July 29, 2010

Alan Solomon
Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

RE: **Palen Solar Power Project, Docket No. 09-AFC-7**
SCAQMD Comments to the SA/DEIS
Technical Area*: Air Quality*

Dear Mr. Solomon:

Attached please find the following SCAQMD comment letter to the SA/DEIS.

If you have any questions on this submittal, please feel free to contact me directly.

Sincerely,

Alice Harron
Senior Director, Development

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July 27, 2010

Mr. Alan Solomon, Project Manager
Siting, Transmission and Environmental Protection Division
California Energy Commission
1516 Ninth Street
Sacramento, California 95814-5512

Re: Palen Solar Power Project (09-AFC-7)
SCAQMD Comments to the SA/DEIS

Dear Mr. Solomon,

On behalf of Palen Solar I, LLC, Solar Millennium LLC has reviewed the comments that the South Coast Air Quality Management District (SCAQMD or District) provided in its July 16, 2010 letter regarding the Staff Assessment and Draft Environmental Impact Statement (SA/DEIS). Based on the comments, it appears that the District's Intergovernmental Review group is not aware of all of the information submitted by Solar Millennium to the permitting group at SCAQMD or to CEC regarding the project. The purpose of this letter, therefore, is to respond to the SCAQMD comments in order to clarify Solar Millennium's position with respect to the issues raised by Mr. MacMillan at the District.

Thresholds of Significance

No comment.

1) HTF Fugitive Emissions

a) Heavy Oil vs. Light Liquid

On June 25, 2010, Solar Millennium submitted to SCAQMD and the CEC a thorough evaluation of EPA's development of heavy liquid emission factors which clearly demonstrates that emissions of HTF piping fugitives should be calculated based on the heavy liquid emission factors (see **Attachment 1**). Since the submittal of that letter, we understand that the Mojave Desert Air Quality Management District (MDAQMD) used the heavy liquid factors in the development of the Final Determination of Compliance (FDOC) for the Blythe Solar Power Project, and based on MDAQMD's acceptance, CEC staff issued the final air quality testimony that reflected the FDOC conditions, including the use of the heavy liquid emission factors in establishing the emission limits for the HTF piping system. We ask that the CEC inform SCAQMD that CEC staff agrees with the use of the heavy liquid factors for the HTF fugitive emission calculations.

b) HTF Speciation

In this SCAQMD comment, Mr. MacMillan's group appears to be confusing the expansion tank emissions with both the HTF heater emissions and the HTF piping fugitive emissions. SCAQMD's comment says: "Page C.5-12 of the Draft SA/EIS states that 99.99% of the ***fugitive*** HTF emissions are modeled as benzene…"[emphasis added]. On page C.5-12 of the Draft SA/EIS, CEC states that the emissions from the HTF ***expansion tanks*** would consist of 99.99% benzene, not the fugitive HTF emissions that would come from the piping network. The emissions from the expansion tanks (which ultimately exhaust through the ullage system vent) are expected to be light hydrocarbons. Solar Millennium does not know with certainty what the speciation of the expansion tank emissions will be. However, to ensure that health risks were not underestimated, the expansion tank emissions were assumed to be 99.99% benzene, as benzene is the most toxic of the compounds that are reasonably expected to be emitted from the expansion tanks.

The composition of the fugitive emissions from the HTF piping network has not been established. However, the emissions would not be expected to consist of 99.99% benzene, as benzene is expected to be present in the HTF at very low concentrations. The ullage system is specifically designed to remove benzene and other light hydrocarbons from the HTF. Based on the expected composition of the HTF under normal operating conditions, the fugitive emissions from piping components would predominately be HTF itself (a mixture of diphenyl ether and biphenyl).

The toxic speciation cited by the SCAQMD in the table in this comment appears to refer to the HTF heater emissions. The speciation of the combustion pollutants from the HTF heater has no relationship to the speciation of the expansion tank emissions. Furthermore, as you know, the HTF heater has been eliminated from the project.

We believe that the Draft SA/EIS correctly identifies the speciation of the HTF expansion tank emissions and, therefore, a revision to the HRA modeling is not required.

c) Inspection and Maintenance Program

Solar Millennium disagrees with the change in the requirements for the Inspection and Maintenance Program (Condition AQ-SC-9) suggested by the SCAQMD. While we agree in principle with the idea that the Inspection and Maintenance Program be conducted when the system is in operation at its peak operating temperature and pressure, the reality is that it is unsafe to conduct an fugitive emission inspection program on the piping system while the solar field is in operation, as the majority of the piping is located at the focal point of the mirrors, where sunlight is concentrated and very high temperatures are expected. That being said, the HTF piping network is very well insulated and consequently, the HTF will remain hot for many hours after sundown. Since the purpose of the inspection program is to determine if a component is leaking, and not to determine the leak rate with absolute accuracy, conducting the inspections after sundown should be sufficient to determine if a component is leaking.

Solar Millennium has been working with the CEC, the MDAQMD permitting staff and the SCAQMD permitting staff to develop an inspection and monitoring program that is acceptable to all parties.

2) Emergency Generators

Due to the expected timing of the Palen Solar Power Project's construction and operation, Solar Millennium is willing to accept SCAQMD's suggestion to install the interim Tier 4 engines for use with the emergency generators at this facility. Please note that the higher emitting Tier 2 engines were evaluated in the AFC; the use of the interim Tier 4 engines will lower emissions and therefore lower the potential impacts.

3) Background Criteria Pollutants

Solar Millennium has no objection to the SCAQMD's recommendation for the selection of background PM10 and PM2.5 data. Please note, however, that it is our opinion that none of the monitors accurately represent the true background PM10 or PM2.5 concentrations for the Project area. Given their proximity to urban areas or agricultural areas, or both, all existing monitoring stations will likely overstate background concentrations for the Project area, as the Project area is remote and is unlikely to be influenced by those same factors.

