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April 29, 2009

VIA HAND DELIVERY AND PER PROOF OF SERVICE

DOCKET	
07-AFC-6	
DATE	APR 29 2009
RECD.	APR 29 2009

Mr. Mike Monasmith, Siting Project Manager
California Energy Commission
1516 Ninth Street, MS-15
Sacramento, CA 95814

Re: Carlsbad Energy Center Project (07-AFC-6)
Revised Health Risk Assessment

Dear Mr. Monasmith:

On behalf of Carlsbad Energy Center LLC, please find enclosed for docketing the Revised Health Risk Assessment for the Carlsbad Energy Center Project. A copy of the enclosed materials will be forwarded to all parties pursuant to the attached Proof of Service.

Should you have any questions regarding this material, please contact Mr. McKinsey at (916) 447-0700.

Respectfully submitted,

Kimberly J. Hellwig
Senior Paralegal

Enclosure
cc: See Attached Proof of Service
Mr. Will Walters, Aspen Environmental Group

Portlnd3-1665702.1 0035434-00009

April 29, 2009

sierra research

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Dr. Steve Moore
Engineering Group
San Diego Air Pollution Control District
10124 Old Grove Road
San Diego, CA 92131

Subject: Application for Authority to Construct for the Proposed Carlsbad Energy Center Project – Supplemental Health Risk Assessment

Dear Dr. Moore:

On behalf of Carlsbad Energy Center LLC, we are providing the enclosed supplemental health risk assessment (SHRA) for the proposed Carlsbad Energy Center Project (CECP). It was necessary to perform a SHRA for CECP due to the recent updates by Office of Environmental Health Hazard Assessment/California Air Resources Board to the acute and chronic reference exposure levels for six toxic air contaminants[1] and new 8-hour RELs for the same six compounds. The enclosed SHRA was performed at the request and under the guidance of the SDAPCD. While we continue to have concerns with several of the technical assumptions used for the SHRA, we performed the analysis as directed by the SDAPCD in order to be responsive.

If you have any questions or need any additional information, please contact me at (916) 444-6666.

Sincerely,

Tom Andrews
Senior Engineer

Enclosures

cc: George L. Piantka, Carlsbad Energy Center LLC
John McKinsey, Stoel
Will Walters, CEC
Michael Monasmith, CEC
CEC Dockets Office (07-AFC-6)

[1] The six TACs are acetaldehyde, acrolein, formaldehyde, arsenic, manganese, and mercury.

Supplemental Health Risk Assessment
Requested by the San Diego County Air Pollution Control District
Carlsbad Energy Center Project

At the request of the San Diego County Air Pollution Control District (SDAPCD), the Applicant performed a supplemental health risk assessment (SHRA) for the CECP. The following is a summary of the technical approach used for this SHRA.

1. At the request of the SDAPCD, the SHRA was performed using the methodology of "dispersing" health impacts directly from the AERMOD dispersion model rather than using the HARP On-Ramp or HARP software for dispersion purposes. This is identical to the HRA modeling approach used by the Applicant in the CECP AFC and by the SDAPCD for the PDOC. This approach for performing an HRA is discussed in detail in both the AFC and PDOC for the CECP.

2. As requested by the SDAPCD, the SHRA computes "resident" cancer risk using the Derived-Adjusted Method, and uses the worker point estimate method to compute off-site worker cancer risk (i.e., assumes a worker breathing rate of 149 l/kgBW-day). The SHRA also computes non-cancer chronic, 8-hour, and acute health hazard indices.

3. The SHRA uses the most recent cancer potency slopes and unit risk factors, and non-cancer Reference Exposure Levels (RELs) available in HARP Version 1.4a , and in the February 9, 2009 version of the Consolidated Table of OEHHA/ARB-Approved Risk Assessment Health Values.

    a. Includes the February 9, 2009 OEHHA/ARB update of acute (1-hour) and chronic (annual) RELs for six toxic air contaminants (TACs), and new 8-hour RELs for the same six TACs, as follows:

        i. Three organic TACs: acetaldehyde, acrolein, and formaldehyde
        ii. Three inorganic TACs: arsenic, manganese, and mercury

    b. At the request of the SDAPCD, the multipathway analyses of carcinogens and chronic TACs also address the additional pathway of Home-Grown Produce, using the rural option of HARP with a deposition rate of 0.05 meters per second, as well as the dermal absorption and soil ingestion pathways.

    c. Chronic RELs for worker receptors are the same as the OEHHA/ARB list for resident receptors with respect to gas turbine emissions, which are assumed under the SDAPCD's assumptions for Potential to Emit (PTE) to occur 8,760 hours per year.

d. Inverse chronic RELs for worker receptors are calculated as 4.2 (= 7/5 x 24/8 adjustments for working days per week and working hours per day, respectively) multiplied by those given by OEHHA/ARB for resident receptors with respect to the Diesel emergency fire water pump engine emissions because these emissions occur only 1 hour per week for approximately 50 hours per year yet the annual emissions and resulting concentrations are computed on the basis of 7 days per week and 24 hours per day.

4. As requested by the SDAPCD, the SHRA analyzed 8-hour RELs using the following approach:

   a. AERMOD is run for each of the three 8-hour blocks in each day (i.e., midnight – 8 AM, 8 AM – 4 PM[1], and 4 PM – midnight).[2]

   b. The 8-hour health hazard index (HHI) is derived the same way as the acute and chronic HHIs,[3] and is assumed to have the same significance level of 1.0 (i.e., no SDAPCD rules in California yet address the 8-hour RELs and limiting HHI for HRAs).

5. The AERMOD runs are structured with separate source groups to combine sources, as needed, to represent the two emitting stacks for the two proposed new combined cycle units: one stack for the Diesel emergency fire water pump engine, and one emitting stack for the existing Encina Power Station Boilers 4 and 5. Separate sources are used to compute 1-hour, 8-hour, and annual averages of the health impacts from the proposed new combined cycle units, including three separate sources to represent the three phases of a startup hour weighted by their relative durations (i.e., 12, 10, and 38 minutes each).

6. All runs of AERMOD are set up to facilitate both tabular output and development of isopleths maps by the SDAPCD.

7. For the SHRA, the following operating cases were analyzed:

   a. As requested by the SDAPCD, for cancer and chronic non-cancer impacts, the following three annual cases were analyzed:

      i. Potential for each gas turbine to operate for 8,760 hours during a non-commissioning year that includes 1,460 startups, 1,460

[1] California Office of Environmental Health Hazard Assessment (OEHHA). *Technical Support Document for the Derivation of Noncancer Reference Exposure Levels*, pages xv-xvi, June 2008.

[2] Even though the OEHHA rationale in developing the 8-hour RELs suggests that the 8-hour period for the 8-hour average TAC emission rates should be 8 AM – 4PM to be approximately coincident with the time workers are at their workplace and children are in school, the SDAPCD requested that the modeling address all three 8-hour blocks of time in each day (i.e., midnight – 8 AM, 8 AM – 4 PM, and 4 PM – midnight).

[3] The maximum 1-hour, 8-hour, or annual ground-level concentration computed by the model for each appropriate TAC is divided by the 1-hour, 8-hour, or annual REL, respectively, to get the health hazard quotient for each TAC, and the quotients are added to compute the HHI.

shutdowns, 40 hours of combustor tuning (assumed at 50% load), 13 hours of low (50%) load operation, and the remaining 7,077 hours at 100% load, plus 50 hours of operation for the Diesel emergency fire water pump engine.[4]

ii. Potential for each gas turbine to operate for 8,760 hours during a commissioning year that includes 1,460 startups, 1,460 shutdowns, 40 hours of combustor tuning (assumed at 50% load), 13 hours of low (50%) load operation, 415 hours of commissioning, and the remaining 6,662 hours at 100% load, plus 50 hours of operation for the Diesel emergency fire water pump engine.

iii. Potential for each gas turbine to operate 8,760 hours during a non-commissioning year at 100% load with no startups, shutdowns, tuning, or low load operation, plus 50 hours of operation for the Diesel emergency fire water pump engine.

b. For acute non-cancer impacts, the SDAPCD required the use of gas turbine low load stack parameters. The corresponding low load natural gas fuel use rate was also used to calculate gas turbine TAC emissions. The following two worst-case hours were analyzed as requested by the SDAPCD:

i. Simultaneous phased startup of both gas turbines plus testing of the Diesel emergency fire water pump engine; and

ii. Commissioning of one gas turbine with the other gas turbine undergoing a routine startup plus testing of the Diesel emergency fire water pump engine.

c. For 8-hour non-cancer impacts, the SDAPCD required the following cases:

i. During an eight-hour period there is a simultaneous startup of both gas turbines. This occurs twice during the 8-hour period. A phased modeling approach is used for the gas turbine startups. For this modeling, there are three phases—each is modeled separately, with the phases occurring over a period of 12, 10, and 38 minutes, respectively. The 8-hour period also assumes two shutdown periods (each occurring over a 7-minute period). During the remaining 346 minutes of the 8-hour period it is assumed that the gas turbines are operating normally at 100% load. During the 8-hour period it is also assumed that the Diesel emergency fire water pump engine is operated for an hour for testing purposes.

[4] Standard SDACPD procedure for calculating annual emissions of emergency engines.

ii. One gas turbine operating as described above with the other gas turbine undergoing commissioning for the entire eight-hour period. During the 8-hour period it is also assumed that the Diesel emergency fire water pump engine is operated for an hour for testing purposes.

iii. Both gas turbines operating normally at 100% load for the entire eight hours. During the 8-hour period it is also assumed that the Diesel emergency fire water pump engine is operated for an hour for testing purposes.

8. Receptor Grid – The same receptor grid used for the HRA performed as part of the CECP AFC was also used for the SHRA.

9. TAC Emission Rates – The TAC emission factors and corresponding emission rates required by the SDAPCD and used for the SHRA are shown in the detailed emission summary tables included as Attachment SHRA-2.

10. SHRA Results – The results of the SHRA are summarized in the attached Table SHRA-Summary (see Attachment SHRA-1).

11. Modeling Files – The modeling input and output files for the SHRA are included in the attached compact disc.

ATTACHMENT SHRA-1
SHRA SUMMARY OF RESULTS

TABLE SHRA -Summary Summary of Modeled HRA Impacts for CECP	
Type of Analysis	**Maximum Impact**
1-Hour Acute HHI Impacts	
Non-Commissioning Year - New Equipment (gas turbines in simultaneous startup and emergency firepump engine operating for testing)	0.13
Commissioning Year - New Equipment (one gas turbine in startup, second gas turbine in commissioning, emergency firepump engine operating for testing)	0.16
Existing Boilers 4 and 5	0.01
Emergency Firepump Engine	0.05
Non-Commissioning Year – Total Impact for New Equipment (simultaneous startup of both gas turbines and emergency firepump engine operating for testing) and Existing Boilers 4 and 5	0.13
Commissioning Year – Total Impact for New Equipment (one gas turbine in startup, second gas turbine in commissioning, emergency firepump engine operating for testing) and Existing Boilers 4 and 5	0.16
8-Hour HHI Impacts	
Non-Commissioning Year – New Equipment (both gas turbines with two startups, two shutdowns, 100% load for remaining hours and emergency firepump engine operating for testing for one hour)	0.04
Commissioning Year – New Equipment (One gas turbine with two startups, two shutdowns, and 100% load for remaining hours. Second gas turbine undergoing commissioning for eight hours. Emergency firepump engine operating for testing for one hour)	0.12
Existing Boilers 4 and 5	0.02
Emergency Firepump Engine	0.02
Non-Commissioning Year – Total Impact for New Equipment (gas turbines undergoing two separate startups, two separate shutdowns, 100% load for remaining hours and emergency firepump engine operating for testing for one hour) and Existing Boilers 4 and 5	0.04
Commissioning Year – Total Impact for New Equipment (One gas turbine undergoing two separate startups, two separate shutdowns, 100% load for remaining hours. Second gas turbine undergoing commissioning for eight hours. Emergency firepump engine operating for testing for one hour) and Existing Boilers 4 and 5	0.12

TABLE SHRA -Summary Summary of Modeled HRA Impacts for CECP	
Type of Analysis	**Maximum Impact**
Cancer Risk Impacts – Residence	
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	1.22
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	1.16
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine)	0.83
Emergency Firepump Engine	0.34
Existing Boilers 4 and 5	0.17
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	1.28
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	1.22
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.89
Cancer Risk Impacts – Worker	
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	0.27
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	0.27
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine)	0.27
Emergency Firepump Engine	0.26
Existing Boilers 4 and 5	0.03
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.28
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.28
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.28

TABLE SHRA -Summary Summary of Modeled HRA Impacts for CECP	
Type of Analysis	**Maximum Impact**
Chronic Impacts – Residence	
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	0.01
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	0.01
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine)	0.01
Emergency Firepump Engine	0.01
Existing Boilers 4 and 5	0.03
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.03
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.03
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.03
Chronic Impacts – Worker	
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	0.01
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine)	0.01
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine)	0.00
Emergency Firepump Engine	0.00
Existing Boilers 4 and 5	0.03
Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.03
Non-Commissioning Year - New Equipment (two gas turbines with startups/shutdowns and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.03
Non-Commissioning Year - New Equipment (two gas turbines operating 8760 hours at 100% load and Diesel emergency firepump engine) and Existing Boilers 4 and 5	0.03

ATTACHMENT SHRA-2
DETAILED TAC EMISSION CALCULATIONS

Table SHRA-1

Maximum Hourly, 8-Hour and Annual TAC Pollutant Emissions From Each Proposed Gas Turbine during Non-Commissioning District Potential-to-Emit-Year and 346 Minutes of the 8-Hour Periods

