APPENDIX P-1

Risk Assessment Tables

Table P-1.1
Pio Pico Energy Center
Annual and Maximum Hourly Non-Criteria Pollutant Emissions from Turbines (per turbine)

CAS No.	Pollutant	Emission Factor lb/MMSCF	Source	Emission Factor lb/MMBtu	Turbine Max firing rate MMBtu/hr	Turbine Operating Hours hours/yr	Turbine Emissions lbs/hr	Turbine Emissions tons/yr	Hourly Emission Rate g/sec	Annual Emission Rate g/sec
7664417	Ammonia	7	SDAPCD Permit	6.87E-03	890.2	4337	6.12E+00	1.33E+01	7.71E-01	3.81E-01
115071	Propylene	3.86E-01	District workbook	3.78E-04	890.2	4337	3.37E-01	7.30E-01	4.24E-02	2.10E-02
	Hazardous Air Pollutants (HAPs, federal)									
75070	Acetaldehyde	2.04E-02	0.5*AP-42(1)	2.00E-05	890.2	4337	1.78E-02	3.86E-02	2.25E-03	1.11E-03
107028	Acrolein	3.27E-03	0.5*AP-42(1)	3.21E-06	890.2	4337	2.86E-03	6.19E-03	3.60E-04	1.78E-04
71432	Benzene	6.10E-03	0.5*AP-42(1)	5.99E-06	890.2	4337	5.33E-03	1.16E-02	6.71E-04	3.32E-04
106990	1,3-Butadiene	2.20E-04	0.5*AP-42(7)	2.15E-07	890.2	4337	1.92E-04	4.16E-04	2.42E-05	1.20E-05
100414	Ethylbenzene	1.63E-02	0.5*AP-42(1)	1.60E-05	890.2	4337	1.42E-02	3.09E-02	1.79E-03	8.88E-04
50000	Formaldehyde	4.59E-01	CATEF	4.50E-04	890.2	4337	4.01E-01	8.69E-01	5.05E-02	2.50E-02
110543	Hexane, n-	1.30E-01	CATEF	1.27E-04	890.2	4337	1.13E-01	2.45E-01	1.43E-02	7.06E-03
91203	Naphthalene	6.65E-04	0.5*AP-42(1)	6.53E-07	890.2	4337	5.81E-04	1.26E-03	7.32E-05	3.62E-05
	PAHs (listed individually below)	3.28E-04	SUM	3.22E-07	890.2	4337	2.86E-04	6.21E-04	3.61E-05	1.79E-05
83329	*Acenaphthene*	*9.50E-06*	*CATEF*	*9.32E-09*	*890.2*	*4337*	*8.30E-06*	*1.80E-05*	*1.05E-06*	*5.18E-07*
208968	*Acenapthyene*	*7.35E-06*	*CATEF*	*7.21E-09*	*890.2*	*4337*	*6.42E-06*	*1.39E-05*	*8.09E-07*	*4.01E-07*
120127	*Anthracene*	*1.69E-05*	*CATEF*	*1.66E-08*	*890.2*	*4337*	*1.48E-05*	*3.20E-05*	*1.86E-06*	*9.21E-07*
56553	*Benzo(a)anthracene*	*1.13E-05*	*CATEF*	*1.11E-08*	*890.2*	*4337*	*9.87E-06*	*2.14E-05*	*1.24E-06*	*6.16E-07*
50328	*Benzo(a)pyrene*	*6.95E-06*	*CATEF*	*6.82E-09*	*890.2*	*4337*	*6.07E-06*	*1.32E-05*	*7.65E-07*	*3.79E-07*
192972	*Benzo(e)pyrene*	*2.72E-07*	*CATEF*	*2.67E-10*	*890.2*	*4337*	*2.38E-07*	*5.15E-07*	*2.99E-08*	*1.48E-08*
205992	*Benzo(b)fluoranthrene*	*5.65E-06*	*CATEF*	*5.54E-09*	*890.2*	*4337*	*4.94E-06*	*1.07E-05*	*6.22E-07*	*3.08E-07*
207089	*Benzo(k)fluoranthrene*	*5.50E-06*	*CATEF*	*5.40E-09*	*890.2*	*4337*	*4.81E-06*	*1.04E-05*	*6.05E-07*	*3.00E-07*
191242	*Benzo(g,h,i)perylene*	*6.85E-06*	*CATEF*	*6.72E-09*	*890.2*	*4337*	*5.98E-06*	*1.30E-05*	*7.54E-07*	*3.73E-07*
218019	*Chrysene*	*1.26E-05*	*CATEF*	*1.24E-08*	*890.2*	*4337*	*1.10E-05*	*2.39E-05*	*1.39E-06*	*6.87E-07*
53703	*Dibenz(a,h)anthracene*	*1.18E-05*	*CATEF*	*1.15E-08*	*890.2*	*4337*	*1.03E-05*	*2.23E-05*	*1.29E-06*	*6.40E-07*
206440	*Fluoranthene*	*2.16E-05*	*CATEF*	*2.12E-08*	*890.2*	*4337*	*1.89E-05*	*4.09E-05*	*2.38E-06*	*1.18E-06*
86737	*Fluorene*	*2.90E-05*	*CATEF*	*2.85E-08*	*890.2*	*4337*	*2.53E-05*	*5.49E-05*	*3.19E-06*	*1.58E-06*
193395	*Indeno(1,2,3-cd)pyrene*	*1.18E-05*	*CATEF*	*1.15E-08*	*890.2*	*4337*	*1.03E-05*	*2.23E-05*	*1.29E-06*	*6.40E-07*
85018	*Phenanthrene*	*1.57E-04*	*CATEF*	*1.54E-07*	*890.2*	*4337*	*1.37E-04*	*2.97E-04*	*1.73E-05*	*8.56E-06*
129000	*Pyrene*	*1.39E-05*	*CATEF*	*1.36E-08*	*890.2*	*4337*	*1.21E-05*	*2.63E-05*	*1.53E-06*	*7.58E-07*
75569	Propylene oxide	1.48E-02	0.5*AP-42(1)	1.45E-05	890.2	4337	1.29E-02	2.80E-02	1.63E-03	8.06E-04
108883	Toluene	6.65E-02	0.5*AP-42(1)	6.53E-05	890.2	4337	5.81E-02	1.26E-01	7.32E-03	3.62E-03
1210	Xylene	3.27E-02	0.5*AP-42(1)	3.20E-05	890.2	4337	2.85E-02	6.19E-02	3.59E-03	1.78E-03
	HAP Total =						**0.655**	**1.419**		

