APPENDIX A – 1

AIR QUALITY
CALCULATION OF MAXIMUM HOURLY, DAILY, AND ANNUAL EMISSIONS

Tables presented in this Appendix are as follows:

Turbine Vendor Data
Turbine Vendor Data, 100%, 75%, and 50% Loading
Stack Emission Calculations
Black Star Engine Emissions
Emissions Summary
Turbine Screening

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamond Energy Larkspur Project (San Diego)**

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G0125O - 8dz.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Gas Fuel #10-12, 20722 Btu/lb,LHV**

Date: **12/05/2006**
Time: **6:52:01 AM**
Version: **3.5.0**

Case #	**Min Temp**	**ISO**	**Ann Avg**	**Summer Avg**	**Max Temp**	**Guar**	**75%**	**50%**	**25%**
Ambient Conditions									
Dry Bulb, °F	38.0	59.0	63.6	75.8	104.0	75.0	75.0	75.0	75.0
Wet Bulb, °F	35.0	51.4	56.9	66.1	67.1	65.0	65.0	65.0	65.0
RH, %	75.0	60.0	66.7	60.6	13.0	59.0	59.0	59.0	59.0
Altitude, ft	526.0	526.0	526.0	526.0	526.0	526.0	526.0	526.0	526.0
Ambient Pressure, psia	14.419	14.419	14.419	14.419	14.419	14.419	14.419	14.419	14.419
Engine Inlet									
Comp Inlet Temp, °F	38.0	52.5	57.9	67.6	72.7	66.5	66.5	66.5	66.5
RH, %	75.0	92.9	94.2	92.8	75.6	92.5	92.5	92.5	92.5
Conditioning	NONE	EVAP	EVAP	EVAP	EVAP	EVAP	EVAP	EVAP	EVAP
Tons or kBtu/hr	0	0	0	0	0	0	0	0	0
Pressure Losses									
Inlet Loss, inH20	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Volute Loss, inH20	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Exhaust Loss, inH20	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
kW, Gen Terms	**50256**	**49134**	**48197**	**46446**	**45550**	**46661**	**34996**	**23330**	**11665**
Est. Btu/kW-hr, LHV	**8525**	**8564**	**8584**	**8622**	**8654**	**8617**	**9141**	**10416**	**14610**
Fuel Flow									
MMBtu/hr, LHV	428.4	420.8	413.7	400.5	394.2	402.1	319.9	243.0	170.4
lb/hr	20676	20305	19965	19325	19023	19403	15436	11727	8224
NOx Control	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**
Water Injection									
lb/hr	22892	19123	18032	16568	16514	16770	10627	9084	4496
Temperature, °F	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SPRINT	**HPC**	**LPC**	**LPC**	**LPC**	**LPC**	**LPC**	**LPC**	**OFF**	**OFF**
lb/hr	3730	8865	9325	9209	9078	9236	9236	0	0
Control Parameters									
HP Speed, RPM	10454	10459	10478	10513	10525	10509	10105	9846	9456
LP Speed, RPM	3600	3600	3600	3600	3600	3600	3600	3600	3600
PS3 - CDP, psia	458.6	449.3	442.9	431.6	426.2	433.0	379.4	315.8	245.0
T3CRF - CDT, °F	988	973	975	981	987	980	903	906	819
T48IN, °R	2038	2038	2038	2038	2038	2038	1896	1817	1681
T48IN, °F	1578	1578	1578	1578	1578	1578	1436	1357	1222

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamond Energy Larkspur Project (San Diego)**

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G0125O - 8dz.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Gas Fuel #10-12, 20722 Btu/lb,LHV**