Carlsbad Energy Center

Toxic Air Contaminant	Emission Factor		Normal-Hour Contribution Emission Rate				
	Emission Factor [1] lb/MMscf	Source	Hourly lbs/hour	Annual tons/year	Hourly g/sec	Annual g/sec	8-Hours[8] g/sec
Ammonia	6.95	SDAPCD Permit	1.42E+01	50.27	1.79E+00	1.45E+00	1.29E+00
Propylene	3.86E-01	District workbook	7.88E-01	2.79	9.93E-02	8.02E-02	7.16E-02
Hazardous Air Pollutants (HAPs, federal)							
Acetaldehyde	2.04E-02	0.5*AP-42[7]	4.17E-02	0.15	5.25E-03	4.24E-03	3.79E-03
Acrolein	3.27E-03	0.5*AP-42[7]	6.68E-03	0.024	8.42E-04	6.80E-04	6.07E-04
Benzene	6.10E-03	0.5*AP-42[7]	1.25E-02	0.044	1.57E-03	1.27E-03	1.13E-03
1,3-Butadiene	2.20E-04	0.5*AP-42[7]	4.49E-04	0.0016	5.65E-05	4.57E-05	4.08E-05
Ethylbenzene	1.63E-02	0.5*AP-42[7]	3.33E-02	0.12	4.20E-03	3.39E-03	3.03E-03
Formaldehyde	4.59E-01	CATEF	9.37E-01	3.32	1.18E-01	9.54E-02	8.51E-02
Hexane, n-	1.30E-01	CATEF	2.65E-01	0.94	3.34E-02	2.69E-02	2.40E-02
Naphthalene	6.65E-04	0.5*AP-42[7]	1.36E-03	0.0048	1.71E-04	1.38E-04	1.23E-04
PAHs (listed individually below)	3.28E-04	SUM	6.70E-04	0.002372	8.44E-05	6.82E-05	6.09E-05
Acenaphthene	9.50E-06	CATEF	1.94E-05	0.000069	2.45E-06	1.98E-06	1.76E-06
Acenapthyene	7.35E-06	CATEF	1.50E-05	0.000053	1.89E-06	1.53E-06	1.36E-06
Anthracene	1.69E-05	CATEF	3.45E-05	0.000122	4.35E-06	3.52E-06	3.14E-06
Benzo(a)anthracene	1.13E-05	CATEF	2.31E-05	0.000082	2.91E-06	2.35E-06	2.10E-06
Benzo(a)pyrene	6.95E-06	CATEF	1.42E-05	0.000050	1.79E-06	1.45E-06	1.29E-06
Benzo(e)pyrene	2.72E-07	CATEF	5.56E-07	0.000002	7.01E-08	5.66E-08	5.05E-08
Benzo(b)fluoranthrene	5.65E-06	CATEF	1.15E-05	0.000041	1.46E-06	1.18E-06	1.05E-06
Benzo(k)fluoranthrene	5.50E-06	CATEF	1.12E-05	0.000040	1.42E-06	1.14E-06	1.02E-06
Benzo(g,h,i)perylene	6.85E-06	CATEF	1.40E-05	0.000050	1.76E-06	1.43E-06	1.27E-06
Chrysene	1.26E-05	CATEF	2.58E-05	0.000091	3.25E-06	2.62E-06	2.34E-06
Dibenz(a,h)anthracene	1.18E-05	CATEF	2.40E-05	0.000085	3.03E-06	2.44E-06	2.18E-06
Fluoranthene	2.16E-05	CATEF	4.42E-05	0.000156	5.56E-06	4.49E-06	4.01E-06
Fluorene	2.90E-05	CATEF	5.93E-05	0.000210	7.47E-06	6.03E-06	5.38E-06
Indeno(1,2,3-cd)pyrene	1.18E-05	CATEF	2.40E-05	0.000085	3.03E-06	2.44E-06	2.18E-06
Phenanthrene	1.57E-04	CATEF	3.21E-04	0.001136	4.04E-05	3.27E-05	2.91E-05
Pyrene	1.39E-05	CATEF	2.84E-05	0.000101	3.58E-06	2.89E-06	2.58E-06
Propylene oxide	1.48E-02	0.5*AP-42[7]	3.02E-02	0.11	3.81E-03	3.08E-03	2.75E-03
Toluene	6.65E-02	0.5*AP-42[7]	1.36E-01	0.48	1.71E-02	1.38E-02	1.23E-02
Xylene	3.27E-02	0.5*AP-42[7]	6.67E-02	0.24	8.41E-03	6.79E-03	6.06E-03
Total HAPs =				5.42			

1) SDAPCD emission factors calculated for normal operation with air pollution control systems operating.

2) Single turbine maximum (100% load) heat input (MMBtu/hr) = 2,085

3) Natural gas heat content (Btu/scf high heating value, HHV) = 1,020.0 SDAPCD Value

4) Maximum single turbine hourly fuel flow (MMscf/hr) = 2.044

5) Maximum turbine annual operating time (hours) = 7,077 without SDAPCD's startup, shutdown, tuning or low-load hours (i.e., 1460, 170, 40 and 13 hours per year, respectively)

6) Maximum single turbine annual fuel flow (MMscf/yr) = 14,466.2

7) SDAPCD assumes that the oxidation catalyst reduces this TAC emission by 50%.

8) This 100% load modeling input emission rate is for 5.767 of the 8 hours in each 8-hour period (i.e., 346 minutes).
Startup emission rates are used for the first and last hours.

Table SHRA-1A

Maximum Non-Commissioning Hour, 8-Hour and Annual TAC Emission Rate From Each Proposed Gas Turbine during Commissioning
District Potential-to-Emit-Year and 346 Minutes of the 8-Hour Periods
Carlsbad Energy Center

Toxic Air Contaminant	Emission Factor		Normal-Hour Contribution Emission Rate				
	Emission Factor [1] lb/MMscf	Source	Hourly lbs/hour	Annual tons/year	Hourly g/sec	Annual g/sec	8-Hours[8] g/sec
Ammonia	6.95	SDAPCD Permit	1.42E+01	47.32	1.79E+00	1.36E+00	1.29E+00
Propylene	3.86E-01	District workbook	7.88E-01	2.62	9.93E-02	7.55E-02	7.16E-02
Hazardous Air Pollutants (HAPs, federal)							
Acetaldehyde	2.04E-02	0.5*AP-42[7]	4.17E-02	0.14	5.25E-03	4.00E-03	3.79E-03
Acrolein	3.27E-03	0.5*AP-42[7]	6.68E-03	0.022	8.42E-04	6.41E-04	6.07E-04
Benzene	6.10E-03	0.5*AP-42[7]	1.25E-02	0.042	1.57E-03	1.19E-03	1.13E-03
1,3-Butadiene	2.20E-04	0.5*AP-42[7]	4.49E-04	0.0015	5.65E-05	4.30E-05	4.08E-05
Ethylbenzene	1.63E-02	0.5*AP-42[7]	3.33E-02	0.11	4.20E-03	3.19E-03	3.03E-03
Formaldehyde	4.59E-01	CATEF	9.37E-01	3.12	1.18E-01	8.98E-02	8.51E-02
Hexane, n-	1.30E-01	CATEF	2.65E-01	0.88	3.34E-02	2.54E-02	2.40E-02
Naphthalene	6.65E-04	0.5*AP-42[7]	1.36E-03	0.0045	1.71E-04	1.30E-04	1.23E-04
PAHs (listed individually below)	3.28E-04	SUM	6.70E-04	0.002232	8.44E-05	6.42E-05	6.09E-05
Acenaphthene	9.50E-06	CATEF	1.94E-05	0.000065	2.45E-06	1.86E-06	1.76E-06
Acenapthyene	7.35E-06	CATEF	1.50E-05	0.000050	1.89E-06	1.44E-06	1.36E-06
Anthracene	1.69E-05	CATEF	3.45E-05	0.000115	4.35E-06	3.31E-06	3.14E-06
Benzo(a)anthracene	1.13E-05	CATEF	2.31E-05	0.000077	2.91E-06	2.21E-06	2.10E-06
Benzo(a)pyrene	6.95E-06	CATEF	1.42E-05	0.000047	1.79E-06	1.36E-06	1.29E-06
Benzo(e)pyrene	2.72E-07	CATEF	5.56E-07	0.000002	7.01E-08	5.33E-08	5.05E-08
Benzo(b)fluoranthrene	5.65E-06	CATEF	1.15E-05	0.000038	1.46E-06	1.11E-06	1.05E-06
Benzo(k)fluoranthrene	5.50E-06	CATEF	1.12E-05	0.000037	1.42E-06	1.08E-06	1.02E-06
Benzo(g,h,i)perylene	6.85E-06	CATEF	1.40E-05	0.000047	1.76E-06	1.34E-06	1.27E-06
Chrysene	1.26E-05	CATEF	2.58E-05	0.000086	3.25E-06	2.47E-06	2.34E-06
Dibenz(a,h)anthracene	1.18E-05	CATEF	2.40E-05	0.000080	3.03E-06	2.30E-06	2.18E-06
Fluoranthene	2.16E-05	CATEF	4.42E-05	0.000147	5.56E-06	4.23E-06	4.01E-06
Fluorene	2.90E-05	CATEF	5.93E-05	0.000197	7.47E-06	5.68E-06	5.38E-06
Indeno(1,2,3-cd)pyrene	1.18E-05	CATEF	2.40E-05	0.000080	3.03E-06	2.30E-06	2.18E-06
Phenanthrene	1.57E-04	CATEF	3.21E-04	0.001069	4.04E-05	3.08E-05	2.91E-05
Pyrene	1.39E-05	CATEF	2.84E-05	0.000095	3.58E-06	2.72E-06	2.58E-06
Propylene oxide	1.48E-02	0.5*AP-42[7]	3.02E-02	0.10	3.81E-03	2.90E-03	2.75E-03
Toluene	6.65E-02	0.5*AP-42[7]	1.36E-01	0.45	1.71E-02	1.30E-02	1.23E-02
Xylene	3.27E-02	0.5*AP-42[7]	6.67E-02	0.22	8.41E-03	6.40E-03	6.06E-03
Total HAPs =				5.10			

1) SDAPCD emission factors calculated for normal operation with air pollution control systems operating.
2) Single turbine maximum heat input (MMBtu/hr) = 2,085
3) Natural gas heat content (Btu/scf high heating value, HHV) = 1,020.0 SDAPCD Value
4) Maximum single turbine hourly fuel flow (MMscf/hr) = 2.044
5) Maximum turbine annual operating time (hours) = 6,662 without SDAPCD's startup, shutdown, commissioning, tuning or low-load hours (i.e., 1460, 170, 415, 40 and 13 hours per year,
6) Maximum single turbine annual fuel flow (MMscf/yr) = 13,617.9
7) SDAPCD assumes that the oxidation catalyst reduces this TAC emission by 50%.
8) This 100% load modeling input emission rate is for 5.767 of the 8 hours in each 8-hour period (i.e., 346 minutes).
Startup emission rates are used for the first and last hours.

Table SHRA-1B

Maximum Hourly, 8-Hour and Annual TAC Pollutant Emissions From Each Proposed Gas Turbine during District "Potential-to-Emit" Hour, 8-Hours and Year with no Startups, Shutdowns or Commissioning

Carlsbad Energy Center

Toxic Air Contaminant	Emission Factor		100% Load Emission Rate				
	Emission Factor [1]	Source	Hourly	Annual	Hourly	Annual	8-Hours[8]
	lb/MMscf		lbs/hour	tons/year	g/sec		
Ammonia	6.95	SDAPCD Permit	1.42E+01	62.22	1.79E+00	1.79E+00	1.34E+00
Propylene	3.86E-01	District workbook	7.88E-01	3.45	9.93E-02	9.93E-02	7.45E-02
Hazardous Air Pollutants (HAPs, federal)							
Acetaldehyde	2.04E-02	0.5*AP-42[7]	4.17E-02	0.18	5.25E-03	5.25E-03	3.94E-03
Acrolein	3.27E-03	0.5*AP-42[7]	6.68E-03	0.029	8.42E-04	8.42E-04	6.32E-04
Benzene	6.10E-03	0.5*AP-42[7]	1.25E-02	0.055	1.57E-03	1.57E-03	1.18E-03
1,3-Butadiene	2.20E-04	0.5*AP-42[7]	4.49E-04	0.0020	5.65E-05	5.65E-05	4.24E-05
Ethylbenzene	1.63E-02	0.5*AP-42[7]	3.33E-02	0.15	4.20E-03	4.20E-03	3.15E-03
Formaldehyde	4.59E-01	CATEF	9.37E-01	4.11	1.18E-01	1.18E-01	8.86E-02
Hexane, n-	1.30E-01	CATEF	2.65E-01	1.16	3.34E-02	3.34E-02	2.50E-02
Naphthalene	6.65E-04	0.5*AP-42[7]	1.36E-03	0.0060	1.71E-04	1.71E-04	1.28E-04
PAHs (listed individually below)	3.28E-04	SUM	6.70E-04	0.002936	8.44E-05	8.44E-05	6.33E-05
Acenaphthene	9.50E-06	CATEF	1.94E-05	0.000085	2.45E-06	2.45E-06	1.84E-06
Acenapthyene	7.35E-06	CATEF	1.50E-05	0.000066	1.89E-06	1.89E-06	1.42E-06
Anthracene	1.69E-05	CATEF	3.45E-05	0.000151	4.35E-06	4.35E-06	3.26E-06
Benzo(a)anthracene	1.13E-05	CATEF	2.31E-05	0.000101	2.91E-06	2.91E-06	2.18E-06
Benzo(a)pyrene	6.95E-06	CATEF	1.42E-05	0.000062	1.79E-06	1.79E-06	1.34E-06
Benzo(e)pyrene	2.72E-07	CATEF	5.56E-07	0.000002	7.01E-08	7.01E-08	5.25E-08
Benzo(b)fluoranthrene	5.65E-06	CATEF	1.15E-05	0.000051	1.46E-06	1.46E-06	1.09E-06
Benzo(k)fluoranthrene	5.50E-06	CATEF	1.12E-05	0.000049	1.42E-06	1.42E-06	1.06E-06
Benzo(g,h,i)perylene	6.85E-06	CATEF	1.40E-05	0.000061	1.76E-06	1.76E-06	1.32E-06
Chrysene	1.26E-05	CATEF	2.58E-05	0.000113	3.25E-06	3.25E-06	2.43E-06
Dibenz(a,h)anthracene	1.18E-05	CATEF	2.40E-05	0.000105	3.03E-06	3.03E-06	2.27E-06
Fluoranthene	2.16E-05	CATEF	4.42E-05	0.000193	5.56E-06	5.56E-06	4.17E-06
Fluorene	2.90E-05	CATEF	5.93E-05	0.000260	7.47E-06	7.47E-06	5.60E-06
Indeno(1,2,3-cd)pyrene	1.18E-05	CATEF	2.40E-05	0.000105	3.03E-06	3.03E-06	2.27E-06
Phenanthrene	1.57E-04	CATEF	3.21E-04	0.001406	4.04E-05	4.04E-05	3.03E-05
Pyrene	1.39E-05	CATEF	2.84E-05	0.000124	3.58E-06	3.58E-06	2.69E-06
Propylene oxide	1.48E-02	0.5*AP-42[7]	3.02E-02	0.13	3.81E-03	3.81E-03	2.86E-03
Toluene	6.65E-02	0.5*AP-42[7]	1.36E-01	0.60	1.71E-02	1.71E-02	1.28E-02
Xylene	3.27E-02	0.5*AP-42[7]	6.67E-02	0.29	8.41E-03	8.41E-03	6.31E-03
Total HAPs =				6.71			

1) SDAPCD emission factors calculated for normal operation with air pollution control systems operating.

2) Single turbine maximum heat input (MMBtu/hr) = 2,085

3) Natural gas heat content (Btu/scf high heating value, HHV) = 1,020.0 SDAPCD Value

4) Maximum single turbine hourly fuel flow (MMscf/hr) = 2.044

5) Maximum turbine annual operating time (hours) = 8,760 (No startup, shutdown, or commissioning hours)

6) Maximum single turbine annual fuel flow (MMscf/yr) = 17,906.5

7) SDAPCD assumes that the oxidation catalyst reduces this TAC emission by 50%.

8) This 100% load modeling input emission rate is for 6 of the 8 hours in each 8-hour period.
Startup emission rates are used for the first and last hours.

