The emission reduction credits (ERC) that will be used to offset the NOx and ROG emission increases must be supplied for the entire cumulative emission increase (CEI) at the PHEP site at a ratio of at least 1.0 tons/year of ERC per 1.0 tons/year of CEI.

Potrero Hills Energy Producers
Landfill Gas Generator Emissions

Equipment:		Caterpillar G3520 Series Engine - Model
Fuel Type:		Landfill Gas
Brake Horsepower:	2,233.0	bhp @ 1600 RPM (60 hz), full standby [2]
Gas Usage per Unit: [1]	600	scfm, not to exceed
% Methane gas [3]	46	
Landfill gas Heating Value:	500	Btu/scf, from CAT spec
Fuel Consumption:	6,354	BTU/bhp-hr, from CAT spec
Annual Op. Hours:	8,760	hrs/yr

								Lean Burn Engine	
Pollutant	**Emission Factors**	**Units**	**Notes**	**Hourly Emissions (lb/hr)**	**Hourly Emissions 6 Units (lb/hr)**	**Daily Emissions per unit (lb/day)**	**Daily Emissions 6 units (lb/day)**	**Annual Emissions (tpy)**	**Annual Emissions 6 Units (tpy)**
Criteria Pollutants									
PM10	0.072	g/bhp-hr	(4)	0.35	2.13	8.51	51.04	1.55	9.30
PM2.5	0.072	g/bhp-hr	(4)	0.35	2.13	8.51	51.04	1.55	9.30
NO_X	0.6	g/bhp-hr	(5)	2.95	17.70	70.80	424.80	12.92	77.52
NOx with SCR	0.15	g/bhp-hr	(5)	0.74	4.44	17.76	106.56	3.24	19.44
SO_2	1.83	lb/hr	(6)	1.83	10.96	43.85	263.10	8.00	48.00
POC	0.16	g/bhp-hr	(5)	0.79	4.74	18.96	113.76	3.46	20.76

Notes:

(1) Assumes gas flow rate is 600 dscf. Per min

(2) Design horsepower and fuel usage from vendor specifications (see attached).

(3) Laboratory analysis of landfill gas at flare inlet. At 2.9% oxygen.

(4) Emission factors based on testing from similar equipment. PM mostly less than PM2.5, therefore, PM EF can be used for estimation of PM10 or PM2.5.

(5) Emission factors provided by vendor.

(6) SO_2 calculated based upon landfill gas analysis of sulfur containing compounds. H_2S based on 90% removal of H_2S prior to engine inlet.

Potrero Hills Energy Producers
TNMOC Calculations

TNMOC Compound (Inlet Gas)	HAP	CAS No.	MW	Sample 1	Sample 2	Engine Inlet Concentration[1]			Inlet Gas Flow Rate	Inlet Mass Flow Rate	DRE[3] (%)	Outlet Emission Rate (One Engine)		Outlet Emission Rate (Six Engines)	
				ppbv	ppbv	ppmv	mg/m^3	lb/ft^3	ft^3/hr	lb/hr		lb/hr	lb/yr	lb/hr	lb/yr
Formaldehyde[4]	Yes	50-00-0	30.03			---	---	---	36,000	---	---	0.25	2,190	1.5	13,140
Hydrogen chloride	Yes											0.019	166	0.11	997
Hydrogen sulfide	No											0.095	835	5.7E-01	5,010
Vinyl Chloride	Yes	79-01-4	62.498	180	170	0.175	0.455	2.8E-08	36,000	1.0E-03	99.5%	5.1E-06	0.0	3.1E-05	0.3
2-Propanol	No	67-63-0	60.1	15000	14000	14.50	36.23	2.3E-06	36,000	8.1E-02	99.5%	4.1E-04	3.6	2.4E-03	21.4
Hexane	Yes	110-54-3	86.18	530	620	0.58	2.06	1.3E-07	36,000	4.6E-03	99.5%	2.3E-05	0.2	1.4E-04	1.2
MEK	No	78-93-3	72.11	18000	17000	17.50	52.47	3.3E-06	36,000	1.2E-01	99.5%	5.9E-04	5.2	3.5E-03	31.0
Benzene	Yes	71-43-2	78.11	1000	960	0.98	3.18	2.0E-07	36,000	7.2E-03	99.5%	3.6E-05	0.3	2.1E-04	1.9
1,1,1-Trichoroethane	Yes	71-55-6	133.4	160	140	0.15	0.83	5.2E-08	36,000	1.9E-03	99.5%	9.3E-06	0.1	5.6E-05	0.5
MIBK	Yes	108-10-1	100.2	1200	1100	1.15	4.79	3.0E-07	36,000	1.1E-02	99.5%	5.4E-05	0.5	3.2E-04	2.8
Toluene	Yes	108-88-3	92.14	13000	12000	12.50	47.89	3.0E-06	36,000	1.1E-01	99.5%	5.4E-04	4.7	3.2E-03	28.3
Tetrachloroethane	No	79-34-5	167.85	310	320	0.32	2.20	1.4E-07	36,000	4.9E-03	99.5%	2.5E-05	0.2	1.5E-04	1.3
Chlorobenzene	Yes	108-90-7	112.56	110	93	0.10	0.48	3.0E-08	36,000	1.1E-03	99.5%	5.3E-06	0.0	3.2E-05	0.3
Ethyl Benzene	Yes	100-41-4	106.167	5200	4900	5.05	22.29	1.4E-06	36,000	5.0E-02	99.5%	2.5E-04	2.2	1.5E-03	13.2
Xylene (all isomers)	Yes	1330-20-7	106.16	13200	12400	12.80	56.50	3.5E-06	36,000	1.3E-01	99.5%	6.3E-04	5.6	3.8E-03	33.4
1,4-Dichlorobenzene	Yes	106-46-7	146.992	600	550	0.58	3.51	2.2E-07	36,000	7.9E-03	99.5%	3.9E-05	0.3	2.4E-04	2.1
Carbon Disulfide	Yes	75-15-0	76.139	73	74	0.07	0.23	1.5E-08	36,000	5.2E-04	99.5%	2.6E-06	0.0	1.6E-05	0.1
Total HAPs	**---**	**---**	**---**			**---**	**---**	**---**	**---**	**---**		**0.27**	**2,370**	**1.62**	**14,221**
Total HAPs (tons/yr)													**1.19**		**7.11**

ppmv = (mg/m3) * (24.05/mw)

(1) TNMOC concentration of flare inlet gas from laboratory analysis. Samples collected 11/10/09 and analyzed by 11/18/09.
(2) TNMOC concentration of flare inlet gas from laboratory analysis, reported as Heptane. Samples collected 11/10/09 and analyzed by 11/16/09.
(3) Used 99.5% control to represent combined control efficiency of combustion and use of oxidation catalyst
(4) Formaldehyde not present in sampled LFG (i.e., engine inlet). It is present in the outlet gas only. Emissions estimated based on manufacturer's specification (0.5 g/bhp·hr).