Date: **12/05/2006**
Time: **6:52:01 AM**
Version: **3.5.0**

Case #	Min Temp	ISO	Ann Avg	Summer Avg	Max Temp	Guar	75%	50%	25%
Exhaust Parameters									
Temperature, °F	837.8	844.3	848.1	855.0	858.2	854.2	786.0	772.7	744.4
lb/sec	298.5	291.7	287.3	279.8	276.4	280.7	256.2	219.1	176.9
lb/hr	1074758	1050011	1034432	1007434	995112	1010658	922157	788583	636795
Energy, Btu/s- Ref 0 °R	100064	98780	97739	95920	94962	96136	82203	68755	53798
Energy, Btu/s- Ref T2 °F	62766	61084	60168	58562	57711	58746	48326	40068	30774
Cp, Btu/lb-R	0.2761	0.2778	0.2783	0.2792	0.2792	0.2791	0.2739	0.2701	0.2670
Emissions (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
NOx ppmvd Ref 15% O2	25	25	25	25	25	25	25	25	25
NOx as NO2, lb/hr	43	42	42	40	40	40	32	24	17
CO ppmvd Ref 15% O2	31	15	12	8	8	8	8	12	10
CO, lb/hr	32.96	15.25	11.65	7.62	7.36	8.09	6.32	7.21	4.29
CO2, lb/hr	55916.77	54927.73	54010.99	52286.88	51472.86	52497.18	41820.16	31825.25	22361.24
HC ppmvd Ref 15% O2	4	2	2	2	2	2	2	2	2
HC, lb/hr	2.10	1.22	1.20	1.16	1.14	1.16	0.93	0.70	0.49
SOX as SO2, lb/hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
AR	1.2266	1.2186	1.2166	1.2132	1.2137	1.2137	1.2230	1.2378	1.2460
N2	71.9573	71.4903	71.3749	71.1755	71.2005	71.2029	71.7451	72.6083	73.0828
O2	14.6650	14.4835	14.4626	14.4466	14.4794	14.4489	15.5591	16.5385	17.4348
CO2	5.2027	5.2312	5.2213	5.1901	5.1726	5.1944	4.5350	4.0357	3.5115
H20	6.9424	7.5721	7.7205	7.9709	7.9302	7.9364	6.9345	5.5765	4.7223
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0031	0.0015	0.0011	0.0008	0.0007	0.0008	0.0007	0.0009	0.0007
HC	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
NOX	0.0028	0.0028	0.0028	0.0027	0.0027	0.0027	0.0024	0.0021	0.0018
Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
AR	0.9667	0.9672	0.9671	0.9670	0.9669	0.9670	0.9624	0.9589	0.9554
N2	80.8744	80.9089	80.9079	80.8984	80.8874	80.8997	80.5089	80.2057	79.9083
O2	14.4301	14.3507	14.3531	14.3757	14.4013	14.3726	15.2859	15.9944	16.6896
CO2	3.7222	3.7686	3.7676	3.7551	3.7406	3.7568	3.2394	2.8378	2.4440
H20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0034	0.0016	0.0013	0.0009	0.0008	0.0009	0.0008	0.0010	0.0007
HC	0.0004	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001
NOX	0.0027	0.0028	0.0028	0.0028	0.0028	0.0028	0.0024	0.0021	0.0018

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GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamond Energy Larkspur Project (San Diego)**

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Fuel: **Gas Fuel #10-12, 20722 Btu/lb,LHV**

Date: **12/05/2006**
Time: **6:52:01 AM**
Version: **3.5.0**

Case #	Min Temp	ISO	Ann Avg	Summer Avg	Max Temp	Guar	75%	50%	25%
Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
AR	0.8621	0.8534	0.8513	0.8476	0.8481	0.8481	0.8585	0.8750	0.8844
N2	72.1233	71.3947	71.2160	70.9086	70.9479	70.9508	71.8184	73.1944	73.9692
O2	12.8687	12.6632	12.6337	12.6005	12.6317	12.6051	13.6358	14.5962	15.4492
CO2	3.3194	3.3254	3.3162	3.2914	3.2809	3.2948	2.8897	2.5897	2.2624
H20	10.8206	11.7592	11.9790	12.3486	12.2881	12.2978	10.7945	8.7416	7.4324
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0031	0.0014	0.0011	0.0008	0.0007	0.0008	0.0007	0.0009	0.0007
HC	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001
NOX	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0021	0.0019	0.0017

Aero Energy Fuel Number	**10-12 (EGTDEF)**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	94.2000	88.4602
Ethane	3.2000	5.6324
Ethylene	0.0000	0.0000
Propane	0.6000	1.5487
Propylene	0.0000	0.0000
Butane	0.2000	0.6804
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.1000	0.4223
Cyclopentane	0.0000	0.0000
Hexane	0.0000	0.0000
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	0.5000	1.2881
Nitrogen	1.2000	1.9678
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000
Btu/lb, LHV	20722	
Btu/scf, LHV	935	
Btu/scf, HHV	1036	
Btu/lb, HHV	22960	
Fuel Temp, °F	60.0	
NOx Scalar	1.000	
Specific Gravity	0.59	

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GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamond Energy Larkspur Project (San Diego)**

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Fuel: **Gas Fuel #10-12, 20722 Btu/lb,LHV**

