Appendix 5.1E
Screening Health Risk Assessment

APPENDIX 5.1E

Screening Health Risk Assessment

The screening level health risk assessment has been prepared using CARB's Hotspots Analysis and Reporting Program (HARP) computer program (Version 1.4d, January 2011) and associated guidance in the OEHHA's *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (August 2003). The HARP model was used to assess cancer risk as well as chronic and acute risk impacts. The most recent health database[1] provided by CARB, reflecting the RELs adopted by OEHHA in December 2008, has been used. Although the December 2008 RELs include 8-hour RELs for acetaldehyde, acrolein and formaldehyde, these 8-hour RELs have not yet been incorporated into the HARP software, so they have been calculated by hand for inclusion in the risk assessment.

Modeling Inputs

HAP emission rates used in the screening health risk assessment are shown in Tables 5.1E-2 and E-3 (emission rates in pounds per hour and pounds per year); Table 5.1E-4 (equivalent emission rates in g/s per μ/m^3 for the 8-hour acute exposures); and Table 5.1E-5 (stack parameters used for modeling). Maximum hourly heat input rates for each unit were used in calculating emissions for acute impacts; annual average heat input rates were used in calculating emission rates for the chronic and cancer risk analyses. Stack parameters were the same as those used in the criteria pollutant impact assessment. Because evaporative drift emissions from the WSACs are so low and because potential impacts will be minimized through the use of high efficiency drift eliminators and treated water with very low TDS levels, these units were not included in the HRA.

Risk Analysis Method

AERMOD/HARP

The dispersion analysis was performed using AERMOD in accordance with the procedures outlined in the modeling protocol (Appendix 5.1H), using the modeling inputs described above. AERMOD produces output files containing modeled concentrations of each compound shown in Section 5.1 at every receptor. However, because the HARP model was designed to use modeling output files from the ISCST3 model, rather than the current recommended guideline AERMOD model, the AERMOD results must be reformatted before they can be used in HARP.

The HARP On-Ramp is a tool provided by CARB that reformats output files from models other than ISCST3 so that they can be read by the HARP Risk Module. Version 1 of the On-Ramp tool was used to create files required by HARP to complete the screening health risk assessment.

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[1] February 2009, available at http://www.arb.ca.gov/toxics/harp/data.htm.

AERMOD for 8-Hour Acute HHI

Because HARP does not yet have the capability of evaluating an acute HHI for an 8-hour period, an alternative analysis method was used. In this method, a weighted acute risk factor is used in place of a g/s emission rate for each unit, and AERMOD is used to evaluate the maximum 8-hour acute HHI from all sources. To calculate the weighted risk for each source, the maximum hourly emission rate in g/s for each pollutant (acetaldehyde, acrolein and formaldehyde) was divided by the individual 8-hour reference exposure level for that pollutant in $\mu g/m^3$. The result was a weighted contribution to the acute 8-hour HHI, in units of g/s per $\mu g/m^3$, for each pollutant. These weighted contributions were then summed for each source. The calculations are shown in Table 5.1E-4.

Summary of Results

The results of the screening level health risk assessment are summarized in Table 5.1E-1.

TABLE 5.1E-1
Screening Level Risk Assessment Results

Risk Methodology	Project Impacts
Modeled Residential Cancer Risk (in one million)	
Residential: Derived (OEHHA) Method at PMI	1.38
Residential: Derived (OEHHA) Method at maximally impacted residential receptor	0.10
Modeled Worker Cancer Risk (in one million)	
Worker Exposure: Derived (OEHHA) Method at PMI	0.21
Modeled Acute and Chronic Impacts	
Acute HHI—1-hour RELs	0.003
Acute HHI—8-hour RELs	0.002
Chronic HHI	0.0007

As shown in Table 5.1E-1, the cancer risk from the project is well below the significance level of 10 in one million. In addition, the acute and chronic health hazard indices are well below the significance level of one. The analysis of potential cancer risk described in this section employs extremely conservative methods and assumptions, as follows:

- The analysis includes representative weather data over five years to ensure that the least favorable conditions producing the highest ground-level concentration of power plant emissions are included. The analysis then assumes that these worst-case weather conditions, which in reality occurred only once in five years, will occur every year for 70 years.

- The power plant is assumed to operate at hourly, daily, and annual emission conditions that produce the highest ground-level concentrations. In fact, the power plant is expected to operate at a variety of conditions that will produce lower emissions and impacts.
- The analysis assumes that a sensitive individual is at the location of the highest ground-level concentration of power plant emissions continuously over the entire 70-year period. In reality, people rarely live in their homes for 70 years, and even if they do, they leave their homes to attend school, go to work, go shopping, and so on.