Potrero Hills Energy Producers
Chlorinated Compound Calculations

Cl Compound (Inlet Gas)	CAS No.	MW	Chlorine Weight	Sample 1	Sample 2	Engine Inlet Concentration[1]			Inlet Gas Flow Rate	Inlet Mass Flow Rate	Inlet Chlorine Mass Flow Rate	**One Engine** Outlet Emission Rate (as HCl)	**Six Engines** Outlet Emission Rate (as HCl)	**Six Engines** Outlet Emission Rate (as HCl)
				ppbv	ppbv	ppmv	mg/m^3	lb/ft^3	ft^3/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/year
Freon 12	75-71-8	120.91	70.91	920	960	0.94	4.73	3.0E-07	36,000	1.1E-02	6.2E-03	6.4E-03	3.8E-02	337
Vinyl Chloride	79-01-4	62.498	35.45	180	170	0.18	0.45	2.8E-08	36,000	1.0E-03	5.8E-04	6.0E-04	3.6E-03	31
cis-1,2-Dichloroethane	107-06-2	98.96	70.91	290	260	0.28	1.13	7.1E-08	36,000	2.5E-03	1.8E-03	1.9E-03	1.1E-02	98
Trichoroethene	71-55-6	133.4	106.36	160	140	0.15	0.83	5.2E-08	36,000	1.9E-03	1.5E-03	1.5E-03	9.2E-03	81
Tetrachloroethene	79-34-5	167.85	141.81	310	320	0.32	2.20	1.4E-07	36,000	4.9E-03	4.2E-03	4.3E-03	2.6E-02	226
Chlorobenzene	108-90-7	112.56	35.45	110	93	0.10	0.48	3.0E-08	36,000	1.1E-03	3.4E-04	3.5E-04	2.1E-03	18
1,4-Dichlorobenzene	106-46-7	146.992	70.91	600	550	0.58	3.51	2.2E-07	36,000	7.9E-03	3.8E-03	3.9E-03	2.4E-02	206
Total HCl	**7647-01-0**	**36.453**	**35.45**			**---**	**---**	**8.3E-07**	**---**	**---**	**---**	**0.019**	**0.11**	**997**

ppmv = (mg/m3) * (24.05/mw)

(1) TNMOC concentration of flare inlet gas from laboratory analysis. Samples collected 11/10/09 and analyzed by 11/18/09.
(2) TNMOC concentration of flare inlet gas from laboratory analysis, reported as Heptane. Samples collected 11/10/09 and analyzed by 11/16/09.
(3) AP-42 Table 2.4-3 - NMOC typical control efficiency of landfill gas using an IC engine. Range is 94 to 99% control.
(4) Emission factors from AP-42, Tables 2.4-1 and 2.4-3. Control efficiencies for Halogenated 93%, Non Halogenated 86.1%, NMOC 97.2%.

Potrero Hills Energy Producers
Sulfur Calculations

Sulfur Compound (Inlet Gas)	MW	Engine Inlet Concentration			Gas Flow Rate	Mass Flow Rate	Mass Flow Sulfur	Mass Flow as Sulfur Dioxide
		ppmv	mg/m^3	lb/ft^3	ft^3/hr	lb/hr	lb/hr	lb/hr
Hydrogen Sulfide[5]	34	300	424.12	2.6E-05	36,000	0.095	0.897	1.79
Methyl Mercaptan	48.1	2.0	4.00	2.5E-07	36,000	0.009	0.006	0.012
Dimethyl Sulfide	62	3.5	9.02	5.6E-07	36,000	0.020	0.010	0.021

Sulfur Compound (Outlet Gas)	MW	Mass Flow	Exhaust Flow	Engine Outlet Concentration		
		lb/hr	ft^3/hr	lb/ft^3	mg/m^3	ppmv
Sulfur Dioxide	64	1.83	759,600	2.4E-06	38.53	14.48

ppmv = (mg/m3) * (24.05/mw)

(1) Worst-case sulfur gas concentration assumed.
(2) Data from generator set specifications for G3520 CAT spark ignition engine.
(3) Sulfur dioxide calculated by assuming that all elemental sulfur is converted to SO2.
(4) SO2 has molecular wt = 64
(5) Assumes 90% destruction of H2S

Engine Size (3)	2233	bhp
Stack Diameter (3)	16	Inches
Stack Area (4)	0.1297	m^2
Stack Exit Velocity (3)	151	ft/sec
	46.06	m/s
Stack Exit Flow Rate (3)	5.97	m^3/s

Potrero Hills Energy Producers
Ammonia Slip from Optional SCR Project Component

Ammonia Calculations:				Reference
Stack Exhaust Mass Flow (1 engine)		12,660	cfm	Caterpillar spec sheet
Stack Exhaust Mass Flow (6 engines)		75,960	cfm	
Exhaust temperature		758	deg F	Caterpillar spec sheet
	=	1,218	deg R	
Exhaust Gas H2O %		10%		Engineering estimate
Stack Exhaust Mass Flow (6 engines)		29,644	dscfm	
Ammonia conc.		10.0	ppmvd @ 15% O2	BAAQMD ammonia slip limit
Exhaust Gas O2 Volume % Dry		10.3%		Caterpillar spec sheet
Ammonia conc.		18.0	ppmvd uncorr.	
Ammonia Molecular Weight		17	lb/lb-mol	

	lb/hr	**lb/year**
Ammonia emissions	1.41	12,343

Potrero Hills Energy Producers
Flare Calculations

Flare heat input	3.2	MMBtu/hr
Flare gas usage	6,400	ft3/hour
	107	scfm

	Emission Factor	Notes	Hourly Emissions	Daily Emissions	Annual Emissions	Annual Emissions
	lb/MMBtu		lb/hr	lb/day	lb/year	tons/yr
PM10		(1)	0.252	6.06	2,211	1.11
PM2.5		(1)	0.252	6.06	2,211	1.11
NO_X	0.025	(2)	0.080	1.92	701	0.35
CO	0.060	(2)	0.192	4.61	1,682	0.84
SO_2	0.102	(3)	0.325	7.80	2,845	1.42
POC	0.003	(4)	0.010	0.25	90	0.05

Notes:

1. PM emissions calculated from siloxane regeneration system (attached)
2. NOx and CO factors from flare manufacturer (John Zinc)
3. SO2 emission factor calculated from LFG data, assumes conversion of all sulfur to SO2.
4. POC emission factor calculated from LFG data, assumes 98% destruction of POC in landfill gas

Potrero Hills Energy Producers

Calculation of PM emissions from siloxane removal system flare

Raw Biogas @ Venture gas conditioning system skid inlet

Siloxanes	≤	50	mg/m^3
Total NMOCs	≤	2,000	mg/m^3
Hydrogen Sulfide (H_2S)	≤	75	ppmv
Operational Days/year		350	days
Flow Rate		1,700	scfm

STEP 1 - Convert H_2S to mg/m^3

Use the formula - **$mg/m^3 = (ppmv)(12.187)(MW) / (273.15 + °C)$**

MW = 34.08

ppmv = 75

Temp. = 25^oC

$mg/m^3 = (X\ ppmv)(12.187)(34.08) / (273.15 + 25)$

mg/m^3 = 104.48

STEP 2 - Convert scfm to scfd

Convert standard cubic feet per minute to standard cubic feet per day gives you the total flow rate through the vessel prior to a regen taking place