Date: **12/05/2006**
Time: **6:52:01 AM**
Version: **3.5.0**

Case #	Min Temp	ISO	Ann Avg	Summer Avg	Max Temp	Guar	75%	50%	25%
Engine Exhaust									
Exhaust MW	28.1	28.0	28.0	27.9	27.9	27.9	28.0	28.2	28.4
Inlet Flow Wet, pps	289.2	281.9	277.8	270.8	267.5	271.6	268.8	262.9	270.8
Inlet Flow Dry, pps	288.1	279.7	275.1	267.1	264.0	268.1	265.3	259.5	267.3
Shaft HP	68568	67043	65770	63393	62177	63684	47872	32100	16359
Generator Information									
Capacity kW	64115	64115	62883	59475	50679	59705	59705	59705	59705
Efficiency	0.956	0.983	0.983	0.983	0.982	0.983	0.980	0.975	0.956
Inlet Temp, °F	38.0	59.0	63.6	75.8	104.0	75.0	75.0	75.0	75.0
Gear Box Loss	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TRQ48, Torque Limit Cold End	123105	119824	117583	113671	111757	114134	91744	69146	44708
Correct Control Parameters									
PS3JQA, psia	463.830	454.424	447.951	436.522	431.061	437.938	383.727	319.402	247.794
XN25R3, rpm	6269	6314	6325	6332	6328	6332	6243	6062	6005
8th Stage Bleed									
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Temperature, °R	0	0	0	0	0	0	0	0	0
CDP Bleed									
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Est. Gas Pressure at Baseplate, psia	**530.6**	**520.3**	**512.7**	**499.1**	**492.6**	**500.8**	**431.7**	**355.7**	**274.5**
CardPack	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**
Exhaust CardPack	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**
NSI	**304**	**304**	**304**	**304**	**304**	**304**	**0**	**439**	**439**
NSI	**1716**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
NSI	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamon Energy Larkspur, 100%/75%/50% Load, Max, Average & Min Temp**

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G0125O - 8dz.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Gas Fuel #10-1, 19000 Btu/lb,LHV**

Date: **02/12/2007**
Time: **2:57:25 PM**
Version: **3.5.0**

Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**
Ambient Conditions									
Dry Bulb, °F	104.0	104.0	104.0	63.6	63.6	63.6	38.0	38.0	38.0
Wet Bulb, °F	67.1	67.1	67.1	56.9	56.9	56.9	35.0	35.0	35.0
RH, %	13.0	13.0	13.0	66.7	66.7	66.7	75.0	75.0	75.0
Altitude, ft	526.0	526.0	526.0	526.0	526.0	526.0	526.0	526.0	526.0
Ambient Pressure, psia	14.419	14.419	14.419	14.419	14.419	14.419	14.419	14.419	14.419
Engine Inlet									
Comp Inlet Temp, °F	72.7	72.7	72.7	57.9	57.9	57.9	38.0	38.0	38.0
RH, %	75.6	75.6	75.6	94.2	94.2	94.2	75.0	75.0	75.0
Conditioning	EVAP	EVAP	EVAP	EVAP	EVAP	EVAP	NONE	NONE	NONE
Tons or kBtu/hr	0	0	0	0	0	0	0	0	0
Pressure Losses									
Inlet Loss, inH20	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Volute Loss, inH20	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Exhaust Loss, inH20	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
kW, Gen Terms	**45626**	**34220**	**22813**	**48276**	**36207**	**24138**	**50336**	**37752**	**25168**
Est. Btu/kW-hr, LHV	**8642**	**9201**	**10505**	**8572**	**9045**	**10265**	**8514**	**8928**	**10138**
Fuel Flow									
MMBtu/hr, LHV	394.3	314.9	239.6	413.8	327.5	247.8	428.6	337.0	255.1
lb/hr	20754	16571	12613	21781	17237	13041	22557	17739	13429
NOx Control	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**
Water Injection									
lb/hr	16469	10558	9008	17986	11446	9593	22839	14801	10398
Temperature, °F	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SPRINT	**LPC**	**LPC**	**OFF**	**LPC**	**LPC**	**OFF**	**HPC**	**HPC**	**OFF**
lb/hr	9078	9078	0	9325	9325	0	3730	3730	0
Control Parameters									
HP Speed, RPM	10526	10136	9877	10478	10058	9800	10455	10029	9666
LP Speed, RPM	3600	3600	3600	3600	3600	3600	3600	3600	3600
PS3 - CDP, psia	426.8	373.3	310.7	443.5	389.2	324.6	459.2	403.9	338.8
T3CRF - CDT, °F	988	912	916	975	893	896	989	904	866
T48IN, °R	2038	1904	1827	2038	1885	1800	2038	1878	1760
T48IN, °F	1578	1444	1367	1578	1425	1340	1578	1418	1300
Exhaust Parameters									
Temperature, °F	857.8	795.6	783.8	847.7	771.2	753.9	837.5	755.2	714.8
lb/sec	276.9	251.6	214.9	287.8	263.8	226.4	299.0	275.3	239.3
lb/hr	996798	905681	773790	1036198	949820	814929	1076566	991210	861552
Energy, Btu/s- Ref 0 °R	95000	81354	68088	97780	83340	69668	100110	85149	70775
Energy, Btu/s- Ref T2 °F	57725	47709	39618	60185	49130	40609	62789	51070	41389

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GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamon Energy Larkspur, 100%/75%/50% Load, Max, Average & Min Temp**

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G0125O - 8dz.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Gas Fuel #10-1, 19000 Btu/lb,LHV**