Table SHRA-2A
Gas Turbine Emissions during Startup Phase 1
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Emission Factor [1]	Emission Rate Per Turbine			
		Maximum Hourly		Annual[5,6]	8-Hour[6,7]
	lb/MMscf	lbs/hr	g/sec	g/sec	g/sec
Ammonia	6.95	0	0	0	0
Propylene	7.71E-01	5.90E-01	7.43E-02	2.48E-03	3.72E-03
Hazardous Air Pollutants (HAPs)					
Acetaldehyde	1.28E+00	9.79E-01	1.23E-01	4.11E-03	6.17E-03
Acrolein	6.89E-02	5.27E-02	6.64E-03	2.21E-04	3.32E-04
Benzene	2.56E-02	1.96E-02	2.47E-03	8.23E-05	1.23E-04
1,3-Butadiene	4.39E-04	3.36E-04	4.23E-05	1.41E-06	2.12E-06
Ethylbenzene	3.26E-02	2.49E-02	3.14E-03	1.05E-04	1.57E-04
Formaldehyde	4.63E+00	3.54E+00	4.46E-01	1.49E-02	2.23E-02
Hexane	2.59E-01	1.98E-01	2.50E-02	8.32E-04	1.25E-03
Naphthalene	1.04E-03	7.94E-04	1.00E-04	3.34E-06	5.00E-06
PAHs (16 listed individually below)					
Acenaphthene	1.90E-05	1.45E-05	1.83E-06	6.11E-08	9.16E-08
Acenaphthylene	1.47E-05	1.12E-05	1.42E-06	4.72E-08	7.09E-08
Anthracene	3.38E-05	2.59E-05	3.26E-06	1.09E-07	1.63E-07
Benzo(a)anthracene	2.25E-05	1.72E-05	2.17E-06	7.22E-08	1.08E-07
Benzo(a)pyrene	1.39E-05	1.06E-05	1.34E-06	4.47E-08	6.70E-08
Benzo(e)pyrene	5.44E-07	4.16E-07	5.24E-08	1.75E-09	2.62E-09
Benzo(b)fluoranthrene	1.13E-05	8.65E-06	1.09E-06	3.63E-08	5.45E-08
Benzo(k)fluoranthrene	1.10E-05	8.42E-06	1.06E-06	3.53E-08	5.30E-08
Benzo(g,h,i)perylene	1.37E-05	1.05E-05	1.32E-06	4.40E-08	6.60E-08
Chrysene	2.25E-05	1.72E-05	2.17E-06	7.22E-08	1.08E-07
Dibenz(a,h)anthracene	2.25E-05	1.72E-05	2.17E-06	7.22E-08	1.08E-07
Fluoranthene	4.32E-05	3.31E-05	4.16E-06	1.39E-07	2.08E-07
Fluorene	5.80E-05	4.44E-05	5.59E-06	1.86E-07	2.80E-07
Indeno(1,2,3-cd)pyrene	2.25E-05	1.72E-05	2.17E-06	7.22E-08	1.08E-07
Phenanthrene	3.13E-04	2.39E-04	3.02E-05	1.01E-06	1.51E-06
Pyrene	2.77E-05	2.12E-05	2.67E-06	8.90E-08	1.34E-07
Propylene oxide	2.96E-02	2.26E-02	2.85E-03	9.51E-05	1.43E-04
Toluene	9.28E-02	7.10E-02	8.94E-03	2.98E-04	4.47E-04
Xylene	3.48E-03	2.66E-03	3.35E-04	1.12E-05	1.68E-05

1) Emission factors same as SDAPCD's in worksheet "Turbine EFs & Source Strength" in workbook "Startup Modeling Parameter EstRev16A".

2) Single turbine maximum heat input (MMBtu/hr) = 780 (SDAPCD's value)

3) Natural gas heat content (Btu/scf high heating value, HHV) = 1020.0 (SDAPCD's value)

4) Maximum single turbine hourly fuel flow (MMscf/hr) 0.7651 (SDAPCD's value)

5) Startup hours/year = 1,460

6) Weighting factor for this phase of the two "8-hour" and annual startup hours = 0.2000 , based on a duration (minutes) = 12

7) Startup hours/8-hour period = 2

Table SHRA-2B
Gas Turbine Emissions during Startup Phase 2
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Emission Factor [1]	Emission Rate Per Turbine			
		Maximum Hourly		Annual[5,6]	8-Hour[6,7]
	lb/MMscf	lbs/hr	g/sec	g/sec	g/sec
Ammonia	6.95	8.56E+00	1.08E+00	3.00E-02	4.50E-02
Propylene	7.71E-01	9.50E-01	1.20E-01	3.33E-03	4.99E-03
Hazardous Air Pollutants (HAPs)					
Acetaldehyde	1.28E+00	1.58E+00	1.99E-01	5.52E-03	8.28E-03
Acrolein	6.89E-02	8.49E-02	1.07E-02	2.97E-04	4.46E-04
Benzene	2.56E-02	3.15E-02	3.98E-03	1.10E-04	1.66E-04
1,3-Butadiene	4.39E-04	5.41E-04	6.82E-05	1.89E-06	2.84E-06
Ethylbenzene	3.26E-02	4.02E-02	5.06E-03	1.41E-04	2.11E-04
Formaldehyde	4.63E+00	5.71E+00	7.19E-01	2.00E-02	3.00E-02
Hexane	2.59E-01	3.19E-01	4.02E-02	1.12E-03	1.68E-03
Naphthalene	1.04E-03	1.28E-03	1.61E-04	4.48E-06	6.72E-06
PAHs (16 listed individually below)					
Acenaphthene	1.90E-05	2.34E-05	2.95E-06	8.20E-08	1.23E-07
Acenaphthylene	1.47E-05	1.81E-05	2.28E-06	6.34E-08	9.51E-08
Anthracene	3.38E-05	4.17E-05	5.25E-06	1.46E-07	2.19E-07
Benzo(a)anthracene	2.25E-05	2.77E-05	3.49E-06	9.69E-08	1.45E-07
Benzo(a)pyrene	1.39E-05	1.71E-05	2.16E-06	6.00E-08	8.99E-08
Benzo(e)pyrene	5.44E-07	6.70E-07	8.45E-08	2.35E-09	3.52E-09
Benzo(b)fluoranthrene	1.13E-05	1.39E-05	1.75E-06	4.87E-08	7.31E-08
Benzo(k)fluoranthrene	1.10E-05	1.36E-05	1.71E-06	4.74E-08	7.12E-08
Benzo(g,h,i)perylene	1.37E-05	1.69E-05	2.13E-06	5.91E-08	8.86E-08
Chrysene	2.25E-05	2.77E-05	3.49E-06	9.69E-08	1.45E-07
Dibenz(a,h)anthracene	2.25E-05	2.77E-05	3.49E-06	9.69E-08	1.45E-07
Fluoranthene	4.32E-05	5.32E-05	6.71E-06	1.86E-07	2.79E-07
Fluorene	5.80E-05	7.15E-05	9.01E-06	2.50E-07	3.75E-07
Indeno(1,2,3-cd)pyrene	2.25E-05	2.77E-05	3.49E-06	9.69E-08	1.45E-07
Phenanthrene	3.13E-04	3.86E-04	4.86E-05	1.35E-06	2.03E-06
Pyrene	2.77E-05	3.41E-05	4.30E-06	1.19E-07	1.79E-07
Propylene oxide	2.96E-02	3.65E-02	4.60E-03	1.28E-04	1.92E-04
Toluene	9.28E-02	1.14E-01	1.44E-02	4.00E-04	6.00E-04
Xylene	3.48E-03	4.28E-03	5.40E-04	1.50E-05	2.25E-05

1) Emission factors same as SDAPCD's in worksheet "Turbine EFs & Source Strength" in workbook "Startup Modeling Parameter EstRev16A".

2) Single turbine maximum heat input (MMBtu/hr) = 1,257.0 (SDAPCD's value)

3) Natural gas heat content (Btu/scf high heating value, HHV) = 1020.0 (SDAPCD's value)

4) Maximum single turbine hourly fuel flow (MMscf/hr) : 1.2324 (SDAPCD's value)

5) Startup hours/year = 1,460

6) Weighting factor for this phase of the annual startup hours = 0.1667 , based on a duration (minutes) = 10

7) Startup hours/8-hour period = 2

Table SHRA-2C
Gas Turbine Emissions during Startup Phase 3, Tuning Time and Low Load Operation
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Emission Factor [1]	Emission Rate Per Turbine			
		Maximum Hourly		Annual[5,6,8,9]	8-Hour[6,7]
	lb/MMscf	lbs/hr	g/sec	g/sec	g/sec
Ammonia	6.95	8.56E+00	1.08E+00	1.20E-01	1.71E-01
Propylene	7.71E-01	9.50E-01	1.20E-01	1.34E-02	1.90E-02
Hazardous Air Pollutants (HAPs)					
Acetaldehyde	1.28E+00	1.58E+00	1.99E-01	2.22E-02	3.15E-02
Acrolein	6.89E-02	8.49E-02	1.07E-02	1.19E-03	1.69E-03
Benzene	2.56E-02	3.15E-02	3.98E-03	4.44E-04	6.29E-04
1,3-Butadiene	4.39E-04	5.41E-04	6.82E-05	7.61E-06	1.08E-05
Ethylbenzene	3.26E-02	4.02E-02	5.06E-03	5.65E-04	8.01E-04
Formaldehyde	4.63E+00	5.71E+00	7.19E-01	8.02E-02	1.14E-01
Hexane	2.59E-01	3.19E-01	4.02E-02	4.49E-03	6.37E-03
Naphthalene	1.04E-03	1.28E-03	1.61E-04	1.80E-05	2.55E-05
PAHs (16 listed individually below)					
Acenaphthene	1.90E-05	2.34E-05	2.95E-06	3.29E-07	4.67E-07
Acenaphthylene	1.47E-05	1.81E-05	2.28E-06	2.55E-07	3.61E-07
Anthracene	3.38E-05	4.17E-05	5.25E-06	5.86E-07	8.31E-07
Benzo(a)anthracene	2.25E-05	2.77E-05	3.49E-06	3.89E-07	5.52E-07
Benzo(a)pyrene	1.39E-05	1.71E-05	2.16E-06	2.41E-07	3.42E-07
Benzo(e)pyrene	5.44E-07	6.70E-07	8.45E-08	9.43E-09	1.34E-08
Benzo(b)fluoranthrene	1.13E-05	1.39E-05	1.75E-06	1.96E-07	2.78E-07
Benzo(k)fluoranthrene	1.10E-05	1.36E-05	1.71E-06	1.91E-07	2.70E-07
Benzo(g,h,i)perylene	1.37E-05	1.69E-05	2.13E-06	2.37E-07	3.37E-07
Chrysene	2.25E-05	2.77E-05	3.49E-06	3.89E-07	5.52E-07
Dibenz(a,h)anthracene	2.25E-05	2.77E-05	3.49E-06	3.89E-07	5.52E-07
Fluoranthene	4.32E-05	5.32E-05	6.71E-06	7.49E-07	1.06E-06
Fluorene	5.80E-05	7.15E-05	9.01E-06	1.01E-06	1.43E-06
Indeno(1,2,3-cd)pyrene	2.25E-05	2.77E-05	3.49E-06	3.89E-07	5.52E-07
Phenanthrene	3.13E-04	3.86E-04	4.86E-05	5.42E-06	7.70E-06
Pyrene	2.77E-05	3.41E-05	4.30E-06	4.80E-07	6.81E-07
Propylene oxide	2.96E-02	3.65E-02	4.60E-03	5.13E-04	7.28E-04
Toluene	9.28E-02	1.14E-01	1.44E-02	1.61E-03	2.28E-03
Xylene	3.48E-03	4.28E-03	5.40E-04	6.02E-05	8.55E-05

1) Emission factors same as SDAPCD's in worksheet "Turbine EFs & Source Strength" in workbook "Startup Modeling Parameter EstRev16A".

2) Single turbine maximum heat input (MMBtu/hr) = 1,257.0 (SDAPCD's value)

3) Natural gas heat content (Btu/scf high heating value, HHV) = 1020.0 (SDAPCD's value)

4) Maximum single turbine hourly fuel flow (MMscf/hr) 1.2324 (SDAPCD's value)

5) Startup hours/year = 1,460

6) Weighting factor for this phase of the annual startup hours = 0.6333 , based on a duration (minutes) = 38

7) Startup hours/8-hour period = 2

8) Tuning hours per year = 40

9) Low (50%) load hours per year = 13

Table SHRA-2D
Gas Turbine Emissions during Startup Phase 4 (Shutdown)
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Emission Factor [1] lb/MMscf	Emission Rate Per Turbine			
		Maximum Hourly		Annual[5]	8-Hour[6,7]
		lbs/hr	g/sec	g/sec	g/sec
Ammonia	6.95	3.87E+00	4.88E-01	9.47E-03	1.42E-02
Propylene	7.71E-01	4.30E-01	5.41E-02	1.05E-03	1.58E-03
Hazardous Air Pollutants (HAPs)					
Acetaldehyde	1.28E+00	7.13E-01	8.99E-02	1.74E-03	2.62E-03
Acrolein	6.89E-02	3.84E-02	4.84E-03	9.39E-05	1.41E-04
Benzene	2.56E-02	1.43E-02	1.80E-03	3.49E-05	5.24E-05
1,3-Butadiene	4.39E-04	2.45E-04	3.08E-05	5.98E-07	8.99E-07
Ethylbenzene	3.26E-02	1.82E-02	2.29E-03	4.44E-05	6.68E-05
Formaldehyde	4.63E+00	2.58E+00	3.25E-01	6.31E-03	9.48E-03
Hexane	2.59E-01	1.44E-01	1.82E-02	3.53E-04	5.31E-04
Naphthalene	1.04E-03	5.79E-04	7.29E-05	1.42E-06	2.13E-06
PAHs (16 listed individually below)					
Acenaphthene	1.90E-05	1.06E-05	1.33E-06	2.59E-08	3.89E-08
Acenaphthylene	1.47E-05	8.19E-06	1.03E-06	2.00E-08	3.01E-08
Anthracene	3.38E-05	1.88E-05	2.37E-06	4.61E-08	6.92E-08
Benzo(a)anthracene	2.25E-05	1.25E-05	1.58E-06	3.06E-08	4.60E-08
Benzo(a)pyrene	1.39E-05	7.75E-06	9.76E-07	1.89E-08	2.85E-08
Benzo(e)pyrene	5.44E-07	3.03E-07	3.82E-08	7.41E-10	1.11E-09
Benzo(b)fluoranthrene	1.13E-05	6.30E-06	7.94E-07	1.54E-08	2.31E-08
Benzo(k)fluoranthrene	1.10E-05	6.13E-06	7.73E-07	1.50E-08	2.25E-08
Benzo(g,h,i)perylene	1.37E-05	7.64E-06	9.62E-07	1.87E-08	2.81E-08
Chrysene	2.25E-05	1.25E-05	1.58E-06	3.06E-08	4.60E-08
Dibenz(a,h)anthracene	2.25E-05	1.25E-05	1.58E-06	3.06E-08	4.60E-08
Fluoranthene	4.32E-05	2.41E-05	3.03E-06	5.89E-08	8.85E-08
Fluorene	5.80E-05	3.23E-05	4.07E-06	7.90E-08	1.19E-07
Indeno(1,2,3-cd)pyrene	2.25E-05	1.25E-05	1.58E-06	3.06E-08	4.60E-08
Phenanthrene	3.13E-04	1.74E-04	2.20E-05	4.27E-07	6.41E-07
Pyrene	2.77E-05	1.54E-05	1.95E-06	3.78E-08	5.67E-08
Propylene oxide	2.96E-02	1.65E-02	2.08E-03	4.03E-05	6.06E-05
Toluene	9.28E-02	5.17E-02	6.52E-03	1.26E-04	1.90E-04
Xylene	3.48E-03	1.94E-03	2.44E-04	4.74E-06	7.12E-06

1) Emission factors same as SDAPCD's in worksheet "Turbine EFs & Source Strength" in workbook "Startup Modeling Parameter EstRev16A".