Based on flow rate provided above:

1,700 standard cubic feet/minute x 60 minutes/hr x 24 hours/day = 2,448,000 ft^3/day

Daily Flow Rate of LFG = 2,448,000 ft^3/day

Potrero Hills Energy Producers

Calculation of PM emissions from siloxane removal system flare

STEP 3 - Convert mg/m^3 to lb/ft^3 and calculate daily mass loading

Assume: 1 mg/m^3 = 6.243E-08 lb/ft^3

	mg/m^3	lb/ft^3	Daily Mass Loading (lb/day)
Siloxanes	50	3.12E-06	7.64
Total NMOCs	2,000	1.25E-04	305.66
Hydrogen Sulfide (H_2S)	104.48	6.52E-06	15.97

STEP 4 - Calculate amount adsorbed on a daily basis

	Daily Mass Loading (lb/day)	Conservative Removal Estimate	Average Removal Estimate
Siloxanes	7.64	7.60	7.53
Total NMOCs	305.66	275.09	213.96
Hydrogen Sulfide (H_2S)	15.97	14.37	11.18

Assume:
99.50% removal for Siloxanes as a conservative estimate
98.50% removal for Siloxanes as an average estimate
90% removal as a conservative estimate
70% removal as an average estimate

STEP 5 - Calculate amount contributed from LFG fuel stream to flare during regen

	lb/ft^3	Mass Contrib During Regen [(1)] (lb/regen)
Siloxanes	3.12E-06	1.02
Total NMOCs	1.25E-04	40.75
Hydrogen Sulfide (H_2S)	6.52E-06	2.13

(1) - assumes 8 hours of regen cycle, 5 hours hot, 3 hours cooling. Regen flowrate set at 40% of process gas flow.

680 standard cubic feet/minute x 60 minutes/hr x 8 hours/day = 326,400 ft^3/regen cycle of air flow

Potrero Hills Energy Producers

Calculation of PM emissions from siloxane removal system flare

STEP 6 - Calculate total combined contribution to the flare during regen (total lbs/regen)

	Conservative	Average
Siloxanes	8.62	8.55
Total NMOCs	315.85	254.71
Hydrogen Sulfide (H_2S)	16.50	13.31

STEP 7 - Calculate total potential pounds of emissions per regen (assuming 98% destruction efficiency of flare)

	Conservative lbs/regen	Average lbs/regen
Siloxanes	0.17	0.17
Total NMOCs [(2)]	6.32	5.09
Hydrogen Sulfide (H_2S)	0.33	0.27

Calculation assumes a flare destruction efficiency equal to 98.00%

(2) - The total shown for Total NMOCs includes the siloxanes contribution

STEP 8 - Total potential pounds of emissions per year (assuming 98% destruction efficiency of flare)

	Conservative lbs/year	Average lbs/year
Estimated PM emissions per year (2):	2,211	1,783

(2) - The total shown for Total NMOCs includes the siloxanes contribution

Table C-5
Potrero Hills Energy Producers
Baseline Flare Emissions

Flare heat input[1]	38.7	MMBTU/hr
Flare gas usage[1]	1380	dscfm
% Methane gas	46%	
Annual operating hours	8760	hours/yr

				Emissions		
Pollutant	**Emission Factor**	**Units**	**Source**	**lbs/hr**	**lbs/day**	**tpy**
PM10	17	lb/10^6 dscf CH4	AP-42[2]	0.65	16	3
PM2.5	17	lb/10^6 dscf CH4	AP-42[2]	0.65	16	3
NOx	0.07	lbs/MMBTU	Permit application[3]	2.709	65	12
VOC	0.02	lbs/hr	Annual test[1,4]	0.02	0.48	0.088

Notes:

(1) Based on results from Potrero Hills Landfill 2010 annual report.

(2) Emission factors from USEPA AP-42, Table 2.4-5 for flares. PM mostly less than PM2.5, therefore, PM EF can be used for estimation of PM10 or PM2.5.

(3) Emission factor provided by manufacturer (John Zinc) in permit application for existing flare.

(4) Estimated from NMOC.

Table C-6
Potrero Hills Energy Producers
Localized CO Concentrations

Timeframe	Emission Rate (lbs/hr)[1]		Dispersion Factor (ug/m3 per lbs/hr) [2]		Concentration from Source[3]		Background[4]	Total Concentration
	Six Engines	Flare	Six Engines	Flare	ug/m3	ppm	ppm	ppm
1-HR	106.32	0.192	8.79	42.8	942.7704	0.82338026	3.3	4.12
8-HR	106.32	0.192	8.79	42.8	848.49336	0.74104224	2.7	3.44

Notes
(1) Appendix D, air permit
(2) Appendix E, air permit
(3) Assumes 8-hr concentrations are approximately 90% of the 1-hr concentrations
(4) AirData for Vallejo (2007-2008)

AirData

EPA is assessing its data systems, including AirData reports and maps. Data updates are suspended while the assessment is underway. The last update included data through January 10, 2009; see database status for details. For more recent air quality data, visit the AirExplorer and Air Emission Sources sites.

Monitor Values Report - Criteria Air Pollutants

Geographic Area: Solano Co, CA
Pollutant: Carbon Monoxide
Year: 2007, 2008

EPA Air Quality Standards:
Carbon Monoxide: 35 ppm (1-hour average), 9 ppm (8-hour average)

ppm = parts per million

4 Rows
See Disclaimer

	CO (ppm)												
	1-Hour Values				8-Hour Values			Monitor Number	Year	Site Address	City	County	State
Row #	# Obs	1st Max	2nd Max	# Exceed	1st Max	2nd Max	# Exceed						
SORT													
1	6,273	1.1	0.9	0	0.6	0.6	0	1	2007	E Second St, Benicia	Benicia	Solano Co	CA
2	8,306	3.3	3.3	0	2.7	2.6	0	1	2007	304 Tuolumne St., Vallejo	Vallejo	Solano Co	CA
3	6,251	0.9	0.9	0	0.7	0.6	0	1	2008	E Second St, Benicia	Benicia	Solano Co	CA
4	6,230	2.7	2.5	0	1.9	1.7	0	1	2008	304 Tuolumne St., Vallejo	Vallejo	Solano Co	CA
Grand Total				0			0		2007				
				0			0		2008				

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AirData - Monitor Values Report - Criteria Air Pollutants
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Disclaimer: AirData reports are produced from a monthly extract of EPA's air pollution database, AQS. Data for this report were extracted on January 10, 2009. They represent the best information available to EPA from state agencies on that date. However, some values may be absent due to incomplete reporting, and some values subsequently may be changed due to quality assurance activities. The AQS database is updated daily by state and local organizations who own and submit the data. Please contact the pertinent state agency to report errors.

