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February 23, 2015

Via Email

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Re: Review of Draft Desert Renewable Energy Conservation Plan and Environmental Impact Report/Environmental Impact Statement

Dear Ms. Boyle,

Per your request, I reviewed the Draft Desert Renewable Energy Conservation Plan ("DRECP" or "Plan") and Environmental Impact Report/Environmental Impact Statement ("DEIR/DEIS"), published by the California Energy Commission ("CEC"), the California Department of Fish and Wildlife ("CDFW"), the U.S. Bureau of Land Management ("BLM"), and the U.S. Fish and Wildlife Service ("USFWS") as the lead agencies for review under the California Environmental Quality Act ("CEQA") and the National Environmental Protection Act ("NEPA") in September 2014.[1] My review focuses on potential impacts on and adequate mitigation for impacts on air quality public health, and climate change.

My qualifications as an environmental expert include a doctorate in Environmental Science and Engineering from the University of California Los Angeles. I am a court-recognized expert with more with more than twenty years of experience in the environmental field and have provided comments on air quality, greenhouse gas emissions, and public health, safety and services for a wide variety of projects including renewable energy projects and general and specific plans under the federal and state Clean Air Acts as well as in the environmental review process under CEQA and NEPA. My résumé is attached to this letter.

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[1] CEC, CDFW, BLM, and USFWS, Desert Renewable Energy Conservation Plan (DRECP) and Environmental Impact Report/Environmental Impact Statement, Draft, SCH No. 2011071092, BLM/CA/PL-2014/025+1793, FWS–R8–ES–2014–N165, September 2014; http://www.drecp.org/draftdrecp/.

While my review focuses on the Preferred Alternative, my comments are equally applicable to the DEIR/DEIS's review of the other alternatives. My comments are organized as follows:

I. Background

The DRECP would create a framework to streamline renewable energy permitting over the next 25 years by planning for the long-term conservation of threatened and sensitive species and other resources in the Mojave and Colorado/Sonoran desert regions of California. The DRECP covers more than 35,000 square miles (22,585,000 acres), collectively referred to as "Plan Area," and encompasses most of western Imperial County, eastern San Diego County, a portion of northwestern Los Angeles County, most of San Bernardino County except the southwestern corner, eastern Kern County, and the Owens River Valley, Panamint/Death Valley and Kingston and Funeral Mountains in southern Inyo County. Within the Plan Area, the DRECP would allow permitting of up to 20,000 Megawatt ("MW") of new renewable energy projects. The DRECP consists of three major planning components: a federal BLM Land Use Plan Amendment ("LUPA") covering nearly 10 million acres of BLM-administered lands, which consists of a set of decisions that establishes management direction for BLM-administered lands through amendment to existing land use plans; a General Conservation Plan ("GCP") covering nearly 5.5 million acres of non-federal lands, which provides a programmatic framework for streamlining the incidental take permitting process under the federal Endangered Species Act ("ESA") for renewable energy and transmission on non-federal lands; and a Conceptual Plan-Wide Natural Community Conservation Plan ("NCCP") that encompasses the entire DRECP Plan Area and includes a Conceptual Plan-Wide NCCP Reserve Design and describes a regional strategy for the protection of plants, animals, and their habitats.[2] To implement the DRECP, the BLM must determine whether to approve the LUPA; the USFWS must determine whether to approve the GCP; and CDFW must determine whether to approve the NCCP. The CEC, which is responsible for permitting large-scale, thermal power plants (≥50 MW), will use the DRECP to streamline permitting of thermal renewable energy projects and appurtenant facilities.

In addition to the No Action Alternative, the DEIR/DEIS analyzes five action alternatives including the "Preferred Alternative." Covered activities under these alternatives include pre-construction, construction, operation, maintenance, and decommissioning of geothermal, solar thermal, solar photovoltaic ("PV"), wind within so-called development focus areas ("DFAs") and transmission facilities within and outside DFAs.[3] Each alternative creates different DFA scenarios that would provide enough acreage to accommodate renewable energy projects up to the 20,000-MW capacity estimate which would be eligible for streamlined review process.[4] The alternatives vary in distribution of DFAs and amount of development flexibility they provide, as well as the technology mixes to meet the capacity target. (The expected

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[2] DEIR/DEIS, p. III.1-1, Figure III.1-1, and Executive Summary, pp. 6, 9 and 38, and Table 1.

[3] DEIR/DEIS, p. II.3-161.

[4] DEIR/DEIS, Executive Summary, pp. 13 and 16.

distribution and amount of geothermal technologies are assumed constant among all action alternatives[5] and would occur exclusively in Imperial Borrego Valley in Imperial County and Owens River Valley in Inyo County.[6]) The five action alternatives vary with respect to the total acreage of DFAs, which range from 1,070,000 acres to 2,473,000 acres.[7] Some alternatives also include Study Area Lands, which may be available for renewable energy development, but would require additional analysis.[8] The Preferred Alternative encompasses 2,024,000 acres of DFAs with about 80 percent on non-federal lands and about 20 percent on federal lands.[9]

II. The DEIR/DEIS's Requirements for Future Project-Specific Analyses and Implementation of Conservation and Management Actions and Additional Mitigation Measures Are Ill-Defined, Internally Inconsistent, and Ambiguous

The DEIR/DEIS claims to provide a programmatic level of analysis under both CEQA and NEPA and lays out a road map summarizing the submittal and review process for projects seeking streamlining under the DRECP.[10] In the Executive Summary, p. 23, the DEIR/DEIS states that projects "initially assessed as consistent with the DRECP during the integrated Project Proposal process and seeking streamlining under the DRECP would be required to comply with DRECP avoidance, minimization, and mitigation requirements as expressed in the DRECP Conservation and Management Actions" ("CMAs"). The DEIR/DEIS clarifies that DRECP biological and nonbiological CMAs apply during all stages of a project including pre-siting and design (due diligence), siting and design, construction and post-construction, operations, and decommissioning. In direct contradiction, three paragraphs later as well as in the roadmap provided in Exhibit 4 on the following pages, the DEIR/DEIS narrows the applicability of nonbiological CMAs (Exhibit 4, Table 9) to projects on BLM-administered public lands only; for projects on non-federal lands, the DEIR/DEIS defers to "permitting agency-specific application requirements."[11]

Further, despite the fact that the DEIR/DEIS's analyses are conducted at a programmatic level and nonbiological CMAs (*e.g.*, for air quality) are only required for BLM-administered lands but not for non-federal lands, the DEIR/DEIS finds that the majority of impacts (80 percent) it analyzes (including impacts on air quality) are less than significant under CEQA, "primarily because the Conservation and Management

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[5] DEIR/DEIS, Executive Summary, p. 28.

[6] DEIR/DEIS, p. II.3-165, and Appx. R.2.2, Preferred Alternative.

[7] DEIR/DEIS, Executive Summary, Table 7.

[8] DEIR/DEIS, Executive Summary, p. 16.

[9] DEIR/DEIS, Executive Summary, Table 7.

[10] DEIR/DEIS, Executive Summary, p. 48, and, *e.g.*, Chapter IV.2 Air Quality, p. IV.2-1.

[11] DEIR/DEIS, Executive Summary, p. 23 and Exhibit 4, pp. 24-25.

Actions defined for each alternative to protect resources in the Plan Area would ensure that impacts are minimized." In some cases, the DEIR/DEIS states "additional mitigation measures are recommended to strengthen resource protection."[12] The DEIR/DEIS does not clarify that these findings apply only to BLM-administered lands because the CMAs and additional mitigation measures are only applicable to BLM-administered lands; in fact, the DEIR/DEIS implies that these findings of less-than-significant impacts are applicable to all lands, federal and non-federal, when it explains that some impacts (Socioeconomics SE-3 through SE-5; BLM Lands and Realty LR-1 through LR-4; BLM Land Designations LD-1 and LD-2; and Wild Horses and Burros WH-1 through WH-4), are applicable to NEPA only: "… either because they are specifically excluded from CEQA consideration (based on CEQA Guidelines), or because they relate only to Bureau of Land Management (BLM) lands or land management concerns."[13] This statement suggests that all other impacts were analyzed under CEQA (and NEPA) and, therefore, all the DEIR/DEIS's findings of "less than significance" are applicable to both CEQA and NEPA review. This is incorrect. The DEIR/DEIS may not find less than significant impacts on nonbiological resource areas under CEQA for all future projects because the majority of projects, more than 80 percent under the Preferred Alternative[14], would not be located on BLM-administered lands and, thus, would not be subject to the nonbiological CMAs and additional mitigation measures specified in the DEIR/DEIS.

While the DEIR/DEIS states that "future projects would require additional site-specific environmental analysis"[15] and in the roadmap (flow-chart) for submittal and review process of projects provided in the Executive Summary, Table 4, indicates (in about 4-point font size) that application review for both projects on federal and nonfederal lands would be subject to project-level technical studies (bio and non-bio), the air quality CMAs require a quantitative analysis and ambient air quality modeling only for PM10 emissions:

> Documentation for each project will require a detailed discussion and analysis of ambient air quality conditions (baseline or existing), National Ambient Air Quality Standards, criteria pollutant nonattainment areas, and potential air quality impacts of the proposed project (including cumulative and indirect impacts). This content is necessary to disclose the potential impacts from temporary or cumulative degradation of air quality. The discussion shall include a description and *estimate of air emissions from potential construction and maintenance activities, and proposed mitigation measures to minimize net PM10*

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[12] DEIR/DEIS, Executive Summary, p. 47, and Table IV.26-3 (Impacts AQ-1 through AQ-5; MC-1 and MC-2; and PS-1 through PS-5).

[13] DEIR/DEIS, pp. IV.26-5 and IV.26-6.

[14] DEIR/DEIS, Executive Summary, Table 7.

[15] DEIR/DEIS, p. 1.3-4.

> *emissions*. The proponent shall specify the emission sources by pollutant from mobile sources, stationary sources, and ground disturbance…[16]

In fact, in Chapter IV.26, Other CEQA and NEPA Considerations, which summarizes significance of impacts, proposed mitigation, and impact conclusions after implementation of mitigation measures for all impact areas, the DEIR/DEIS not once mentions "program level" or "programmatic" review or the fact that the findings for nonbiological resource areas are only applicable for federal lands. In sum, the DEIR/DEIS's ambiguous and confusing presentation fails to ensure that future projects on federal and non-federal lands will be adequately analyzed on a project-level basis. The DEIR/DEIS should be revised to clearly identify in the executive summary, introduction, the individual impact sections, and Chapter IV.26, the types and extent of project-level impact analyses required for future projects on both federal or non-federal lands.

III. The DEIR/DEIS's Environmental Baseline for Impact Analyses Is Substantially Flawed

The DEIR/DEIS recognizes that an accurate description of the "environmental setting" or "affected environment" is fundamental to the analysis of a project under CEQA and NEPA, respectively. The lead agencies chose October 15, 2013 as the appropriate baseline date for the analyses in the DEIR/DEIS.[17] For purposes of its baseline determination of "existing projects," the DEIR/DEIS considers those projects that were either operational or under construction within the Plan Area on BLM-administered public lands or private and other public lands by the baseline date.[18] The DEIR/DEIS identifies 53 existing renewable energy projects within the Plan Area in Appendix O (Existing Renewable Energy Projects), Table O-2, including two (2) geothermal plants, 38 solar plants, and 13 wind facilities. This list is substantially incomplete for existing geothermal plants within the Plan Area and, thus, the DRECP's presentation of baseline conditions is incorrect.

Specifically, the DEIR/DEIS lists only two (2) existing geothermal power plants within the Plan Area – Hudson Ranch I and ORNI 18 – with a combined generating capacity of 99.9 MW. In contrast, a database maintained by the CEC[19] lists 20 geothermal plants as operating between 2011 and 2013 on BLM-administered public lands or private and other public lands within the Plan Area, specifically within

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[16] DEIR/DEIS, p. IV.2-24, *emphasis* added.

[17] DEIR/DEIS, p. II.1-5 through II.1-7.

[18] DEIR/DEIS, p. III.1-7.

[19] CEC, California Geothermal Energy Statistics & Data, Geothermal Electric Generation; http://energyalmanac.ca.gov/renewables/geothermal/index.php (accessed January 27, 2015).

Imperial County. (*See* Exhibits 1a through 1c.) All of these plants, which have a combined installed capacity of 704.8 MW, started operations well before the DEIR/DEIS's October 15, 2013 baseline date. They include 11 geothermal plants within the Salton Sea geothermal field at the southeast end of the Salton Sea near the cities of Niland and Calipatria; six (6) plants within the East Mesa geothermal field; two (2) plants within the Heber geothermal field; and one (1) plant within the North Brawley geothermal field. (The latter plant, North Brawley, is the same plant cited by the DEIR/DEIS as "ORNI 18". It is owned by ORNI 18, LLC, a wholly owned subsidiary of Ormat Nevada, Inc.,[20] which is a wholly owned subsidiary of Ormat Technologies, Inc.,[21] hereafter collectively referred to as "Ormat"). In addition, Ormat reports operation of two more geothermal plants within the Heber geothermal field, Heber II and Heber South, with installed capacities of 10 and 48 MW, respectively.[22] The total installed capacity for these 22 geothermal plants is 757.7 MW (the DEIR/DEIS lists a total of 99.9 MW). Table 1 summarizes the geothermal field, owner, installed capacity, type of geothermal technology, and startup year for each of these 22 geothermal plants; Exhibits 1a and 1b show their location.

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[20] CEC, Proposed Decision, In the Matter of The Complaint Against Ormat Nevada, Inc., Brought by California Unions for Reliable Energy, Docket No. 11-CAI-02; http://www.energy.ca.gov/proceedings/11-cai-02/documents/staff/2011-11-08_Ormat_Proposed_Decision.pdf. ("The Respondent is Ormat Nevada, Inc., (Ormat), a Delaware corporation…, and sole owner of ORNI 18, LLC and ORNI 19, LLC which own the North Brawley Geothermal Project and the East Brawley Geothermal Project, respectively.")