Closing

We appreciate your consideration of these comments. If you wish to discuss any of these comments, please contact Russ Kingsley at AECOM at (805)388-3775.

Sincerely,

Elizabeth Ingram
Project Manager, Development
Solar Millennium, LLC

Attachment 1

Palen Solar Power Project Fugitive Components Letter to the SCAQMD, June 25, 2010

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June 25, 2010

Mr. Kenneth L. Coats
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765-4178

Re: Palen Solar Power Project Fugitive Components
Facility ID No. 163054

Dear Mr. Coats,

Thank you for meeting with us on May 27, 2010 to discuss the use of heavy liquid emission factors for calculating fugitive emissions from piping system components. Your insights and recommendations were very helpful in understanding and addressing the issues. As we discussed, AECOM, on behalf of Solar Millennium, has prepared a detailed evaluation of the basis for our use of heavy liquid emission factors, provided an evaluation of the effectiveness of routine inspection and maintenance for controlling fugitive emissions, and provided a Best Available Control Technology evaluation for fugitive components.

Background and Introduction

For calculating Heat Transfer Fluid (HTF) fugitive component emissions during normal operating hours, the Kern County Air Pollution Control District (KCAPCD) proposed using “light liquid” emission factors based on the assumption that the HTF at elevated temperature and pressure resembled light liquids rather than “heavy liquids” as was proposed by Solar Millennium in its Application for Certification (AFC) and Preliminary Determination of Compliance (PDOC) application. Subsequently, the California Energy Commission (CEC) adopted the methods and assumptions proposed by KCAPCD for its calculations for the various solar thermal projects that are currently under review (e.g., Blythe Solar Power Project [BSPP], Palen Solar Power Project [PSPP] and the Ridgecrest Solar Power Project [RSPP]). Finally, the California Unions for Reliable Energy (CURE), in its comments to the SCAQMD regarding the PSPP PDOC, also suggested that the light liquid emission factors should be used for emission estimates during normal operating hours.

“Light liquid” and “heavy liquid” are terms of art used in the refinery industry and Synthetic Organic Chemical Manufacturing Industries (SOCMI) to identify appropriate regulatory requirements and emission factors for emission estimates from fugitive piping components. The grouping of organic compounds into these two classifications has been studied extensively by EPA in the development of emission factors for fugitive components. The relevant EPA studies thoroughly document the basis for the definitions and associated emission factors. It is inappropriate and unnecessary for CEC or KCAPCD to deviate from the definitions of light liquid and heavy liquid based on the properties of HTF at conditions of use such as elevated temperature or pressure, as EPA has established that the emission factors are not dependant on those properties. **Section 1** of this correspondence provides a summary and analysis of the various EPA guidance on the subject to substantiate this conclusion.

KCAPCD proposed as a permit condition in its PDOC for RSPP an inspection and maintenance program (also known as Leak Detection and Repair [LDAR] program). Subsequently, CEC adopted the proposed KCAPCD condition for the other two solar thermal projects that are currently under review (i.e., BSPP and PSPP). EPA has studied the effectiveness of LDAR programs for reducing the emissions from fugitive piping components. In the fugitive component emissions calculations provided in its AFC, Solar Millennium did not take into account the control effectiveness of the LDAR program. As shown in **Section 2** of this correspondence, implementation of the LDAR program, as proposed by CEC could reduce potential fugitive emissions from HTF piping components by 30 to 90 percent. Thus, if the condition is imposed, the emission estimates presented in the AFC would over-estimate the emissions substantially.

Finally, at the request of SCAQMD, Solar Millennium has evaluated Best Available Control Technology for the fugitive components. Taken as a whole, the HTF piping network would have uncontrolled fugitive VOC emissions exceeding the BACT threshold of one pound per day. Application of BACT would further serve to reduce actual emissions compared to those emissions reported in the AFC for the Project. A BACT determination for the fugitive piping components is presented in **Section 3** of this correspondence.

Section 1 EPA Development of Heavy and Light Liquid Definitions and Emission Factors

As noted in the introduction, KCAPCD, CEC and CURE have asserted that because HTF is operated at elevated temperature and pressure, the vapor pressure of HTF at operating condition more closely resembles light liquids at ambient conditions, and thus the light liquid emission factors should be applied. This logic is flawed, as EPA, in the development of the definitions of light and heavy liquid and associated emission factors, took into account the operating conditions such as temperature and pressure in both light and heavy liquid streams by studying organic liquid emissions in operating refineries and SOCMI plants. Both light and heavy organic liquids are frequently processed at elevated temperatures and pressures in refineries and SOCMI plants. In addition, to further demonstrate that operating heavy liquids at elevated temperatures and pressures is not uncommon in a refinery, a summary of refinery process units, with process inputs, outputs and operating conditions is provided.

In its 1984 Guidelines Series,[1] EPA discussed how it developed emission factors using a model unit approach. The Guideline Series focuses on emissions of gases or liquid from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, and agitators. In the cases of pumps, compressors, in-line process valves, pressure relief devices, flanges and agitators, the potential source of a leak is a seal at the point where the process stream can contact a part of the equipment, e.g., at a valve stem. Leaks from open-ended valves and sampling connections typically are the result of an incompletely closed valve. Under these circumstances, EPA stated that "available data show that fugitive emissions are proportional to the number of potential sources but are not related to capacity, throughput, age, ***temperature, or pressure*** [emphasis added][2]. EPA's conclusions are based on fugitive equipment located at 62 SOCMI plants which produce 35 different chemicals.