Readers are cautioned not to infer a qualitative ranking order of geographic areas based on AirData reports. Air pollution levels measured in the vicinity of a particular monitoring site may not be representative of the prevailing air quality of a county or urban area. Pollutants emitted from a particular source may have little impact on the immediate geographic area, and the amount of pollutants emitted does not indicate whether the source is complying with applicable regulations.

Table C-7
Potrero Hills Energy Producers
GHGs Calculations for Proposed Project

Landfill gas Heating Value:	456	Btu/scf, from CAT spec
Gas Usage per Unit (engine):	600	scfm, not to exceed
Engine fuel input	16.42	MMBtu/hr
Flare heat input	3.2	MMBtu/hr
Flare gas usage	7,018	ft3/hr
% Methane gas	46%	
Methane density	0.0423	lb/scf
CO_2 density	0.115	lb/scf

				Generators					Flare				TOTAL		
	Emission Factor	**Notes**	**Global Warming Potential**	**CH_4 Destruction Efficiency**	**Annual Emissions**	**Annual Emissions (6 units)**	**Annual Emissions (6 units)**	**CO2e**	**CH_4 Destruction Efficiency**	**Annual Emissions**	**Annual Emissions**	**CO2e**	**Annual Emissions**	**Annual CO_2eq Emissions**	**Annual CO_2eq Emissions**
	kg/MMBtu				tons/year	tons/year	MT/yr	MT/yr		tons/year	MT/yr	MT/yr	tons/year	tons/year	metric tonnes/year
CO_2		(1), (2)	1	98.0%	8,174	49,047	44,494	44,494	99.5%	1,618	1,468	1,468	50,665	50,665	45,962
CH_4		(1), (2)	21	98.0%	61	368	334	7,014	99.5%	3.0	3	57	371	7,795	7,071
N_2O	0.0001	(2)	310		0.016	0.095	0.09	27		0.0031	0.0028	1	0.098	30.4	28
TOTAL								**51,534.96**				**1,525.52**		**58,489**	**53,060**

Notes:

(1) Methane destruction efficiency for engine with oxidation catalyst estimated based on past experience. Methane destruction efficiency for flare from Table C.3 of Climate Action Reserve "Landfill Project Protocol - Collecting and Destroying Methane from Landfills," Version 3.0, December 2, 2009.

(2) Emission factor for N2O from landfill gas combustion and global warming potentials for individual species (CH4: 21 and N2O: 310) from the California GHG Mandatory Reporting Rule (17 CCR 95100 to 95133), Appendix A.

Table C-8
Potrero Hills Energy Producers
GHGs Calculations for Existing Flare

Flare heat input	38.7	MMBtu/hr
Flare gas usage	1,380	dscfm
% Methane gas	46%	
Methane density	0.0423	lb/scf
CO_2 density	0.115	lb/scf

	Emission Factor	Notes	Global Warming Potential	CH_4 Destruction Efficiency	Hourly Emissions	Annual Emissions	CO2e
	kg/MMBtu				lb/hr	MT/yr	MT/yr
CO_2		(1), (2)	1	99.5%	73	289	289
CH_4		(1), (2)	21	99.5%	0.13	1	11
N_2O	0.0001	(2)	310		0.009	0.0339	11
TOTAL							**310.33**

Notes:

(1) Methane destruction efficiency for engine with oxidation catalyst estimated based on past experience. Methane destruction efficiency for flare from Table C.3 of Climate Action Reserve "Landfill Project Protocol - Collecting and Destroying Methane from Landfills," Version 3.0, December 2, 2009.

(2) Emission factor for N2O from landfill gas combustion and global warming potentials for individual species (CH4: 21 and N2O: 310) from the California GHG Mandatory Reporting Rule (17 CCR 95100 to 95133), Appendix A.

Summary Results

Project Name: DTE PHEP

Project and Baseline Years: 2012 N/A

Results	Unmitigated Project-Baseline CO2e (metric tons/year)	Mitigated Project-Baseline CO2e (metric tons/year)
Transportation:	2.39	2.39
Area Source:	0.00	0.00
Electricity:	30.63	30.63
Natural Gas:	3.26	3.26
Water & Wastewater:	0.03	0.46
Solid Waste:	2.48	2.48
Agriculture:	0.00	0.00
Off-Road Equipment:	0.00	0.00
Refrigerants:	0.00	0.00
Sequestration:	N/A	0.00
Purchase of Offsets:	N/A	0.00
Total:	38.77	39.20

Baseline is currently: **OFF**

Baseline Project Name:

Go to Settings Tab to Turn On Baseline

DTE Energy

DTE Energy Resources

MEMO

To: Tom Durham

From: Steve Zervas

Date: May 13, 2011

Subject: Potrero Hills Energy Producers, LLC, Suisun City, California, PM2.5 Modeling Results

---

As an addendum to the earlier modeling report for Health Risk Assessment (HRA), I have modeled PM2.5 emissions from the proposed six landfill gas fired engines and Siloxane Regenerative Flare at the Potrero Hills Landfill. All previous model settings and protocols were followed. Only the receptors were changed. All previous receptors were replaced with small Cartesian grids centered on each nearby residential property. These grids are generally 100 x 100 meters with 10 meter spacing. One grid is 150 x 150 meters with 10 meter spacing and covers two residences.

The results from 5 years of met data showed that the maximum annual impact from the engines and the flare are located on the same grid. To identify this grid, it is circled in red in the attached figure. Even though the high engine and the high flare impacts are located in the same grid, they are not located at the same receptor. This difference is ignored in calculating the maximum combined impact for both the engines and the flare.

AERMOD was used to estimate the highest ambient air concentration of PM2.5 at or around the nearby residences. The following table presents the maximum predicted annual impacts. These values are compared to the 0.3 µg/m^3 PM2.5 Significant Impact Level (SIL) used by the Agency.

Table 2 – Modeled Impacts and RELs

Met Data	Emission Rates (lb/hr)		Modeled Impact (µg/m^3)	Modeled Impact (µg/m^3)	Modeled Impact (µg/m^3)	SIL (µg/m^3)
	Flare	Engines	Flare	Enignes	Combined	Annual
2004	0.252	0.8	0.046	0.78	0.125	0.3
2005	0.252	0.8	0.059	0.91	0.150	0.3
2006	0.252	0.8	0.048	0.76	0.124	0.3
2007	0.252	0.8	0.057	0.94	0.151	0.3
2008	0.252	0.8	0.050	0.8	0.130	0.3