[21] Ormat, Press Release February 5, 2015: Ormat Technologies Inc. Announces $175 Million Agreement with Northleaf Capital Partners for a 40% Equity Investment in Certain Power Plants at a Valuation of $438 Million; http://www.ormat.com/news/latest-items/ormat-technologies-inc-announces-175-million-agreement-northleaf-capital-partners-. ("Ormat Technologies, Inc. … today announced that its wholly-owned subsidiary Ormat Nevada Inc. …")

[22] Ormat, Heber Complex; http://www.ormat.com/case-studies/heber-complex.

Table 1: Existing geothermal power plants within the Plan Area
(plants identified by DEIR/DEIS bolded)

Plant Name	Installed Capacity (MW)[a]	Owner	Start Year	Technology
East Mesa Geothermal Field				
GEM Resources II	18.5	Ormat	1989	Double flash
GEM Resources III	18.5	Ormat	1989	Double flash
Ormesa I	22.4	Ormat	1986	Binary
Ormesa IE	14.4	Ormat	1988	Binary
Ormesa IH	14.4	Ormat	1989	Binary
Ormesa II	24.0	Ormat	1987	Double flash
Heber Geothermal Field				
Heber Geothermal Plant (Heber I)	62.5	Ormat	1985	Double flash
Heber II	48.0	Ormat	1993	Binary
Heber South	10.0	Ormat	2008	Binary
Second Imperial Geothermal Co. (SIGC)	80.0	Ormat	1993	Binary
North Brawley Geothermal Field				
North Brawley (ORNI 18)	49.9	Ormat	2009	Binary
Salton Sea Geothermal Field				
CE Turbo LLC	11.5	CalEnergy	2000	Single flash
Del Ranch (formerly AW Hoch)	35.8	CalEnergy	1989	Double flash
JJ Elmore	35.8	CalEnergy	1989	Double flash
JM Leathers	35.8	CalEnergy	1990	Double flash
John L Featherstone (formerly Hudson Ranch I)[b]	49.9[c]	EnergySource	2012	Triple flash
Salton Sea I	10.0	CalEnergy	1982	Single flash
Salton Sea II	21.7	CalEnergy	1990	Double flash
Salton Sea III	54.0	CalEnergy	1989	Double flash
Salton Sea IV	51.0	CalEnergy	1996	Double flash
Salton Sea V	49.9	CalEnergy	2000	Double flash
Vulcan	39.7	CalEnergy	1986	Double flash
Total	**757.7**			

a From: CEC, California Geothermal Energy Statistics & Data 2011 through 2013 (*see* Exhibits 1a through 1c), unless noted otherwise

b *See* Power Technology, John L Featherstone (Hudson Ranch I) Geothermal Power Plant, California United States; http://www.power-technology.com/projects/john-l-featherstone-hudson-geothermal-power-plant-california/

c The CEC's database reports a capacity of 55 MW for Hudson Ranch I; however, the facility was issued an authority to construct and permit to operate by the ICAPCD for 49.9 MW (#3734A, May 2, 2009)

IV. The DEIR/DEIS Analysis of DRECP Impacts on Air Quality Is Inadequate

The DRECP would affect the air quality in four air basins: the Great Basin Valleys, the Mojave Desert, the Salton Sea, and the San Diego air basins and the Plan Area boundaries encompass areas under the jurisdiction of seven air districts: the Antelope Valley Air Quality Management District ("AVAQMD"), the Great Basin Unified Air Pollution Control District ("GBUAPCD"), the Imperial County Air Pollution Control District ("ICAPCD"), the Eastern Kern County Air Pollution Control

District ("ECAPCD"), the Mojave Desert Air Quality Management District ("MDAQMD"), the San Diego County Air Pollution Control District ("SDAPCD"), and the South Coast Air Quality Management District ("SCAQMD").[23]

The DEIR/DEIS presents the environmental setting/affected environment regarding air quality in Chapter III.2; and alternative-specific air quality impact analyses in Chapter IV.2. As discussed in the following comments, these chapters are substantially flawed and are inadequate for purposes of CEQA and NEPA review.

A. The DEIR/DEIS's Presentation of the Environmental Setting for Air Quality and Its Analyses of DRECP Impacts on Air Quality Are Substantially Flawed

In Chapter III.2, the DEIR/DEIS discusses at length (on 52 pages) the environmental setting for air quality, specifically, the DEIR/DEIS lists the Class I lands within the Plan Area;[24] lists the federal and state ambient air quality standards for 10 air pollutants: ozone ("O_3"), respirable particulate matter, *i.e.*, particulate matter equal to or smaller than 10 micrometers ("PM10") and fine particulate matter, *i.e.*, particulate matter equal to or smaller than 2.5 micrometers ("PM2.5"), carbon monoxide ("CO"), nitrogen dioxide ("NO_2"), sulfur dioxide ("SO_2"), lead, visibility reducing particles, sulfates, hydrogen sulfide ("H_2S"), and vinyl chloride;[25] lists the attainment status and provides an ambient air quality summary for seven (7) air pollutants (O_3, CO, NO_2, SO_2, PM10, PM2.5, and H_2S) for the four air basins affected by the DRECP, *i.e.*, the Great Basin Valleys, the Mojave Desert, the Salton Sea, and the San Diego air basins;[26] maps the attainment status of the Plan Area with the 1997 federal 8-hour ozone, 2008 federal 8-hour ozone, federal PM10, federal and state PM2.5, and state H_2S ambient air quality standards;[27] discusses the typical sources of seven (7) air pollutants (O_3, PM10, PM2.5, NO_2, SO_2, CO, and lead);[28] discusses the health effects of four air pollutants (NO_2, SO_2, CO, and lead);[29] mentions that diesel exhaust particulate matter ("DPM")[30] has been established as a toxic air contaminant ("TAC") in California; and discusses programs and strategies developed by the California Air Resources Board ("CARB") to reduce DPM emissions.[31] In Chapter IV. 2.1.1, the DEIR/DEIS summarizes the federal and state

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[23] DEIR/DEIS, p. III.2-16.

[24] DEIR/DEIS, Table III.2-3.

[25] DEIR/DEIS, Table IV.2-2.

[26] DEIR/DEIS, Tables III.2-4 through III.2-11.

[27] DEIR/DEIS, Figures III.2-4 through III.2-7.

[28] DEIR/DEIS, pp. III.2.23 through III.2-25.

[29] *Ibid*.

[30] DEIR/DEIS, p. III.2-14.

[31] DEIR/DEIS, pp. III.2-14 through III.2-16.

attainment status for seven (7) air pollutants (O_3, CO, NO_2, SO_2, PM10, PM2.5, and H_2S) for each ecoregion subarea;[32] identifies the potential for emissions during construction, operation, and decommissioning of renewable energy projects and their associated transmission facilities of hazardous air pollutants ("HAPs") and TACs including DPM, mercury, arsenic, and boron[33] as well as PM10, PM2.5, and their precursors, and the ozone precursors nitrogen oxides ("NOx") and volatile organic compounds ("VOCs"), also called reactive organic gases ("ROG"); and provides emission estimates for NOx, VOCs, PM10, and PM2.5 for construction of renewable energy projects.[34] This presentation is internally inconsistent and fails to provide sufficient information and analyses for the DRECP's potential impacts on air quality.

First, while the DEIR/DEIS recognizes that activities related to development of renewable energy projects and associated transmission facilities under the DRECP would result in emissions of DPM, ozone, PM10, PM2.5, H_2S, mercury, arsenic, and boron, the document fails to discuss in Chapter III.2 the health effects for these pollutants. (The DEIR/DEIS discusses potential health effects of exposure to H_2S in Chapter IV.2.2.1.3 Impacts of Operations and Maintenance.)

Second, while the DEIR/DEIS recognizes that activities related to development of renewable energy projects and their transmission facilities would result in emissions of air pollutants during site characterization, construction, operation, and decommissioning, the document only quantifies emissions for the construction phase of renewable energy projects.[35] The DEIR/DEIS provides no discussion whatsoever of why it did not provide emission estimates for the site characterization, operational, and decommissioning phases of renewable energy projects or for any of the phases of transmission facilities. Instead, the DEIR/DEIS summarily claims in one to three paragraph-long qualitative discussions that air pollutant emissions during long-term operations of renewable energy projects and transmission facilities could violate or contribute to existing violations of ambient air quality standards (AQ-2 through AQ-5) but application of Mitigation Measures AQ-1a, AQ-1b, AQ-1c, AQ-1d, AQ-2a, AQ-2b, and AQ-3a would reduce these impacts to less than significance.[36] These conclusions are entirely unsupported. A conclusion regarding the significance of emissions requires some kind of quantitative analysis. Whether mitigated emissions would adversely affect air quality, i.e., result in or contribute to existing violations of air quality standards, depends on the magnitude of unmitigated emissions and the efficiency of proposed mitigation methods. There are two options for quantitative analyses: 1) modeling of

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[32] DEIR/DEIS, Table IV.2-1.

[33] DEIR/DEIS, pp. IC.2-3 and IV.2-6.

[34] DEIR/DEIS, Tables IV.2-2 through IV.2-9.

[35] *Ibid*.

[36] DEIR/DEIS, pp. IV.2-30 and IV.2-31.

pollutant concentrations in ambient air and comparison to ambient air quality standards or 2) comparison of mitigated emissions to quantitative mass thresholds of significance, *e.g.*, those established by the air districts with jurisdiction over the affected air basins within the Plan Area, as a proxy. In other words, the DEIR/DEIS may not find that impacts are less than significant without a quantitative analysis of mitigated emissions. Absent such a quantitative analysis, the DEIR/DEIS's conclusions as to the significance of mitigated impacts on air quality are guess work at best.

Third, while the DEIR/DEIS lists Class I areas by ecoregion subareas within the Plan Area, it fails to provide actual analyses for air quality impacts on these Class I areas.

Fourth, the DEIR/DEIS claims that the Preferred Alternative "would create more emissions from ground disturbance and other development activities in the Imperial Borrego Valley, Mojave and Silurian Valley, Owens River Valley, Pinto Lucerne Valley and Eastern Slopes, and West Mojave and Eastern Slopes ecoregion subareas than under the No Action Alternative."[37] This claim is entirely unsupported since the DEIR/DEIS does not provide emission estimates for the construction phase for these ecoregion subareas; rather it provides emission estimates by air basin only.[38] Further, and directly related to this lack of a quantitative analysis for these ecoregions, the DEIR/DEIS fails to put its comparison of the Preferred Alternative and the No Action Alternative in perspective: just how much "more emissions" would the Preferred Alternative generate within the affected ecoregion subareas (or within air basins and Class I areas) and how would these emissions impact the areas' air quality and future attainment status of federal and state ambient air quality standards? Moreover, the DEIR/DEIS is silent on air quality impacts on the other five ecoregion subareas, *i.e.*, Cadiz Valley and Chocolate Mountain, Kingston and Funeral Mountains, Panamint Death Valley, Piute Valley and Sacramento Mountains, and Providence and Bullion Mountains. Finally, the DEIR/DEIS does not provide a comparison of the action alternatives and No Action Alternative to determine which alternative would result in the least impacts on air quality depending on location. (For a discussion of the DEIR/DEIS's analyses of impacts on air quality from construction of renewable energy projects under the DRECP, *see* Comment II.)

Fifth, while the DEIR/DEIS recognizes that construction of renewable energy projects would result in emissions of ozone precursors, CO, SO_2, PM10, PM2.5, and H_2S, the document provides emission estimates for only four pollutants: PM10 and PM2.5 and the ozone precursors NOx and VOCs. The DEIR/DEIS fails to provide any explanation for why it omitted to quantify emissions of CO, SO_2 and H_2S and fails to

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[37] DEIR/DEIS, p. IV.2-32.

[38] *See* DEIR/DEIS, Tables IV.2-3 through IV.2-7.

provide any discussion of emissions of these pollutants. (H_2S may be released during geothermal well development as well as during geothermal well-venting events during the operational phase of geothermal plants.[39])

Sixth, while the DEIR/DEIS lists the Plan Area's attainment status with state and federal ambient air quality standards and provides maps for the Plan Area's attainment status with the 1997 federal 8-hour ozone, 2008 federal 8-hour ozone, federal PM10, federal and state PM2.5, and the state H_2S attainment status, it fails to provide maps for the Plan Area's attainment status for the state ozone and PM10 ambient air quality standards.

Seventh, while the DEIR/DEIS recognizes that construction and operation of renewable energy projects would result in emissions of HAPs and TACs, including DPM, mercury, arsenic, and boron, the document fails entirely to discuss, let alone quantify, emissions of these pollutants to analyze their impacts.

Eighth, the DEIS/DEIR discusses the various alternatives' potential impacts on air quality on 13 pages for the No Action Alternative and the Preferred Alternative and 7 to 8 pages each for Alternatives 1 through 4. Much of this presentation is unnecessarily repetitive. For example, the only differences in the DEIR/DEIS's discussion between Alternatives 1 through 4 are the total affected acreage, the permanently affected acreage, construction emission estimates in Tables IV.2-4 through IV.2-7, and which areas would or would not be affected under each alternative; the Preferred Alternative differs only in that it includes a summary of CMAs and additional mitigation measures. In essence, the information that is different for the five action alternatives could have been easily presented on two to three pages and/or in a summary table instead of (or at least in addition to) 43 pages of run-on repetitive narrative. I suggest that the DEIR/DEIS be revised to contain such a summary discussion and table to clearly identify and help the reviewer in understanding the differences in impacts on air quality between the various alternatives. Because of the DEIR/DEIS's complete lack of quantitative analyses for most phases of the renewable energy projects and transmission facilities, these differences basically boil down to a comparison of the affected acreages per air basin or ecoregion. Construction emissions, which were quantified, can also be directly proportionally related to the affected acreage due to the way the DEIR/DEIS calculates emissions (acre/air basin × acre/MW × ton/MW for each pollutant = ton pollutant/air basin) and because the DEIR/DEIS fails to provide a comparison to any kind of quantitative standard for construction emissions, its conclusions for each alternative are, again, simply based on acreage. In other words, the entire DEIR/DEIS's air quality section consists of little more than a qualitative comparison of the extent of affected areas under each alternative.