EPA also states: "Data from petroleum refineries indicates that emission rates of sources decrease as the vapor pressure (volatility) of the process fluid decreases. Three classes of volatility have been established based on the petroleum refinery data. These include gas/vapor service, light liquid service, and heavy liquid service. The split between light and heavy liquids for the refinery data is between naphtha (a gasoline blending component) and kerosene. Since similar streams names may have different vapor pressure, depending on site specific factors, it is difficult to quantify the light-heavy split. The break point is approximately at a vapor pressure of 0.3 kilopascals (kPa) at 20^{o}C [68^{o}F]".[3] A similar

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[1] U. S. EPA. Guideline Series: Control of Volatile Organic Compound Leaks from synthetic organic Chemical and Polymer Manufacturing Equipment, EPA-450/3-83-006, March 1984.
[2] U. S. EPA. Guideline Series: Control of Volatile Organic Compound Leaks from synthetic organic Chemical and Polymer Manufacturing Equipment, EPA-450/3-83-006, March 1984, pp. 2-17.
[3] U. S. EPA. Guideline Series: Control of Volatile Organic Compound Leaks from synthetic organic Chemical and Polymer Manufacturing Equipment, EPA-450/3-83-006, March 1984, pp. 2-18.

statement was made in a 1986 report: "the only equipment or proves variable found to correlate with fugitive emission rates was the volatility of the stream components."[4]

During the EPA's refinery study, process units at nine refiners were sampled, including atmospheric distillation, vacuum distillation, thermal operation (coking), catalytic cracking, catalytic reforming, catalytic hydrocracking, catalytic hydrorefining, catalytic hydrotreating, alkylation, aromatics/isomerization, lube oil manufacture, asphalt manufacture, fuel gas/light ends processing liquefied petroleum gas, and sulfur recovery, so a range of operating temperatures and pressures were encountered.[5]

EPA reported that "in 1980, [it] coordinated a study of 24 individual chemical process units. The process units were selected to represent a cross-section of the population across SOCMI. Among the chemical compounds included in the survey were acrylonitrile, ethylene dichloride, formaldehyde, perchloroethylene, and vinyl chloride. Selections of equipment to be screened were made prior to screening activities: screening was conducted by two-person teams using portable organic analyzers. Calibration was done daily at a minimum. A large number of the following types of equipment were screened in the 24 units for determination of leak frequency: flanges, process drains, open-ended lines, agitator seals, relief valves, valves, pump seals, and compressor seals. These sources were further grouped by the chemical phase of the material being handled: in gas/vapor service, in light liquid services, and in heavy liquid service."[6]

For reference purposes, the vapor pressure of selected liquids processed in refineries or SOCMI plants that meet the definition of a heavy liquid are presented in **Table 1**. Note that the HTF has a vapor pressure of 0.0026 to 0.0071 kilopascals (kPa) in the temperature range of 80 to 100^{o}F. Vapor pressures at lower temperatures are not provided by the manufacturer as HTF crystallizes below 54^{o}F. As shown in the table, the vapor pressure of HTF is much lower than any of these recognized "heavy" liquids.

Table 1 Vapor Pressure of Selected "Heavy" Organic Liquids (kPa)

Temperature ^{o}F (^{o}C)	#2 Diesel	Jet kerosene	Mineral spirits	#6 Fuel oil	Decane	HTF
40 (4.4))	0.0031	0.0041	0.00773	2.00E-05	0.0210	0.00
50 (10)	0.0045	0.006	0.01063	3.00E-05	0.0264	0.00
60 (15.6)	0.0074	0.0085	0.01256	4.00E-05	0.3320	0.00
70 (21.1)	0.009	0.011	0.01546	6.00E-05	0.0418	0.00
80 (26.7)	0.012	0.015	0.02417	9.00E-05	0.0525	0.0026
90 (32.2)	0.016	0.021	0.02803	1.30E-04	0.0660	0.0049
100 (38)	0.022	0.09	0.03093	1.90E-04	0.0831	0.0071
Ref: U. S. EPA. TANKS 4.09d and Antoine Coefficients for Vapor Pressure found at www.IrChe.com.						

[4] U. S. EPA. Emission Factors for Equipment Leaks of VOC and HAP, EPA-450/3-86-002, January 1986, p. 3-2.
[5] U. S. EPA. Fugitive Emission Sources of Organic Compounds – Additional Information on Emissions, Emission Reductions, and Costs, April 1982, p. 2-2.
[6] U. S., EPA. Emission Factors for Equipment Leaks of VOC and HAP. EPA-450/3-86-002, January 1986, p. 3-6.

Several selected refinery processes are listed in **Table 2**, shown with process inputs and outputs, and typical operating conditions of temperature and pressure. As shown in the table, all of these refinery operations process light and/or heavy liquids at elevated temperatures and pressures.

Table 2 Example Refinery Process Operating Parameters

Refinery process	Input examples	Temperatures and Pressures	Product examples
Catalytic cracking unit (CCU)	Extra heavy gas oil, heavy gas oil	Ambient - 1200°F; 10 - 50 psig	Light gas oil
Catalytic gas plant	CCU main fractionator tops	Ambient to 390°F; 10 - 175 psig	Light gasoline, heavy gasoline
Catalytic feed hydrotreater	Extra heavy gas oil, heavy gas oil	Ambient - 750°F; 50 – 1,550 psig	CCU feed (flash distillate)
Catalytic gasoline hydrotreater	Light gasoline	Ambient - 750 °F; 40 - 900 psig	Volatile light hydrocarbons
Delayed Coker Unit	Resid, naphthenic bottoms, heavy and light flushing oils, marine fuel oil	Ambient - 950 °F; Atmospheric – 4,000 psig	Naphtha, light/heavy gas oils
Hydrotreater	Gas oils, heavy gas oil	Ambient - 950 °F; Atmospheric – 2,500 psig	Naphtha
Heavy gasoline hydotreater	Naphtha, heavy gasoline, rich sponge oil	Ambient - 750 °F; Atmospheric – 1,250 psig	Various fractions
Crude unit/Vacuum flasher	Crude oil	Ambient to 750 °F; Vacuum to 25 psig	Naphtha, light gas oil, heavy gas oil, extra heavy gas oil
Naphtha hydrotreater (NHT), Gas oil hydrotreater (GOHT)	Naphtha, light gas oil	NHT = 740 °F, 650 psig GOHT - 602 °F; 1,500 psig	Stabilizer side stripper bottoms, stabilizer tops, stabilizer bottoms; primary side stripper bottoms; secondary bottoms; secondary tops
Flexicoker unit	Vacuum residue	Ambient - 1700 °F; 2 - 165 psig	Naphtha, heavy gas oil, light gas oil, extra heavy gas oil