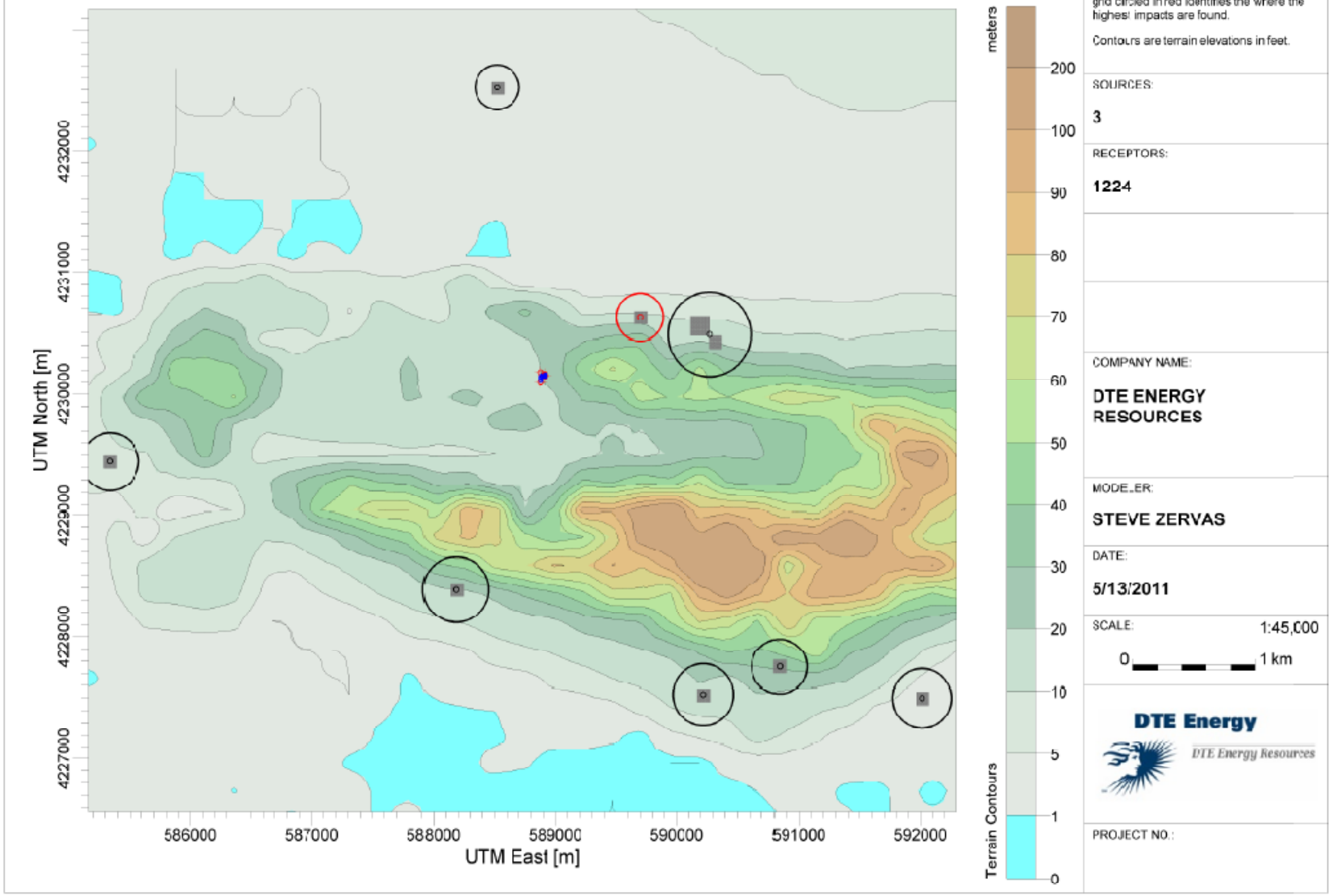
DTE Energy

DTE Energy Resources

PROJECT TITLE:

Potrero Hills Energy Producers, LLC - Annual PM2.5

Nearby Residential Receptor Grids



COMMENTS:

Gray boxes are receptor grids centered on each nearby residential property. The circles help locate each of the grids. The grid circled in red identifies the where the highest impacts are found.

Contours are terrain elevations in feet.

SOURCES:

3

RECEPTORS:

1224

COMPANY NAME:

DTE ENERGY RESOURCES

MODELER:

STEVE ZERVAS

DATE:

5/13/2011

SCALE: 1:45,000

0 1 km

DTE Energy

DTE Energy Resources

PROJECT NO.:

AERMOD View - Lakes Environmental Software

C:\Users\u16020\Documents\Models\PHAERMOD 3-4\PM25\7Res.isc

DTE Energy

DTE Energy Resources

PROJECT TITLE:

Potrero Hills Energy Producers, LLC - Annual PM2.5
Nearby Residential Receptor Grids - Maximum Engine Impacts

COMMENTS:

Maximum impact over all grids is shown in red.

Maximum Impact is for unit emission rate (1.0 lb/hr) from all six engines

SOURCES:

3

RECEPTORS:

1224

OUTPUT TYPE:

Concentration

MAX:

0.11795 ug/m^3

COMPANY NAME:

DTE ENERGY RESOURCES

MODELER:

STEVE ZERVAS

DATE:

5/13/2011

SCALE: 1:1,000

0 0.02 km

DTE Energy

DTE Energy Resources

PROJECT NO.:

AERMOD View - Lakes Environmental Software

C:\Users\u16020\Documents\Models\PHAERMOD 3-4\PM25\7Res.isc

DTE Energy

DTE Energy Resources

PROJECT TTLE:

Potrero Hills Energy Producers, LLC - Annual PM2.5
Nearby Residential Receptor Grids - Maximum Flare Impacts

COMMENTS:

Maximum impact over all grids is shown in red.

Maximum Impact is for unit emission rate (1.0 lb/hr) from the Siloxane Regen Flare

SOURCES:

3

RECEPTORS:

1224

OUTPUT TYPE:

Concentration

MAX:

0.22616 ug/m^3

COMPANY NAME:

DTE ENERGY RESOURCES

MODELER:

STEVE ZERVAS

DATE:

5/13/2011

SCALE: 1:1,000

0 0.02 km

DTE Energy

DTE Energy Resources

PROJECT NO.:

AERMOD View - Lakes Environmental Software

C:\Users\u16020\Documents\Models\PHAERMOD 3-4\PM25\7Res.isc

POTRERO HILLS LANDFILL
P.O. Box 68
Fairfield, CA 94533
T: 707-432-4621
F: 707-432-4630

August 26, 2010

TO: Compliance and Enforcement Division

TO: Source Test Section

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

Re: **ANNUAL SOURCE TEST, LANDFILL GAS FLARE**
Potrero Hills Landfill, Plant Site #A2039

Dear Sir:

We are pleased to submit the enclosed Annual Source Test (electronic and paper copy) for the landfill gas flare at the Potrero Hills Landfill. This submittal is to comply with Conditions 11 and 12 of the Permit To Operate (PTO) for Plant # A2039 (Potrero Hills Landfill).

The enclosed Compliance Source Emissions Test Report documents the annual test that was conducted on July 29, 2010. This is within the allowable period of less than 12 months from the prior test date of August 10, 2009. The Report includes the required information (Condition 11) as specified in the PTO and a characterization of the landfill gas (Condition 12).

We are available to respond to any questions concerning the data in this report. If you should have any questions about any of the information presented above, please feel free to call me at (707)-432-4621.