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[39] *Ibid.*

In sum, the DEIR/DEIS provides a deceptively detailed discussion of the DRECP's potential impacts on air quality but in effect fails to convey much relevant information and fails to adequately evaluate the DRECP's impacts on air quality.

B. The DEIR/DEIS Fails to Adequately Quantify, Determine the Significance of, and Mitigate Emissions for the Construction Phase of the Renewable Energy Projects under the DRECP

The DEIR/DEIS recognizes that "[h]igh levels of construction-phase emissions can exacerbate regional nonattainment conditions or expose sensitive receptors to substantial concentrations of hazardous or toxic air pollutants during project construction."[40] The DEIR/DEIS identifies "typical air impacts" from construction and decommissioning activities as fugitive dust from grading, vehicles driving on unpaved surfaces or roadways, and emissions from heavy-duty construction equipment and vehicles carrying construction materials and workers. These emissions would occur during site development and preparation, transmission line development, building and roadway construction, and during decommissioning and facility removal.[41] The DEIR/DEIS claims that the types of emissions would be the same for each renewable energy technology and cross-references Volume II, Sections II.3.1.3.1 to II.3.1.3.4 for an "in-depth list of activities"[42] that would occur during construction. (This cross-reference is incorrect; the list of activities is provided in Volume II, Sections II.3.1.4.1 (solar), II.3.1.4.2 (wind), and II.3.1.4.3 (geothermal).)

As the DEIR/DEIS recognizes, assessing the air quality impacts from construction emissions typically involves project-specific quantification of air pollutants emitted by construction activities for each phase of site development for each project.[43] Typically, this site-specific information includes, but is not limited to: the duration of each construction phase (*e.g.*, site preparation, building construction, equipment installation, paving, etc.); the acreage of site disturbance and amount of cut-and-fill; the number, load factor and hours in use per day for equipment (*e.g.*, graders, dozers, pile drivers, well drilling equipment, etc.); the vehicle miles traveled by haul trucks and construction worker commuter vehicles; and so forth. Such site-specific information is not available for the future renewable energy projects that may be constructed under the DRECP. In this situation, it is standard practice in emission estimating to provide a range of emissions.

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[40] DEIR/DEIS, p. IV.2-5.

[41] *Ibid*.

[42] *Ibid*.

[43] *Ibid*.

Such a range of typical construction activities for the types of renewable energy projects could be developed based on past experience. For example, contractors experienced with construction of solar PV facilities should be able to provide a range of equipment use and duration of the construction period per acre of PV panels to be installed; a well drilling company experienced with geothermal well drilling should be able to provide a range of time and equipment it takes to drill and test one well; and so forth. This information could be used to estimate emissions using current emission factors from reliable databases, methodologies, and modeling software that are typically used for estimating construction emissions (*e.g.*, EMFAC, OFFROAD, CalEEMod, etc., maintained or recommended by CARB[44] and emission estimation methodologies for fugitive dust developed by the U.S. Environmental Protection Agency). This information could be supplemented and refined with project-specific information from selected projects. The DEIR/DEIS provides no discussion whether it attempted to develop such a range of emission estimates for the various renewable energy technologies. Instead, the DEIR/DEIS derives emission factors for NOx, VOCs, PM10, and PM2.5 based on emission estimates for 10 renewable energy projects (*see* Appendix R1-2), nine (9) of which are among the 52 baseline projects identified in Appendix O, Table O-2; the other project is a binary-cycle geothermal project in Mono County.

The DEIR/DEIS refers to the construction emission estimates for these 10 projects as "baseline emissions" in Section III.2.8 Baseline Emissions for the Plan Area.[45] This characterization of the 10 selected projects is incorrect. While these projects indeed exist and are part of the baseline environmental setting, their emissions do not represent baseline emissions. Rather, baseline emissions are zero (0) because the 20,000 MW of renewable energy projects envisioned under the DRECP do not yet exist and are not intended to replace existing projects; in other words, the emissions for the anticipated 20,000 MW of capacity of renewable energy projects must be analyzed as increases over zero emissions.

The DEIR/DEIS does not actually contain a comparison of DRECP emissions against baseline emissions. Instead, DEIR/DEIS uses the 10 selected projects as a proxy to determine emissions for the DRECP renewable energy projects in the absence of site-specific conditions. Specifically, the DEIR/DEIS determines "average" emission factors for NOx, VOC, PM10 and PM2.5 in tons per Megawatt ("tons/MW") of installed capacity for a "typical project's construction phase" based on capacity-weighted emission estimates for the 10 selected projects (summarized in Appendix R.1-2, Table R.1-2-1). The latter were allegedly sourced from documents prepared for environmental review under CEQA and/or NEPA (*see* Comment IV.B.2 below). Based

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[44] *See* CARB, Modeling Software; http://www.arb.ca.gov/html/soft.htm.

[45] DEIR/DEIS, p. III.2-60.

on these "average" capacity-weighted emission factors — 0.29 tons/MW NOx; 0.07 tons/MW VOC; 0.20 tons/MW PM10; and 0.04 tons/MW PM2.5[46] — and the respective MW-allocation under each alternative for each of the four affected air basins, the DEIR/DEIS then estimates emissions for the construction phase of renewable energy projects. This approach and the resulting emission estimates, which are presented in DEIR/DEIS Tables IV.2-1 through IV.2-7, are substantially flawed and do not adequately characterize impacts on air quality resulting from construction of renewable energy projects under the DRECP. As a result, the DRECP's conclusions regarding significance are not supported.

1. Average Capacity-weighted Emission Factors Are Not Supported

The DEIR/DEIS acknowledges that environmental review documents for existing renewable energy projects in the Plan Area "show a wide range in levels of construction-phase emissions and depend, among other factors, on each project's particular accessibility, phasing or sequencing of activity, and its fleet of construction vehicles and equipment."[47] Yet, despite this acknowledged wide range in levels of construction-phase emissions, the DEIR/DEIS claims, without any support, that "greater levels of emissions occur at sites where greater electrical generating capacities are installed,"[48] implying a linear relationship between emissions and installed capacity. Review of the emissions estimates presented by the DEIR/DEIS in Appendix R.1.2, Table R.1.2-1, shows that this claim is patently false.

For example, construction emissions for the 250-MW Genesis NextEra solar plant were estimated at 182.2 tons of NOx, whereas construction emissions for the Desert Sunlight Solar Farm with more than twice the installed capacity, 550 MW, were estimated at 151.8 tons of NOx, about 30 tons fewer than for the Next Era solar plant. Similarly, construction emissions for the 40-MW Rosamond I and II solar facility were estimated at 14.6 tons of NOx, whereas construction emissions for the Imperial Solar Energy Center South with more than three (3) times the installed capacity at 130 MW was estimated at only 8.9 tons of NOx.[49] Clearly, there is no linear relationship between estimated NOx construction emissions and the installed capacity of these facilities; in other words, the installed capacity is not a predictor for the quantity of emissions that occur during construction. Estimated construction emissions for the other three pollutants – ROG, PM10, and PM2.5 – do not follow a linear relationship between installed capacity and emissions either. This lack of a linear relationship is clearly illustrated by the graphs below, which plot the mass pollutant emissions estimated for

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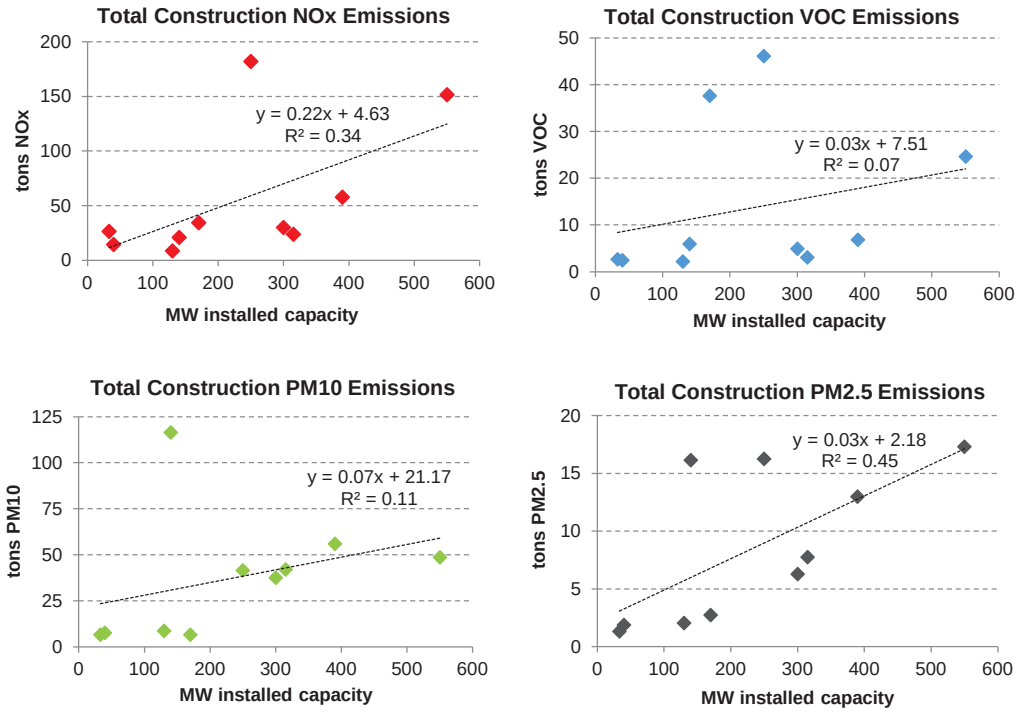
[46] DEIR/DEIS, p. IV.2-5 and Appx. R1, p. R1.2-1.

[47] DEIR/DEIS, p. IV.2-5.

[48] *Ibid*.

[49] *See* DEIR/DEIS, Appx. R.1.2, Table R.1.2-1.

NOx, VOC, PM10, and PM2.5 for construction of the 10 selected projects as a function of their installed capacity.



Each graph above includes the line derived by linear regression that best fits each graph's data set (dashed line). Also posted on each graph is the best-fit line's R squared ("R^2") value. The R squared value quantifies the proportion of the scatter in the data that is accounted for by the best-fit line. R squared must be between 0 and 1; an R squared of one (1) means that the line perfectly accounts for the data; all of the data points would be exactly on the line. Conversely, an R squared of zero (0) means that there is no linear relationship among the data points, that is, the line does not account for any of the scatter in the data points. The closer R squared is to one (1), the stronger the linear (proportional) relationship in the data. As a rule of thumb, R squared values less than 0.7 signify that no meaningful relationship exists; the possibility of the distribution of the data points occurs by chance is simply too great. If R squared is greater than 0.95 (sometimes 0.9), one can reasonably be confident in the relationship. In the four graphs above, the R squared values are between 0.07 and 0.45, signifying that the linear best fit line is not reliable and, consequently, emissions of these four pollutants are <u>not</u> linearly proportional to installed capacity, contrary to the DEIR/DEIS's claim.

This complete absence of a linear relationship between the installed capacity of the various types of renewable energy projects and their estimated construction emissions is not surprising in light of the fact that the 10 projects selected by the DEIR/DEIS include five (5) substantially different technologies – geothermal binary,

wind, power tower solar thermal, trough-type solar thermal, and solar photovoltaic – which require different amounts and types of equipment use and result in vastly different amounts of ground disturbance for their construction.

In fact, the DEIR/DEIS's assumption that the magnitude of construction emissions for these substantially dissimilar renewable energy facilities are comparable and can simply be "averaged" relative to their installed capacity is particularly perplexing when considering the extensive list of dissimilar activities for construction of these different types of renewable energy facilities and appurtenant structures provided in DEIR/DEIS Sections II.3.1.4.1 through II.3.1.4.3. For example, installation of geothermal facilities typically requires geothermal well boring, geothermal well testing, and installation of pipelines to convey the geothermal brine, none of which are required for either solar or wind facilities; solar thermal projects may require evaporation ponds, which are not required for any of the other types of technologies; and construction of wind projects may require substantial lengths of access roads not required for other projects; etc.[50]

Table 2 summarizes the capacity and average capacity-weighted emission factors for NOx, VOC, PM10, and PM2.5 in tons/MW for each of the 10 baseline projects presented by the DEIR/DEIS as well as the capacity-weighted average for all projects and capacity-weighted averages for technology types where multiple projects of the same technology were considered (all solar, solar PV, and all wind).

[50] *See* DEIR/DEIS, Chapter II.3.