Date: **02/12/2007**
Time: **2:57:25 PM**
Version: **3.5.0**

Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**
Cp, Btu/lb-R	0.2790	0.2741	0.2705	0.2781	0.2725	0.2685	0.2759	0.2698	0.2656
CT Exhaust Flow, ACFM	584,029	502,021	421,762	600,216	516,135	433,650	616,508	527,878	442,033
Emissions (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
NOx ppmvd Ref 15% O2	25	25	25	25	25	25	25	25	25
NOx as NO2, lb/hr	40	32	24	42	33	25	43	34	26
CO ppmvd Ref 15% O2	8	8	12	12	13	18	33	32	37
CO, lb/hr	7.82	6.14	6.98	12.37	10.22	11.00	34.89	26.74	23.34
CO2, lb/hr	52452.84	41933.34	31970.35	55040.34	43617.56	33056.87	56981.60	44880.46	34033.03
HC ppmvd Ref 15% O2	2	2	2	2	2	2	4	4	4
HC, lb/hr	1.25	0.99	0.76	1.31	1.03	0.78	2.22	1.69	1.50
SOX as SO2, lb/hr	0.83	0.66	0.50	0.87	0.69	0.52	0.90	0.71	0.53
S in Fuel	0.75 grain total S/100 scf								
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
AR	1.2116	1.2208	1.2357	1.2146	1.2247	1.2401	1.2245	1.2361	1.2478
N2	71.2259	71.7420	72.5972	71.4000	71.9709	72.8534	71.9818	72.6332	73.3025
O2	14.4718	15.5214	16.4862	14.4547	15.6444	16.6702	14.6567	15.9359	16.9557
CO2	5.2621	4.6300	4.1317	5.3118	4.5922	4.0564	5.2929	4.5278	3.9502
H20	7.8250	6.8826	5.5461	7.6149	6.5642	5.1763	6.8380	5.6618	4.5389
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0008	0.0007	0.0009	0.0012	0.0011	0.0014	0.0032	0.0027	0.0027
HC	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002
NOX	0.0027	0.0024	0.0021	0.0028	0.0024	0.0021	0.0028	0.0024	0.0020
Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
AR	0.9645	0.9604	0.9572	0.9647	0.9601	0.9567	0.9643	0.9595	0.9559
N2	80.8480	80.4849	80.1911	80.8683	80.4568	80.1440	80.8352	80.4006	80.0757
O2	14.3815	15.2448	15.9433	14.3331	15.3115	16.0552	14.4100	15.4438	16.2162
CO2	3.8021	3.3064	2.9051	3.8296	3.2678	2.8405	3.7836	3.1904	2.7469
H20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0009	0.0008	0.0010	0.0014	0.0012	0.0015	0.0036	0.0030	0.0030
HC	0.0003	0.0002	0.0002	0.0003	0.0002	0.0002	0.0004	0.0003	0.0003
NOX	0.0028	0.0024	0.0021	0.0028	0.0024	0.0021	0.0027	0.0023	0.0020
Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)									
AR	0.8474	0.8575	0.8739	0.8506	0.8618	0.8788	0.8614	0.8743	0.8875
N2	71.0365	71.8571	73.2161	71.3050	72.2162	73.6246	72.2122	73.2608	74.3436
O2	12.6362	13.6106	14.5566	12.6381	13.7432	14.7491	12.8729	14.0723	15.0554
CO2	3.3407	2.9520	2.6524	3.3767	2.9331	2.6094	3.3800	2.9071	2.5502
H20	12.1358	10.7198	8.6979	11.8257	10.2423	8.1345	10.6674	8.8803	7.1584
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0008	0.0007	0.0009	0.0012	0.0011	0.0014	0.0033	0.0027	0.0027
HC	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0004	0.0003	0.0003
NOX	0.0024	0.0021	0.0019	0.0025	0.0021	0.0019	0.0025	0.0021	0.0018

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamon Energy Larkspur, 100%/75%/50% Load, Max, Average & Min Temp**

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G0125O - 8dz.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Gas Fuel #10-1, 19000 Btu/lb,LHV**