In its comments to the PDOC, CURE states that products of thermal breakdown of the HTF would include light liquid hydrocarbons that have lower boiling points and higher vapor pressures than HTF. HTF is known to degrade slowly over time to produce light hydrocarbons and heavy hydrocarbon which are undesirable contaminants of the HTF, as they degrade thermal properties, cause pump cavitations, and potentially foul the heat exchangers. To prevent these problems, the Project is equipped with a Ullage system. The Ullage system is a flash distillation process specifically designed to remove these unwanted contaminants. The Ullage system will maintain the concentration of light liquids in the HTF at less than 2 percent, and the normal operating concentration will usually be substantially less than 2 percent.

In conclusion, when developing the definitions and corresponding emission factors for heavy and light liquids, EPA evaluated refinery and SOCMI process streams, both heavy and light liquids, at actual operating temperatures and pressures. Those temperatures and pressures were typically substantially above ambient conditions, and in many cases the temperature and pressure would have been above the conditions at which the HTF would operate in a solar field. Based on their research, EPA concluded that the emissions expected from fugitive components are not dependent upon process temperature and pressure. Instead, EPA concluded that light and heavy liquids could be defined according to relative volatility, with the split between heavy and light liquids of 0.3 kPa at 68°F. The choice of 68°F is a convenience for classification of materials (as MSDS typically list vapor pressure at standard conditions of 68°F), and has no relationship to the conditions under which the material is processed. Simply stated, naphtha is a light liquid under all process conditions and kerosene is a heavy liquid under all process conditions. Based on the published vapor pressure of HTF and a comparison of the volatility of HTF to that of gasoline or kerosene, HTF is a heavy liquid, under all process conditions.

Section 2 Control Effectiveness of Inspection and Monitoring Program

In the Revised Staff Assessment for PSPP, CEC proposes an LDAR program for the fugitive piping components that Staff intends to apply to all solar projects.[7] EPA has studied the effectiveness of LDAR programs for reducing the emissions from fugitive piping components and found emission reductions on the order of 30 to 90 percent. Thus, the emission estimates presented in the AFC using heavy liquid emission factors are likely to over-estimate the emissions substantially because reductions due to LDAR implementation were not considered. The control effectiveness of LDAR programs is evaluated in this section.

In the Background Information Document (BID)[8] for proposed standards for fugitive emissions from SOCMI plants, EPA calculated control efficiencies for sources in gas and light liquid service for various regulatory alternatives. These data are all based upon the “ABCD model,” whereas in the Guideline Series,[9] both the ABCD model and the “LDAR model” were used. The ABCD and LDAR models are mathematical modeling tools used by EPA to evaluate the numerical monitoring information developed during the studies. A more complete discussion of these tools is provided in **Attachment A**. **Table 3** indicates that control efficiencies between 32.5 and 90 percent were achievable, depending on the nature of the source, the model used and the frequency of inspection.

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[7] The Revised Staff Assessment for PSPP has not been published yet.
[8] U. S. EPA. VOC Fugitive Emissions in Synthetic Organic Chemical Manufacturing industry – Background Information for Proposed Standards, EP-450/3-80-033a, November 1980, pp. 7-3 – 7-5.
[9] U. S. EPA. Guideline Series: Control of Volatile Organic Compound Leaks from Synthetic Organic Chemical and Polymer Manufacturing Equipment, EPA-450/3-83-006, March 1984, p. 3-8.

Table 3 Control Efficiency of LDAR Programs, BID and Guideline Series

Source	Inspection frequency	Control efficiency, percent	Estimation method
Pumps - light liquid service	Annually	63	ABCD model
	Monthly	75	ABCD model
	Quarterly	32.5	LDAR model
Valves - gas service	Quarterly	86	ABCD model
	Quarterly	63.9	LDAR model
	Monthly	90	ABCD model
Valves - light liquid service	Annually	62	ABCD model
	Quarterly	43.9	LDAR model
	Monthly	74	ABCD model
Safety relief valves - gas service	Quarterly	59	ABCD model
	Quarterly	44.2	Modified ABCD model
	Monthly	62	ABCD model
Compressor	Quarterly	72	ABCD model
	Monthly	32.9	Modified ABCD model

Another source comparing control effectiveness is EPA-450/3-82-010.[10] The data in **Table 4** show some differences from **Table 3**. As the three references were published in three different years and may represent different sets of data, this is not unexpected. EPA does believe that the LDAR model better represents observed fugitive emission behavior.[11] Note that negative numbers may occur when the monitoring interval exceeds the leak frequency.

[10] U. S. EPA. Fugitive Emission Sources of Organic Compounds – Additional Information on Emissions, Emission Reductions, and Costs, April 1982, pp. 4-39, 4-53, 4-61.
[11] U. S. EPA. Fugitive Emission Sources of Organic Compounds – Additional Information on Emissions, Emission Reductions, and Costs, April 1982, p. 1-4.