2) Single turbine maximum heat input (MMBtu/hr) = 568.5 (SDAPCD's value)

3) Natural gas heat content (Btu/scf, HHV) = 1020.0 (SDAPCD's value)

4) Maximum single turbine hourly fuel flow (MMscf/hr) = 0.5574 (SDAPCD's value)

5) Shutdown hours/year = 170 (Note: Shutdown = Startup Phase 4)

6) Weighting factor for this phase of the annual startup hours = 0.1167 , based on a duration (minutes) = 7

7) Startup hours/8-hour period = 2

Table SHRA[1]-2E
Encina Power Station
Maximum Non-Criteria Pollutant Emission Rates For Existing Boilers Fueled with Natural Gas

Boiler Toxic Air Contaminant	Emission Factors	Maximum Hourly and 8-Hour Emission Rate[4,5,6]				Maximum Annual Emission Rate[4,5,6,7,8]			
	lb/MMscf	lbs/hr		g/s		tons/year		g/s	
	Boiler[2]	Boiler 4	Boiler 5	Boiler 4	Boiler 5	Boiler 4	Boiler 5	Boiler 4	Boiler 5
Ammonia[2A]	4.896	1.56E+01	1.67E+01	1.96E+00	2.10E+00	6.82E+01	7.31E+01	1.96E+00	2.10E+00
Benzene	2.10E-03	6.68E-03	7.15E-03	8.42E-04	9.01E-04	2.93E-02	3.13E-02	8.42E-04	9.01E-04
Dichlorobenzene	1.2E-03	3.82E-03	4.09E-03	4.81E-04	5.15E-04	1.67E-02	1.79E-02	4.81E-04	5.15E-04
Formaldehyde	7.50E-02	2.39E-01	2.56E-01	3.01E-02	3.22E-02	1.05E+00	1.12E+00	3.01E-02	3.22E-02
Hexane	1.8	5.73E+00	6.13E+00	7.21E-01	7.72E-01	2.51E+01	2.69E+01	7.21E-01	7.72E-01
Naphthalene	6.1E-04	1.94E-03	2.08E-03	2.44E-04	2.62E-04	8.50E-03	9.10E-03	2.44E-04	2.62E-04
Toluene	3.4E-03	1.08E-02	1.16E-02	1.36E-03	1.46E-03	4.74E-02	5.07E-02	1.36E-03	1.46E-03
PAHs (16 detailed below)									
Acenaphthene	1.80E-06	5.73E-06	6.13E-06	7.21E-07	7.72E-07	2.51E-05	2.69E-05	7.21E-07	7.72E-07
Acenaphthylene	1.80E-06	5.73E-06	6.13E-06	7.21E-07	7.72E-07	2.51E-05	2.69E-05	7.21E-07	7.72E-07
Anthracene	2.40E-06	7.64E-06	8.18E-06	9.62E-07	1.03E-06	3.34E-05	3.58E-05	9.62E-07	1.03E-06
Benzo(a)anthracene	1.8E-06	5.73E-06	6.13E-06	7.21E-07	7.72E-07	2.51E-05	2.69E-05	7.21E-07	7.72E-07
Benzo(a)pyrene	1.2E-06	3.82E-06	4.09E-06	4.81E-07	5.15E-07	1.67E-05	1.79E-05	4.81E-07	5.15E-07
Benzo(b)fluoranthrene	1.8E-06	5.73E-06	6.13E-06	7.21E-07	7.72E-07	2.51E-05	2.69E-05	7.21E-07	7.72E-07
Benzo(k)fluoranthrene	1.8E-06	5.73E-06	6.13E-06	7.21E-07	7.72E-07	2.51E-05	2.69E-05	7.21E-07	7.72E-07
Benzo(g,h,i)perylene	1.2E-06	3.82E-06	4.09E-06	4.81E-07	5.15E-07	1.67E-05	1.79E-05	4.81E-07	5.15E-07
Chrysene	1.8E-06	5.73E-06	6.13E-06	7.21E-07	7.72E-07	2.51E-05	2.69E-05	7.21E-07	7.72E-07
Dibenz(a,h)anthracene	1.2E-06	3.82E-06	4.09E-06	4.81E-07	5.15E-07	1.67E-05	1.79E-05	4.81E-07	5.15E-07
Fluoranthene	3.0E-06	9.54E-06	1.02E-05	1.20E-06	1.29E-06	4.18E-05	4.48E-05	1.20E-06	1.29E-06
Fluorene	2.8E-06	8.91E-06	9.54E-06	1.12E-06	1.20E-06	3.90E-05	4.18E-05	1.12E-06	1.20E-06
Indeno(1,2,3-cd)pyrene	1.8E-06	5.73E-06	6.13E-06	7.21E-07	7.72E-07	2.51E-05	2.69E-05	7.21E-07	7.72E-07
Phenanthrene	1.7E-06	5.41E-06	5.79E-06	6.81E-07	7.30E-07	2.37E-05	2.54E-05	6.81E-07	7.30E-07
Pyrene	5.0E-06	1.59E-05	1.70E-05	2.00E-06	2.15E-06	6.97E-05	7.46E-05	2.00E-06	2.15E-06
Arsenic	2.0E-04	6.36E-04	6.81E-04	8.02E-05	8.58E-05	2.79E-03	2.98E-03	8.02E-05	8.58E-05
Beryllium	1.20E-05	3.82E-05	4.09E-05	4.81E-06	5.15E-06	1.67E-04	1.79E-04	4.81E-06	5.15E-06
Cadmium	1.10E-03	3.50E-03	3.75E-03	4.41E-04	4.72E-04	1.53E-02	1.64E-02	4.41E-04	4.72E-04
Copper	8.50E-04	2.70E-03	2.90E-03	3.41E-04	3.65E-04	1.18E-02	1.27E-02	3.41E-04	3.65E-04
Manganese	3.80E-04	1.21E-03	1.29E-03	1.52E-04	1.63E-04	5.30E-03	5.67E-03	1.52E-04	1.63E-04
Mercury	2.60E-04	8.27E-04	8.86E-04	1.04E-04	1.12E-04	3.62E-03	3.88E-03	1.04E-04	1.12E-04
Nickel	2.10E-03	6.68E-03	7.15E-03	8.42E-04	9.01E-04	2.93E-02	3.13E-02	8.42E-04	9.01E-04
Selenium	2.40E-05	7.64E-05	8.18E-05	9.62E-06	1.03E-05	3.34E-04	3.58E-04	9.62E-06	1.03E-05
Vanadium[3]	2.30E-03	7.32E-03	7.84E-03	9.22E-04	9.87E-04	3.20E-02	3.43E-02	9.22E-04	9.87E-04

(1) SHRA = Supplemental Health Risk Assessment

(2) USEPA. *Compilation of Air Pollutant Emission Factors,* Volume I, Stationary Area and Point Sources, Section 1.4, Natural Gas Combustion, Table 1.4-3, July 1998. Assume no control systems. Only metals with ARB/OEHHA health values are included.

(2A) Based on ammonia permit limit of 10 ppmvd @ 3% O_2 and EPA F-factor (at 68°F) calculation of emission factor to get lbs/MMBtu

(3) Assumed to be emitted in the form vanadium pentoxide.

(4) Maximum heat input for Boiler No. 4 MMBtu/hr) = 3,245.0
Maximum heat input for Boiler No. 5 MMBtu/hr) = 3,475.0

(5) Natural gas heat content (Btu/scf) = 1,020 SDAPCD Value

(6) Maximum hourly fuel consumption for Boiler No. 4 (MMscf/hr) = 3.181
Maximum hourly fuel consumption for Boiler No. 5 (MMscf/hr) = 3.407

(7) Maximum annual fuel consumption for Boiler No. 4 (MMscf/yr) = 27,869
Maximum annual fuel consumption for Boiler No. 5 (MMscf/yr) = 29,844

(8) Maximum possible operation (hours/year) = 8,760 (Value used by the Applicant to be conservative.)

Boiler Stack Parameters
Boilers 4/5 stack height (m) = 116.738
Boilers 4/5 stack exhaust temperature (K) = 427.594
Boilers 4/5 stack exhaust velocity (m/s) = 19.035
Boilers 4/5 stack inside diameter (m) = 7.9248

Table SHRA-2F
Gas Turbine Emissions during Commissioning
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Emission Factor [1]	Emission Rate Per Turbine			
		Maximum Hourly		Commissioning Hours Contribution to Annual[5,6]	8-Hour[6,7]
	lb/MMscf	lbs/hr	g/sec	g/sec	g/sec
Ammonia	6.95	8.56E+00	1.08E+00	5.11E-02	1.08E+00
Propylene	7.71E-01	9.50E-01	1.20E-01	5.67E-03	1.20E-01
Hazardous Air Pollutants (HAPs)				0.00E+00	
Acetaldehyde	1.28E+00	1.58E+00	1.99E-01	9.42E-03	1.99E-01
Acrolein	6.89E-02	8.49E-02	1.07E-02	5.07E-04	1.07E-02
Benzene	2.56E-02	3.15E-02	3.98E-03	1.88E-04	3.98E-03
1,3-Butadiene	4.39E-04	5.41E-04	6.82E-05	3.23E-06	6.82E-05
Ethylbenzene	3.26E-02	4.02E-02	5.06E-03	2.40E-04	5.06E-03
Formaldehyde	4.63E+00	5.71E+00	7.19E-01	3.41E-02	7.19E-01
Hexane	2.59E-01	3.19E-01	4.02E-02	1.91E-03	4.02E-02
Naphthalene	1.04E-03	1.28E-03	1.61E-04	7.64E-06	1.61E-04
PAHs (16 listed individually below)					
Acenaphthene	1.90E-05	2.34E-05	2.95E-06	1.40E-07	2.95E-06
Acenaphthylene	1.47E-05	1.81E-05	2.28E-06	1.08E-07	2.28E-06
Anthracene	3.38E-05	4.17E-05	5.25E-06	2.49E-07	5.25E-06
Benzo(a)anthracene	2.25E-05	2.77E-05	3.49E-06	1.65E-07	3.49E-06
Benzo(a)pyrene	1.39E-05	1.71E-05	2.16E-06	1.02E-07	2.16E-06
Benzo(e)pyrene	5.44E-07	6.70E-07	8.45E-08	4.00E-09	8.45E-08
Benzo(b)fluoranthrene	1.13E-05	1.39E-05	1.75E-06	8.31E-08	1.75E-06
Benzo(k)fluoranthrene	1.10E-05	1.36E-05	1.71E-06	8.09E-08	1.71E-06
Benzo(g,h,i)perylene	1.37E-05	1.69E-05	2.13E-06	1.01E-07	2.13E-06
Chrysene	2.25E-05	2.77E-05	3.49E-06	1.65E-07	3.49E-06
Dibenz(a,h)anthracene	2.25E-05	2.77E-05	3.49E-06	1.65E-07	3.49E-06
Fluoranthene	4.32E-05	5.32E-05	6.71E-06	3.18E-07	6.71E-06
Fluorene	5.80E-05	7.15E-05	9.01E-06	4.27E-07	9.01E-06
Indeno(1,2,3-cd)pyrene	2.25E-05	2.77E-05	3.49E-06	1.65E-07	3.49E-06
Phenanthrene	3.13E-04	3.86E-04	4.86E-05	2.30E-06	4.86E-05
Pyrene	2.77E-05	3.41E-05	4.30E-06	2.04E-07	4.30E-06
Propylene oxide	2.96E-02	3.65E-02	4.60E-03	2.18E-04	4.60E-03
Toluene	9.28E-02	1.14E-01	1.44E-02	6.83E-04	1.44E-02
Xylene	3.48E-03	4.28E-03	5.40E-04	2.56E-05	5.40E-04

1) Emission factors same as SDAPCD's in worksheet "Turbine EFs & Source Strength" in workbook "Startup Modeling Parameter EstRev16A".

2) Single turbine maximum heat input (MMBtu/hr) = 1,257.0 (SDAPCD's value)

3) Natural gas heat content (Btu/scf high heating value, HHV) = 1020.0 (SDAPCD's value)

4) Maximum single turbine hourly fuel flow (MMscf/hr) : 1.2324 (SDAPCD's value)

5) Commissioning hours/year = 415

6) Weighting factor for annual commissioning hours = 1 , based on a duration (minutes) = 60

7) Commissioning hours/8-hour period = 8

Table SHRA-2G
Fire Water Pump Engine Emissions
Carlsbad Energy Center

Rating (bhp) =	246	
Fuel =	Diesel	
Fuel Consumption (gal/hr) =	12.2	
Exhaust Temperature (F) =	938	
Exhaust Diameter (inches) =	4	
Exhaust Flow Rate (acfm) =	1,328	
Exhaust Velocity (ft/sec) =	253.629	
Daily Operating Hours =	1	
Annual Operating Hours =	50	(Application limit for planned testing and maintenance)
Annual Operating Hours =	50	(District standard procedure for health risk assessments)

Diesel-Fueled Engine Toxic Air Contaminant	Emission Factor [1] (lbs/1000 gal)	1-Hour Emission Rate (lbs/hr)	1-Hour Emission Rate (g/sec)	8-Hour Emission Rate (g/sec)	Annual Emission Rate (tons/yr)	Annual Emission Rate (g/sec)
PM10		3.525E-02	4.442E-03	5.552E-04	8.813E-04	2.535E-05
Acrolein	3.390E-02	4.136E-04	5.211E-05	6.514E-06	1.034E-05	2.974E-07
Arsenic	1.600E-03	1.952E-05	2.459E-06	3.074E-07	4.880E-07	1.404E-08
Benzene	1.863E-01	2.273E-03	2.864E-04	3.580E-05	5.682E-05	1.635E-06
Copper	4.100E-03	5.002E-05	6.302E-06	7.878E-07	1.251E-06	3.597E-08
Formaldehyde	1.726E+00	2.106E-02	2.653E-03	3.317E-04	5.265E-04	1.514E-05
Hydrogen chloride	1.863E-01	2.273E-03	2.864E-04	3.580E-05	5.682E-05	1.635E-06
Mercury	2.000E-03	2.440E-05	3.074E-06	3.843E-07	6.100E-07	1.755E-08
Nickel	3.900E-03	4.758E-05	5.995E-06	7.494E-07	1.190E-06	3.422E-08
Toluene	1.054E-01	1.286E-03	1.620E-04	2.025E-05	3.215E-05	9.248E-07
Xylenes	4.240E-02	5.173E-04	6.518E-05	8.147E-06	1.293E-05	3.720E-07

1) Ventura County Air Pollution Control District. AB 2588 Combustion Emission Factors, Diesel (Internal) Combustion Factors, May 17, 2001.