Date: **02/12/2007**
Time: **2:57:25 PM**
Version: **3.5.0**

Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**
Aero Energy Fuel Number	**10-1 (GEDEF)**								
	Volume %	**Weight %**							
Hydrogen	0.0000	0.0000							
Methane	84.5000	71.8447							
Ethane	5.5800	8.8924							
Ethylene	0.0000	0.0000							
Propane	2.0500	4.7909							
Propylene	0.0000	0.0000							
Butane	0.7800	2.4027							
Butylene	0.0000	0.0000							
Butadiene	0.0000	0.0000							
Pentane	0.1800	0.6883							
Cyclopentane	0.0000	0.0000							
Hexane	0.1700	0.7764							
Heptane	0.0000	0.0000							
Carbon Monoxide	0.0000	0.0000							
Carbon Dioxide	0.6700	1.5628							
Nitrogen	5.9300	8.8044							
Water Vapor	0.0000	0.0000							
Oxygen	0.1400	0.2374							
Hydrogen Sulfide	0.0000	0.0000							
Ammonia	0.0000	0.0000							
Btu/lb, LHV	19000								
Btu/scf, LHV	946								
Btu/scf, HHV	1047								
Btu/lb, HHV	20996								
Fuel Temp, °F	77.0								
NOx Scalar	0.998								
Specific Gravity	0.65								
Engine Exhaust									
Exhaust MW	27.9	28.1	28.3	28.0	28.1	28.3	28.1	28.3	28.4
Inlet Flow Wet, pps	267.5	265.4	259.9	277.8	274.5	267.0	289.2	284.1	281.9
Inlet Flow Dry, pps	264.0	261.9	256.5	275.1	271.8	264.4	288.1	283.0	280.9
Shaft HP	62279	46822	31401	65878	49512	33191	68677	51604	34582
Generator Information									
Capacity kW	64115	50679	50679	62883	62883	62883	69366	69366	69366
Efficiency	0.976	0.980	0.974	0.983	0.981	0.975	0.983	0.981	0.976
Inlet Temp, °F	104.0	104.0	104.0	63.6	63.6	63.6	38.0	38.0	38.0
Gear Box Loss	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TRQ48, Torque Limit Cold End	111906	89851	67727	117740	94688	71449	123264	99439	74890

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **RICHARD BOULAY**
Project Info: **Diamon Energy Larkspur, 100%/75%/50% Load, Max, Average & Min Temp**

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G0125O - 8dz.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Gas Fuel #10-1, 19000 Btu/lb,LHV**

Date: **02/12/2007**
Time: **2:57:25 PM**
Version: **3.5.0**

Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**
Correct Control Parameters									
PS3JQA, psia	431.667	377.557	314.243	448.558	393.639	328.302	464.437	408.506	342.664
XN25R3, rpm	6326	6242	6063	6323	6234	6053	6268	6180	6035
8th Stage Bleed									
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Temperature, °R	0	0	0	0	0	0	0	0	0
CDP Bleed									
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Est. Gas Pressure at Baseplate, psia	**562.4**	**477.8**	**388.5**	**585.9**	**496.9**	**403.8**	**605.9**	**513.4**	**419.1**
CardPack	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**	**8dz**
Exhaust CardPack	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**	**7f5**
NSI	**304**	**0**	**439**	**304**	**0**	**439**	**304**	**0**	**439**
NSI	**0**	**0**	**0**	**0**	**0**	**0**	**1716**	**0**	**0**
NSI	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

XNENG

Case	100	101	102	103	104	105	106	107	108
Ambient Temperature (°F)	104	104	104	63.6	63.6	63.6	38	38	38
Stack Diameter (ft)	12	12	12	12	12	12	12	12	12
Exhaust Density (lb/ft^3)	0.03028	0.03028	0.03028	0.03028	0.03028	0.03028	0.03028	0.03028	0.03028
CTG Load Level	**100%**	**75%**	**50%**	**100%**	**75%**	**50%**	**100%**	**75%**	**50%**
Sprint	ON	ON	OFF	ON	ON	OFF	ON	ON	OFF
Evap. Cooler	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF

Expected Operation of Gas Turbine - Normal Operation

(Reference: Emission Summary LM6000 PC-SPRINT w/ FIGV at -5 Degrees by RICHARD BOULAY, Feb 12, 2007)

Fuel Flow (MMBTU/hr)	394.3	314.9	239.6	413.8	327.5	247.8	428.6	337.0	255.1
Fuel Flow (lb/hr)	20754	16571	12613	21781	17237	13041	22557	17739	13429
Exhaust Flow (lb/hr)	996798	905681	773790	1036198	949820	814929	1076566	991210	861552
Stack Outlet Temperature (°F)	857.8	795.6	783.8	847.7	771.2	753.9	837.5	755.2	714.8
Exhaust Flow @ T stack (acfm)	584029	502021	421762	600216	516135	433650	616508	527878	442033
Stack Exit Velocity, ft/m	5164.0	4438.8	3729.2	5307.1	4563.6	3834.3	5451.1	4667.5	3908.4
Stack Exit Velocity, m/s	26.2	22.5	18.9	27.0	23.2	19.5	27.7	23.7	19.9

Average Emission Rates from each Gas Turbine (lbs/hr/turbine) - Normal Operations