Table 4 Control Effectiveness for LDAR Programs, Fugitive Organic Sources

Source	Inspection frequency	Control efficiency, percent		
		ABCD model	Modified ABCD model	LDAR model
Valves - gas service	Monthly	93	78	73
	Quarterly w/ monthly follow-up on repaired devices	--	--	65
	Quarterly	88	69	64
	Semi-annual	--	56	50
	Annual	78	30	24
Valves - light liquid service	Monthly	90	62	59
	Quarterly w/ monthly follow-up on repaired devices	--	--	46
	Quarterly	85	46	44
	Semi-annual	--	24	22
	Annual	76	-21	-19
Pumps - light liquid service	Monthly	89.7	75.9	60.8
	Quarterly	85.44	44.3	32.5
	Semi-annual		7.5	-7.6
	Annual	75.1	-34.7	-80
Safety relief valves	Monthly	62	--	60
	Quarterly	59	--	44

Another way to evaluate the effectiveness of an LDAR program is to compare what control levels were estimated for regulatory programs existing at the time emission factors were developed. **Table 5** lists what was deemed achievable by the Control Techniques Guideline (CTG) and New Source Performance Standards (NSPS) for SOCMI plants.[12]

[12] U. S., EPA. Emission Factors for Equipment Leaks of VOC and HAP. EPA-450/3-86-002, January 1986, p. 4-8.

Table 5 Control Levels for SOCMI Fugitive Emissions

Source	CTG		NSPS	
	Control Technique	Percent Control	Control Technique	Percent Control
Valves, gas	Quarterly leak detection and repair	64	Monthly leak detection and repair	73
Valves, light liquid	Quarterly leak detection and repair	44	Monthly leak detection and repair	59
Pumps, light liquid	Quarterly leak detection and repair	33	Monthly leak detection and repair Dual mechanical seal/heavy liquid barrier fluid	61 100
Pressure relief valves, gas	Quarterly leak detection and repair	44	Rupture disk, soft seats (O-rings), vent to control device	100
Open-ended lines	Plugs, caps, blinds, etc.	100	Plugs, caps, blinds, etc.	100
Compressor	Quarterly leak detection and repair	33	Seal enclosed/vented to control device	100
Sampling connections	--	--	Closed purge sampling	100

Please note in **Tables 3**, **4**, and **5** that the vast majority of control effectiveness determinations are for components in light liquid and gas service. The reason for this is that most LDAR programs exempt all components in heavy liquid service from LDAR requirements, except for pumps in heavy liquid service. Thus the LDAR program proposed by CEC for PSPP exceeds most regulatory requirements for emissions controls. That said, if an LDAR program for components in heavy liquid service is as effective as an LDAR program for components in light liquid or gas service, a control effectiveness of approximately 30 to 90 percent could be expected.

Section 3 Best Available Control for Piping System Fugitive Components

At the request of the SCAQMD, AECOM, on behalf of Solar Millennium, has prepared a BACT analysis for the fugitive piping components. SCAQMD's New Source Review (NSR) program establishes pre-construction permit review requirements for equipment or processes subject to permit requirements. Under NSR, applicants are required to incorporate BACT when new equipment is installed, existing stationary permitted equipment is relocated, or existing permitted equipment is modified such that there is an emissions increase of NOx, SOx, PM10, CO or VOC. BACT is applied on a pollutant-specific basis. BACT means the most stringent emission limitation or control technique which:

- Has been achieved in practice for such category or class of source;
- Is contained in any State Implementation Plan (SIP) approved by the EPA for such category or class of source (unless demonstrated to the satisfaction of the Air Pollution Control Officer [APCO] or designee to be not presently achievable); or

- Is any other emission limitation or control technique, found by the APCO or designee to be technologically feasible for such class or category of sources or for a specific source and cost-effective as compared to measures listed in the SIP.

The process for determining BACT differs between major and non-major (i.e., minor source) polluting facilities. Major polluting facilities that are subject to NSR are required by the Clean Air Act (CAA) to have the Lowest Achievable Emission Rate (LAER), with little or no regard for cost, and consistent with the EPA's LAER policy as to what is achieved in practice.

For non-major polluting facilities, SCAQMD Rule 1303(a)(2) allows that economic and technical feasibility be considered in establishing the class or category of sources and the applicable BACT requirements. Further, as indicated in the SCAQMD BACT Policy and Procedures for Non- Major Polluting Facilities, the permitting staff may consider unusual equipment-specific and site-specific characteristics of the proposed project that would warrant reconsideration of the minor source BACT requirement for the new equipment. Some examples include:

- Technical infeasibility of the control technology: a particular control technology may not be required as BACT if the applicant demonstrates that it is not technically feasible to install and operate it to meet a specific BACT emission limitation in a specific permitting situation.
- Operating schedule and project length: if the equipment will operate much fewer hours per year than what is typical, or for a much shorter project length, it can affect what is considered "Achieved in Practice".
- Availability of fuel or electricity: some BACT determinations may not be feasible if a project will be located in an area where natural gas or electricity is not available.
- Process requirements: some BACT determinations specify a particular type of process equipment. SCAQMD staff may consider requirements of the proposed process equipment that would make the BACT determination not technically feasible.

Publicly available information on emission control technologies was reviewed for step one of this analysis. The SCAQMD Major Source BACT Guidelines, the SCAQMD's Non-Major Source Guidelines, the Bay Area Air Quality Management District (BAAQMD) BACT Guidelines, the California Air Resources Board (ARB's) BACT database, and EPA's RACT/BACT/LAER Clearinghouse (RBLC) were reviewed to determine BACT for each source. These guidelines are examples of past determinations that help in determining BACT for new permit applications.

The EPA RBLC database lists a number of determinations for fugitive emissions from petroleum refineries and SOCMI plants. The CARB database identified BACT for fugitive components for one facility. **Table 6** summarizes the requirements for the seven facilities that have the most stringent requirements from EPA's RBLC database and the one facility from the CARB database.