Table 2: Technology, capacity and capacity-weighted emission factors for baseline projects

Project	Technology	MW[a]	Emission factors (tons/MW)[b] NOx	VOC	PM10	PM2.5
Geothermal						
Casa Diablo	Binary cycle[c]	33	0.81	0.08	0.20	0.04
Solar						
Rosamond I and II	PV	40	0.37	0.06	0.19	0.05
Imperial Solar Energy Center South	PV	130	0.07	0.02	0.07	0.02
Centinela Solar	PV	170	0.20	0.22	0.04	0.02
Genesis NextEra	Thermal trough	250	0.73	0.18	0.17	0.07
Ivanpah Solar	Thermal power tower	390	0.15	0.02	0.14	0.03
Desert Sunlight Solar Farm	PV	550	0.28	0.04	0.09	0.03
Average solar PV			**0.23**	**0.09**	**0.10**	**0.03**
Average all solar			**0.30**	**0.09**	**0.12**	**0.03**
Wind						
Pacific Wind Energy	Wind	140	0.15	0.04	0.83	0.12
Alta East Wind	Wind	300	0.10	0.02	0.13	0.02
Ocotillo Express Wind	Wind	315	0.08	0.01	0.13	0.02
Average all wind			**0.11**	**0.02**	**0.36**	**0.05**
All projects						
Average			**0.29**	**0.07**	**0.20**	**0.04**

a From: DEIR/DEIS Appendix R1.2, Table R.1.2-1, unless stated otherwise

b Calculated as: (emission estimates in tons/year from DEIR/DEIS Appendix R1.2, Table R.1.2-1 for each project) / (installed capacity in MW for each project)

c BLM, United States Department of Agriculture Forest Service, and GBUAPCD, Casa Diablo IV Geothermal Development Project, Final Joint Environmental Impact Statement and Environmental Impact Report ("Casa Diablo FJEIS/EIR"), June 2013, p. ES-1

As shown in Table 2, even among the same types of technologies, the capacity-weighted emission factors for the DEIR/DEIS's selected 10 projects are all over the map. For example, NOx emission factors for solar PV vary by an order of magnitude from 0.07 to 0.73 tons/MW with an average of 0.23 tons/MW; PM10 emissions for wind energy projects vary by a factor of more than six from 0.13 to 0.83 tons/MW with an average of 0.36 tons/MW. Given the small sample size, this no big surprise. In this situation, it is standard practice to bound the range of reported values, *i.e.*, to define the lower and upper end of the range of emission factors for each pollutant. This is not speculation but a standard method for dealing with uncertainty. In short, the emission factors developed by the DEIR/DEIS are inadequate to characterize emissions for construction activities.

2. Presented Emission Estimates Are Unsupported and Not Representative

The emission estimates for the 10 selected projects presented by the DEIR/DEIS are unsupported and not representative for a number of reasons.

First, the DEIR/DEIS provides no discussion of which considerations (*e.g.*, capacity, acreage, location, technology type, type of environmental review [CEQA

and/or NEPA review], date of environmental review), influenced the agencies' selection of these 10 projects and why construction emission estimates for these facilities were determined to be representative.

Second, with the exception of the Pacific Wind Energy Project, for which Kern County was the lead agency under CEQA, the BLM was the lead agency for environmental review of the selected projects. Some projects were reviewed under CEQA, some under CEQA and NEPA, and some only under NEPA. The DEIR/DEIS provides no discussion whether it reviewed the respective documents' methodologies for estimating construction emissions and their consistency and validity for purposes of determining emission factors for the DRECP.

Third, for some of the selected projects, the preparation of emission estimates dates back a number of years (*e.g.*, Ivanpah Solar Electric Generating System to 2007[51]) and, thus, these estimates may be no longer representative for construction emissions that would occur during construction of renewable energy projects under the DRECP.

Fourth, the DEIR/DEIS provides no discussion why a sample size of only 10 projects (and only 9 within the Plan Area) was deemed representative for the universe of renewable energy projects that may be constructed under the DRECP.

Fifth, the DEIR/DEIS provides no discussion why it included emission estimates for only five (5) different renewable energy technologies (binary cycle, solar thermal power tower, solar thermal trough, solar PV, and wind) when elsewhere the document discusses two (2) additional geothermal technologies (dry steam and flash) and two (2) additional solar thermal technologies (parabolic dish and compact linear Fresnel reflector).[52]

Sixth, the DEIR/DEIS provides no explanation why for some technologies it considered emission estimates for several plants (4 solar PV, 3 wind) whereas for other technologies only one emission estimate was considered (binary cycle geothermal, solar power tower, solar trough) and fails to discuss how this mix of technologies and installed capacities affect the "average emission factors" and whether it is representative for the mix of renewable energy projects under the DRECP.

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[51] BLM, California Desert Conservation Area Plan Amendment / Final Environmental Impact Statement for Ivanpah Solar Electric Generating System, FEIS-10-31, July 2010 ("Ivanpah FEIS"), Footnote to Table 4.1-1; http://www.blm.gov/ca/st/en/prog/energy/pendingapps/ivanpahsolar/fedstatus.html.

[52] DEIR/DEIS, pp. II.3-167 through II.3-195.

3. Construction Emission Estimates for Selected Projects Are Not Adequately Documented and Are Misreported

Assuming, *arguendo*, that the DEIR/DEIS's selection of projects to determine average emission factors was acceptable, review of the underlying environmental review documents for the 10 selected baseline projects (the DEIR/DEIS provides weblinks in Appendix R.1.2) shows that the presented emission estimates are not supported.

First, review of the underlying environmental review documents shows that the DEIR/DEIS substantially misreported installed capacity (and acreage) for most of the 10 projects it relied upon to develop emission factors, as shown in Table 3.

Table 3: Installed capacity and acreage presented by DEIR/DEIS and sourced from cited environmental review documents (inconsistent values bolded)

Project	DEIR/DEIS Appendix R1.2		Environmental Review Documents	
	MW	Acres	MW	Acres
Geothermal				
Casa Diablo	33	**17**[a]	33	**78.3**[a]
Solar				
Rosamond I and II	40	**480**	40	**320**[b]
Imperial Solar Energy Center South	**130**	**946**	**200**[c]	**946.6**[c]
Centinela Solar	**170**	2,067	**175**[d]	2,067
Genesis NextEra	250	1,950	250	**1,808**[e]
Ivanpah Solar	**390**	**3,471**	**400**[f]	**3,671**[f]
Desert Sunlight Solar Farm	550	**4,144**	550	**4,176**[g]
Wind				
Pacific Wind Energy	140	8,300	**250**[h]	8,300
Alta East Wind	**300**	2,592	**360**[i]	2,592
Ocotillo Express Wind	**315**	12,436	**465**[j]	12,436
All projects				
Total	**2,318**	**36,403**	**2,781**	**36,395**

a The Casa Diablo FJEIS/EIR, *op. cit.*, Table ES-1 indicates a total of 78.3 acres of temporary ground disturbance and 17.3 acres of permanent impervious surface

b BLM, Rosamond I and II, Draft Environmental Impact Report. Air Quality and GHG Report ("Rosamond DEIS"), p. 3; http://www.co.kern.ca.us/planning/pdfs/eirs/recurrent_desert/Appendix_C-Air_Quality_and_GHG_Report.pdf

c County of Imperial and BLM, Imperial Solar Energy Center South, Final Environmental Impact Report and Environmental Assessment, April 2011, SCH #2010061038 ("Imperial FEIS/EA"), pp. 1-9 and ES-1 and Appx. C, p. 1 (the DEIR/DEIS appears to confuse the capacity that would be purchased by San Diego Gas and Electric (130 MW) with the total installed capacity; *see* p. 1.0-4); http://www.blm.gov/ca/st/en/fo/elcentro/nepa/isec_south.html; *see* also: BLM, Approved Renewable Energy Projects; http://www.blm.gov/ca/st/en/prog/energy/Approved_Projects.html

d The air quality analysis for the 275-MW project is based on Phase I with 175 MW. *See* BLM, Centinela Solar Energy, Draft Environmental Impact Report/Environmental Assessment for the Centinela Solar Energy Project, October 2011, SCH #2010111056, Appx. D, p. 20; http://www.blm.gov/ca/st/en/fo/elcentro/nepa/centinela.html

e BLM, Genesis Solar Power Project (aka Genesis NextEra), Plan Amendment/Final EIS for the Genesis Solar Energy Project, August 2010 ("Genesis FEIS"), p. ES-4; http://www.blm.gov/ca/st/en/fo/palmsprings/Solar_Projects/Genesis_Ford_Dry_Lake.html

f Ivanpah FEIS, *op. cit.*, p. 1-3 (100 MW Phase 1: 914 acres) + (100 MW Phase 2: 921 acres) + (200 MW Phase 3: 1836 acres)

g BLM, Desert Sunlight Solar Farm Project, California Desert Conservation Area Plan Amendment and Final Environmental Impact Statement, CACA #48649, April 2011 ("Desert Sunlight FEIS"), Abstract; http://www.blm.gov/ca/st/en/fo/palmsprings/Solar_Projects/Desert_Sunlight.html

h County of Kern, Pacific Wind Energy Project, Draft Environmental Impact Report, SCH #2009091127, June 2010, Executive Summary p. 1-6; http://www.co.kern.ca.us/planning/pdfs/eirs/PacWind/pacwind_deir.html

i Emission estimates are based on 360 MW even though the project would have a maximum installed capacity of 318 MW; *see* BLM, Alta East Wind, Proposed Plan Amendment and Final Environmental Impact Statement, CACA #0052537, February 2013 ("Alta East Wind FEIS"), p. 4.2-4; http://www.blm.gov/ca/st/en/fo/ridgecrest/alta_east_wind_project.html

j BLM, Ocotillo Wind Energy Facility, Proposed Plan Amendment & Final Environmental Impact Statement/ Final Environmental Impact Report, CACA #051552, SCH #2010121055 February 2012, p. ES-1; http://www.blm.gov/ca/st/en/fo/elcentro/nepa/ocotillo_express_wind.html

While some of these projects may have been not been built out completely (*e.g.*, the Pacific Wind Energy currently has an installed capacity of 140 MW,[53] the same capacity as reported in the DEIR/DEIS), and, thus, installed capacity in MW may be different than reported in the environmental review documents, the presented emission estimates must be reported based on the corresponding capacity relied upon in the environmental analysis.

Second, the emission estimates for many of the 10 selected projects presented in the DEIR/DEIS, Appendix R1-2, are equally inconsistent with the underlying environmental review documents. In fact, the DEIR/DEIS's emission estimates can be readily sourced from the cited environmental review documents for only five projects for all four pollutants (Imperial Solar Energy Center South, Desert Sunlight Solar Farm, Genesis NextEra, Alta East Wind, and Casa Diablo); for Rosamond I and II, only PM10 and PM2.5 emissions are the same as presented in the underlying environmental review document. For the other four projects, emission estimates presented by the DEIR/DEIS and the underlying environmental review documents are substantially different and I was unable to deduce how they were derived and resolve these discrepancies. Table 4 summarizes two such examples.

[53] EDF Renewable Energy, Pacific Wind Project; http://edf-re.com/projects/detail/pacific_wind_project/.

Table 4: Construction emissions presented by DEIR/DEIS and by underlying environmental review documents for Ocotillo Express Wind and Pacific Wind Energy

Project	MW		Emissions (tons) NOx	VOC	PM10	PM2.5
Ocotillo Express Wind						
DEIR/DEIS[a]	**140**	?	**24.01**	**3.08**	**42.11**	**7.75**
Ocotillo Wind Final EIS/EIR[b]	**250**	unmitigated	**100.06**	**11.24**	**61.61**	**14.25**
		mitigated	**91.56**	**10.23**	**61.61**	**14.25**
Pacific Wind Energy						
DEIR/DEIS[r]	465	?	**21.11**	**5.91**	**116.37**	**16.16**
Pacific Wind Energy DEIR[c]	465	unmitigated	**19.71**	**2.06**	**127.15**	**27.12**
		mitigated	**11.83**	**2.06**	**66.26**	**14.40**

a From: Appendix R1.2

b From: Ocotillo Wind Final EIS/EIR, *op. cit*., p. 4.2-3 and Appx. G, p. 5

c From: Pacific Wind Energy DEIR, *op. cit*., p. 2-55 and Attachment A to Appx. D: URBEMIS Output, calculated as: [sum of all phases in (lbs/day per phase × number of active days per phase)]/(2,000 lbs/ton)

As shown in Table 4, the DEIR/DEIS's presented emission estimates match up with neither mitigated nor unmitigated emission estimates from the underlying environmental review documents for these two projects, even if the difference in reported capacity for the Ocotillo Express Wind project were taken into account.

Third, for some projects, the DEIR/DEIS presents emission estimates for only one year of the entire construction period (*e.g.*, for Casa Diablo geothermal project[54]), for other projects for the entire construction period (*e.g.*, for Desert Sunlight Solar Farm[55]).

Fourth, for some projects, the DEIR/DEIS presents emissions only within one county (*e.g.*, for the Rosamond I and II solar project[56]), for others it presents emissions within an entire air basin (*e.g.*, for the Casa Diablo geothermal project[57]).

Fifth, for some projects and/or pollutants, the DEIR/DEIS reports mitigated emissions; for others, unmitigated emissions. For example, for the Imperial Solar

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[54] Casa Diablo FJEIS/EIR, *op. cit*. (Table 4.2-2 presents maximum annual construction emissions in tons/year. The FEIS/FEIR at p. 4.2-8 notes: "It is estimated that approximately the same amount of construction-related activity would occur in 2013 and in 2014, with considerably less construction-related activity occurring in 2015. Therefore, the maximum annual construction emissions represent the emissions that would occur in 2013 and 2014.")

[55] *Compare* DEIR/DEIS, Appx. R1-2, and Desert Sunlight FEIS, Tables 4.2-4 through 4.2-6, 4.2-12, 4.2-14, 4.2-15, 4.2-21, 4.2-22, 4.2-13, and 4.2-28.

[56] *See* Rosamond DEIS, Appx. C, Table "RE Rosamond Photovoltaic Projects – 40 MW, Construction Phase Emissions within Kern County Portion of Mojave Desert Air Basin."

[57] Casa Diablo FJEIS/EIR, *op. cit*. ("The maximum annual air pollutant emissions that would be generated within the GBVAB during construction of the CD-IV Project have been estimated…").

Energy Center South and Genesis NextEra projects, the DEIR/DEIS reports unmitigated emissions for all pollutants;[58] for the Rosamond I and II and Desert Sunlight solar projects, the DEIR/DEIS reports unmitigated emissions for NOx and VOC but mitigated emissions for PM10 and PM2.5 (for palliative control);[59] and for the Alta East Wind project, the DEIR/DEIS reports mitigated emissions for all four pollutants.[60]

Clearly, "average" emission factors derived from both mitigated and unmitigated emission estimates, some accounting for construction of only one year and others for the entire construction period, are meaningless and, thus, unsuitable to determine emission estimates for the mix of renewable energy projects that would be constructed under the DRECP.