NO_X at 25 ppmvd pre-BACT level	39.85	31.80	24.16	41.86	33.04	24.97	43.30	34.03	25.71
NO_X at 2.5 ppmvd BACT level	3.99	3.18	2.42	4.19	3.30	2.50	4.33	3.40	2.57
CO ppmvd pre BACT	8	8	12	12	13	18	33	32	37
CO at pre BACT level	7.82	6.14	6.98	12.37	10.22	11.00	34.89	26.74	23.34
CO at 6.0 ppmvd BACT level	5.87	4.61	3.49	6.19	4.72	3.67	6.34	5.01	3.78
VOC ppmvd pre BACT level	2.00	2.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00
VOC at pre BACT level	1.25	0.99	0.76	1.31	1.03	0.78	2.22	1.69	1.50
VOC at 2.0 ppmvd BACT level	1.25	0.99	0.76	1.31	1.03	0.78	1.11	0.85	0.75
SO_2	0.83	0.66	0.50	0.87	0.69	0.52	0.90	0.71	0.53
PM_{10}	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
NH_3 at 10 ppmvd tBACT level	5.93	4.66	3.53	6.26	4.77	3.71	6.42	5.07	3.83
NH_3 at 5 ppmvd BACT level	2.97	2.33	1.77	3.13	2.39	1.86	3.21	2.54	1.91
Sulfur content in fuel basis for above:	0.75	grain total S/100 scf							

Startup / Shutdown Emissions from Turbine (1CT)

Startup

duration in minutes	10	50		10
	Startup Emissions	Normal Emissions	Total Startup Emissions	Full Hour of Only Startup Emissions
	lb/event	lb/hour	lb/hour	lb/hour
NO_X	4.30	4.33	7.91	25.80
CO	3.70	6.34	8.99	22.20
VOC	0.10	1.31	1.19	0.60
SO_2	0.15	0.90	0.90	0.90
PM_{10}	0.40	4.00	3.73	2.40

Assumptions:

Startup Emissions for CO, NO_2, PM_{10}, and VOC integrated from data provided by GE.

SO_2 emissions assume complete conversion of all sulfur to SO_2.

Shutdown

duration in minutes	8	52		8
	Shutdown Emissions	Normal Emissions	Total Shutdown Emissions	Full Hour of Only Shutdown Emissions
	lb/event	lb/hour	lb/hr	lb/hour
NO_X	2.80	4.33	6.55	21.00
CO	2.40	6.34	7.90	18.00
VOC	0.09	1.31	1.23	0.68
SO_2	0.12	0.90	0.90	0.90
PM_{10}	0.60	4.00	4.07	4.50

Assumptions:

Shutdown Emissions for CO, NO_2, PM_{10}, and VOC integrated from data provided by GE.

SO_2 emissions assume complete conversion of all sulfur to SO_2.

Worst-Case 1-Hour Emissions per Turbine

Worst-Case (non-commissioning) 1-Hour Emissions consists of the maximum of an hour with 1 startup & normal operations; an hour with 1 shutdown and normal operations; or normal operations
Comparison of normal, startup and shutdown emissions presented below

Emissions per turbine	Worst-case Total	Startup	Shutdown	Normal Operations					Worst-case Total
	lb/hr								g/s
NO_2	7.91	7.91	6.55	4.33					1.00
CO	8.99	8.99	7.90	6.34					1.13
VOC	1.31	1.19	1.23	1.31					0.17
SO_2	0.90	0.90	0.90	0.90					0.11
PM_{10}	4.07	3.73	4.07	4.00					0.51

Worst-Case 3 Hour Emission Rate per Turbine

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard. Since the SO_2 emission rate does not change during Startup, Maintenance or Normal operations, the worst-case 3-hour emission rate is the maximum SO2 rate for 100% load case (104°F; with Sprint and Evap. Cooler On).

Emissions per turbine	Worst-case Total			Normal Operations	Worst-case Total			Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
Total Hours of Operation	3			3					
SO_2	0.90			0.90	2.69			2.69	0.11

Worst-Case 8-Hour Emission Rates

Only CO is considered for an average 8-hour Ambient Air Quality Standard.
Worst-case 8-Hour Scenario includes 2 startups and 2 shutdowns

Emissions per turbine	Worst-case Total	Startup	Shutdown	Normal Operations	Worst-case Total	Startup	Shutdown	Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
Total Hours of Operation	8	0.33	0.27	7.40					
Number per Scenario		2	2						
Duration of Event (min)		10	8						
CO	7.39	22.20	18.00	6.34	59.14	7.40	4.80	46.94	0.93

Worst-Case 24 Hour Emission Rate

Only SO_2 and PM_{10} are considered for an average 24-hour Ambient Air Quality Standard.

Worst-case 24-Hour Scenario includes 24 hours at normal rate.

Emissions per turbine	Worst-case Total			Normal Operations					Worst-case Total
	lb/hr								g/s
Total Hours of Operation	24			24.00					
SO_2	0.90			0.90					0.11
PM_{10}	4.00			4.00					0.50

Average Annual Emissions

Average Operation Emission Rates are based on the maximum emissions per pollutant for 4000 hours plus 300 startup events and 300 shutdown events.