Table 6 Summary of BACT determinations

Determination Number (Agency)	Facility	Requirements
NM-0050 EPA RBLC	Navajo Refining Company, LLC, Artesia Refinery	Compliance with 40 CFR 63 Subpart CC.
LA -0197 EPA RBLC	ConocoPhillips Company, Alliance Refinery	Compliance with the Louisiana Refinery MACT LDAR program, 40 CFR 63, Subparts CC and H, and 40 CFR 60, Subparts VV and GGG.
LA-0211 EPA RBLC	Marathon Petroleum Company, LLC, Garyville Refinery	Compliance with the Louisiana Refinery MACT LDAR program, 40 CFR 63, Subparts CC and H.
LA-0213 EPA RBLC	Valero Refining – New Orleans, LLC, St. Charles Refinery	Compliance with the Louisiana Refinery MACT LDAR program, 40 CFR 63, Subpart H.
IL-01-3 EPA RBLC	Conoco Phillips Company, Wood River Refinery	Compliance with 40 CFR 63 Subpart H
OH-0308 EPA RBLC	Sunoco, Inc., Toledo Refinery	Compliance with 40 CFR 63, Subpart CC and 40 CFR 60, Subparts VV and GGG.
AZ-0046[1] EPA RBLC	Arizona Clean Fuels Yuma LLC	The requirements of the HON Subpart H LDAR program have been deemed to be BACT. In addition, the following leak definitions have been included: 100 ppmv for valves and connectors in gas/vapor and light liquid service and 500 ppmv for all other components. All pumps must be equipped with a shaft sealing system that prevents or detects emissions of VOC from the seal. All compressors must be equipped with a seal system that includes a barrier fluid system that prevents leakage of process fluid to the atmosphere. Other requirements exist for other connector types and valves. The percent of leaking components cannot exceed the following: 1.0% for pumps in light liquid service and compressors on a source-wide basis, 1.0% for the total number of pressure relief devices on a source-wide basis, 0.3% for total number of connectors in gas/vapor service and connectors in light liquid service on a source-wide basis, 0.3% of the total number of valves in gas/vapor service and valves in light liquid service on a source-wide basis, and not more than 0.025% of valves in gas/vapor service and valves in light liquid service shall be leaking with a concentration in excess of 10,000 ppmv.

Table 6 Summary of BACT determinations

Determination Number (Agency)	Facility	Requirements
ATC 12084b CARB Clearinghouse	Brietburn Energy – Newlove Lease, Orcutt Hill Field, Santa Barbara County	The valves, flanges, pump seals, compressor seals, etc, are required to be designed for low emissions. Valves use bellows, diaphragm seals, spring-loaded packing, expandable packing, graphite packing, PTE-coated packing, precision machined stem, sealant injection and LDAR to comply with a 100 ppmv total hydrocarbon (THC) limit. Flanges/connectors/others use welded, new gaskets rated to 150 percent of process pressure at process temperature and LDAR to comply with a 100 ppmv THC limit. Compressor seals (rotary drive) are vented to vapor recovery or use closed vent, dual/tandem mechanical seals, leakless design (e.g. magnetic drive) and LDAR to comply with a 100 ppmv THC limit. Compressor seals (reciprocating drive) are vented to vapor recovery or use elastomer bellows, O-ring seals, dry running secondary containment seals and LDAR to comply with a 100 ppmv THC limit. Pump seals are vented to vapor recovery or use closed vent, dual/tandem mechanical seals and LDAR to comply with a 500 ppmv THC limit. Pressure relief devices are vented to vapor recovery or use closed vent, soft-seat design and LDAR to comply with a 100 ppmv THC limit.
1. The Arizona Clean Fuels Yuma LLC (Refinery) has not been constructed.		

Bay Area Air Quality Management District (BAAQMD) identifies BACT for flanges, pressure relief valves, process valves, pumps and compressors at petroleum refineries. **Table 7** summarizes the requirements. The BAAQMD uses the term photochemically reactive organic compounds (POC) and non-photochemically reactive organic compounds (NPOC) rather than VOC. VOC and POC are equivalent for the purpose of this analysis.

Table 7 BAAQMD BACT Requirements for Fugitive Component Emissions

Source	BACT 1. Technologically Feasible/Cost Effective 2. Achieved in Practice	Typical Technology
Process Valves	1. n/d[1] 2. 100 ppm expressed as methane measured using EPA Reference Method 21	1. n/d 2. Bellow valves; diaphragm valve; quarter turn valves; live loaded valves; or other low-emission valves; each w/ BAAQMD approved inspection and maintenance

Table 7 BAAQMD BACT Requirements for Fugitive Component Emissions

Source	BACT 1. Technologically Feasible/Cost Effective 2. Achieved in Practice	Typical Technology
Pressure Relief Valves	1. Rupture disk w/vent to fuel gas recovery system, furnace or flare, with a recovery destruction efficiency ≥ 98% 2. Vent to fuel gas recovery system, furnace, or flare with a recovery destruction efficiency ≥ 98%	1. BAAQMD approved design and operation 2. BAAQMD approved design and operation
Flanges	1. n/d 2. 100 ppm expressed as methane measured using EPA Reference Method 21	1. n/d 2. Graphitic gaskets & BAAQMD approved inspection & maintenance
Pumps	1. 100 ppm expressed as methane measured using EPA Reference Method 21 2. 500 ppm expressed as methane measured using EPA Reference Method 21	1. Double mechanical seals w/ barrier fluid; magnetically coupled pumps; canned pumps; magnetic fluid sealing technology; or gas seal system vented to thermal oxidizer or other BAAQMD approved control device; all w/ BAAQMD approved quarterly inspection and maintenance program 2. Double mechanical seals w/ barrier fluid, and BAAQMD approved quarterly inspection and maintenance program
1. n/d = "No Determination". No BACT determination has been made to date for the source category or BACT category under consideration.		

The potential BACT requirements identified in this evaluation fall into three basic categories: 1) an inspection and maintenance (LDAR) program; 2) advanced seal technologies (e.g., bellow seal valves); and 3) specified maximum leak rates (e.g., 100 ppmv for valves and connectors in gas/vapor and light liquid service and 500 ppmv for all other components). These three options are discussed in more detail below.