4. The DEIR/DEIS Fails to Quantify and Determine the Significance of Mitigated Emissions

The DEIR/DEIS finds that the nonattainment air basins with renewable energy development under the Preferred Alternative "would experience a short-term air quality impact from increased dust emissions and vehicle and equipment exhaust emissions" which could "violate or contribute to an existing violation of air quality standards."[61] In other words, the DEIR/DEIS identifies the potential for significant impacts. The DEIR/DEIS then lists "impact reduction strategies and mitigation" that apply to air resources including conservation and management actions ("CMAs") that would be required for all project authorizations for the BLM land in the entire Plan Area[62] and a number of additional mitigation measures intended to further reduce emissions during the construction phase of the renewable energy projects.[63] The DEIR/DEIS makes no attempt at quantifying mitigated construction emissions after implementation of the CMAs and additional mitigation measures but instead simply claims that implementation of these CMA and mitigation measures would reduce construction emissions to a less-than-significant level.[64] This claim is entirely unsupported.

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[58] *Compare* DEIR/DEIS, Appx. R1-2, and Imperial FEIS/EA, Appx. C1, Table 9; and Genesis FEIS, Chapter 4.2.

[59] *Compare* DEIR/DEIS, Appx. R1-2, and Rosamond DEIS, Appx. C, Table "RE Rosamond Photovoltaic Projects – 40 MW, Construction Phase Emissions within Kern County Portion of Mojave Desert Air Basin;" and Desert Sunlight FEIS, p. 4.2-8 ("Dust control by watering was assumed to provide 50 percent control for fugitive dust for the early construction phases.").

[60] Alta East Wind FEIS, Table 4.2-2 "Maximum Mitigated Annual Construction Emissions (tons/year)."

[61] DEIR/DEIS, p. IV.2-21 and IV.2-30.

[62] DEIR/DEIS, pp. IV.2-24 and IV.2-25.

[63] DEIR/DEIS, pp. IV.2-25 through IV.2-28.

[64] DEIR/DEIS, p. IV.2-28.

First, as discussed above, the DEIR/DEIS ignores that some of the emission estimates it relies upon already incorporate the control efficiency of a variety of mitigation measures. Thus, the DEIR/DEIS CMAs and additional mitigation measures may not further reduce these mitigated emissions.

Second, and most importantly, one may only conclude that emissions are less than significant when comparing emission estimates to some quantitative standard. Typically, environmental review documents either a) compare emission estimates to CEQA mass thresholds of significance established by air districts with jurisdiction over the affected air basins or b) compare modeled ambient concentrations of air pollutants to federal and state ambient air quality standards to determine the effect of a project's emissions on the future attainment of an affected area. While the DEIR/DEIS identifies the respective air districts with jurisdiction over the Plan Area, it fails to a) identify any quantitative standards to compare to construction emissions estimates or b) model ambient air concentrations of air pollutants. Thus, its claim that construction emissions would be less than significant after implementation of CMAs and mitigation measures is entirely unsupported by evidence.

For example, according to the DEIR/DEIS's emission estimates, the Preferred Alternative would result in construction emissions of 3509 tons of NOx in the Mojave Desert Air Basin over the 25-year Plan period, or about 140 tons of NOx annually.[65] Assuming that emissions are evenly spread out over the year and assuming 250 working days per year for the 25-year construction period, NOx emissions of 140 tons/year are equivalent to more than 1100 pounds per day[66] ("lbs/day"). Assuming that these emissions would be equally divided among the four affected air districts, NOx emissions in each air district can be estimated at 35 tons/year[67] and 281 lbs/day.[68] These NOx emissions by far exceed the daily and/or annual CEQA thresholds of significance for construction established by the air districts with jurisdiction over the MDAB[69], the MDAQMD (137 lbs/day and 25 tons/year[70]), which covers most of the MDAB, the AVAQMD (137 lbs/day and 25 tons/year[71]), and the

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[65] (3,509 tons NOx/25 years within MDAB)/(25 years) = 140.4 tons NOx/year within MDAB.

[66] (140.4 tons NOx/year within MDAB)(2,000 lbs/ton)/(250 days/year) = 1,122.9 lbs NOx/day within MDAB.

[67] (140.4 tons NOx/year within MDAB)/(4 air districts) = 35.1 tons NOx/year within MDAB/air district.

[68] (1,122.9 lbs NOx/day within MDAB)/(4 air districts) = 280.8 lbs NOx/day within MDAB/air district.

[69] *See* DEIR/DEIS, Figures III.2-2 and III.2-4.

[70] MDAQMD, California Environmental Quality Act (CEQA) and Federal Conformity Guidelines, February 2009, pp. 9-10, and Table 6; http://www.mdaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=1806.

[71] AVAQMD, California Environmental Quality Act (CEQA) and Federal Conformity Guidelines, August 2011, p. 6 and Table 6; http://www.avaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=2911.

SCAQMD (100 lbs/day[72]). (The ECAPCD, which has jurisdiction over the West Mojave and Easter Slopes Ecoregion within Kern County, has not established CEQA thresholds of significance for construction emissions.[73]) Thus, even assuming that construction of renewable energy projects within the MDAB would have no overlap (as the DEIR/DEIS claims[74]), in my opinion a highly unlikely assumption, but instead are spread out evenly over the next 25 years and would be equally divided between the four air districts, annual and daily emissions of NOx would be significant. In order to reduce daily NOX construction emissions to less than significance, the CMAs and additional mitigation measures would have to have an overall combined effect control efficiency of 51 percent[75] for the construction equipment fleet and on-road vehicles, or a correspondingly higher control efficiency for the construction equipment fleet as the contractor typically has no control over on-road vehicles. Because on-road vehicle traffic accounts for a substantial proportion, if not a majority, of total construction emissions — *e.g.*, on-road vehicle construction NOx emissions for the Ocotillo Express Wind project account for 77 percent of total unmitigated construction emissions[76]) — it is highly unlikely that on-site emissions can be reduced to bring total construction emissions below the applicable significance thresholds. (For a discussion of Mitigation Measure AQ-1d regarding emission reduction offsets, etc., *see* Comment IV.B.5.)

5. CMAs and Additional Mitigation Measures Are Not Adequate

In addition to the CMAs, the DEIR/DEIS specifies a number of mitigation measures to control emissions during the construction phase of future renewable energy projects. While these mitigation measures are extensive and stringent at the moment, additional mitigation measures may be available at the time future projects are constructed. Thus, the DEIR/DEIS should require that these mitigation measures be amended to reflect state-of-the-art mitigation, *e.g.*, in consultation with the local air district.

In addition to requiring low-emission engines and electric-powered equipment for the construction fleet[77] (which as discussed above is unlikely to result in sufficient

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[72] SCAQMD, SCAQMD Air Quality Significance Thresholds, revised March 2011; http://www.aqmd.gov/docs/default-source/ceqa/handbook/scaqmd-air-quality-significance-thresholds.pdf?sfvrsn=2.

[73] EKAPCD, Guidelines for Implementation of the California Environmental Quality Act (CEQA) of 1970, as amended, July 1, 1999, pp. 12-14; http://www.kernair.org/Documents/CEQA/CEQA_Guidelines%20&%20Charts.pdf.

[74] DEIR/DEIS, p. IV.2-1 ("Because of the size of the Plan Area and the long-term nature of the Plan, it is unlikely that the timing (*e.g.*, construction) and location of projects would overlap").

[75] (1)-(137 lbs/day)/(280.8 lbs/day) = 0.51.

[76] *See* Ocotillo Wind Final EIS/EIR, *op. cit.*, Appx. G, p. 5 (unmitigated NOx on-road: 77.25 tons/year)/(unmitigated NOx total: 100.6/ tons/year) = 0.77.

[77] DEIR/DEIS, Mitigation Measure AQ-1b and AQ-1c, pp. IV.2-27 and IV.2-28.

emission reductions, the DEIR/DEIS, in Mitigation Measure AQ-1d[78], requires mitigation of construction emissions on federally-administered lands in federal nonattainment areas to levels below applicable *de minimis* levels in the general conformity rule through emission offset credits or funding to local air districts to sponsor emission reduction projects and off-site mitigation. Since emission reduction credits may have been created in a different area than where a project would be constructed and often were created many years prior to their use, such offsets are not effective in protecting affected receptors from adverse air quality impacts. I suggest that the lead agencies strike this option and instead require funding of air districts' emission reduction programs.

V. The DEIR/DEIS Fails to Adequately Mitigate Potential Exposure of Construction Workers and the Public to Valley Fever

Valley Fever, also called desert fever, San Joaquin Valley fever, desert rheumatism, or coccidioidomycosis (short cocci), is an infectious disease caused by inhaling the spores of *Coccidioides immitis*, a soil-dwelling fungus. Spores, or arthroconidia, are released into the air when infected soils are disturbed, *e.g.*, by construction activities, agricultural operations, dust storms, or during earthquakes. The disease is endemic (native and common) in the semiarid regions of the southwestern United States and reported cases have been dramatically increasing in the past decades (10-fold from 1988-2011). Typical symptoms of Valley Fever include fatigue, fever, cough, headache, shortness of breath, rash, muscle aches, and joint pain. Symptoms of advanced Valley Fever include chronic pneumonia, meningitis, skin lesions, and bone or joint infections or even death. The most common clinical presentation of Valley Fever is a self-limited acute or subacute community-acquired pneumonia that becomes evident 13 weeks after infection.No vaccine or known cure exists for the disease.[79]

The potential for exposure to Valley Fever is of particular concern for large-scale construction projects in the arid regions of the southwest including the Mojave and Sonoran Deserts as well as San Joaquin Valley. Enormous dust storms have been linked to construction of solar facilities (*see* photos below) and two large-scale solar projects were linked to outbreaks of Valley Fever among construction workers.[80]

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[78] DEIR/DEIS, p. IV.2-28.

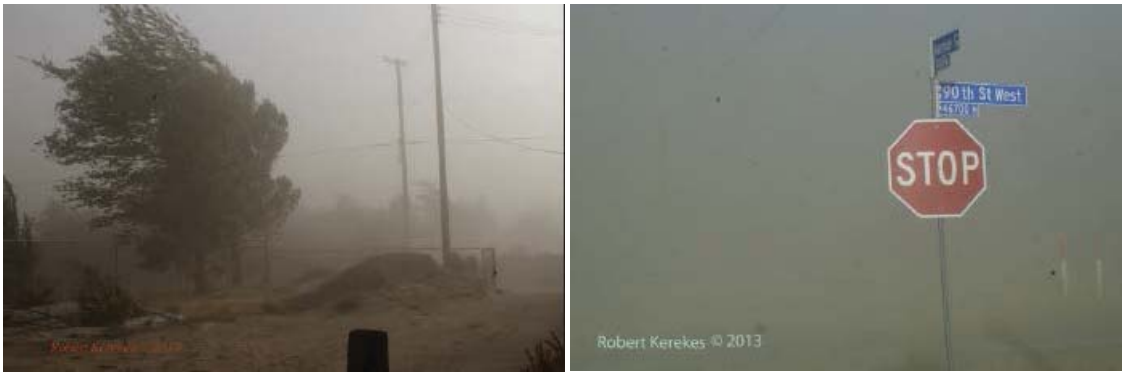
[79] *See, e.g.*, Wikipedia, Coccidioidomycosis, http://en.wikipedia.org/wiki/Coccidioidomycosis; and Centters for Disearse Control and Prevention, Valley Fever: Awareness Is Key; http://www.cdc.gov/features/valleyfever/.

[80] Julie Cart, Los Angeles Times, 28 Solar Workers Sickened by Valley Fever in San Luis Obispo County, May 01, 2013; http://articles.latimes.com/2013/may/01/local/la-me-ln-valley-fever-solar-sites-20130501.

Severe dust storm blowing off the Ivanpah Solar Electric Generating System construction site February 23, 2013 (from: Chris Clarke, KCET, Dust Problem at Ivanpah Solar February 27; http://www.kcet.org/news/redefine/rewire/solar/concentrating-solar/dust-problem-at-ivanpah-solar.html)

(from: Peter McRae, International Erosion Control Association, Drought: Fugitive Dust or IECA Opportunity? Western Chapter News, Vol. 18, No. 1, Summer 2014; http://www.wcieca.org/images/stories/newsletter/WCIECA_Summer_2014.pdf)

(from: Herman K. Trabish, GreenTechMedia, Construction Halted at First Solar's 230 MW Antelope Valley Site, April 22, 2013; http://www.greentechmedia.com/articles/read/Construction-Halted-At-First-Solars-230-MW-Antelope-Valley-Site)



(from: Peter McRae, Summer 2014, *op. cit.*)

The DEIR/DEIS recognizes that soil disturbance could lead to release and airborne transmission of spores of the Valley Fever fungus, which is endemic in some

soils within the Plan Area, particularly in the West Mojave area.[81] The DEIR/DEIS recognizes that the Plan Area spans areas favorable to the growth of the Valley Fever vector and discusses the recent rise in Valley Fever cases and deaths in the southwestern United States, especially in California. To reduce the potential exposure to fugitive dust, which may contain the fungus spores, and likelihood of contracting Valley Fever for construction workers and the public, the DEIR/DEIS proposes to:

> Implement strict dust control measures (speed limits, spraying water on unpaved roads) to avoid the spread of Valley Fever spores.[82]
> …
> Provide dust suppression measures as defined in air quality measures (see Chapter IV.2, Air Quality) to lessen potential exposure to Valley Fever spores.[83]

These mitigation measures are not sufficiently protective to limit exposure of construction workers and the general public to Valley Fever spores.