Emissions per turbine	Worst-case Total	Startup	Shutdown	Normal Operations	Worst-case Total	Startup	Shutdown	Normal Operations	Worst-case Total	Worst-case Total
	lb/hr				Total lbs				g/s	ton/yr
Total Hours of Operation	4090	50.00	40.00	4000						
Number per Scenario		300	300							
Duration of Event (min)		10	8							
NO_X	2.22	25.80	21.00	4.33	19450.0	1290.0	840.0	17320.0	0.28	9.73
CO	3.11	22.20	18.00	6.34	27204.5	1110.0	720.0	25374.5	0.39	13.60
VOC	0.60	0.60	0.68	1.31	5297.0	30.0	27.0	5240.0	0.08	2.65
SO_2	0.42	0.90	0.90	0.90	3668.3	44.8	35.9	3587.6	0.05	1.83
PM_{10}	1.86	2.40	4.50	4.00	16300.0	120.0	180.0	16000.0	0.23	8.15

Note: Worst-case lb/hr is the total emissions (lbs) over 8760 hours/year

Greenhouse Gas Emission Rates from each Gas Turbine (lbs/hr/turbine) - Normal Operations										Worst-case Total ton/yr
CO_2 from manufacturer data	52452.84	41933.34	31970.35	55040.34	43617.56	33056.87	56981.60	44880.46	34033.03	110080.68
N_2O at 0.003 lb/MMBTU	1.18	0.94	0.72	1.24	0.98	0.74	1.29	1.01	0.77	2.4828
CH_4 at 8.6E-03 lb/MMBTU	3.39	2.71	2.06	3.56	2.82	2.13	3.69	2.90	2.19	7.11736

Greenhouse gas emissions from AP-42, Section 3.1, natural gas turbines.

Larkspur Gas Turbine Facility

Emissions from Black Start Engine Generator

Rated Horsepower	**805**	**bhp**	
Fuel Consumption	**7098**	**Btu/bhp-hr**	
Testing duration	**2**	**hr/month**	
Expected non-emergency usage	**24**	**hr/yr**	
Natural Gas Fired	Emision Factor	Emission Rate	Emission Rate
	g/HP/Hr	lb/hr	lb/yr
NO_X	0.500	0.44	21.29
CO	2.500	2.22	106.43
VOC (Total Hydrocarbons)	5.400	4.79	229.89
	lb/MMBtu		
PM_{10}	4.83E-02	0.138	6.62
SO_2	5.88E-04	0.002	0.08

Emission factors for NOx, CO, VOC, and PM10 from vendor
Note: SO2 emission rates from EPA AP-42 Table 3.2-2 for natural gas 4-STROKE LEAN-BURN ENGINES
PM10 emission rate includes filterable and condensable emissions.
Fuel consumption based on Caterpillar specification for 600 kW engine generator, G3512.
Assume 30 minutes operation per run

stack height = 8 ft
stack diameter = 8 inches
stack temperature = 797F
Exhaust Flow Rate = 8916 lb/hr

Greenhouse Gas Emissions from Black Start Engine Generator

	lb/MMBtu	Emission Rate	Emission Rate
		lb/hr	tons/yr
CO_2	1.10E+02	314.108	7.54
CH_4	1.25E+00	3.569	0.09

Note: Greenhouse Gas emission rates from EPA AP-42 Table 3.2-2 for natural gas 4-STROKE LEAN-BURN ENGINES

1-Hour Worst-Case Emission Scenario for Larkspur Plant

Only NO_2, CO and SO_2 are considered for the 1-hour Ambient Air Quality Standard.
Worst-case 1-Hour Scenario includes 1 turbine operating for 1 hour at Startup rate,
and 1 hour of the Black Start Engine Generator being tested

Emissions per turbine	**lb/hr**	**g/s**
NO_2	7.91	0.9964
CO	8.99	1.1323
SO_2	0.90	0.1130
Emissions from Black Start Engine Generator	**lb/hr**	**g/s**
NO_2	0.44	0.0559
CO	2.22	0.2794
SO_2	0.002	2.1156E-04

3 Hour Emissions Scenarios for Larkspur Plant

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard. Since the SO_2 emission rate does not change during Startup, Maintenance or Normal operations, the worst-case 3-hour emission rate is the maximum SO2 rate for 100% load case (38°F; with Sprint On and Evap. Cooler Off).
and 1 hour of the Black Start Engine Generator being tested

Emissions per turbine	**lb/hr**	**g/s**
SO_2	0.90	0.1130
Emissions from Black Start Engine Generator	**lb/hr**	**g/s**
SO_2	5.60E-04	7.0519E-05

8-Hour Emissions Scenarios for Larkspur Plant

Only CO is considered for an average 8-hour Ambient Air Quality Standard.
Worst-case 8-Hour Scenario includes 2 startups and 2 shutdowns
and 1 hour of the Black Start Engine Generator being tested

Emissions per turbine	**lb/hr**	**g/s**
CO	7.39	0.9315
Emissions from Black Start Engine Generator	**lb/hr**	**g/s**
CO	2.77E-01	3.4922E-02

24-Hour Emissions Scenarios for Larkspur Plant

Only SO_2 and PM_{10} are considered for an average 24-hour Ambient Air Quality Standard.