Table SHRA-3A
Calculation of Acute HHI Modeling Inputs for Gas Turbines During Startup Phase
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Weighted[1] Max Hourly Emissions Per Turbine g/s	Acute Reference Exposure Level ($\mu g/m^3$)	HARP Acute HI (per $\mu g/m^3$)	Acute HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	0.000	3,200	3.13E-04	0.00E+00
Acetaldehyde	0.025	470	2.13E-03	5.25E-05
Acrolein	1.33E-03	2.5	4.00E-01	5.31E-04
Benzene	4.94E-04	1,300	7.69E-04	3.80E-07
Formaldehyde	0.09	55	1.82E-02	1.62E-03
Propylene oxide	5.71E-04	3,100	3.23E-04	1.84E-07
Toluene	1.79E-03	37,000	2.70E-05	4.83E-08
Xylene	6.70E-05	22,000	4.55E-05	3.05E-09
			Total =	**2.21E-03**

1) Weighting factor for this phase of startup hour = 0.2000 , based on a duration (minutes) = 12

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	332.04
Turbine stack exhaust velocity (m/s) =	8.07
Turbine stack inside diameter (m) =	6.49

Table SHRA-3B
Calculation of Acute HHI Modeling Inputs for Gas Turbines During Startup Phase
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Weighted[1] Max Hourly Emissions Per Turbine g/s	Acute Reference Exposure Level ($\mu g/m^3$)	HARP Acute HI (per $\mu g/m^3$)	Acute HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	0.180	3,200	3.13E-04	5.62E-05
Acetaldehyde	0.033	470	2.13E-03	7.05E-05
Acrolein	1.78E-03	2.5	4.00E-01	7.13E-04
Benzene	6.63E-04	1,300	7.69E-04	5.10E-07
Formaldehyde	0.12	55	1.82E-02	2.18E-03
Propylene oxide	7.66E-04	3,100	3.23E-04	2.47E-07
Toluene	2.40E-03	37,000	2.70E-05	6.49E-08
Xylene	9.00E-05	22,000	4.55E-05	4.09E-09
			Total =	**3.02E-03**

1) Weighting factor for this phase of startup hour = 0.1667 , based on a duration (minutes) = 10

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	411.48
Turbine stack exhaust velocity (m/s) =	11.49
Turbine stack inside diameter (m) =	6.49

Table SHRA-3C
Calculation of Acute HHI Modeling Inputs for Gas Turbines During Startup Phase 3
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Weighted[1] Max Hourly Emissions Per Turbine g/s	Acute Reference Exposure Level ($\mu g/m^3$)	HARP Acute HI (per $\mu g/m^3$)	Acute HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	0.683	3,200	3.13E-04	2.14E-04
Acetaldehyde	0.126	470	2.13E-03	2.68E-04
Acrolein	6.78E-03	2.5	4.00E-01	2.71E-03
Benzene	2.52E-03	1,300	7.69E-04	1.94E-06
Formaldehyde	0.46	55	1.82E-02	8.28E-03
Propylene oxide	2.91E-03	3,100	3.23E-04	9.39E-07
Toluene	9.12E-03	37,000	2.70E-05	2.47E-07
Xylene	3.42E-04	22,000	4.55E-05	1.55E-08
			Total =	**1.15E-02**

1) Weighting factor for this phase of startup hour = 0.6333 , based on a duration (minutes) = 38

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	12.50
Turbine stack inside diameter (m) =	6.49

Table SHRA-3D
Calculation of Acute HHI Modeling Inputs for Normal Operation of Encina Power Station Boilers 4 and 5
Carlsbad Energy Center Project

Boiler Toxic Air Contaminant	Max Hourly Emissions for Boilers 4&5 g/s	Acute Reference Exposure Level ($\mu g/m^3$)	HARP Acute HI (per $\mu g/m^3$)	Acute HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	4.06E+00	3,200	3.13E-04	1.27E-03
Benzene	1.74E-03	1,300	7.69E-04	1.34E-06
Formaldehyde	6.22E-02	55	1.82E-02	1.13E-03
Toluene	2.82E-03	37,000	2.70E-05	7.63E-08
Arsenic	1.66E-04	0.20	5.00E+00	8.30E-04
Copper	7.05E-04	100	1.00E-02	7.05E-06
Mercury	2.16E-04	0.6	1.67E+00	3.60E-04
Nickel	1.74E-03	6.0	1.67E-01	2.91E-04
Vanadium(1)	1.91E-03	30	3.33E-02	6.36E-05
			Total =	**3.95E-03**

1) Assumed to be emitted in the form vanadium pentoxide.

Boiler Stack Parameters

Boilers 4/5 stack height (m) = 116.738
Boilers 4/5 stack exhaust temperature (K) = 427.594
Boilers 4/5 stack exhaust velocity (m/s) = 19.035
Boilers 4/5 stack inside diameter (m) = 7.9248

Table SHRA-3E
Calculation of Acute HHI Modeling Inputs for Each Proposed Gas Turbine During Commissioning
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Maximum-Impact Commissioning[1] Hourly Emissions Per Turbine g/s	Acute Reference Exposure Level ($\mu g/m^3$)	HARP Acute HHI (per $\mu g/m^3$)	Acute HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	1.079	3,200	3.13E-04	3.37E-04
Acetaldehyde	0.199	470	2.13E-03	4.23E-04
Acrolein	1.07E-02	2.5	4.00E-01	4.28E-03
Benzene	3.98E-03	1,300	7.69E-04	3.06E-06
Formaldehyde	0.72	55	1.82E-02	1.31E-02
Propylene oxide	4.60E-03	3,100	3.23E-04	1.48E-06
Toluene	1.44E-02	37,000	2.70E-05	3.89E-07
Xylene	5.40E-04	22,000	4.55E-05	2.45E-08
			Total =	**1.81E-02**

1) Weighting factor for a commissioning hour = 1 , based on a duration (minutes) = 60

1) SDAPCD selected startup Phase 3 stack parameters, and hence, Phase 3 heat rate, natural gas use rate, and TAC emissions are also used.

Turbine Stack Parameters for Commissioning (same as Startup Phase 3 [50% load])

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	12.50
Turbine stack inside diameter (m) =	6.49

Table SHRA-3F
Calculation of Acute HHI Modeling Inputs for 1-Hour Testing of Fire Water Pump Engine
Carlsbad Energy Center Project

Diesel-Fueled Engine Toxic Air Contaminant	Maximum Hourly Emissions for Engine g/s	Acute Reference Exposure Level ($\mu g/m^3$)	HARP Acute Inverse REL (per $\mu g/m^3$)	Acute HHI Model Input (g/s per $\mu g/m^3$)
Acrolein	5.21E-05	2.5	4.00E-01	2.08E-05
Benzene	2.86E-04	1,300	7.69E-04	2.20E-07
Formaldehyde	2.65E-03	55	1.82E-02	4.82E-05
Hydrogen chlorid	2.86E-04	2,100	4.76E-04	1.36E-07
Toluene	1.62E-04	37,000	2.70E-05	4.38E-09
Xylene	6.52E-05	22,000	4.55E-05	2.96E-09
Arsenic	2.46E-06	0.20	5.00E+00	1.23E-05
Copper	6.30E-06	100	1.00E-02	6.30E-08
Mercury	3.07E-06	0.6	1.67E+00	5.13E-06
Nickel	5.99E-06	6.0	1.67E-01	1.00E-06
			Total =	**8.795E-05**

1) Assumed to be emitted in the form vanadium pentoxide.

Fire Water Pump Engine Stack Parameters

Height (m) =	9.144
Exhaust temperature (K) =	776.48
Exhaust velocity (m/s) =	77.306
Inside diameter (m) =	0.1016

Table SHRA-4
Calculation of 100% Base Load Contribution to Cancer Risk for Proposed Turbines Operating 8,760 Hours in the District's PTE Non-Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	4.24E-03	2.90E-06	1.23E-02	5.72E-07	2.43E-03
Benzene	1.27E-03	2.90E-05	3.68E-02	5.72E-06	7.26E-03
1,3-Butadiene	4.57E-05	1.74E-04	7.95E-03	3.43E-05	1.57E-03
Ethylbenzene	3.39E-03	2.52E-06	8.55E-03	4.97E-07	1.69E-03
Formaldehyde	9.54E-02	6.08E-06	5.80E-01	1.20E-06	1.14E-01
Naphthalene	1.38E-04	3.48E-05	4.82E-03	6.86E-06	9.49E-04
PAHs (listed individually below)					
Acenaphthene	1.98E-06	1.63E-01	3.22E-01	1.47E-02	2.91E-02
Acenaphthylene	1.53E-06	1.63E-01	2.49E-01	1.47E-02	2.25E-02
Anthracene	3.52E-06	1.63E-01	5.73E-01	1.47E-02	5.18E-02
Benzo(a)anthracene	2.35E-06	1.63E-02	3.83E-02	1.47E-03	3.46E-03
Benzo(b)fluoranthrene	1.18E-06	1.63E-02	1.92E-02	1.47E-03	1.73E-03
Benzo(k)fluoranthrene	1.14E-06	1.63E-02	1.87E-02	1.47E-03	1.68E-03
Benzo(g,h,i)perylene	1.43E-06	1.63E-01	2.32E-01	1.47E-02	2.10E-02
Benzo(a)pyrene	1.45E-06	1.63E-01	2.36E-01	1.47E-02	2.13E-02
Benzo(e)pyrene	5.66E-08	1.63E-01	9.23E-03	1.47E-02	8.33E-04
Chrysene	2.62E-06	1.63E-03	4.27E-03	1.47E-04	3.86E-04
Dibenz(a,h)anthracene	2.44E-06	5.64E-02	1.38E-01	5.17E-03	1.27E-02
Fluoranthene	4.49E-06	1.63E-01	7.33E-01	1.47E-02	6.62E-02
Fluorene	6.03E-06	1.63E-01	9.84E-01	1.47E-02	8.88E-02
Indeno(1,2,3-cd)pyrene	2.44E-06	1.63E-02	3.99E-02	1.47E-03	3.60E-03
Phenanthrene	3.27E-05	1.63E-01	5.32E+00	1.47E-02	4.81E-01
Pyrene	2.89E-06	1.63E-01	4.71E-01	1.47E-02	4.26E-02
Propylene oxide	3.08E-03	3.76E-06	1.16E-02	7.43E-07	2.29E-03
			1.01E+01 per ug/m^3		**9.79E-01** per ug/m^3

1) Because turbine operates 8,760 hours in **SDAPCD**'s PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	455.67
Turbine stack exhaust velocity (m/s) =	20.86
Turbine stack inside diameter (m) =	6.49

Table SHRA-4A
Calculation of Cancer Risk for Existing Boilers 4 and 5 Operating 8,760 Hours in the District's PTE Year
Carlsbad Energy Center

Boiler Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Existing Encina Power Station Boilers 4 and 5					
Acetaldehyde	0.00E+00	2.90E-06	0.00E+00	5.72E-07	0.00E+00
Benzene	1.74E-03	2.90E-05	5.05E-02	5.72E-06	9.97E-03
1,3-Butadiene	0.00E+00	1.74E-04	0.00E+00	3.43E-05	0.00E+00
Dichlorobenzene, para	9.96E-04	1.16E-05	1.16E-02	2.29E-06	2.28E-03
Ethylbenzene	0.00E+00	2.52E-06	0.00E+00	4.97E-07	0.00E+00
Formaldehyde	6.22E-02	6.08E-06	3.78E-01	1.20E-06	7.47E-02
Naphthalene	5.06E-04	3.48E-05	1.76E-02	6.86E-06	3.47E-03
PAHs (15 listed individually below)					
Acenaphthene[2]	1.49E-06	1.63E-01	2.43E-01	1.47E-02	2.20E-02
Acenaphthylene[2]	1.49E-06	1.63E-01	2.43E-01	1.47E-02	2.20E-02
Anthracene[2]	1.99E-06	1.63E-01	3.25E-01	1.47E-02	2.93E-02
Benzo(a)anthracene	1.49E-06	1.63E-02	2.43E-02	1.47E-03	2.20E-03
Benzo(b)fluoranthrene	1.49E-06	1.63E-02	2.43E-02	1.47E-03	2.20E-03
Benzo(k)fluoranthrene	1.49E-06	1.63E-02	2.43E-02	1.47E-03	2.20E-03
Benzo(g,h,i)perylene[2]	9.96E-07	1.63E-01	1.62E-01	1.47E-02	1.47E-02
Benzo(a)pyrene	9.96E-07	1.63E-01	1.62E-01	1.47E-02	1.47E-02
Chrysene	1.49E-06	1.63E-03	2.43E-03	1.47E-04	2.20E-04
Dibenz(a,h)anthracene	9.96E-07	5.64E-02	5.62E-02	5.17E-03	5.15E-03
Fluoranthene[2]	2.49E-06	1.63E-01	4.06E-01	1.47E-02	3.67E-02
Fluorene[2]	2.32E-06	1.63E-01	3.79E-01	1.47E-02	3.42E-02
Indeno(1,2,3-cd)pyrene	1.49E-06	1.63E-02	2.43E-02	1.47E-03	2.20E-03
Phenanthrene[2]	1.41E-06	1.63E-01	2.30E-01	1.47E-02	2.08E-02
Pyrene[2]	4.15E-06	1.63E-01	6.76E-01	1.47E-02	6.11E-02
Propylene oxide	0.00E+00	3.76E-06	0.00E+00	7.43E-07	0.00E+00
Arsenic	1.66E-04	5.31E-02	8.82E+00	1.19E-02	1.98E+00
Beryllium	9.96E-06	2.43E-03	2.42E-02	4.80E-04	4.78E-03
Cadmium	9.13E-04	4.34E-03	3.96E+00	8.57E-04	7.82E-01
Nickel	1.74E-03	2.64E-04	4.60E-01	5.20E-05	9.06E-02
			1.67E+01 per $\mu g/m^3$		**3.21E+00** per $\mu g/m^3$

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

(2) Assigned unit risk factor for benzo(a)pyrene.