For example, the County of San Luis Obispo's Public Health Department, in conjunction with the California Department of Public Health, developed specific recommendations in response to an outbreak of Valley Fever in construction workers at a construction site for a solar facility. These recommended measures go far beyond the conventional dust control measures recommended in the DEIR/DEIS:

1. *Implement comprehensive Injury and Illness Prevention Program (required by Title 8, Section 3203) ensuring safeguards to prevent Valley Fever are included.*
2. *Work with a medical professional with expertise in cocci to develop a training program for all employees discussing the following issues: potential presence of C. immites in soils; the risks involved with inhaling spores; how to recognize common symptoms (which resemble common viral infections, and may include fatigue, cough, chest pain, fever, rash, headache, and body and joint ache); requesting prompt reporting of suspected symptoms to a supervisor and health care provider; discussing worker entitlement to receive prompt medical care if they suspect symptoms of work-related Valley Fever; and requesting the use of personal protection measures as outlined below.*
3. *Control exposure to dust:*
    - Consult with local Air Pollution Control District Compliance Assistance programs and with California Occupational Safety and Health Administration ("Cal/OSHA") compliance program regarding meeting the requirements of dust control plans and for specific methods of dust control. These methods may include wetting the soil while ensuring that

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[81] DEIR/DEIS, pp. IV.22-5, IV.22-9, IV.22-17, IV.22-22, IV.22-26, and IV.22-33.

[82] DEIR/DEIS, pp. IV.22-21.

[83] DEIR/DEIS, p. IV.22-29.

the wetting process does not raise dust or adversely affect the construction process.

- Provide high-efficiency particulate ("HEP")-filtered, air-conditioned enclosed cabs on heavy equipment. Train workers on proper use of cabs, such as turning on air conditioning prior to using the equipment.
- Provide communication methods, such as 2-way radios, for use in enclosed cabs.
- Provide National Institute for Occupational Safety and Health ("NIOSH")-approved respirators for workers without a prior history of Valley Fever.
- Half-face respirators equipped with N-100 or P-100 filters should be used during digging. Employees should wear respirators when working near earth moving machinery.
- Employees should be medically evaluated, fit-tested, and properly trained on the use of the respirators, and a full respiratory protection program in accordance with the applicable Cal/OSHA Respiratory Protection Standard (8 CCR 5144) should be in place.
- Prohibit eating and smoking at the worksite, and provide separate, clean eating areas with hand-washing facilities.
- Avoid outdoor construction operations during unusually windy conditions.
- Consider limiting outdoor construction during the fall to essential jobs only, as the risk of cocci infection is higher during this season.

4. *Prevent transport of cocci outside endemic areas:*
    - Thoroughly clean equipment, vehicles, and other items before they are moved off-site to other work locations.
    - Provide workers with coveralls daily, lockers (or other system for keeping work and street clothing and shoes separate), daily changing and showering facilities.
    - Clothing should be changed after work every day, preferably at the work site.
    - Train workers to recognize that cocci may be transported offsite on contaminated equipment, clothing, and shoes; alternatively, consider installing boot-washing.
    - Post warnings onsite and consider limiting access to visitors, especially those without adequate training and respiratory protection.
5. *Improve medical surveillance for employees*
    - Employees should have prompt access to medical care, including suspected work-related illnesses and injuries.
    - Work with a medical professional to develop a protocol to medically evaluate employees who have symptoms of Valley Fever.
    - Consider preferentially contracting with 1-2 clinics in the area and communicate with the health care providers in those clinics to ensure that

providers are aware that Valley Fever has been reported in the area. This will increase the likelihood that ill workers will receive prompt, proper and consistent medical care.

- Respirator clearance should include medical evaluation for all new employees, annual re-evaluation for changes in medical status, and annual training, and fit-testing.
- If an employee is diagnosed with Valley Fever, a physician must determine if the employee should be taken off work, when they may return to work, and what type of work activities they may perform.[84]

Two other studies have developed complementary recommendations to minimize the incidence of Valley Fever. The U.S. Geological Survey ("USGS") has developed recommendations to protect geological field workers in endemic areas.[85] An occupational study of Valley Fever in California workers also developed recommendations to protect those working and living in endemic areas.[86] These two sources identified the following measures, in addition to those identified by the County of San Luis Obispo's Public Health Department, to minimize exposure to Valley Fever:

- Pretest soils to determine if each work location is within an endemic area.
- Implement a vigorous program of medical surveillance.
- Implement aggressive enforcement of respiratory use where exposures from manual digging are involved.
- Test all potential employees for previous infection to identify the immune population and assign immune workers to operations involving known heavy exposures.
- Hire resident labor whenever available, particularly for heavy dust exposure work.
- All workers in endemic areas should use dust masks to protect against inhalation of particles as small as 0.4 microns. Mustaches or beards may prevent a mask from making an airtight seal against the fact and thus should be discouraged.
- Establish a medical program, including skin tests on all new employees, retesting of susceptibles, and prompt treatment of respiratory illness in susceptibles; periodic medical examination or interview to discover a history

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[84] San Luis Obispo County Health Agency, Recommendations for Workers to Prevent Infection by Valley Fever in SLO County; http://www.slocounty.ca.gov/Assets/PH/Epidemiology/Cocci+Recomendations.pdf.

[85] Fisher et al. 2000.

[86] Schmelzer and Tabershaw, 1968, pp. 111 - 113.

of low grade or subclinical infection, including repeated skin testing of susceptibles.

All of the above health-protective measures are feasible for construction of renewable energy projects under the DRECP and should be required in an enhanced dust control plan to reduce the risk for construction workers, on-site employees and the public of contracting Valley Fever. As with mitigation measures for air quality, review of individual projects should amend these mitigation measures to reflect the most up-to-date recommendations by, *e.g.*, the Centers for Disease Control ("CDC") and local health districts.

VI. Recommendation

Activities associated with the DRECP activities will occur in regions with substantially impaired air quality currently designated nonattainment for federal and/or state ambient air quality standards for most criteria pollutants; it is therefore imperative that EIS/EIR a) provide a full description of the health impacts of and maps for the attainment status with state and federal ambient air quality standards for all relevant air pollutants' to adequately inform the public and b) ensure that emissions associated with all phases of future renewable energy projects that would be developed under the DRECP are limited to the maximum extent feasible.

As discussed above, quantitative analyses for impacts on air quality that would adequately reflect the DRECP's impacts on air quality for all phases of projects and the various technologies for the next 25 years, are difficult to prepare due to the lack of project site-specific information, future development of renewable energy technologies, future availability of additional mitigation measures, etc., and the DEIR/DEIS's ambiguous directions fail to ensure that adequate project-level analyses will be conducted for all future projects. I suggest that the lead agencies revise the air quality chapter to provide programmatic level analyses that clearly indicate that unmitigated emissions associated with site-preparation, construction, operation, and decommissioning of the renewable energy projects and associated facilities that will be developed under the DRECP will likely be significant and will adversely affect air quality, especially in air basins already out of compliance with ambient air quality standards. This revised chapter should not attempt to draw conclusions with respect to mitigated emissions but instead should clearly state that up-to-date project-level quantitative air quality impact analyses based on site-specific information, respective technology, and associated facilities must be prepared for all future projects (on both federal and nonfederal lands) and for all pollutants to ensure compliance with CEQA and NEPA. Such future air quality impact analyses should incorporate the DEIR/DEIS's CMAs and additional mitigation measures and amend them to reflect state-of-the art mitigation available at the time of review. Proposed Mitigation Measures AQ-1d and AQ-2b, which provide two options for projects in federal nonattainment

areas – offsets or funding of air districts' emission reduction programs – should be restricted to the latter as offsets are not effective in reducing air pollution.

Further, I recommend that the DEIR/DEIS's mitigation measures to reduce the public's and construction workers' potential exposure to Valley Fever spores, which are not sufficiently protective, be revised to include the additional measures summarized in Comment V and be amended during each project-level review to reflect the most up-to-date measures.

Please feel free to call me at (415) 492-2131 or e-mail at petra.pless@gmail.com if you have any questions about the comments in this letter. For most cited sources not provided as exhibits, weblinks are provided in footnotes; however, I will gladly make any document available upon request.

Best regards,

Petra Pless, D.Env.

Exhibit 1a:
CEC
2011 California Geothermal Energy Statistics & Data

CALIFORNIA ENERGY COMMISSION
Energy ALMANAC

California Geothermal Energy Statistics & Data

Due to its location on the Pacific's "ring of fire" and because of tectonic plate conjunctions, California contains the largest amount of geothermal electric generation capacity in the United States.

In 2011, geothermal energy in our state produced 12,685 gigawatt-hours (GWh) of electricity. Combined with another 700 GWh of imported geothermal power, geothermal energy produced 6.33 percent of the state's total system power. There are a total of 43 operating geothermal power plants in California with an installed capacity of 2,648 megawatts.

The largest concentration of geothermal plants is located north of San Francisco in the Geysers Geothermal Resource Area in Lake and Sonoma Counties (shown in photo on the right). This location has been producing electricity since the 1960s. It uses dry steam; one of only two places in the world for this resource (the other being in Larderello, Italy).

Photo by Pacific Gas & Electric NREL 00060

Geothermal Electric Generation

Go to a Different Year Go

Year	Company Name	EIA Plant ID	CEC Plant ID	Plant Name	State	Capacity (MW)	Gross MWh	Net MWh
2011	Bottle Rock Power, LLC	902	T0080	Bottle Rock Power	CA	55.0	104,921	88,086
2011	CE Turbo LLC	55984	T0073	CE Turbo LLC	CA	11.5	76,305	72,487
2011	Coso Operating Company LLC	10875	T0009	Coso Energy Developers	CA	100.0	485,434	405,657
2011	Coso Operating Company LLC	10873	T0010	Coso Finance Partners	CA	102.4	616,230	553,631
2011	Coso Operating Company LLC	10874	T0011	Coso Power Developers	CA	100.0	606,814	532,755
2011	Del Ranch L P	10632	T0012	Del Ranch Company (formerly A W Hoch)	CA	35.8	378,523	337,355
2011	Elmore LP	10634	T0015	J J Elmore	CA	35.8	395,084	343,749
2011	Geysers Power Company, LLC	10469	T0005	Bear Canyon #2	CA	22.0	117,231	102,764
2011	Geysers Power Company, LLC	10199	T0007	West Ford Flat #4	CA	28.8	231,608	221,135
2011	Geysers Power Company, LLC	52158	T0023	Aidlin #1	CA	22.4	143,777	132,182
2011	Geysers Power Company, LLC	286H	T0027	Quick Silver #16	CA	120.0	437,097	383,283
2011	Geysers Power Company, LLC	286I	T0028	Lakeview #17	CA	120.0	473,273	430,862
2011	Geysers Power Company, LLC	286J	T0029	Socrates #18	CA	120.0	475,563	372,387
2011	Geysers Power Company, LLC	286K	T0030	Grant #20	CA	120.0	344,736	309,728
2011	Geysers Power Company, LLC	510	T0046	Sonoma #3	CA	78.0	358,676	304,221
2011	Geysers Power Company, LLC	50066	T0050	Calistoga #19	CA	97.0	561,041	522,264
2011	Geysers Power Company, LLC	286A	T0055	McCabe #5-#6	CA	110.0	719,912	684,077
2011	Geysers Power Company, LLC	286B	T0056	Ridge Line #7-#8	CA	110.0	669,505	631,320
2011	Geysers Power Company, LLC	286D	T0058	Eagle Rock #11	CA	110.0	610,701	569,985
2011	Geysers Power Company, LLC	286E	T0059	Cobb Creek #12	CA	110.0	460,741	425,983
2011	Geysers Power Company, LLC	286F	T0060	Big Geysers #13	CA	95.0	511,487	468,186
2011	Geysers Power Company, LLC	286G	T0061	Sulphur Springs #14	CA	117.5	461,478	422,586
2011	Heber Geothermal Co	54689	T0033	Heber Geothermal Co	CA	62.5	398,141	332,560
2011	Heber Geothermal Co	54111	T0051	Second Imperial Geothermal Co SIGC Plant	CA	80.0	568,228	387,402
2011	Leathers LP	10631	T0034	J M Leathers	CA	35.8	392,380	347,561
2011	Mammoth Pacific LP	10480	T0035	Mammoth Pacific I	CA	10.0	46,996	34,357
2011	Mammoth Pacific LP	10481	T0036	Mammoth Pacific II	CA	15.0	140,078	88,203
2011	Mammoth Pacific LP	10479	T0038	Ples I	CA	15.0	147,591	107,981
2011	Northern California Power Agency	7368	T0039	Geothermal 1	CA	110.0	435,683	435,683
2011	Northern California Power Agency	7369	T0040	Geothermal 2	CA	110.0	422,781	422,781
2011	Ormat Technologies, Inc.	54038	T0021	GEM II	CA	18.5	129,820	86,354
2011	Ormat Technologies, Inc.	10763	T0022	GEM III	CA	18.5	163,290	113,186
2011	Ormat Technologies, Inc.	54724	T0043	Ormesa Geothermal II	CA	24.0	180,752	143,399
2011	Ormat Technologies, Inc.	56832	T0081	North Brawley	CA	49.9	300,286	187,738
2011	Ormesa Geothermal	50766	T0062	Ormesa I	CA	22.4	174,299	131,422
2011	Ormesa Geothermal 1H Trust	50762	T0066	Ormesa 1H	CA	14.4	57,226	40,043

2011	Salton Sea 4 Fish Lake Pwr Gen	54996	T0016	Salton Sea Unit 4	CA	51.0	366,691	330,391
2011	Salton Sea Power Generatn LP 1	10878	T0047	Salton Sea Unit 1	CA	10.0	79,229	73,082
2011	Salton Sea Power Generatn LP 2	10879	T0048	Salton Sea Unit 2	CA	21.7	142,083	125,081
2011	Salton Sea Power Generatn LP 3	10759	T0049	Salton Sea Unit 3	CA	54.0	406,739	369,650
2011	Salton Sea Power LLC	55983	T0017	Salton Sea Unit 5	CA	49.9	413,424	348,734
2011	Star Group 1E Geothermal Partn	50764	T0063	Ormesa 1 E	CA	14.4	0	0
2011	Vulcan/BN Geothermal Power Co	50210	T0053	Vulcan	CA	39.7	328,478	264,399
					Total	**2,648.0**	**14,534,332**	**12,684,690**