Sincerely,

James E. Dunbar, P.E.
District Manager

Attachment

Cc: Tom Reilly, Waste Connections, Inc.
Michael O'Connor, SCS Engineers
Marcy Hannum, Solano County/LEA, Department of Resource Management

Blue Sky Environmental, LLC
624 San Gabriel Ave
Albany, California 94706
510 525 1261 ph/fax
510 508 3469 cell
blueskyenvironmental@yahoo.com

August 23rd, 2010

Potrero Hills Landfill Inc.,
A District of Waste Connections, Inc
PO Box 68
Fairfield, CA 94533

Attn: Bruce Pope

Subject: Source test emission report for one Flare (A-2) located at Potrero Hills Landfill at 3675 Potrero Hills Lane, Suisun, California. BAAQMD Facility #A2039. Permit Condition 1948, part 11 and 12.

Test Date(s): July 29th, 2010.

Sampling Location: The flare is equipped with a fixed vertical ladder that was used to access the flare exit. Sampling was conducted using a stainless steel hook-style probe that was placed so that the tip was fixed near the center of the flare.

Sampling Personnel: Sampling was performed by Guy Worthington and Morgan Worthington of Blue Sky Environmental, LLC.

Observing Personnel: The BAAQMD were notified (NST 2051) but no representative from the BAAQMD was present during the test program.

Process Description: The flare is used to continuously burn landfill gas generated in the active landfill. The flare was tested as found at ~1700°F and ~ 1380 SCFM Landfill Gas flowrate. The landfill gas fuel flow and flare temperature are continuously recorded.

Test Program: The test program objective was to comply with the prevailing Permit requirements and Regulation 8 Rule 34 limits that came into effect on July 1, 2002. The flare is only required to meet hydrocarbon emission and or destruction efficiency limits.

Three 30-minute tests were performed on the flare. The continuous emission monitoring system was checked for leaks before testing, and was calibrated before and after each run with EPA protocol calibration gas standards.

One landfill gas sample was collected and analyzed to determine the NMHC, $\%CH_4$, BTU and F-Factors. The LFG flowrate, BTU and F-Factor was used along with the Flare exhaust $\%O_2$ to determine the emission flowrate using EPA Method 19.

One landfill gas sample was collected and analyzed for compounds listed in Item 12 of Condition 1948 of the Permit.

Readings of the flare temperature and LFG flowrate were recorded during each test run. The facility flow monitor values were used in the calculation of the stack flowrate.

Sampling and Analysis Methods: The following BAAQMD and EPA sampling and ASTM analytical methods were used:

BAAQMD ST-7	NMOC
BAAQMD ST-14	O_2
BAAQMD ST-5	CO_2
EPA 19	Flare exhaust flowrate by calculation, DSCFM
EPA 25C	NMHC in landfill gas
EPA TO-15	Organics analysis by GCMS
ASTM 5504	Sulfur Species
ASTM 1945/3588	Gas analysis for BTU and F-Factor

Continuous Emission Monitoring by BAAQMD Methods ST-5, 6, 7, 13A, 14 and 19A. These methods are all continuous monitoring techniques using instrumental analyzers to measure carbon dioxide (CO_2), carbon monoxide (CO), non-methane hydrocarbons (NMHC), nitrogen oxides (NOx), oxygen (O_2) and sulfur dioxide (SO_2) respectively. Sampling is performed by extracting exhaust flue gas from the stack, conditioning the sample and analyzing it by continuous monitoring gas analyzers in a CEM test van. The sampling system consists of a stainless steel sample probe, Teflon sample line, glass-fiber particulate filter, glass moisture-knockout condensers in ice, Teflon sample transfer tubing, diaphragm pump and a stainless steel/Teflon manifold and flow control/delivery system. A constant sample and calibration gas supply pressure of 5 PSI was provided to each analyzer to avoid pressure variable response differences. The entire sampling system was leak checked prior to and at the end of the sampling program.

The sampling and analytical system (for BAAQMD Methods) was calibrated at the beginning and end of each test run. The calibration gases were selected to fall approximately within 80 to 90 percent of the instrument range. Zero and calibration drift values were determined for each test. All calibration gases are EPA Protocol #1. The analyzer data recording system consists of Omega 3 channel strip chart recorders, which can be supported by a PC/laptop based Data Acquisition System (DAS).

Method 19 (gas) was used to determine stack gas volumetric flow rates using oxygen based F-factors. F-factors are ratios of combustion gas volumes generated from heat input. The heating value of the fuel in Btu per cubic foot is determined from analysis of the fuel gas samples using ASTM D1946/3588 gas chromatography analytical procedures. Fuel consumption is monitored by a flowmeter. The total cubic feet per hour of fuel multiplied times the Btu/cf provides million Btu per hour (MMBtu) heat input. The heat input in MMBtu/hr is multiplied by the F-factor (DSCF/MMBtu) and adjusted for the measured oxygen content of the source to determine volumetric flow rate. The flow rates were used to determine exhaust flow and emission rates.

Instrumentation: The following continuous emissions analyzers were used:

Instrument	Analyte	Principle
Rosemount 400A	THC	FID
Rosemount 755R	O_2	Paramagnetic
Horiba PIR 2000	CO_2	Infrared

Test Results: Testing was performed according to the Source Test Plan, and all emissions were in Compliance with the Permit Conditions. The emission results are presented in Tables 1 and 2 on the following pages, and are summarized as follows:

	Flare (A-2) Avg	Permit Limit
NMOC ppm as CH_4 @ 3% O_2	**<0.94**	**either 30**
TNMHC Destruction or Removal Efficiency (DRE)	**>99.8%**	**or 98%**
THC (TOC) Destruction or Removal Efficiency (DRE)	**99.999%**	**98%**
TRS in Landfill Gas, ppm	**81.9**	**150**

The appendices are organized as follows:

Calculations
: All the calculations performed on the continuous emissions monitoring (CEM) data and flow rate calculations are presented in this section.

Laboratory Reports
: All laboratory reports and chain of custody.

Field Data Sheets
: All the CEMS data, any transcribed data from the strip charts.

Strip Chart Records
: The strip chart records of all the CEM data.

Calibration Gas Certifications
: Certifications for the calibration gas standards.

Stack Diagram
: Sketch or photograph of the stack.

Sample System Diagram
: Schematic of the sampling system configuration

Permit to Operate / ATC
: Permit to Operate / Authority to Construct

Source Test Plan
: Sampling protocols submitted to the BAAQMD prior to testing

Comments: The details and results contained within this report are to the best of Blue Sky Environmental, LLC's knowledge an authentic and accurate representation of the test program. If this report is submitted for Compliance purposes, it should be only reproduced in its entirety.

If there are any questions concerning this report, please contact Guy Worthington at 510 525 1261.