LDAR

It is important to recognize when reviewing these BACT determinations that these determinations are for petroleum refineries. The principle product of a refinery is gasoline, typically accounting for more than 90 percent of the refinery's output. While the crude feedstock is a blend of various fractions of light and heavy hydrocarbons, and there are many process units at a refinery designed to process heavy liquid streams, the majority of the components at a refinery are in light liquid or gas service. By contrast, as discussed in Section 2, HTF is a heavy liquid. As discussed in **Section 2**, most LDAR programs, including SCAQMD Rule 1173, exempt fugitive components in heavy liquid service, except pumps, from routine monitoring.

Advanced Seal Technologies

Advanced seal technologies are not a cost effective option for this facility. Based on the heavy liquid emission factors, as presented in the AFC for the Project, fugitive emissions from HTF piping components are estimated to be 1.6 tons per year for the facility (combined total for the two power blocks and associated solar fields). Assuming that advanced seal technologies could achieve a control effectiveness of 90 percent, the potential emission reductions that could be expected from advanced seals is 1.44 tons per year. While the costs for implementing advanced seals on every component have not been developed, the additional cost per valve is expected to be in excess of $500, and may be more than $2,000 for larger valves. Based on the preliminary component counts, there are more than 6,000 valves at the facility. If the additional cost of advanced seals of $500 per valve is assumed, the total cost for the facility would be in excess of $3,000,000, or a cost effectiveness of $2,080,000 per ton reduced. The SCAQMD cost effectiveness value for minor sources is $22,200[13] per ton. Therefore, the advance seal technologies are not cost effective for this facility.

Specified Maximum Leak Rates

Although not explicitly stated in the BACT determinations, it is assumed that a specified maximum leak rate such as 100 ppmv total hydrocarbon limit would be achieved through the use of advanced seal technologies such as bellows, diaphragm seals, spring-loaded packing, expandable packing, graphite packing, PTE-coated packing, precision machined stem, and/or sealant injection. As discussed above, advanced seal technology is not a cost effective alternative for this facility; thus specification of a maximum leak rate is not practical.

BACT Determination

Because advanced seals are not cost effective, and specified maximum leak rates are not practical without advanced seals, these two alternatives are not appropriate as BACT for this facility. As discussed, conventional LDAR programs exempt components in heavy liquid service from routine monitoring, except for pumps. In the AFC for the Project, the Applicant has proposed to perform daily visual inspections of all components. This monitoring plan is significantly more robust than what is required under most LDAR programs for heavy liquid components. Therefore, BACT for fugitive components at this facility is quarterly LDAR monitoring in accordance with SCAQMD Rule 1173 for pumps in heavy liquid service, and daily visual inspection of the piping components at the facility.

However, as noted in the introduction, CEC has recommended that PSPP adopt an LDAR program similar to what was proposed by KCAPCD for RSPP. Solar Millennium has agreed in principle with the LDAR condition for the PSPP. Solar Millennium has recommended certain changes to the condition as it was proposed by KCAPCD to incorporate certain provisions that are standard to LDAR programs adopted by EPA and other air districts, and to clarify other requirements. In the end, Solar Millennium expects that a LDAR program will be implemented at PSPP. Implementation of such a condition exceeds the BACT requirements for the Project, and will contribute to lower overall emissions from the Project.

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[13] The SCAQMD lists the value in 2003 dollars and requires that the value be adjusted using the Marshall & Swift cost index. The cost effectiveness value shown reflects the adjustment to 2008 dollars using the adjustment factor of 1.1. (Note: The 2009 Marshall & Swift cost index is not available yet.)

Solar Millennium has proposed the following modifications to the LDAR condition that was proposed by CEC. Additions to the condition are shown using underline format and deletions are shown using ~~strikethough~~ format. Because there are three air districts and the CEC involved in developing conditions, we expect that additional refinements of this condition may be necessary to satisfy all parties.

The o/o shall establish an inspection and maintenance program to determine, repair, and log leaks in HTF piping network and expansion tanks. Inspection and maintenance program and related logs shall be available to District staff upon request.

a. All pumps, compressors and pressure relief devices (pressure relief valves or rupture disks) shall be electronically, audio, or visually inspected once every operating day.

b. All accessible valves, fittings, pressure relief devices (PRDs), hatches, pumps, compressors, etc. shall be inspected quarterly using a leak detection device such as a Foxboro OVA 108 calibrated for methane.

c. Components situated in unsafe areas shall be inspected and repaired at the next process turnaround.

d. Inaccessible components (located over 15 feet above ground when access is required from the ground or over 6 feet away from a platform when access is required from the platform) shall be inspected at least annually using a leak detection device such as a Foxboro OVA 108 calibrated for methane.

e. Inspection frequency for accessible components, except pumps, compressors and pressure relief valves, may be changed from quarterly to annual when two percent or less of the components within a component type are found to leak during an inspection for five consecutive quarters.

f. If evidence of a potential leak is found by electronic, audio, or visual inspection, the equipment shall be monitored within 5 days and the indication of the potential leak shall be eliminated within 5 calendar days of detection. ~~VOC leaks greater than 100-ppmv shall be repaired within seven calendar days of detection.~~

g~~d~~. The first attempt to repair VOC leaks greater than 10,000-ppmv shall be made within 5 calendar days ~~repaired within 24-hours~~ of detection and the leak shall be repaired as soon as practicable, but no later than 15 calendar days after it is detected.

h. The repair of critical components shall occur during the next scheduled shutdown, but no later than three months from the date of detection.

i. After a repair, the component shall be reinspected for leaks as soon as practicable, but no later than 30 days after the date on which the component is repaired and placed in service.

j~~e~~. Permittee shall maintain a log of all VOC leaks exceeding 10,000-ppmv, including location, component type, date of leak detection, emission level (ppmv), method of leak detection, date of ~~and~~ repair, date and emission level of reinspection after leak is repaired.

k. Permittee shall maintain records of the total number of components inspected, and the total number and percentage of leak components found, by component types ~~made~~.

l~~f~~. Permittee shall maintain record of the amount of HTF replaced on a monthly basis for a period of 5 years.