The purpose of using these unrealistic assumptions is to consciously overstate the potential impacts. No one will experience exposures as great as those assumed for this analysis. By determining that even this highly overstated exposure will not be significant, there is a high degree of confidence that the much lower exposures that actual persons will experience will not result in a significant increase in cancer risk. In short, the analysis ensures that there will not be significant public health impacts at any location, under any weather condition, or under any operating condition. A more detailed discussion of potential project impacts on public health is provided in Section 5.16, Public Health.

The locations of the maximum acute, chronic, and cancer risks are shown in Figure 5.1E-1.

FIGURE 5.1E-1
Locations of Maximum Acute, Chronic, and Cancer Risks from Project Operation

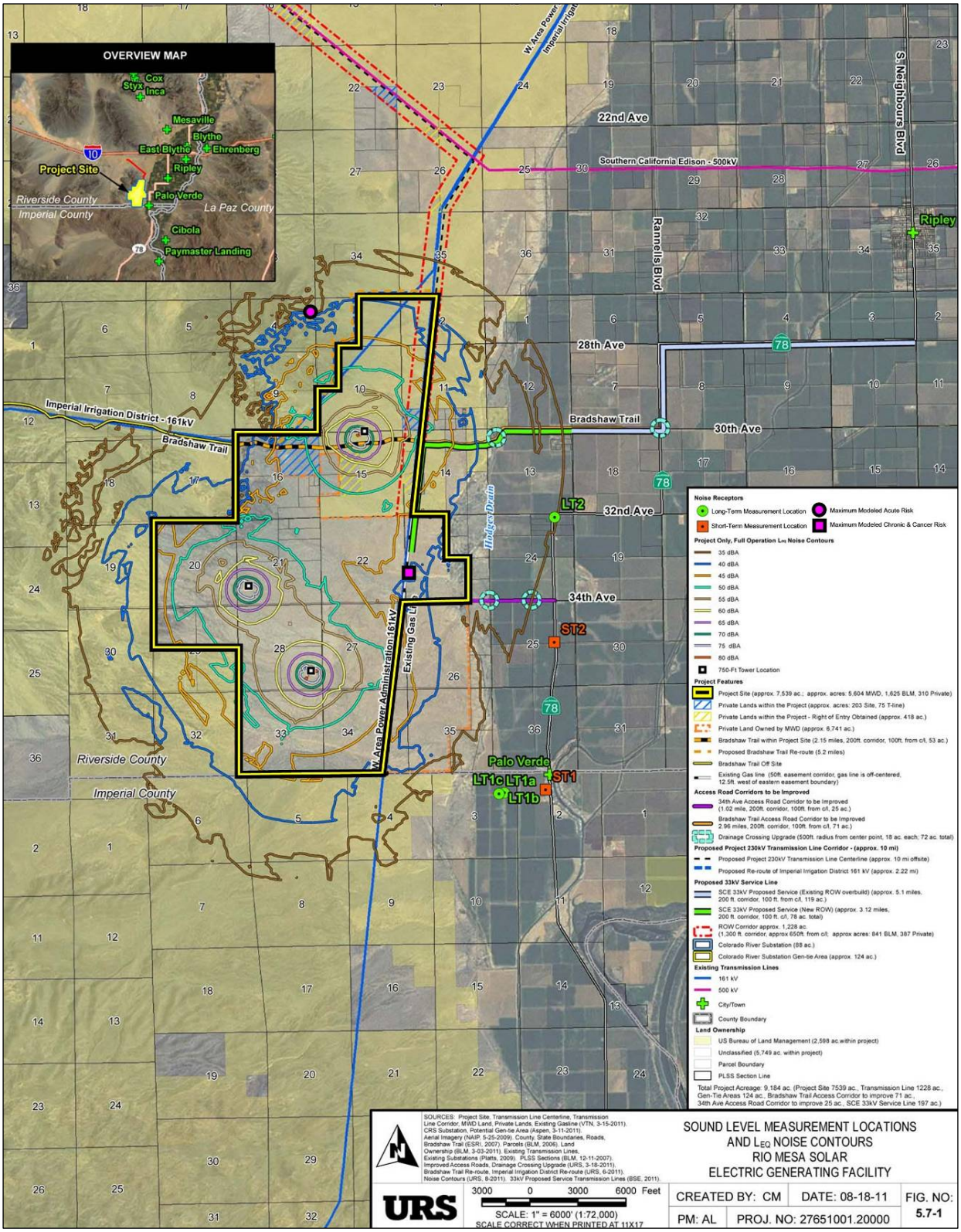

Table 5.1E-2
Rio Mesa Solar Electric Generating Facility
Risk Assessment Modeling Inputs for Boilers