Geothermal Electric Generation (Imported)

Year	Company Name	EIA Plant ID	CEC Plant ID	Plant Name	State	Capacity (MW)	Gross MWh	Net MWh
2011	Terra-Gen Dixie Valley LLC	52015	T0077	Terra-Gen Dixie Valley (NV)	NV	64.7	526,671	474,037
					Total	**64.7**	**526,671**	**474,037**

Geothermal Electric Generation

(Annual Totals; Includes Imports)

Year	Capacity (MW)	Gross MWh	Net MWh
2013	2,698.3	14,847,000	12,980,421
2012	2,767.7	15,171,117	13,210,713
2011	2,712.7	15,061,003	13,158,727
2010	2,712.7	14,951,831	13,167,518
2009	2,712.7	15,065,605	13,333,576
2008	2,662.8	14,967,686	13,291,111
2007	2,650.8	15,303,907	13,564,792
2006	2,595.8	15,052,270	13,593,587
2005	2,578.1	15,324,091	13,803,544
2004	2,578.1	15,500,832	14,000,452
2003	2,578.1	15,167,291	13,770,566
2002	2,578.1	15,318,675	13,867,398
2001	2,560.8	15,298,662	13,889,942
2000	N/A	N/A	13,456,000
1999	N/A	N/A	13,251,000
1998	N/A	N/A	12,554,000
1997	N/A	N/A	11,950,000
1996	N/A	N/A	13,539,000
1995	N/A	N/A	14,267,000
1994	N/A	N/A	15,573,000
1993	N/A	N/A	15,770,000
1992	N/A	N/A	16,491,000
1991	N/A	N/A	15,566,000
1990	N/A	N/A	16,038,000
1989	N/A	N/A	15,247,000
1988	N/A	N/A	14,194,000
1987	N/A	N/A	14,083,000
1986	N/A	N/A	13,094,000
1985	N/A	N/A	10,957,000
1984	N/A	N/A	9,272,000
1983	N/A	N/A	7,020,000

Exhibit 1b:
CEC
2012 California Geothermal Energy Statistics & Data

CALIFORNIA ENERGY COMMISSION
Energy ALMANAC

California Geothermal Energy Statistics & Data

Due to its location on the Pacific's "ring of fire" and because of tectonic plate conjunctions, California contains the largest amount of geothermal electric generation capacity in the United States.

In 2012, geothermal energy in our state produced 12,733 gigawatt-hours (GWh) of electricity. Combined with another 700 GWh of imported geothermal power, geothermal energy produced 6.47 percent of the state's total system power. There are a total of 44 operating geothermal power plants in California with an installed capacity of 2,703 megawatts.

The largest concentration of geothermal plants is located north of San Francisco in the Geysers Geothermal Resource Area in Lake and Sonoma Counties (shown in photo on the right). This location has been producing electricity since the 1960s. It uses dry steam; one of only two places in the world for this resource (the other being in Larderello, Italy).

Photo by Pacific Gas & Electric NREL 00060

Geothermal Electric Generation

Go to a Different Year Go

Year	Company Name	EIA Plant ID	CEC Plant ID	Plant Name	State	Capacity (MW)	Gross MWh	Net MWh
2012	Bottle Rock Power, LLC	902	T0080	Bottle Rock Power	CA	55.0	87,742	71,939
2012	CE Turbo LLC	55984	T0073	CE Turbo LLC	CA	11.5	69,391	65,971
2012	Coso Operating Company LLC	10875	T0009	Coso Energy Developers	CA	100.0	438,863	358,848
2012	Coso Operating Company LLC	10873	T0010	Coso Finance Partners	CA	102.4	581,853	520,004
2012	Coso Operating Company LLC	10874	T0011	Coso Power Developers	CA	100.0	657,427	527,013
2012	Del Ranch L P	10632	T0012	Del Ranch Company (formerly A W Hoch)	CA	35.8	297,728	260,549
2012	Elmore LP	10634	T0015	J J Elmore	CA	35.8	392,300	340,782
2012	Geysers Power Company, LLC	10469	T0005	Bear Canyon #2	CA	22.0	110,063	98,339
2012	Geysers Power Company, LLC	10199	T0007	West Ford Flat #4	CA	28.8	234,190	221,401
2012	Geysers Power Company, LLC	52158	T0023	Aidlin #1	CA	22.4	131,757	119,469
2012	Geysers Power Company, LLC	286H	T0027	Quick Silver #16	CA	120.0	450,137	393,049
2012	Geysers Power Company, LLC	286I	T0028	Lakeview #17	CA	120.0	553,012	508,540
2012	Geysers Power Company, LLC	286J	T0029	Socrates #18	CA	120.0	424,450	339,548
2012	Geysers Power Company, LLC	286K	T0030	Grant #20	CA	120.0	385,194	346,995
2012	Geysers Power Company, LLC	510	T0046	Sonoma #3	CA	78.0	383,723	324,759
2012	Geysers Power Company, LLC	50066	T0050	Calistoga #19	CA	97.0	578,440	536,436
2012	Geysers Power Company, LLC	286A	T0055	McCabe #5-#6	CA	110.0	726,508	690,435
2012	Geysers Power Company, LLC	286B	T0056	Ridge Line #7-#8	CA	110.0	664,796	627,745
2012	Geysers Power Company, LLC	286D	T0058	Eagle Rock #11	CA	110.0	646,625	601,883
2012	Geysers Power Company, LLC	286E	T0059	Cobb Creek #12	CA	110.0	468,809	433,794
2012	Geysers Power Company, LLC	286F	T0060	Big Geysers #13	CA	95.0	527,503	483,631
2012	Geysers Power Company, LLC	286G	T0061	Sulphur Springs #14	CA	117.5	422,714	388,901
2012	Heber Geothermal Co	54689	T0033	Heber Geothermal Co	CA	62.5	385,589	323,995
2012	Heber Geothermal Co	54111	T0051	Second Imperial Geothermal Co SIGC Plant	CA	80.0	553,931	368,085
2012	Hudson Ranch Energy Services, LLC	56791	T0082	Hudson Ranch Power I LLC	CA	55.0	384,150	352,755
2012	Leathers LP	10631	T0034	J M Leathers	CA	35.8	379,708	335,962
2012	Mammoth Pacific LP	10480	T0035	Mammoth Pacific I	CA	10.0	23,810	18,693
2012	Mammoth Pacific LP	10481	T0036	Mammoth Pacific II	CA	15.0	136,689	89,273
2012	Mammoth Pacific LP	10479	T0038	Ples I	CA	15.0	147,351	102,693
2012	Northern California Power Agency	7368	T0039	Geothermal 1	CA	110.0	458,243	458,243
2012	Northern California Power Agency	7369	T0040	Geothermal 2	CA	110.0	416,600	416,600
2012	Ormat Technologies, Inc.	54038	T0021	GEM II	CA	18.5	126,716	85,013
2012	Ormat Technologies, Inc.	10763	T0022	GEM III	CA	18.5	152,215	104,769
2012	Ormat Technologies, Inc.	54724	T0043	Ormesa Geothermal II	CA	24.0	179,623	137,561
2012	Ormat Technologies, Inc.	56832	T0081	North Brawley	CA	49.9	308,976	187,075
2012	Ormesa Geothermal	50766	T0062	Ormesa I	CA	22.4	173,917	130,925

2012	Ormesa Geothermal 1H Trust	50762	T0066	Ormesa 1H	CA	14.4	55,401	36,594
2012	Salton Sea 4 Fish Lake Pwr Gen	54996	T0016	Salton Sea Unit 4	CA	51.0	326,377	293,343
2012	Salton Sea Power Generatn LP 1	10878	T0047	Salton Sea Unit 1	CA	10.0	56,502	52,686
2012	Salton Sea Power Generatn LP 2	10879	T0048	Salton Sea Unit 2	CA	21.7	126,141	110,998
2012	Salton Sea Power Generatn LP 3	10759	T0049	Salton Sea Unit 3	CA	54.0	377,376	343,971
2012	Salton Sea Power LLC	55983	T0017	Salton Sea Unit 5	CA	49.9	347,820	291,353
2012	Star Group 1E Geothermal Partn	50764	T0063	Ormesa 1 E	CA	14.4	1	1
2012	Vulcan/BN Geothermal Power Co	50210	T0053	Vulcan	CA	39.7	287,784	232,554
					Total	**2,703.0**	**14,638,145**	**12,733,172**

Geothermal Electric Generation (Imported)

Year	Company Name	EIA Plant ID	CEC Plant ID	Plant Name	State	Capacity (MW)	Gross MWh	Net MWh
2012	Terra-Gen Dixie Valley LLC	52015	T0077	Terra-Gen Dixie Valley (NV)	NV	64.7	532,972	477,541
					Total	**64.7**	**532,972**	**477,541**

Geothermal Electric Generation

(Annual Totals; Includes Imports)

Year	Capacity (MW)	Gross MWh	Net MWh
2013	2,698.3	14,847,000	12,980,421
2012	2,767.7	15,171,117	13,210,713
2011	2,712.7	15,061,003	13,158,727
2010	2,712.7	14,951,831	13,167,518
2009	2,712.7	15,065,605	13,333,576
2008	2,662.8	14,967,686	13,291,111
2007	2,650.8	15,303,907	13,564,792
2006	2,595.8	15,052,270	13,593,587
2005	2,578.1	15,324,091	13,803,544
2004	2,578.1	15,500,832	14,000,452
2003	2,578.1	15,167,291	13,770,566
2002	2,578.1	15,318,675	13,867,398
2001	2,560.8	15,298,662	13,889,942
2000	N/A	N/A	13,456,000
1999	N/A	N/A	13,251,000
1998	N/A	N/A	12,554,000
1997	N/A	N/A	11,950,000
1996	N/A	N/A	13,539,000
1995	N/A	N/A	14,267,000
1994	N/A	N/A	15,573,000
1993	N/A	N/A	15,770,000
1992	N/A	N/A	16,491,000
1991	N/A	N/A	15,566,000
1990	N/A	N/A	16,038,000
1989	N/A	N/A	15,247,000
1988	N/A	N/A	14,194,000
1987	N/A	N/A	14,083,000
1986	N/A	N/A	13,094,000
1985	N/A	N/A	10,957,000
1984	N/A	N/A	9,272,000
1983	N/A	N/A	7,020,000

Exhibit 1c:
CEC
2013 California Geothermal Energy Statistics & Data

CALIFORNIA ENERGY COMMISSION
Energy ALMANAC

California Geothermal Energy Statistics & Data

Due to its location on the Pacific's "ring of fire" and because of tectonic plate conjunctions, California contains the largest amount of geothermal electric generation capacity in the United States.

In 2013, geothermal energy in our state produced 12,485 gigawatt-hours (GWh) of electricity. Combined with another 700 GWh of imported geothermal power, geothermal energy produced 6.28 percent of the state's total system power. There are a total of 43 operating geothermal power plants in California with an installed capacity of 2,634 megawatts.

The largest concentration of geothermal plants is located north of San Francisco in the Geysers Geothermal Resource Area in Lake and Sonoma Counties (shown in photo on the right). This location has been producing electricity since the 1960s. It uses dry steam; one of only two places in the world for this resource (the other being in Larderello, Italy).

Photo by Pacific Gas & Electric NREL 00060

Geothermal Electric Generation

Go to a Different Year Go

Year	Company Name	EIA Plant ID	CEC Plant ID	Plant Name	State	Capacity (MW)	Gross MWh	Net MWh
2013	Bottle Rock Power, LLC	902	T0080	Bottle Rock Power	CA	55.0	88,929	72,877
2013	CE Turbo LLC	55984	T0073	CE Turbo LLC	CA	11.5	57,798	54,805
2013	Coso Operating Company LLC	10875	T0009	Coso Energy Developers	CA	100.0	448,802	373,191
2013	Coso Operating Company LLC	10873	T0010	Coso Finance Partners	CA	102.4	553,135	492,796
2013	Coso Operating Company LLC	10874	T0011	Coso Power Developers	CA	100.0	563,564	488,709
2013	Del Ranch L P	10632	T0012	Del Ranch Company (formerly A W Hoch)	CA	35.8	350,585	308,984
2013	Elmore LP	10634	T0015	J J Elmore	CA	35.8	361,646	312,895
2013	Geysers Power Company, LLC	10469	T0005	Bear Canyon #2	CA	22.0	105,163	94,786
2013	Geysers Power Company, LLC	10199	T0007	West Ford Flat #4	CA	28.8	220,800	207,478
2013	Geysers Power Company, LLC	52158	T0023	Aidlin #1	CA	22.4	124,292	112,148
2013	Geysers Power Company, LLC	286H	T0027	Quick Silver #16	CA	120.0	432,432	381,150
2013	Geysers Power Company, LLC	286I	T0028	Lakeview #17	CA	120.0	552,447	506,450
2013	Geysers Power Company, LLC	286J	T0029	Socrates #18	CA	120.0	466,470	374,886
2013	Geysers Power Company, LLC	286K	T0030	Grant #20	CA	120.0	367,263	329,348
2013	Geysers Power Company, LLC	510	T0046	Sonoma #3	CA	78.0	387,687	332,408
2013	Geysers Power Company, LLC	50066	T0050	Calistoga #19	CA	97.0	512,011	470,898
2013	Geysers Power Company, LLC	286A	T0055	McCabe #5-#6	CA	110.0	672,031	640,069
2013	Geysers Power Company, LLC	286B	T0056	Ridge Line #7-#8	CA	110.0	708,854	670,775
2013	Geysers Power Company, LLC	286D	T0058	Eagle Rock #11	CA	110.0	604,428	565,293
2013	Geysers Power Company, LLC	286E	T0059	Cobb Creek #12	CA	110.0	463,923	428,532
2013	Geysers Power Company, LLC	286F	T0060	Big Geysers #13	CA	95.0	480,256	439,554
2013	Geysers Power Company, LLC	286G	T0061	Sulphur Springs #14	CA	117.5	485,856	448,878
2013	Heber Geothermal Co	54689	T0033	Heber Geothermal Co	CA	62.5	369,511	301,464
2013	Heber Geothermal Co	54111	T0051	Second Imperial Geothermal Co SIGC Plant	CA	80.0	521,378	342,858
2013	Hudson Ranch Energy Services, LLC	56791	T0082	Hudson Ranch Power I LLC	CA	55.0	420,236	386,399
2013	Leathers LP	10631	T0034	J M Leathers	CA	35.8	354,114	310,477
2013	Mammoth Pacific LP	10480	T0035	Mammoth Pacific I	CA	10.0	3,599	3,058
2013	Mammoth Pacific LP	10481	T0036	Mammoth Pacific II	CA	15.0	128,502	90,652
2013	Mammoth Pacific LP	10479	T0038	Ples I	CA	15.0	141,269	96,571
2013	Northern California Power Agency	7368	T0039	Geothermal 1	CA	110.0	384,217	417,949
2013	Northern California Power Agency	7369	T0040	Geothermal 2	CA	55.0	422,842	398,908
2013	Ormat Technologies, Inc.	54038	T0021	GEM II	CA	18.5	126,987	85,033
2013	Ormat Technologies, Inc.	10763	T0022	GEM III	CA	18.5	151,304	103,924
2013	Ormat Technologies, Inc.	54724	T0043	Ormesa Geothermal II	CA	24.0	178,777	137,715
2013	Ormat Technologies, Inc.	56832	T0081	North Brawley	CA	49.9	305,866	188,940
2013	Ormesa Geothermal	50766	T0062	Ormesa I	CA	22.4	129,126	95,041