Submitted by,

Guy Worthington
Principal

TABLE #1

Potrero Hills Landfill
Flare
Set Point 1700°F

RUN	1	2	3	AVERAGE	LIMITS
Test Date	7/29/10	7/29/10	7/29/10		
Test Time	0856-0926	0937-1007	1013-1043		
Standard Temp., °F	70	70	70		
Flare Temp., °F	1,700	1,700	1,700	1,700	
Fuel Flow Rate, DSCFM	1,380	1,380	1,380	1,380	
Fuel, MMBtu/hr	38.7	38.7	38.7	38.7	
Exhaust Flow Rate, DSCFM (Method 19)	14,175	13,164	13,389	13,576	
Oxygen, O_2, %	11.8	11.1	11.3	11.4	
THC, ppm	<0.5	<0.5	<0.5	<0.5	
THC, lbs/hr as CH_4	<0.02	<0.02	<0.02	<0.02	
CH_4, ppm	<0.5	<0.5	<0.5	<0.5	
CH_4, lbs/hr	<0.02	<0.02	<0.02	<0.02	<30 ppm NMHC @ 3%O_2 or >98% THC DRE
NMHC, ppm as CH_4	<0.50	<0.50	<0.50	<0.50	
NMHC, lbs/hr as CH_4	<0.02	<0.02	<0.02	<0.02	
NMHC, ppm @ 3% O_2 as CH_4	**<0.98**	**<0.91**	**<0.93**	**<0.94**	
INLET CH_4, ppm				489,000	
INLET CH_4 lbs/hr				1,930.1	
CH_4 Removal Efficiency				**99.999%**	**99**
INLET NMHC ppm as CH_4				2,495	
INLET NMHC lbs/hr as CH_4				9.8	
NMHC Removal Efficiency				**>99.8%**	**98**
INLET THC (TOC) ppm as CH_4				491,495	
INLET THC (TOC) lbs/hr as CH_4				1,940.0	
THC (TOC) Removal Efficiency				**99.999%**	**98**

WHERE,

ppm = Parts Per Million Concentration
Lbs/hr = Pound Per Hour Emission Rate
Tstd. = Standard Temp. (°R = °F+460)
MW = Molecular Weight
DSCFM = Dry Standard Cubic Feet Per Minute
TOC = THC = Total Organic Carbon as Methane including CH_4 (MW = 16)
THC = Total Hydrocarbons as Methane (MW = 16)
NMHC = Total Non-Methane Hydrocarbons as Methane (MW = 16)

CALCULATIONS,

PPM @ 15% O_2 = ppm * 5.9 / (20.9 - %O_2)
PPM @ 3% O_2 = ppm * 17.9 / (20.9 - %O_2)
Lbs/hr = ppm x 8.223 E-05 x DSCFM x MW / Tstd. °R
Lbs/day = Lbs/hr * 24
THC (TOC) Removal Efficiency = (inlet lbs/hr- outlet lbs/hr) / inlet lbs/hr
NMHC Removal Efficiency = (inlet lbs/hr- outlet lbs/hr) / inlet lbs/hr

TABLE # 2

Landfill Gas Analysis

Constituent	Units	Detection Limit MRL/SRL ppb	Landfill Gas Samples 7/29/10 **Potrero-Flare**
Acrylonitrile	ppb	1.0/100	ND
Benzene	ppb	0.5/1000	**1,190.0**
Carbon Tetrachloride	ppb	0.5/50	ND
Chlorobenzene	ppb	0.5/50	**76.0**
Chlorodifluoromethane	ppb	0.5/1000	**700.0**
Chloroethane	ppb	0.5/50	**63.0**
Chloroform	ppb	0.5/50	ND
1,1-Dichloroethane	ppb	0.5/50	ND
1,1-Dichloroethene	ppb	0.5/50	ND
1,2-Dichloroethane (Ethylene Dichloride)	ppb	0.5/50	**56.0**
1,4-Dichlorobenzene	ppb	0.5/50	**607.0**
Dichlorodifluoromethane	ppb	0.5/50	**858.0**
Dichlorofluoromethane	ppb	0.5/50	**184.0**
Ethyl Benzene	ppb	0.5/1000	**6,830.0**
1,2 Dibromethane (Ethylene Dibromide)	ppb	0.5/50	ND
Trichlorofluoromethane (Fluorotrichloromethane)	ppb	0.5/50	ND
Hexane	ppb	0.5/50	**675.0**
2-Propanol (IPA)	ppb	2/4000	**26,400.0**
2-Butanone (MEK)	ppb	1/2000	**28,600.0**
Dichloromethane (Methylene Chloride)	ppb	0.5/50	ND
Tetrachloroethylene (Perchloroethylene)	ppb	0.5/50	**321.0**
Toluene	ppb	0.5/50	**16,700.0**
1,1,1-Trichloroethane	ppb	0.5/50	ND
1,1,2,2-Tetrachloroethane	ppb	0.5/50	ND
Trichloroethylene	ppb	0.5/50	**129.0**
Vinyl Chloride	ppb	0.5/50	**221.0**
m,p-Xylene	ppb	0.5/1000	**13,200.0**
o-Xylene	ppb	0.5/1000	**132.0**

Hydrogen Sulfide (ASTM 5504)	ppm	0.05/0.5	**66.0**
Carbon Disulfide (TO-15)	ppb	0.5/50	**83.0**

ND = not detected

CEM BIAS CORRECTION SUMMARY

Facility:	Potrero Hills Landfill	Barometric:	
Unit:	Flare	Leak Check:	OK
Condition:	Set Point 1700°F	Strat. Check:	
Date:	7/29/10	Personnel:	gw, mtw

	O_2	CO_2			THC	CH4			
Analyzer	755R	PIR 2000			400A	400A			
Range	25	15			50	50			r
Units, ppm or %	%	%			ppm	ppm			
Span Gas Value	20.45	12.56			46.2	46.2			Ccal

Run 1									
Test Time:	0.00	0.00			0.0	0.0			zero (initial), Cib
	20.45	12.68			46.3	46.3			cal (initial), Cib
0856-0926	11.77	7.98			-0.70	-<0.70			TEST AVG, Cavg
	0.00	0.15			-1.5	-1.5			zero (final), Cfb
	20.37	12.75			45.8	45.8			cal (final), Cfb
	0%	*1%*			*-3%*	*-3%*			% zero drift
	0%	*0%*			*-1%*	*-1%*			% cal drift
	11.79	**7.85**			**0.0**	**0.0**			**Cgas**

Run 2									
Test Time:	0.00	0.15			0.0	0.0			zero (initial), Cib
	20.37	12.75			46.0	46.0			cal (initial), Cib
0937-1007	11.05	8.25			<0.5	<0.5			TEST AVG, Cavg
	0.00	0.00			0.0	0.0			zero (final), Cfb
	20.37	12.75			46.0	46.0			cal (final), Cfb
	0%	*-1%*			*0%*	*0%*			% zero drift
	0%	*0%*			*0%*	*0%*			% cal drift
	11.09	**8.10**			**<0.5**	**<0.5**			**Cgas**

Run 3									
Test Time:	0.00	0.00			0.0	0.0			zero (initial), Cib
	20.37	12.75			46.0	46.0			cal (initial), Cib
1013-1043	11.25	8.25			<0.5	<0.5			TEST AVG, Cavg
	0.00	0.00			-0.4	-0.4			zero (final), Cfb
	20.50	12.75			45.8	45.8			cal (final), Cfb
	0%	*0%*			*-1%*	*-1%*			% zero drift
	1%	*0%*			*-1%*	*-1%*			% cal drift
	11.26	**8.13**			**<0.7**	**<0.7**			**Cgas**