Worst-case 24-Hour Scenario includes 24 hours at normal rate.
and 1 hour of the Black Start Engine Generator being tested

Emissions per turbine	**lb/hr**	**g/s**
SO_2	0.90	0.1130
PM_{10}	4.00	0.5040
Emissions from Black Start Engine Generator	**lb/hr**	**g/s**
SO_2	7.00E-05	8.8148E-06
PM_{10}	5.75E-03	7.2407E-04

Average Annual Emissions

Average Operation Emission Rates are based on the maximum emissions per pollutant for 4000 hours
plus 300 startup events and 300 shutdown events.
and 24 hours of the Black Start Engine Generator being tested

Emissions per turbine	**lb/hr**	**g/s**
NO_X	2.22	0.2798
SO_2	0.42	0.0528
PM_{10}	1.86	0.2344
Emissions from Black Start Engine Generator	**lb/hr**	**g/s**
NO_X	2.43E-03	3.0616E-04
SO_2	9.20E-06	1.1592E-06
PM_{10}	7.56E-04	9.5221E-05

Normal Operations - Emissions and stack parameters per Turbine

	Ambient Temperature	Winter Minimum - 38°F			Yearly Average - 63.6°F			Summer Maximum - 104°F		
	CTG Load Level	**50%**	**75%**	**100%**	**50%**	**75%**	**100%**	**50%**	**75%**	**100%**
	Duct Burner Status	No	No	No	No	No	No	No	No	No
	Stack Outlet Temperature (°K)	652.48	674.93	720.65	674.21	683.82	726.32	690.82	697.37	731.93
	Stack Exit Velocity (m/s)	19.86	23.71	27.69	19.48	23.18	26.96	18.94	22.55	26.23
lb/hr	**NO_x (@ 2.5 ppm)**	2.571	3.403	4.33	2.497	3.304	4.186	2.416	3.18	3.99
lb/hr	**CO (@ 6.0 ppm)**	3.785	5.014	6.344	3.667	4.716	6.185	3.49	4.605	5.865
lb/hr	**SO_2**	0.53	0.71	0.90	0.52	0.69	0.87	0.50	0.66	0.83
lb/hr	**PM10**	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	NOx (g/s)	0.324	0.429	0.546	0.315	0.417	0.528	0.305	0.401	0.503
	CO (g/s)	0.477	0.632	0.800	0.462	0.595	0.780	0.440	0.581	0.740
	SO2 (g/s)	0.067	0.090	0.114	0.066	0.087	0.110	0.063	0.083	0.105
	PM10 (g/s)	0.504	0.504	0.504	0.504	0.504	0.504	0.504	0.504	0.504

Model Results - Maximum X/Q concentration (ug/m3/(g/s)) predicted from AERMOD

1 hour	10.44705	9.16558	8.05025	10.44522	9.27019	8.14365	10.52052	9.3871	8.26654
3 hour	7.27349	6.10213	5.61967	7.23842	6.1676	5.66773	7.33848	6.24039	5.71162
8 hour	5.89103	5.41108	4.60034	5.89682	5.453	4.71465	5.92511	5.49755	4.82921
24 hour	2.23515	1.93245	1.73031	2.22989	1.95242	1.75208	2.24882	1.97507	1.77501
annual	0.39272	0.34118	0.29392	0.39227	0.34481	0.29921	0.3957	0.34884	0.30483

Maximum Concentration (ug/m3) predicted per Pollutant Normal Operations

											max
NOx	**1 hour**	3.3873	3.9335	4.3959	3.2892	3.8626	4.2990	3.2054	3.7645	4.1544	4.3959
	annual	0.1273	0.1464	0.1605	0.1235	0.1437	0.1580	0.1206	0.1399	0.1532	0.1605
CO	**1 hour**	4.9867	5.7956	6.4406	4.8304	5.5134	6.3520	4.6304	5.4515	6.1143	6.4406
	8 hour	2.8120	3.4215	3.6805	2.7270	3.2431	3.6774	2.6078	3.1927	3.5719	3.6805
SO2	**1 hour**	0.6983	0.8207	0.9137	0.6850	0.8067	0.8935	0.6634	0.7813	0.8653	0.9137
	3 hour	0.4862	0.5464	0.6378	0.4747	0.5367	0.6218	0.4627	0.5194	0.5978	0.6378
	24 hour	0.1494	0.1730	0.1964	0.1462	0.1699	0.1922	0.1418	0.1644	0.1858	0.1964
	annual	0.0262	0.0305	0.0334	0.0257	0.0300	0.0328	0.0250	0.0290	0.0319	0.0334
PM10	**24 hour**	1.1275	0.9748	0.8728	1.1249	0.9849	0.8838	1.1344	0.9963	0.8954	1.1344
	annual	0.1981	0.1721	0.1483	0.1979	0.1739	0.1509	0.1996	0.1760	0.1538	0.1996