Boiler Stack Parameters

Boilers 4/5 stack height (m) = 116.738

Boilers 4/5 stack exhaust temperature (K) = 427.594

Boilers 4/5 stack exhaust velocity (m/s) = 19.035

Boilers 4/5 stack inside diameter (m) = 7.9248

Table SHRA-4B

Calculation of Cancer Risk for Proposed Turbines Operating at 100% Load for 8,760 Hours in the District's PTE Baseload Year (No Startups, Shutdowns, Commissioning, Tuning or Low Load)

Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	5.25E-03	2.90E-06	1.52E-02	5.72E-07	3.01E-03
Benzene	1.57E-03	2.90E-05	4.56E-02	5.72E-06	8.99E-03
1,3-Butadiene	5.65E-05	1.74E-04	9.84E-03	3.43E-05	1.94E-03
Ethylbenzene	4.20E-03	2.52E-06	1.06E-02	4.97E-07	2.09E-03
Formaldehyde	1.18E-01	6.08E-06	7.18E-01	1.20E-06	1.42E-01
Naphthalene	1.71E-04	3.48E-05	5.96E-03	6.86E-06	1.17E-03
PAHs (listed individually below)					
Acenaphthene	2.45E-06	1.63E-01	3.99E-01	1.47E-02	3.60E-02
Acenaphthylene	1.89E-06	1.63E-01	3.09E-01	1.47E-02	2.79E-02
Anthracene	4.35E-06	1.63E-01	7.09E-01	1.47E-02	6.41E-02
Benzo(a)anthracene	2.91E-06	1.63E-02	4.74E-02	1.47E-03	4.29E-03
Benzo(b)fluoranthrene	1.79E-06	1.63E-02	2.92E-02	1.47E-03	2.64E-03
Benzo(k)fluoranthrene	7.01E-08	1.63E-02	1.14E-03	1.47E-03	1.03E-04
Benzo(g,h,i)perylene	1.46E-06	1.63E-01	2.37E-01	1.47E-02	2.14E-02
Benzo(a)pyrene	1.42E-06	1.63E-01	2.31E-01	1.47E-02	2.09E-02
Benzo(e)pyrene	1.76E-06	1.63E-01	2.88E-01	1.47E-02	2.60E-02
Chrysene	3.25E-06	1.63E-03	5.29E-03	1.47E-04	4.78E-04
Dibenz(a,h)anthracene	3.03E-06	5.64E-02	1.71E-01	5.17E-03	1.57E-02
Fluoranthene	5.56E-06	1.63E-01	9.07E-01	1.47E-02	8.19E-02
Fluorene	7.47E-06	1.63E-01	1.22E+00	1.47E-02	1.10E-01
Indeno(1,2,3-cd)pyrene	3.03E-06	1.63E-02	4.93E-02	1.47E-03	4.46E-03
Phenanthrene	4.04E-05	1.63E-01	6.59E+00	1.47E-02	5.95E-01
Pyrene	3.58E-06	1.63E-01	5.84E-01	1.47E-02	5.27E-02
Propylene oxide	3.81E-03	3.76E-06	1.43E-02	7.43E-07	2.83E-03
			1.26E+01 per ug/m^3		**1.23E+00** per ug/m^3

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	455.67
Turbine stack exhaust velocity (m/s) =	20.86
Turbine stack inside diameter (m) =	6.49

Table SHRA-4C

Calculation of Cancer Risk for Fire Water Pump Engine

Carlsbad Energy Center

Diesel-Fueled Fire Water Pump Engine Toxic Air Contaminant	Annual Average Emissions (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method With Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Benzene	1.63E-06	2.90E-05	4.74E-05	2.40E-05	3.92E-05
Formaldehyde	1.51E-05	6.08E-06	9.21E-05	5.04E-06	7.63E-05
Diesel Particulate Matter	2.54E-05	3.19E-04	8.09E-03	2.64E-04	6.69E-03
Arsenic	1.40E-08	5.31E-02	7.46E-04	1.41E-02	1.98E-04
Nickel	3.42E-08	2.64E-04	9.03E-06	2.18E-04	7.46E-06
			8.981E-03 per $\mu g/m^3$		**7.014E-03** per $\mu g/m^3$

1) Because the fire water pump engine only operates 50 hours in SDAPCD's PTE Year, and most likely when offsite workers are at work, worker multiplicative adjustment factor to inhalation URF of 4.2 is applied.

Fire Water Pump Engine Stack Parameters

Height (m) =	9.144
Exhaust temperature (K) =	776.48
Exhaust velocity (m/s) =	77.306
Inside diameter (m) =	0.1016

Table SHRA-4D
Calculation of Cancer Risk for Proposed Turbines Operating in Phase 1 Portion of 1,460 Startup Hours in the District's PTE Non-Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	4.11E-03	2.90E-06	1.19E-02	5.72E-07	2.35E-03
Benzene	8.23E-05	2.90E-05	2.39E-03	5.72E-06	4.71E-04
1,3-Butadiene	1.41E-06	1.74E-04	2.45E-04	3.43E-05	4.84E-05
Ethylbenzene	1.05E-04	2.52E-06	2.64E-04	4.97E-07	5.21E-05
Formaldehyde	1.49E-02	6.08E-06	9.05E-02	1.20E-06	1.79E-02
Naphthalene	3.34E-06	3.48E-05	1.16E-04	6.86E-06	2.29E-05
PAHs (listed individually below)					
Acenaphthene	6.11E-08	1.63E-01	9.95E-03	1.47E-02	8.99E-04
Acenaphthylene	4.72E-08	1.63E-01	7.70E-03	1.47E-02	6.95E-04
Anthracene	1.09E-07	1.63E-01	1.77E-02	1.47E-02	1.60E-03
Benzo(a)anthracene	7.22E-08	1.63E-02	1.18E-03	1.47E-03	1.06E-04
Benzo(b)fluoranthrene	3.63E-08	1.63E-02	5.92E-04	1.47E-03	5.35E-05
Benzo(k)fluoranthrene	3.53E-08	1.63E-02	5.76E-04	1.47E-03	5.20E-05
Benzo(g,h,i)perylene	4.40E-08	1.63E-01	7.18E-03	1.47E-02	6.48E-04
Benzo(a)pyrene	4.47E-08	1.63E-01	7.28E-03	1.47E-02	6.58E-04
Benzo(e)pyrene	1.75E-09	1.63E-01	2.85E-04	1.47E-02	2.57E-05
Chrysene	7.22E-08	1.63E-03	1.18E-04	1.47E-04	1.06E-05
Dibenz(a,h)anthracene	7.22E-08	5.64E-02	4.07E-03	5.17E-03	3.74E-04
Fluoranthene	1.39E-07	1.63E-01	2.26E-02	1.47E-02	2.04E-03
Fluorene	1.86E-07	1.63E-01	3.04E-02	1.47E-02	2.74E-03
Indeno(1,2,3-cd)pyrene	7.22E-08	1.63E-02	1.18E-03	1.47E-03	1.06E-04
Phenanthrene	1.01E-06	1.63E-01	1.64E-01	1.47E-02	1.48E-02
Pyrene	8.90E-08	1.63E-01	1.45E-02	1.47E-02	1.31E-03
Propylene oxide	9.51E-05	3.76E-06	3.58E-04	7.43E-07	7.07E-05
			3.95E-01 per ug/m^3		**4.70E-02** per ug/m^3

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	332.04
Turbine stack exhaust velocity (m/s) =	8.07
Turbine stack inside diameter (m) =	6.49

Table SHRA-4E
Calculation of Cancer Risk for Proposed Turbines Operating in Phase 2 Portion of 1,460 Startup Hours in the District's PTE Non-Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	5.52E-03	2.90E-06	1.60E-02	5.72E-07	3.16E-03
Benzene	1.10E-04	2.90E-05	3.20E-03	5.72E-06	6.32E-04
1,3-Butadiene	1.89E-06	1.74E-04	3.29E-04	3.43E-05	6.49E-05
Ethylbenzene	1.41E-04	2.52E-06	3.54E-04	4.97E-07	6.99E-05
Formaldehyde	2.00E-02	6.08E-06	1.21E-01	1.20E-06	2.40E-02
Naphthalene	4.48E-06	3.48E-05	1.56E-04	6.86E-06	3.07E-05
PAHs (listed individually below)					
Acenaphthene	8.20E-08	1.63E-01	1.34E-02	1.47E-02	1.21E-03
Acenaphthylene	6.34E-08	1.63E-01	1.03E-02	1.47E-02	9.33E-04
Anthracene	1.46E-07	1.63E-01	2.38E-02	1.47E-02	2.15E-03
Benzo(a)anthracene	9.69E-08	1.63E-02	1.58E-03	1.47E-03	1.43E-04
Benzo(b)fluoranthrene	4.87E-08	1.63E-02	7.94E-04	1.47E-03	7.18E-05
Benzo(k)fluoranthrene	4.74E-08	1.63E-02	7.73E-04	1.47E-03	6.99E-05
Benzo(g,h,i)perylene	5.91E-08	1.63E-01	9.63E-03	1.47E-02	8.70E-04
Benzo(a)pyrene	6.00E-08	1.63E-01	9.77E-03	1.47E-02	8.83E-04
Benzo(e)pyrene	2.35E-09	1.63E-01	3.82E-04	1.47E-02	3.45E-05
Chrysene	9.69E-08	1.63E-03	1.58E-04	1.47E-04	1.43E-05
Dibenz(a,h)anthracene	9.69E-08	5.64E-02	5.47E-03	5.17E-03	5.02E-04
Fluoranthene	1.86E-07	1.63E-01	3.04E-02	1.47E-02	2.74E-03
Fluorene	2.50E-07	1.63E-01	4.08E-02	1.47E-02	3.68E-03
Indeno(1,2,3-cd)pyrene	9.69E-08	1.63E-02	1.58E-03	1.47E-03	1.43E-04
Phenanthrene	1.35E-06	1.63E-01	2.20E-01	1.47E-02	1.99E-02
Pyrene	1.19E-07	1.63E-01	1.95E-02	1.47E-02	1.76E-03
Propylene oxide	1.28E-04	3.76E-06	4.80E-04	7.43E-07	9.48E-05
			5.30E-01 per ug/m^3		**6.31E-02** per ug/m^3

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	411.48
Turbine stack exhaust velocity (m/s) =	11.49
Turbine stack inside diameter (m) =	6.49

Table SHRA-4F

Calculation of Cancer Risk for Proposed Turbines Operating in Phase 3 Portion of 1,460 Startup Hours, Tuning Hours and Low Load Operation in the District's PTE Non-Commissioning Year

Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	2.22E-02	2.90E-06	6.43E-02	5.72E-07	1.27E-02
Benzene	4.44E-04	2.90E-05	1.29E-02	5.72E-06	2.54E-03
1,3-Butadiene	7.61E-06	1.74E-04	1.32E-03	3.43E-05	2.61E-04
Ethylbenzene	5.65E-04	2.52E-06	1.42E-03	4.97E-07	2.81E-04
Formaldehyde	8.02E-02	6.08E-06	4.88E-01	1.20E-06	9.63E-02
Naphthalene	1.80E-05	3.48E-05	6.26E-04	6.86E-06	1.23E-04
PAHs (listed individually below)					
Acenaphthene	3.29E-07	1.63E-01	5.37E-02	1.47E-02	4.85E-03
Acenaphthylene	2.55E-07	1.63E-01	4.15E-02	1.47E-02	3.75E-03
Anthracene	5.86E-07	1.63E-01	9.55E-02	1.47E-02	8.62E-03
Benzo(a)anthracene	3.89E-07	1.63E-02	6.35E-03	1.47E-03	5.73E-04
Benzo(b)fluoranthrene	1.96E-07	1.63E-02	3.19E-03	1.47E-03	2.88E-04
Benzo(k)fluoranthrene	1.91E-07	1.63E-02	3.11E-03	1.47E-03	2.81E-04
Benzo(g,h,i)perylene	2.37E-07	1.63E-01	3.87E-02	1.47E-02	3.50E-03
Benzo(a)pyrene	2.41E-07	1.63E-01	3.93E-02	1.47E-02	3.55E-03
Benzo(e)pyrene	9.43E-09	1.63E-01	1.54E-03	1.47E-02	1.39E-04
Chrysene	3.89E-07	1.63E-03	6.35E-04	1.47E-04	5.73E-05
Dibenz(a,h)anthracene	3.89E-07	5.64E-02	2.20E-02	5.17E-03	2.02E-03
Fluoranthene	7.49E-07	1.63E-01	1.22E-01	1.47E-02	1.10E-02
Fluorene	1.01E-06	1.63E-01	1.64E-01	1.47E-02	1.48E-02
Indeno(1,2,3-cd)pyrene	3.89E-07	1.63E-02	6.35E-03	1.47E-03	5.73E-04
Phenanthrene	5.42E-06	1.63E-01	8.84E-01	1.47E-02	7.99E-02
Pyrene	4.80E-07	1.63E-01	7.82E-02	1.47E-02	7.07E-03
Propylene oxide	5.13E-04	3.76E-06	1.93E-03	7.43E-07	3.81E-04
			2.13E+00 per ug/m^3		**2.53E-01** per ug/m^3

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	12.50
Turbine stack inside diameter (m) =	6.49

Table SHRA-4G

Calculation of Cancer Risk for Proposed Turbines Operating in Shutdown (Phase 4) Portion of 1,460 Startup Hours in the District's PTE Non-Commissioning Year

Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	1.74E-03	2.90E-06	5.06E-03	5.72E-07	9.98E-04
Benzene	3.49E-05	2.90E-05	1.01E-03	5.72E-06	2.00E-04
1,3-Butadiene	5.98E-07	1.74E-04	1.04E-04	3.43E-05	2.05E-05
Ethylbenzene	4.44E-05	2.52E-06	1.12E-04	4.97E-07	2.21E-05
Formaldehyde	6.31E-03	6.08E-06	3.84E-02	1.20E-06	7.57E-03
Naphthalene	1.42E-06	3.48E-05	4.92E-05	6.86E-06	9.70E-06
PAHs (listed individually below)					
Acenaphthene	2.59E-08	1.63E-01	4.22E-03	1.47E-02	3.81E-04
Acenaphthylene	2.00E-08	1.63E-01	3.27E-03	1.47E-02	2.95E-04
Anthracene	4.61E-08	1.63E-01	7.51E-03	1.47E-02	6.78E-04
Benzo(a)anthracene	3.06E-08	1.63E-02	4.99E-04	1.47E-03	4.51E-05
Benzo(b)fluoranthrene	1.54E-08	1.63E-02	2.51E-04	1.47E-03	2.27E-05
Benzo(k)fluoranthrene	1.50E-08	1.63E-02	2.44E-04	1.47E-03	2.21E-05
Benzo(g,h,i)perylene	1.87E-08	1.63E-01	3.04E-03	1.47E-02	2.75E-04
Benzo(a)pyrene	1.89E-08	1.63E-01	3.09E-03	1.47E-02	2.79E-04
Benzo(e)pyrene	7.41E-10	1.63E-01	1.21E-04	1.47E-02	1.09E-05
Chrysene	3.06E-08	1.63E-03	4.99E-05	1.47E-04	4.51E-06
Dibenz(a,h)anthracene	3.06E-08	5.64E-02	1.73E-03	5.17E-03	1.58E-04
Fluoranthene	5.89E-08	1.63E-01	9.60E-03	1.47E-02	8.67E-04
Fluorene	7.90E-08	1.63E-01	1.29E-02	1.47E-02	1.16E-03
Indeno(1,2,3-cd)pyrene	3.06E-08	1.63E-02	4.99E-04	1.47E-03	4.51E-05
Phenanthrene	4.27E-07	1.63E-01	6.95E-02	1.47E-02	6.28E-03
Pyrene	3.78E-08	1.63E-01	6.15E-03	1.47E-02	5.56E-04
Propylene oxide	4.03E-05	3.76E-06	1.52E-04	7.43E-07	3.00E-05
			1.68E-01 per ug/m^3		**1.99E-02** per ug/m^3