~~g. Any leak detected by District inspection(s) exceeding 100-ppmv and not repaired in 7-days and 10,000-ppmv not repaired within 24-hours shall constitute a violation of this Authority to Construct (ATC)/Permit to Operate (PTO).~~

~~h. Pressure sensing equipment shall be installed that will be capable of sensing a major rupture or spill within the HTF network.~~

Closing

Thank you again for allowing us to comment on the use of heavy liquid emission factors. If you have any questions or require additional information, please don't hesitate to contact Russ Kingsley at AECOM at (805) 388-3775 or Elizabeth Ingram at Solar Millennium at (510) 809-4663.

Best Regards
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Attachment A

Overview of Inspection and Monitoring Control Effectiveness Protocols

Attachment A

Overview of Inspection and Monitoring Control Effectiveness Protocols

In evaluating the effectiveness of LDAR programs, EPA used two numerical modeling approaches to evaluate the data, referred to as the ABCD model and the LDAR model. For this correspondence, no effort was made to evaluate the impact of these models on the control effectiveness determinations. However, as the various EPA source documents referenced in **Section 2** of this correspondence discuss these models, the following is a summary explanation of methods.

ABCD Model

The ABCD model uses the equation A x B x C x D to represent the reduction efficiency. In this equation, A is the theoretical maximum control deficiency, or the fraction of total mass emissions for each source type with VOC concentration greater than the action level selected. B is the leak occurrence and recurrence correction factor, or the correction factor to account for sources which start to leak between inspections; for sources which are found to be leaking, are repaired and start to leak again before the next inspection; and for known leaks which are not repaired. C is the non-instantaneous repair correction factor, or the correction factor to account for emissions which occur between detection of a leak and subsequent repair; that is repair in non instantaneous. D is the imperfect repair correction factor, or correction factor to account for the fact that some sources which are repaired are not reduced to zero emission levels. For computational purposes, all sources which are repaired are assumed to be reduced to a 1000 ppmv emission level.[14]

LDAR Model

The LDAR model utilizes eight inputs and provides 12 outputs as listed in Table A-1[15].

Table A-1 LDAR Model Inputs and Outputs

Inputs	Outputs
1. Emissions factor – the initial emission factor for all sources in units of mass/time/source. 2. Occurrence rate – the faction of sources operating properly at the beginning of the monitoring interval that become leakers during a monitoring interval. 3. Initial leak frequency – the fraction of sources leaking initially. 4. Fractional emission reductions from unsuccessful repair – emission reductions for valves for which maintenance did not reduce the screening values to below the action level.	1. Estimated emission factors by turnaround – the average emissions per source for the period between plant shutdowns in units of mass per time with an approximate 90 percent confidence interval. 2. Fraction reduction in mass emissions by turnaround – the average fractional reduction in emissions for the period between plant shutdowns relative to initial emissions with an approximate 90 percent confidence interval. 3. Total fraction of sources screened per year – the fraction of sources screened in each year of a five year period.

[14] U. S. EPA. VOC Fugitive Emissions in Synthetic Organic Chemical Manufacturing industry – Background Information for Proposed Standards, EP-450/3-80-033a, November 1980, p. 4-12.
[15] U. S. EPA. Fugitive Emission Sources of Organic Compounds – Additional Information on Emissions, Emission Reductions, and Costs, April 1982, pp. 4-25 – 4-26.

Table A-1 LDAR Model Inputs and Outputs

Inputs	Outputs
5. Fractional emission reductions from successful repair – emission reductions for valves for which maintenance reduced the screening values to below the action level. 6. Fraction of sources that are leaking and for which attempts at repair have failed – the fraction of sources screening above the action level for which maintenance has failed to decrease the screening value to below the action level. 7. Fraction of repaired sources that experience early failure – fraction of sources which screened above the action level, were repaired to screening values below the action level, and which were screened above the action level within five days. 8. Turnaround frequency - the length of time between plant shutdowns.	4. Total fraction of sources with attempted repair during a year – the fraction of sources for which repair is attempted for each year of a five year period. 5. Fraction of sources screened per month – the fraction of the sources which are screened during each month of a five year period. 6. Fraction of sources with attempted repair per month – the fraction of sources for which maintenance is attempted in each month of a five year period. 7. Estimated emission factor for the monitoring interval - average emissions per source for the monitoring interval in units of mass per time. 8. Fractional reduction in mass emissions between monitoring intervals – the average fractional reduction in emissions from the monitoring interval relative to initial emissions with an approximate 90 percent confidence interval. 9. Fractional distribution of leakers due to occurrence – fraction of sources screening below the action level initially which screen above the action level at the end of the monitoring period. 10. Fractional distribution of unrepaired sources – the fraction of sources screening above the action level for which maintenance failed to reduce the screening value below the action level at the end of the monitoring period. 11. Fractional distribution of sources experiencing early failures- fraction of sources screening above the action level which were repaired to screening values below the action level but screened above the action level within five days of repair. 12. Fractional distribution of non-leaking sources – fraction of sources screening below the action level at the end of the monitoring period.

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA

In the Matter of:
APPLICATION FOR CERTIFICATION for the *PALEN SOLAR POWER PROJECT*

Docket No. 09-AFC-7
PROOF OF SERVICE
(Revised 7/2/10)

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<u>DECLARATION OF SERVICE</u>

I, <u>Carl Lindner</u>, declare that on, <u>July 29, 2010</u>, I served and filed copies of the <u>SCAQMD Comments to the SA/DEIS</u>. The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at: **[http://www.energy.ca.gov/sitingcases/solar_millennium_palen]**.

The document has been sent to the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

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1516 Ninth Street, MS-4
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docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct, that I am employed in the country where this mailing occurred, and that I am over the age of 18 years and not a party to the proceeding.

Carl E. Lindner