Table P-1.2
Pio Pico Energy Center
Annual and Maximum Hourly Non-Criteria Pollutant Emissions from Cooling Tower (total)

Cast. No.	Pollutant	TAC concentration makeup water ug/liter	Cooling Tower circulating water ug/liter	Cooling Tower Max circulation gpm	Operating Hours hours/yr	Totsl Per Cell				Hourly Emission Rate g/sec	Annual Emission Rate g/sec
						Cooling Tower Emissions lbs/hr	Cooling Tower Emissions tons/yr	Cooling Tower Emissions lbs/hr	Cooling Tower Emissions tons/yr		
7440382	Arsenic	1.80E+00	8.41E+00	14,000	4,337	5.89E-08	1.28E-07	4.91E-09	1.06E-08	7.43E-09	3.68E-09
56235	Carbon Tetrachloride	2.10E+00	9.81E+00	14,000	4,337	6.88E-08	1.49E-07	5.73E-09	1.24E-08	8.66E-09	4.29E-09
7782505	Chlorine	2.30E+05	1.07E+06	14,000	4,337	7.53E-03	1.63E-02	6.28E-04	1.36E-03	9.49E-04	4.70E-04
7440473	Chromium	2.80E+00	1.31E+01	14,000	4,337	9.17E-08	1.99E-07	7.64E-09	1.66E-08	1.16E-08	5.72E-09
7440508	Copper*	6.50E+00	3.04E+01	14,000	4,337	2.13E-07	4.61E-07	1.77E-08	3.85E-08	2.68E-08	1.33E-08
1101	Fluoride*	1.10E+03	5.14E+03	14,000	4,337	3.60E-05	7.82E-05	3.00E-06	6.51E-06	4.54E-06	2.25E-06
7439921	Lead	8.60E-01	4.02E+00	14,000	4,337	2.82E-08	6.11E-08	2.35E-09	5.09E-09	3.55E-09	1.76E-09
	HAP Total =					**0.0076**	**0.0164**	**0.0006**	**0.0014**		

TAC = toxic air contaminants
HAP = hazardous air pollutants
Bg/liter = micrograms per liter
lb = pound
The maximum concentration for each TAC in makeup water as determined from the highest water samples collected from Otay Water District's Ralph W. Chapman Water Recycling Facility effluent in 2007, 2008, and 2009.
Cycles of concentration = 4.67
Drift rate = 0.0001%

Table P-1.3
Pio Pico Energy Center
Stack Parameters for HRA Modeling

Case/Year	Stack height feet	Stack Diam feet	Stack flow wacfm	Stack Vel ft/sec	Stack Temp deg F	Stack Height meters	Stack Diam meters	Stack flow m3/sec	Stack Vel m/sec	Stack Temp deg K
Turbines: Cold Low / All met data used	100	14.5	645,580	65.16	802	30.48	4.42	414.3	27.0	700.9
Cooling Tower (per cell)	22	13	268,650	33.73	86	6.71	3.96	126.8	10.3	303.2

Comparison of Impacts of Specified Pollutants with 8-hour RELs

The District also requested that predicted impacts of certain pollutants be compared with the 8-hour RELs published by OEHHA. The maximum 8-hour concentrations for these pollutants were calculated by multiplying the highest 8-hour unit impact factor from the turbine impact screening runs (see Table G-4.4, excerpted below as Table P-1.4) times the emission rate for each pollutant. The result is the 8-hour concentration (in µg/m^3), which can be compared with the REL. Table P-1.6 shows that the project impacts are below the 8-hour RELs.