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	10.17
Turbine stack inside diameter (m) =	6.49

Table SHRA-4H

Commissioning Contribution to Cancer Risk for Proposed Turbines During 415 Hours in the District's 8,760 PTE Year

Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	9.42E-03	2.90E-06	2.73E-02	5.72E-07	5.39E-03
Benzene	1.88E-04	2.90E-05	5.46E-03	5.72E-06	1.08E-03
1,3-Butadiene	3.23E-06	1.74E-04	5.62E-04	3.43E-05	1.11E-04
Ethylbenzene	2.40E-04	2.52E-06	6.04E-04	4.97E-07	1.19E-04
Formaldehyde	3.41E-02	6.08E-06	2.07E-01	1.20E-06	4.09E-02
Naphthalene	7.64E-06	3.48E-05	2.66E-04	6.86E-06	5.24E-05
PAHs (listed individually below)					
Acenaphthene	1.40E-07	1.63E-01	2.28E-02	1.47E-02	2.06E-03
Acenaphthylene	1.08E-07	1.63E-01	1.76E-02	1.47E-02	1.59E-03
Anthracene	2.49E-07	1.63E-01	4.05E-02	1.47E-02	3.66E-03
Benzo(a)anthracene	1.65E-07	1.63E-02	2.69E-03	1.47E-03	2.43E-04
Benzo(b)fluoranthrene	8.31E-08	1.63E-02	1.35E-03	1.47E-03	1.22E-04
Benzo(k)fluoranthrene	8.09E-08	1.63E-02	1.32E-03	1.47E-03	1.19E-04
Benzo(g,h,i)perylene	1.01E-07	1.63E-01	1.64E-02	1.47E-02	1.48E-03
Benzo(a)pyrene	1.02E-07	1.63E-01	1.67E-02	1.47E-02	1.51E-03
Benzo(e)pyrene	4.00E-09	1.63E-01	6.52E-04	1.47E-02	5.89E-05
Chrysene	1.65E-07	1.63E-03	2.69E-04	1.47E-04	2.43E-05
Dibenz(a,h)anthracene	1.65E-07	5.64E-02	9.32E-03	5.17E-03	8.55E-04
Fluoranthene	3.18E-07	1.63E-01	5.18E-02	1.47E-02	4.68E-03
Fluorene	4.27E-07	1.63E-01	6.95E-02	1.47E-02	6.28E-03
Indeno(1,2,3-cd)pyrene	1.65E-07	1.63E-02	2.69E-03	1.47E-03	2.43E-04
Phenanthrene	2.30E-06	1.63E-01	3.75E-01	1.47E-02	3.39E-02
Pyrene	2.04E-07	1.63E-01	3.32E-02	1.47E-02	3.00E-03
Propylene oxide	2.18E-04	3.76E-06	8.19E-04	7.43E-07	1.62E-04
			9.04E-01 per ug/m^3		**1.08E-01** per ug/m^3

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	12.50
Turbine stack inside diameter (m) =	6.49

Table SHRA-4I

Calculation of 100% Load Contribution for 6,662 Hours to Cancer Risk for Proposed Turbines Operating 8,760 Hours in the District's PTE Commissioning Year

Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions Per Turbine (g/s)	Derived (Adjusted) Method		Worker Exp: Point Estimate Method Without Inhalation 4.2 Factor[1]	
		Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)	Unit Risk (per $\mu g/m^3$)	Cancer Risk Model Input (g/s per $\mu g/m^3$)
Proposed Gas Turbines					
Acetaldehyde	4.00E-03	2.90E-06	1.16E-02	5.72E-07	2.29E-03
Benzene	1.19E-03	2.90E-05	3.47E-02	5.72E-06	6.83E-03
1,3-Butadiene	4.30E-05	1.74E-04	7.48E-03	3.43E-05	1.47E-03
Ethylbenzene	3.19E-03	2.52E-06	8.05E-03	4.97E-07	1.59E-03
Formaldehyde	8.98E-02	6.08E-06	5.46E-01	1.20E-06	1.08E-01
Naphthalene	1.30E-04	3.48E-05	4.53E-03	6.86E-06	8.93E-04
PAHs (listed individually below)					
Acenaphthene	1.86E-06	1.63E-01	3.03E-01	1.47E-02	2.74E-02
Acenaphthylene	1.44E-06	1.63E-01	2.35E-01	1.47E-02	2.12E-02
Anthracene	3.31E-06	1.63E-01	5.40E-01	1.47E-02	4.87E-02
Benzo(a)anthracene	2.21E-06	1.63E-02	3.61E-02	1.47E-03	3.26E-03
Benzo(b)fluoranthrene	1.11E-06	1.63E-02	1.80E-02	1.47E-03	1.63E-03
Benzo(k)fluoranthrene	1.08E-06	1.63E-02	1.76E-02	1.47E-03	1.59E-03
Benzo(g,h,i)perylene	1.34E-06	1.63E-01	2.19E-01	1.47E-02	1.98E-02
Benzo(a)pyrene	1.36E-06	1.63E-01	2.22E-01	1.47E-02	2.00E-02
Benzo(e)pyrene	5.33E-08	1.63E-01	8.68E-03	1.47E-02	7.84E-04
Chrysene	2.47E-06	1.63E-03	4.02E-03	1.47E-04	3.63E-04
Dibenz(a,h)anthracene	2.30E-06	5.64E-02	1.30E-01	5.17E-03	1.19E-02
Fluoranthene	4.23E-06	1.63E-01	6.90E-01	1.47E-02	6.23E-02
Fluorene	5.68E-06	1.63E-01	9.26E-01	1.47E-02	8.36E-02
Indeno(1,2,3-cd)pyrene	2.30E-06	1.63E-02	3.75E-02	1.47E-03	3.39E-03
Phenanthrene	3.08E-05	1.63E-01	5.01E+00	1.47E-02	4.53E-01
Pyrene	2.72E-06	1.63E-01	4.44E-01	1.47E-02	4.01E-02
Propylene oxide	2.90E-03	3.76E-06	1.09E-02	7.43E-07	2.15E-03
			9.47E+00 per ug/m^3		**9.22E-01** per ug/m^3

1) Because turbine operates 8,760 hours in SDAPCD's PTE Year, worker multiplicative adjustment factor to inhalation URF of 4.2 not applied.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	455.67
Turbine stack exhaust velocity (m/s) =	20.86
Turbine stack inside diameter (m) =	6.49

Table SHRA-5
Calculation of 100% Base Load Contribution to Gas Turbine Chronic HHI Operating 8,760 Hours in the District's PTE Non-Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	1.446	5.00E-03	7.23E-03	5.00E-03	7.23E-03
Propylene	8.02E-02	3.33E-04	2.67E-05	3.33E-04	2.67E-05
Acetaldehyde(1)	4.24E-03	7.14E-03	3.03E-05	7.14E-03	3.03E-05
Acrolein(1)	6.80E-04	2.86	1.94E-03	2.86E+00	1.94E-03
Benzene	1.27E-03	1.67E-02	2.12E-05	1.67E-02	2.12E-05
1,3-Butadiene	4.57E-05	5.00E-02	2.28E-06	5.00E-02	2.28E-06
Ethylbenzene	3.39E-03	5.00E-04	1.70E-06	5.00E-04	1.70E-06
Formaldehyde(1)	9.54E-02	1.11E-01	1.06E-02	1.11E-01	1.06E-02
Hexane	2.69E-02	1.43E-04	3.85E-06	1.43E-04	3.85E-06
Naphthalene	1.38E-04	1.11E-01	1.54E-05	1.11E-01	1.54E-05
Propylene oxide	3.08E-03	3.33E-02	1.02E-04	3.33E-02	1.02E-04
Toluene	1.38E-02	3.33E-03	4.61E-05	3.33E-03	4.61E-05
Xylene	6.79E-03	1.43E-03	9.71E-06	1.43E-03	9.71E-06
		Total =	**2.00E-02**	Total =	**2.00E-02**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	455.67
Turbine stack exhaust velocity (m/s) =	20.86
Turbine stack inside diameter (m) =	6.49

Table SHRA-5A
Calculation of Existing Boilers 4 and 5 Chronic HHI
Carlsbad Energy Center

Boiler Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per $\mu g/m^3$)	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	4.063	5.00E-03	2.03E-02	5.00E-03	2.03E-02
Propylene	0.00E+00	3.33E-04	0.00E+00	3.33E-04	0.00E+00
Acetaldehyde(1)	0.00E+00	7.14E-03	0.00E+00	7.14E-03	0.00E+00
Acrolein(1)	0.00E+00	2.86	0.00E+00	2.86E+00	0.00E+00
Benzene	1.74E-03	1.67E-02	2.91E-05	1.67E-02	2.91E-05
1,3-Butadiene	0.00E+00	5.00E-02	0.00E+00	5.00E-02	0.00E+00
Dichlorobenzene	9.96E-04	1.25E-03	1.24E-06	1.25E-03	1.24E-06
Ethylbenzene	0.00E+00	5.00E-04	0.00E+00	5.00E-04	0.00E+00
Formaldehyde(1)	6.22E-02	1.11E-01	6.92E-03	1.11E-01	6.92E-03
Hexane	1.49E+00	1.43E-04	2.14E-04	1.43E-04	2.14E-04
Naphthalene	5.06E-04	1.11E-01	5.62E-05	1.11E-01	5.62E-05
Propylene oxide	0.00E+00	3.33E-02	0.00E+00	3.33E-02	0.00E+00
Toluene	2.82E-03	3.33E-03	9.40E-06	3.33E-03	9.40E-06
Arsenic	1.66E-04	1.00E+04	1.66E+00	1.00E+04	1.66E+00
Beryllium	9.96E-06	1.43E+02	1.42E-03	1.43E+02	1.42E-03
Cadmium	9.13E-04	2.01E+02	1.83E-01	2.01E+02	1.83E-01
Manganese	3.15E-04	1.11E+01	3.50E-03	1.11E+01	3.50E-03
Mercury	2.16E-04	8.85E+02	1.91E-01	8.85E+02	1.91E-01
Nickel	1.74E-03	2.00E+01	3.49E-02	2.00E+01	3.49E-02
Selenium	1.99E-05	5.00E-02	9.96E-07	5.00E-02	9.96E-07
		Total =	**2.10E+00**	Total =	**2.10E+00**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Boiler Stack Parameters

Boilers 4/5 stack height (m) =	116.738
Boilers 4/5 stack exhaust temperature (K) =	427.594
Boilers 4/5 stack exhaust velocity (m/s) =	19.035
Boilers 4/5 stack inside diameter (m) =	7.9248

Table SHRA-5B
Calculation of Gas Turbine Chronic HHI Operating 100% Load for 8,760 Hours in the District's PTE Baseload Year (No Startups, Shutdowns, Commissioning, Tuning or Low Load)
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	1.790	5.00E-03	8.95E-03	5.00E-03	8.95E-03
Propylene	9.93E-02	3.33E-04	3.31E-05	3.33E-04	3.31E-05
Acetaldehyde(1)	5.25E-03	7.14E-03	3.75E-05	7.14E-03	3.75E-05
Acrolein(1)	8.42E-04	2.86	2.41E-03	2.86E+00	2.41E-03
Benzene	1.57E-03	1.67E-02	2.62E-05	1.67E-02	2.62E-05
1,3-Butadiene	5.65E-05	5.00E-02	2.83E-06	5.00E-02	2.83E-06
Ethylbenzene	4.20E-03	5.00E-04	2.10E-06	5.00E-04	2.10E-06
Formaldehyde(1)	1.18E-01	1.11E-01	1.31E-02	1.11E-01	1.31E-02
Hexane	3.34E-02	1.43E-04	4.77E-06	1.43E-04	4.77E-06
Naphthalene	1.71E-04	1.11E-01	1.90E-05	1.11E-01	1.90E-05
Propylene oxide	3.81E-03	3.33E-02	1.27E-04	3.33E-02	1.27E-04
Toluene	1.71E-02	3.33E-03	5.70E-05	3.33E-03	5.70E-05
Xylene	8.41E-03	1.43E-03	1.20E-05	1.43E-03	1.20E-05
		Total =	**2.48E-02**	Total =	**2.48E-02**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	455.67
Turbine stack exhaust velocity (m/s) =	20.86
Turbine stack inside diameter (m) =	6.49

Table SHRA-5C
Calculation of Fire Water Pump Engine Chronic HHI
Carlsbad Energy Center

Diesel-Fueled Fire Water Pump Engine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per $\mu g/m^3$)	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Diesel Particulate Matter	2.54E-05	2.00E-01	5.07E-06	8.40E-01	2.13E-05
Acrolein(1)	2.97E-07	2.86	8.50E-07	1.20E+01	3.57E-06
Benzene	1.63E-06	1.67E-02	2.73E-08	7.00E-02	1.14E-07
Formaldehyde(1)	1.51E-05	1.11E-01	1.68E-06	4.67E-01	7.07E-06
Toluene	9.25E-07	3.33E-03	3.08E-09	1.40E-02	1.29E-08
Xylene	3.72E-07	1.43E-03	5.32E-10	6.00E-03	2.23E-09
Arsenic	1.40E-08	1.00E+04	1.40E-04	5.86E+03	8.23E-05
Hydrogen chloride	1.63E-06	1.11E-01	1.81E-07	4.67E-01	7.63E-07
Mercury	1.75E-08	8.85E+02	1.55E-05	2.84E+02	4.98E-06
Nickel	3.42E-08	2.00E+01	6.84E-07	8.40E+01	2.87E-06
		Total =	**1.644E-04**	Total =	**1.229E-04**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Fire Water Pump Engine Stack Parameters

Height (m) =	9.144
Exhaust temperature (K) =	776.48
Exhaust velocity (m/s) =	77.306
Inside diameter (m) =	0.1016