	Auxiliary Boilers (each)		Startup Boilers (each)		Nighttime Boilers (each)	
	Emission Rates		Emission Rates		Emission Rates	
Compound	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr
Acetaldehyde	4.412E-04	9.088E-02	2.197E-04	1.775E-01	4.559E-05	1.842E-01
Acrolein	3.922E-04	8.078E-02	1.953E-04	1.578E-01	3.971E-05	1.605E-01
Benzene	8.333E-04	1.717E-01	4.150E-04	3.354E-01	8.529E-05	3.447E-01
Ethylbenzene	9.804E-04	2.020E-01	4.882E-04	3.946E-01	1.015E-04	4.101E-01
Formaldehyde	1.765E-03	3.635E-01	8.788E-04	7.102E-01	1.809E-04	7.310E-01
Hexane	6.373E-04	1.313E-01	3.174E-04	2.565E-01	6.765E-05	2.734E-01
Naphthalene	1.471E-04	3.029E-02	7.324E-05	5.918E-02	4.412E-06	1.783E-02
PAHs						
Benzo(a)anthracene	7.740E-06	1.594E-03	3.854E-06	3.115E-03	2.322E-07	9.384E-04
Benzo(a)pyrene	5.160E-06	1.063E-03	2.570E-06	2.077E-03	1.548E-07	6.256E-04
Benzo(b)fluoranthrene	7.740E-06	1.594E-03	3.854E-06	3.115E-03	2.322E-07	9.384E-04
Benzo(k)fluoranthrene	7.740E-06	1.594E-03	3.854E-06	3.115E-03	2.322E-07	9.384E-04
Chrysene	7.740E-06	1.594E-03	3.854E-06	3.115E-03	2.322E-07	9.384E-04
Dibenz(a,h)anthracene	5.160E-06	1.063E-03	2.570E-06	2.077E-03	1.548E-07	6.256E-04
Indeno(1,2,3-cd)pyrene	7.740E-06	1.594E-03	3.854E-06	3.115E-03	2.322E-07	9.384E-04
Propylene	7.613E-03	1.568	3.791E-03	3.064	7.794E-03	31.498
Toluene	3.824E-03	0.788	1.904E-03	1.539	3.897E-04	1.575
Xylene	2.843E-03	0.586	1.416E-03	1.144	2.897E-04	1.171

Table 5.1E-3
Rio Mesa Solar Electric Generating Facility
Risk Assessment Modeling Inputs for Emergency Engines

Unit	DPM Emission Rate lb/hr	lb/yr
Power Block Emergency Generators (each)	0.6007	60.069
Common Area Emergency Generator	6.581E-02	6.581
Power Block Fire Pump Engines (each)	3.307E-02	3.307
Common Area Fire Pump Engine	3.031E-02	3.031

Table 5.1E-4
Rio Mesa Solar Electric Generating Facility
Calculation of Screening HRA Inputs for 8-Hour Exposure Periods

		Auxiliary Boilers (each)		Startup Boilers (each)		Nighttime Preservation Boilers (each)	
Chemical	8-hour REL (ug/m3)	One-hour Emission Rate, g/s	Weighted Contribution to Acute HHI (g/s per ug/m3)	One-hour Emission Rate, g/s	Weighted Contribution to Acute HHI (g/s per ug/m3)	One-hour Emission Rate, g/s	Weighted Contribution to Acute HHI (g/s per ug/m3)
Acetaldehyde	300	5.56E-05	1.85E-07	2.77E-05	9.23E-08	5.74E-06	1.91E-08
Acrolein	0.7	4.94E-05	7.06E-05	2.46E-05	3.52E-05	5.00E-06	7.15E-06
Formaldehyde	9	2.22E-04	2.47E-05	1.11E-04	1.23E-05	2.28E-05	2.53E-06
	Acute Risk Factor		9.55E-05		4.75E-05		9.70E-06

Table 5.1E-5
Rio Mesa Solar Electric Generating Facility
Stack Parameters for Screening HRA

Stack Parameters				
	Stack Diam (m)	Stack Ht (m)	Exhaust Temp (deg K)	Exhaust Velocity (m/s)
Auxiliary Boilers	2.540	41.148	480.778	15.554
Startup Boilers	1.676	41.148	421.889	15.844
Nighttime Preservation Boilers	0.457	10.668	421.889	16.673
Power Block Emergency Generators (each)	0.457	3.048	769.111	56.344
Common Area Emergency Generator	0.203	3.048	730.222	32.745
Power Block Fire Pump Engines (each)	0.102	3.048	796.889	96.051
Common Area Fire Pump Engine	0.102	3.048	783.000	56.757