Table P-1.4
Modeling Unit Impacts
Pio Pico Energy Center

Operating Mode/Year	8-hr unit Conc. (µg/m3)
2008 Met Data	
Startup/shutdown	5.7689
1. Hot Base	5.0529
2. Avg Base	4.9330
3. Cold Base	5.0247
4. Hot Low	5.7689
5. Avg Low	6.3693
6. Cold Low	6.3948
2007 Met Data	
Startup/shutdown	5.3818
1. Hot Base	5.0009
2. Avg Base	4.9220
3. Cold Base	4.9815
4. Hot Low	5.3818
5. Avg Low	5.8517
6. Cold Low	5.8820
2006 Met Data	
Startup/shutdown	7.0322
1. Hot Base	6.2762
2. Avg Base	6.1252
3. Cold Base	6.2393
4. Hot Low	7.0322
5. Avg Low	7.6959
6. Cold Low	**7.7377**

Table P-1.5
Calculation of Maximum 8-hour Concentration for Compounds with 8-Hour RELs

Pollutant	Emission rate (g/sec)	Unit Impact (µg/m^3) per (g/sec)	Maximum 8-hour Average Concentration (µg/m^3)
Acetaldehyde	2.25E-03	7.7337	1.74E-02
Acrolein	3.60E-04	7.7337	2.79E-03
Formaldehyde	5.05E-02	7.7337	3.91E-01

Table P-1.6
Comparison of Maximum 8-Hour Average Impacts from Project Operation with 8-Hour RELs

Pollutant	8-hour REL[1] (µg/m^3)	Maximum 8-hour Average Concentration (µg/m^3)	Complies? (Y/N)
Acetaldehyde	300	0.02	Y
Acrolein	0.7	0.003	Y
Formaldehyde	9	0.4	Y

Notes:

[1]OEHHA, *Table of All Acute, Chronic and 8 hour Reference Exposure Levels*, http://www.oehha.ca.gov/air/allrels.html (December 18, 2008)

Diesel Health Risks from Construction Activities

Construction of the PPEC is expected to take approximately 16 months. No significant public health effects are expected during construction. Strict construction practices that incorporate safety and compliance with applicable LORS will be followed. In addition, mitigation measures to reduce air emissions from construction impacts will be implemented as described in Section 5.2.

The dominant emission with potential health risk is diesel particulate matter (DPM) from combustion of diesel fuel in construction equipment (e.g., cranes, dozers, excavators, graders, front-end loaders, backhoes). DPM emissions from on-site construction are summarized in Table P-1.7.

Table P-1.7
MAXIMUM ONSITE CONSTRUCTION DPM EMISSIONS

Emitting Activity	Pounds per Day	Tons per Year
Construction Equipment	1.6	0.2

This HRA was performed in accordance with OEHHA (2003) guidance, which requires adjusting the 70-year lifetime dosage to an exposure period of 9 years (despite the fact that project construction will only last 16 months). The resulting maximum off-property cancer risk is located at the project's fenceline, a workplace receptor. When the dosage is adjusted to account for the reduced period of time that a worker is present (8 hours per day, 245 days per year), the calculated risk from this temporary activity is 3.2 in one million. This is below the significance threshold of 10 in one million.

TABLE P-1.8
MAXIMUM MODELED CONSTRUCTION IMPACTS

	Impact, µg/m^3		
Pollutant	**2006**	**2007**	**2008**
Annual Combustion DPM	0.208	0.205	0.196

TABLE P-1.9
MAXIMUM CONSTRUCTION DIESEL RISK CALCULATIONS

Annual Avg DPM concentration at PMI (µg/m^3)	Unit Risk (µg/m^3)$^{-1}$	Duration Exposure Adjustment	Residential Risk at PMI	Worker Exposure Adjustment	Worker Risk at PMI
0.208	5.28E-04	0.129	1.41E-05	0.223	3.15E-06

Notes:
All combustion PM2.5 is assumed to be DPM
DPM = Diesel Particulate Matter
Unit Risk = (Lifetime Dose Response) * (Breathing Rate) = (1.1 mg/kg)$^{-1}$ * (581 l/day per kg of body weight)
Duration Exposure Adjustment = 9 years/70 years
Worker Exposure Adjustment = (245 days per year) * (8 hours per day) / (365 days per year) * (24 hours per day)

Because the offsite particulate impacts fall off sharply with distance from the facility, the residential risk at the nearest residential receptor, more than 1.4 km away, will be well below the significance threshold, as shown in Table P-1.10.

TABLE P-1.10
MAXIMUM CONSTRUCTION DIESEL RISK CALCULATIONS

Annual Avg DPM concentration at MEIR (µg/m^3)	Unit Risk (µg/m^3)$^{-1}$	Duration Exposure Adjustment	Residential Risk at MEIR
0.00041	5.28E-04	0.129	2.79E-08

Notes:
All combustion PM2.5 is assumed to be DPM
DPM = Diesel Particulate Matter
Unit Risk = (Lifetime Dose Response) * (Breathing Rate) = (1.1 mg/kg)$^{-1}$ * (581 l/day per kg of body weight)
Duration Exposure Adjustment = 9 years/70 years