Table SHRA-5D
Calculation of Startup Phase 1 Contribution to Gas Turbine Chronic HHI Operating 8,760 Hours in the District's PTE Non-Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	0	5.00E-03	0.00E+00	5.00E-03	0.00E+00
Propylene	2.48E-03	3.33E-04	8.25E-07	3.33E-04	8.25E-07
Acetaldehyde(1)	4.11E-03	7.14E-03	2.94E-05	7.14E-03	2.94E-05
Acrolein(1)	2.21E-04	2.86	6.33E-04	2.86E+00	6.33E-04
Benzene	8.23E-05	1.67E-02	1.37E-06	1.67E-02	1.37E-06
1,3-Butadiene	1.41E-06	5.00E-02	7.05E-08	5.00E-02	7.05E-08
Ethylbenzene	1.05E-04	5.00E-04	5.24E-08	5.00E-04	5.24E-08
Formaldehyde(1)	1.49E-02	1.11E-01	1.65E-03	1.11E-01	1.65E-03
Hexane	8.32E-04	1.43E-04	1.19E-07	1.43E-04	1.19E-07
Naphthalene	3.34E-06	1.11E-01	3.70E-07	1.11E-01	3.70E-07
Propylene oxide	9.51E-05	3.33E-02	3.17E-06	3.33E-02	3.17E-06
Toluene	2.98E-04	3.33E-03	9.93E-07	3.33E-03	9.93E-07
Xylene	1.12E-05	1.43E-03	1.60E-08	1.43E-03	1.60E-08
		Total =	**2.32E-03**	Total =	**2.32E-03**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	332.04
Turbine stack exhaust velocity (m/s) =	8.07
Turbine stack inside diameter (m) =	6.49

Table SHRA-5E
Calculation of Startup Phase 2 Contribution to Gas Turbine Chronic HHI Operating 8,760 Hours in the District's PTE Non-Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	3.00E-02	5.00E-03	1.50E-04	5.00E-03	1.50E-04
Propylene	3.33E-03	3.33E-04	1.11E-06	3.33E-04	1.11E-06
Acetaldehyde(1)	5.52E-03	7.14E-03	3.94E-05	7.14E-03	3.94E-05
Acrolein(1)	2.97E-04	2.86	8.49E-04	2.86E+00	8.49E-04
Benzene	1.10E-04	1.67E-02	1.84E-06	1.67E-02	1.84E-06
1,3-Butadiene	1.89E-06	5.00E-02	9.47E-08	5.00E-02	9.47E-08
Ethylbenzene	1.41E-04	5.00E-04	7.03E-08	5.00E-04	7.03E-08
Formaldehyde(1)	2.00E-02	1.11E-01	2.22E-03	1.11E-01	2.22E-03
Hexane	1.12E-03	1.43E-04	1.60E-07	1.43E-04	1.60E-07
Naphthalene	4.48E-06	1.11E-01	4.97E-07	1.11E-01	4.97E-07
Propylene oxide	1.28E-04	3.33E-02	4.25E-06	3.33E-02	4.25E-06
Toluene	4.00E-04	3.33E-03	1.33E-06	3.33E-03	1.33E-06
Xylene	1.50E-05	1.43E-03	2.14E-08	1.43E-03	2.14E-08
		Total =	**3.27E-03**	Total =	**3.27E-03**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	411.48
Turbine stack exhaust velocity (m/s) =	11.49
Turbine stack inside diameter (m) =	6.49

Table SHRA-5F

Calculation of Startup Phase 3, Tuning and Low Load Contribution to Gas Turbine Chronic HHI Operating 8,760 Hours in the District's PTE Non-Commissioning Year

Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	1.20E-01	5.00E-03	6.02E-04	5.00E-03	6.02E-04
Propylene	1.34E-02	3.33E-04	4.45E-06	3.33E-04	4.45E-06
Acetaldehyde(1)	2.22E-02	7.14E-03	1.58E-04	7.14E-03	1.58E-04
Acrolein(1)	1.19E-03	2.86	3.41E-03	2.86E+00	3.41E-03
Benzene	4.44E-04	1.67E-02	7.41E-06	1.67E-02	7.41E-06
1,3-Butadiene	7.61E-06	5.00E-02	3.80E-07	5.00E-02	3.80E-07
Ethylbenzene	5.65E-04	5.00E-04	2.82E-07	5.00E-04	2.82E-07
Formaldehyde(1)	8.02E-02	1.11E-01	8.92E-03	1.11E-01	8.92E-03
Hexane	4.49E-03	1.43E-04	6.42E-07	1.43E-04	6.42E-07
Naphthalene	1.80E-05	1.11E-01	2.00E-06	1.11E-01	2.00E-06
Propylene oxide	5.13E-04	3.33E-02	1.71E-05	3.33E-02	1.71E-05
Toluene	1.61E-03	3.33E-03	5.35E-06	3.33E-03	5.35E-06
Xylene	6.02E-05	1.43E-03	8.62E-08	1.43E-03	8.62E-08
		Total =	**1.31E-02**	Total =	**1.31E-02**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	12.50
Turbine stack inside diameter (m) =	6.49

Table SHRA-5G

Calculation of Shutdown (Phase 4) Contribution to Gas Turbine Chronic HHI Operating 8,760 Hours in the District's PTE Non-Commissioning Year

Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	9.47E-03	5.00E-03	4.73E-05	5.00E-03	4.73E-05
Propylene	1.05E-03	3.33E-04	3.50E-07	3.33E-04	3.50E-07
Acetaldehyde(1)	1.74E-03	7.14E-03	1.25E-05	7.14E-03	1.25E-05
Acrolein(1)	9.39E-05	2.86	2.68E-04	2.86E+00	2.68E-04
Benzene	3.49E-05	1.67E-02	5.83E-07	1.67E-02	5.83E-07
1,3-Butadiene	5.98E-07	5.00E-02	2.99E-08	5.00E-02	2.99E-08
Ethylbenzene	4.44E-05	5.00E-04	2.22E-08	5.00E-04	2.22E-08
Formaldehyde(1)	6.31E-03	1.11E-01	7.01E-04	1.11E-01	7.01E-04
Hexane	3.53E-04	1.43E-04	5.05E-08	1.43E-04	5.05E-08
Naphthalene	1.42E-06	1.11E-01	1.57E-07	1.11E-01	1.57E-07
Propylene oxide	4.03E-05	3.33E-02	1.34E-06	3.33E-02	1.34E-06
Toluene	1.26E-04	3.33E-03	4.21E-07	3.33E-03	4.21E-07
Xylene	4.74E-06	1.43E-03	6.78E-09	1.43E-03	6.78E-09
		Total =	**1.03E-03**	Total =	**1.03E-03**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	10.17
Turbine stack inside diameter (m) =	6.49

Table SHRA-5H
Calculation of Commissioning Contribution to Gas Turbine Chronic HHI Operating 8,760 Hours in the District's PTE Non-Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	5.11E-02	5.00E-03	2.56E-04	5.00E-03	2.56E-04
Propylene	5.67E-03	3.33E-04	1.89E-06	3.33E-04	1.89E-06
Acetaldehyde(1)	1.74E-03	7.14E-03	1.25E-05	7.14E-03	1.25E-05
Acrolein(1)	9.39E-05	2.86	2.68E-04	2.86E+00	2.68E-04
Benzene	3.49E-05	1.67E-02	5.83E-07	1.67E-02	5.83E-07
1,3-Butadiene	5.98E-07	5.00E-02	2.99E-08	5.00E-02	2.99E-08
Ethylbenzene	4.44E-05	5.00E-04	2.22E-08	5.00E-04	2.22E-08
Formaldehyde(1)	6.31E-03	1.11E-01	7.01E-04	1.11E-01	7.01E-04
Hexane	3.53E-04	1.43E-04	5.05E-08	1.43E-04	5.05E-08
Naphthalene	1.42E-06	1.11E-01	1.57E-07	1.11E-01	1.57E-07
Propylene oxide	4.03E-05	3.33E-02	1.34E-06	3.33E-02	1.34E-06
Toluene	1.26E-04	3.33E-03	4.21E-07	3.33E-03	4.21E-07
Xylene	4.74E-06	1.43E-03	6.78E-09	1.43E-03	6.78E-09
		Total =	**1.24E-03**	Total =	**1.24E-03**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	447.59
Turbine stack exhaust velocity (m/s) =	12.50
Turbine stack inside diameter (m) =	6.49

Table SHRA-5I
Calculation of 100% Base Load Contribution to Gas Turbine Chronic HHI Operating 8,760 Hours in the District's PTE Commissioning Year
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Annual Average Emissions (g/s)	HARP Chronic Resident HHI (per	Chronic Resident HHI Model Input (g/s per $\mu g/m^3$)	HARP Chronic Worker HHI (per $\mu g/m^3$)	Chronic Worker HHI Model Input (g/s per $\mu g/m^3$)
Ammonia	1.36E+00	5.00E-03	6.81E-03	5.00E-03	6.81E-03
Propylene	7.55E-02	3.33E-04	2.51E-05	3.33E-04	2.51E-05
Acetaldehyde(1)	4.00E-03	7.14E-03	2.85E-05	7.14E-03	2.85E-05
Acrolein(1)	6.41E-04	2.86	1.83E-03	2.86E+00	1.83E-03
Benzene	1.19E-03	1.67E-02	2.00E-05	1.67E-02	2.00E-05
1,3-Butadiene	4.30E-05	5.00E-02	2.15E-06	5.00E-02	2.15E-06
Ethylbenzene	3.19E-03	5.00E-04	1.60E-06	5.00E-04	1.60E-06
Formaldehyde(1)	8.98E-02	1.11E-01	9.98E-03	1.11E-01	9.98E-03
Hexane	2.54E-02	1.43E-04	3.63E-06	1.43E-04	3.63E-06
Naphthalene	1.30E-04	1.11E-01	1.45E-05	1.11E-01	1.45E-05
Propylene oxide	2.90E-03	3.33E-02	9.65E-05	3.33E-02	9.65E-05
Toluene	1.30E-02	3.33E-03	4.34E-05	3.33E-03	4.34E-05
Xylene	6.40E-03	1.43E-03	9.15E-06	1.43E-03	9.15E-06
		Total =	**1.89E-02**	Total =	**1.89E-02**

1) Chronic RELs recently (February 9, 2009) updated by OEHHA.

Turbine Stack Parameters

Turbine stack height (m) =	42.37
Turbine stack exhaust temperature (K) =	455.67
Turbine stack exhaust velocity (m/s) =	20.86
Turbine stack inside diameter (m) =	6.49

Table SHRA-6
Calculation of 8-Hour HHI Modeling Inputs for Each Gas Turbine
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Weighted Maximum 8-Hour Emissions Per Turbine, g/s	8-Hour Reference Exposure Level ($\mu g/m^3$)	8-Hour HHI (per $\mu g/m^3$)	8-Hour HHI Model Input (g/s per $\mu g/m^3$)
Acetaldehyde	5.23E-02	300	3.333E-03	1.74E-04
Acrolein	3.22E-03	0.7	1.43E+00	4.60E-03
Formaldehyde	9.48E-03	9	1.11E-01	1.05E-03
			Total =	**5.83E-03**

Turbine Stack Parameters (100% load)

Turbine stack height (m) =	42.37	
Turbine stack exhaust temperature (K) =	**332.04**	**(worst-case [lowest]: startup Phase 1)**
Turbine stack exhaust velocity (m/s) =	**8.07**	**(worst-case [lowest]: startup Phase 1)**
Turbine stack inside diameter (m) =	6.49	

Table SHRA-6A
Calculation of 8-Hour HHI Modeling Inputs for Normal Operation of Encina Power Station Boilers 4 and 5
Carlsbad Energy Center Project

Boiler Toxic Air Contaminant	Maximum 8-Hour Emissions, g/s	8-Hour Reference Exposure Level ($\mu g/m^3$)	8-Hour HHI (per $\mu g/m^3$)	8-Hour HHI Model Input (g/s per $\mu g/m^3$)
Formaldehyde	6.22E-02	9	1.11E-01	6.92E-03
Arsenic	1.66E-04	0.015	6.67E+01	1.11E-02
Manganese	3.15E-04	0.017	5.88E+01	1.86E-02
Mercury	2.16E-04	0.06	1.67E+01	3.60E-03
			Total =	**4.01E-02**

Boiler Stack Parameters

Boilers 4/5 stack height (m) =	116.738
Boilers 4/5 stack exhaust temperature (K) =	427.594
Boilers 4/5 stack exhaust velocity (m/s) =	19.035
Boilers 4/5 stack inside diameter (m) =	7.9248

Table SHRA-6B
Calculation of Commissioning 8-Hour HHI Modeling Inputs for Each Gas Turbine
Carlsbad Energy Center

Turbine Toxic Air Contaminant	Maximum Commissioning 8-Hour Emissions Per Turbine, g/s	8-Hour Reference Exposure Level ($\mu g/m^3$)	8-Hour HHI (per $\mu g/m^3$)	8-Hour HHI Model Input (g/s per $\mu g/m^3$)
Acetaldehyde	1.99E-01	300	3.333E-03	6.63E-04
Acrolein	1.07E-02	0.7	1.43E+00	1.53E-02
Formaldehyde	7.19E-01	9	1.11E-01	7.99E-02
			Total =	**9.58E-02**

Turbine Stack Parameters

Turbine stack height (m) =	42.37	
Turbine stack exhaust temperature (K) =	**447.59**	**Commissioning parameter**
Turbine stack exhaust velocity (m/s) =	**12.50**	**Commissioning parameter**
Turbine stack inside diameter (m) =	6.49	

Table SHRA-6C
Calculation of 8-Hour HHI Modeling Inputs for Testing of Fire Water Pump Engine
Carlsbad Energy Center Project

Diesel-Fueled Fire Water Pump Engine Toxic Air Contaminant	Maximum 8-Hour Emissions, g/s	8-Hour Reference Exposure Level ($\mu g/m^3$)	8-Hour Inverse REL (per $\mu g/m^3$)	8-Hour HHI Model Input (g/s per $\mu g/m^3$)
Acrolein	6.51E-06	0.7	1.43	9.31E-06
Formaldehyde	3.32E-04	9	0.11	3.69E-05
Arsenic	3.07E-07	0.015	66.67	2.05E-05
Mercury	3.84E-07	0.06	16.67	6.40E-06
			Total =	**7.306E-05**

Fire Water Pump Engine Stack Parameters

Height (m) =	9.144
Exhaust temperature (K) =	776.48
Exhaust velocity (m/s) =	77.306
Inside diameter (m) =	0.1016

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
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APPLICATION FOR CERTIFICATION FOR THE CARLSBAD ENERGY CENTER PROJECT

Docket No. 07-AFC-6
PROOF OF SERVICE
(Revised 4/29/2009)

Carlsbad Energy Center Project
Revised Health Risk Assessment

CALIFORNIA ENERGY COMMISSION
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DECLARATION OF SERVICE

I, Elizabeth Hecox, declare that on April 29, 2009, I deposited copies of the aforementioned document in the United State mail at 980 Ninth Street, Suite 1900, Sacramento, California 95814, with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above.

OR

Transmission via electronic mail was consistent with the requirements of California Code of Regulations, Title 20, sections 1209, 1209.5, and 1210. All electronic copies were sent to all those identified on the Proof of Service list above.

I declare under penalty of perjury that the foregoing is true and correct.

Elizabeth Hecox

Elizabeth Hecox