Pollutant Concentration (Cgas) = (Cavg - Co) x Ccal / (Cbcal - Co)
Zero and Calibration Drift = 100 x (Cfb - Cib) / r

Co = (Cib + Cfb) / 2 for zero gas
Cbcal = (Cif + Cfb) / 2 for cal gas

STACK GAS FLOW RATE DETERMINATION -- Method 19

Facility: Potrero Hills Landfill
Unit: Flare
Condition: Set Point 1700°F
Date: 7/29/10

		Time:	0856-0926	0937-1007	1013-1043	
		Run:	1	2	3	
# cubic feet/rev	scfm		1,380	1380	1380	ft^3
# of seconds/rev			60	60	60	seconds
Gas Line Pressure (PSIG)			0.0	0.0	0.0	PSI Gauge
Gas Line Pressure (PSIA)			14.7	14.7	14.7	PSI Absolute
Gross Calorific Value @ 60°F			475.9	475.9	475.9	Btu / ft^3
Stack Oxygen			11.8	11.1	11.3	%
Gas Fd-Factor @ 60°F			9,405.1	9,405.1	9,405.1	DSCF/MMBtu
Gas Temperature (°F)			70	70	70	°F
Standard Temperature (°F) Tstd			70	70	70	°F
Realtime Fuel Rate (CFM)			1380.0	1380.0	1380.0	CFM
Corrected Fuel Rate (SCFM) @ Tstd			1380.0	1380.0	1380.0	SCFM
Fuel Flowrate (SCFH)			82,800	82,800	82,800	SCFH
Million Btu per minute			0.644	0.644	0.644	MMBtu/min
Heat Input (MMBtu/hour)			38.7	38.7	38.7	MMBtu/Hr
Stack Gas Flow Rate @ Tstd			**14,175**	**13,164**	**13,389**	**DSCFM**

WHERE:

Gas Fd-Factor = Fuel conversion factor (ratio of combustion gas volumes to heat inputs)
MMBtu = Million Btu

CALCULATIONS:

SCFM = CFM * (460+Tstd) * (PSIA) / 14.7 / (460+Gas°F))
SCFH = SCFM * 60
MMBtu/min = SCFM * (Btu/ft^3) * (520/(460+Tstd)) / 1,000,000
MMBtu/hr Heat Input = MMBtu/min * 60
DSCFM = Gas Fd-Factor * ((460+Tstd)/520) * MMBtu/min * 20.9/ (20.9 - O_2%)

Fd-FACTOR CALCULATION

Landfill Gas

Sample ID: Potrero Hills Landfill
Date: 7/29/2010

	Molecular Weight	Ideal Gas Specific Gravity, G_i	Ideal Gas Total Calorific Value, H_i	Compressibility Saturation Factor, $\sqrt{b_i}$	Specific Volume, ft^3/lb	PPM	Composition Mole Fraction, x_i	Specific Gravity Fraction, x_iG_i	Calorific Value Fraction, x_iH_i	Compressibility Fraction, $x_i\sqrt{b_i}$	x_iMW	Weight Fraction, $\xi MW / \Sigma xiMW$	CARBON Weight Fraction	HYDROGEN Weight Fraction	OXYGEN Weight Fraction	NITROGEN Weight Fraction	SULFUR Weight Fraction	CHONS SUM	Specific Volume, ft^3/lb
Helium‡	4.00	0.1382	0.0	-0.0170		0	0.0000	0.0000	0.0	0.0000	0.0000	0.0000						0.0000	
Hydrogen (H_2) ‡	2.02	0.0696	324.9		187.723	0	0.0000	0.0000	0.0	0.0000	0.0000					0.1524		0.1524	2.0487
Nitrogen	28.01	0.9672	0.0	0.0164	13.443	16.4	0.1530	0.1480	0.0	0.0025	4.2855	0.1524			0.0239			0.0239	0.2824
Oxygen	32.00	1.1053	0.0		11.819	2.6	0.0210	0.0232	0.0	0.0000	0.6720	0.0239						0.0000	0.0000
Carbon Monoxide	28.01	0.9671	321.3	0.0217	13.506	0	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.5556	4.7493
Carbon Dioxide‡	44.01	1.5194	0.0	0.0640	8.548	32	0.3550	0.5394	0.0	0.0227	15.6236	0.5556	0.1516	0.0000	0.4040			0.2681	6.3177
Methane	16.04	0.5539	1012.0	0.0436	23.565	48.9	0.4700	0.2603	475.6	0.0205	7.5388	0.2681	0.2007	0.0674				0.0000	0.0000
Ethane(C2)	30.01	1.0382	1772.9	0.0917	12.455	170.9	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000				0.0000	0.0000
Propane(C3)	44.09	1.5224	2523.0	0.1342	8.365	54.3	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000				0.0000	0.0000
Isobutane(C4)	58.12	2.0067	3260.1	0.1744	6.321	13.7	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000				0.0000	0.0000
n-Butane	58.12	2.0067	3269.6	0.1825	6.321		0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000				0.0000	0.0000
Isopentane(C5)	72.14	2.4910	4009.4	0.2276	5.252	12.1	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000				0.0000	0.0000
n-Pentane	72.14	2.4910	4018.5	0.2377	5.252		0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000				0.0000	0.0000
Hexanes(C6)	86.17	2.9753	4758.0	0.2830	4.398	34.1	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0000	0.0000				0.0015	0.0058
C6+	86.17	2.9753	4758.0	0.2830	4.398	429.0	0.0004	0.0013	2.0	0.0001	0.0370	0.0013	0.0011	0.0004				1.0000	13.40
Total							0.9990	0.971 SG	475.6 Btu/ft^3	0.0230 $\Sigma x_i\sqrt{b_i}$	28.1199 $\Sigma xiMW$	1.0000	0.3524 35.23%	0.0674 6.74%	0.4279 42.79%	0.1524 15.24%	0.0000 0.00%		ft^3/lb

‡ Omitted from Compressibility Factor Calculation

Calculated Specific Gravity (SG) *(Air = 1.000 @ 760mm Hg, 60°F)* **0.971**

Compressibility Factor (Z) **0.9995**

$Z = 1 - [(\Sigma x_i \sqrt{b_i})^2 + (2x_H - x_H^2)(0.0005)]$

Specific Gravity (corrected) **0.971**

Specific Volume, (SV) ft^3/lb **13.40** ft^3/lb

Gross Calorific Value (GCV) @ 60°F **475.9** Btu/ft^3 Gross

Gross Calorific Value (GCV) @ 68°F **468.7** Btu/ft^3 Gross

Gross Calorific Value (GCV) **6,376** Btu/lb

$Btu/lb = Btu/ft^3 * ft^3/lb$

Gas Fd-Factor @ 68°F **9,550** DSCF/MMBtu

$DSCF/MMBtu = 10^6 * (3.64 * x_{H_2} + (1.53 * x_C) + (0.57 * x_S) + (0.14 * x_{N_2}) - (0.46 * x_{O_2})) / Btu/lb$

Gas Fd-Factor @ 60°F **9,405** DSCF/MMBtu