2013	Ormesa Geothermal 1H Trust	50762	T0066	Ormesa 1H	CA	14.4	54,838	36,664
2013	Salton Sea 4 Fish Lake Pwr Gen	54996	T0016	Salton Sea Unit 4	CA	51.0	349,414	310,981
2013	Salton Sea Power Generatn LP 1	10878	T0047	Salton Sea Unit 1	CA	10.0	69,067	64,473
2013	Salton Sea Power Generatn LP 2	10879	T0048	Salton Sea Unit 2	CA	21.7	125,559	108,417
2013	Salton Sea Power Generatn LP 3	10759	T0049	Salton Sea Unit 3	CA	54.0	357,888	323,577
2013	Salton Sea Power LLC	55983	T0017	Salton Sea Unit 5	CA	49.9	351,003	293,853
2013	Vulcan/BN Geothermal Power Co	50210	T0053	Vulcan	CA	39.7	337,982	281,428
					Total	**2,633.6**	**14,291,851**	**12,485,292**

Geothermal Electric Generation (Imported)

Year	Company Name	EIA Plant ID	CEC Plant ID	Plant Name	State	Capacity (MW)	Gross MWh	Net MWh
2013	Terra-Gen Dixie Valley LLC	52015	T0077	Terra-Gen Dixie Valley (NV)	NV	64.7	555,149	495,129
					Total	**64.7**	**555,149**	**495,129**

Geothermal Electric Generation

(Annual Totals; Includes Imports)

Year	Capacity (MW)	Gross MWh	Net MWh
2013	2,698.3	14,847,000	12,980,421
2012	2,767.7	15,171,117	13,210,713
2011	2,712.7	15,061,003	13,158,727
2010	2,712.7	14,951,831	13,167,518
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2005	2,578.1	15,324,091	13,803,544
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2002	2,578.1	15,318,675	13,867,398
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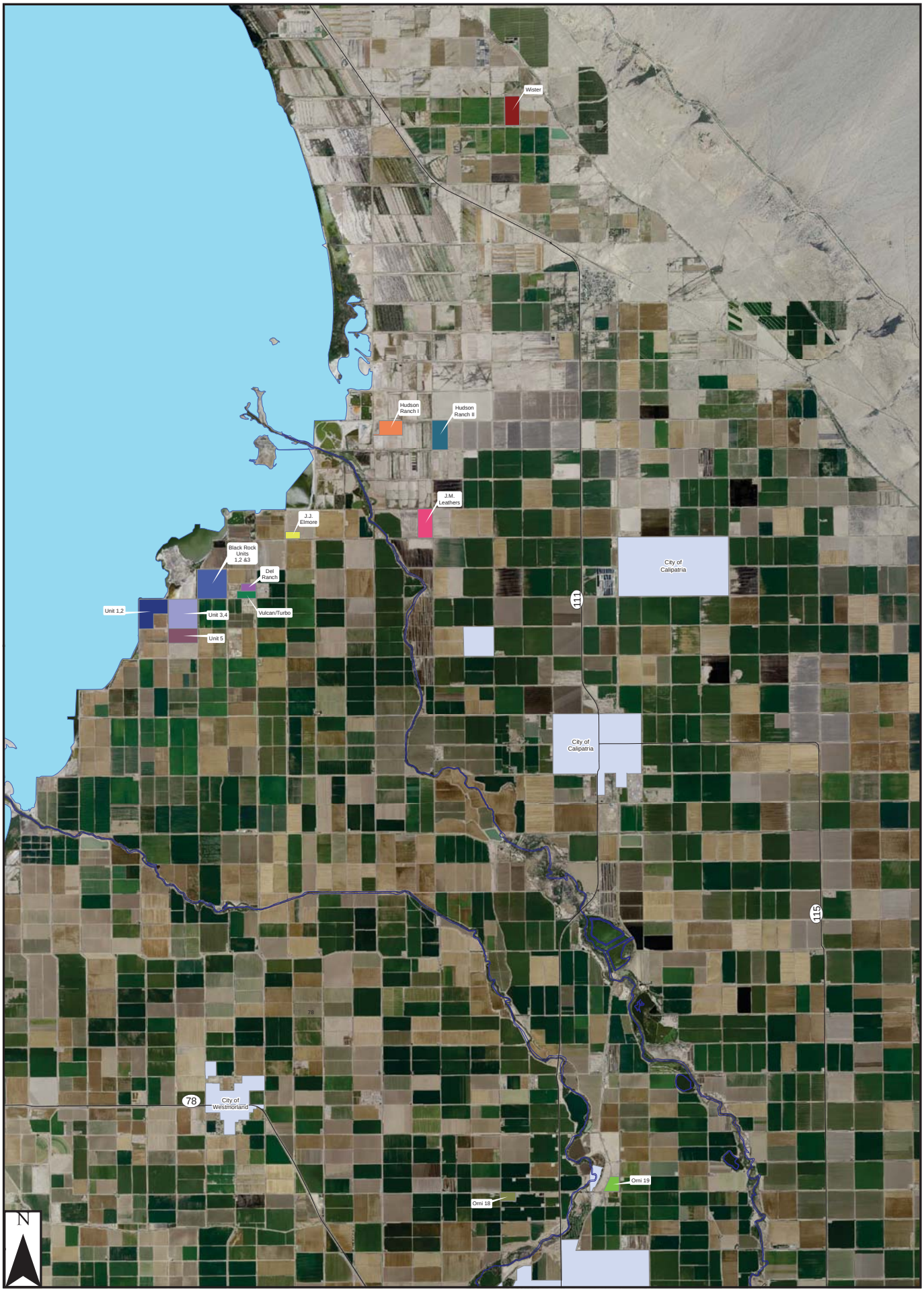
1990	N/A	N/A	16,038,000
1989	N/A	N/A	15,247,000
1988	N/A	N/A	14,194,000
1987	N/A	N/A	14,083,000
1986	N/A	N/A	13,094,000
1985	N/A	N/A	10,957,000
1984	N/A	N/A	9,272,000
1983	N/A	N/A	7,020,000

Exhibit 2a:
Imperial County
Imperial County Geothermal Projects (northend)



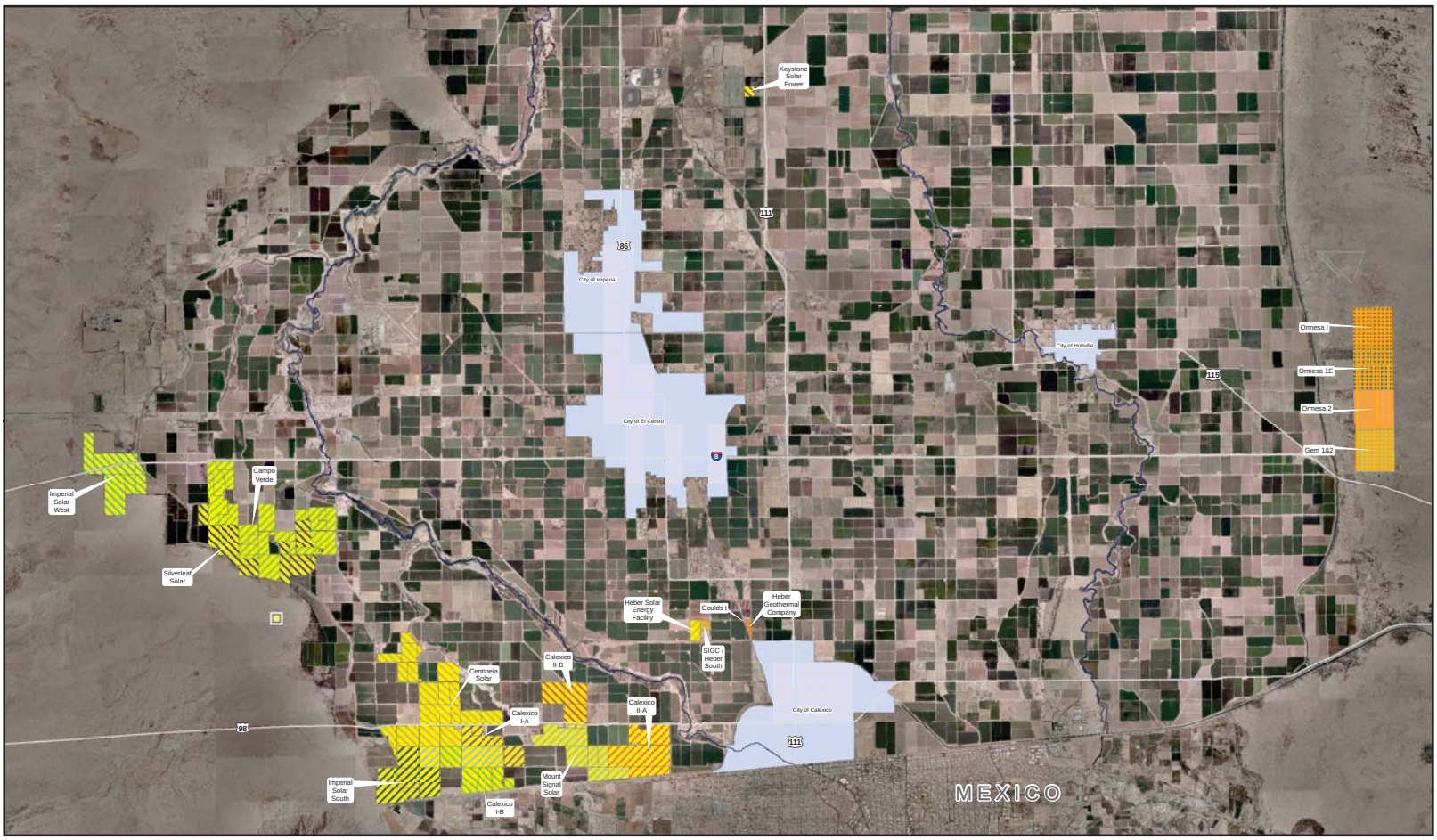
Imperial County Geothermal Projects
Northend Projects

Highways
Salton_Sea
Cities

Geothermal Projects

- Black Rock Units 1,2 &3
- Del Ranch
- Hudson Ranch I
- Hudson Ranch II
- J.J. Elmore
- J.M. Leathers
- Orni 18
- Orni 19
- Unit 1,2
- Unit 3,4
- Unit 5
- Vulcan/Turbo
- Wister

Exhibit 2b:
Imperial County
Imperial County Renewable Energy Projects (southend)



Imperial County Power Plant Projects
Southend Projects

Updated: May 31, 2012

Sources: IC Assessors, IC Planning Dept., Aerial: NAIP 2010. created by IC Planning Dept., DN

IV Substation
Highways
Geothermal
Solar
Cities

Solar Projects
Calexico I-A
Calexico I-B
Calexico II-A
Calexico II-B
Campo Verde
Centinela Solar
Heber Solar Energy Facility
Imperial Solar South
Imperial Solar West
Imperial Valley Solar
Keystone Solar Power
Mount Signal Solar
Silverleaf Solar

Geothermal Projects
Gem 1&2
Goulds I
Heber Geothermal Company
Ormesa 1E
Ormesa 2
Ormesa I
SIGC / Heber South

0 0.5 1 2 3
Miles

N

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petra.pless@gmail.com

Dr. Pless is a court-recognized expert with over 20 years of experience in environmental consulting conducting and managing interdisciplinary environmental research projects and preparing and reviewing environmental permits and other documents for U.S. and European stakeholder groups. Her broad-based experience includes air quality and air pollution control; water quality, water supply, and water pollution control; biological resources; public health and safety; noise studies; California Environmental Quality Act ("CEQA"), Clean Air Act ("CAA"), and National Environmental Policy Act ("NEPA") review; industrial ecology and risk assessment; and use of a wide range of environmental software.

EDUCATION

Doctorate in Environmental Science and Engineering (D.Env.), University of California Los Angeles, 2001

Master of Science (equivalent) in Biology (focus on Limnology), Technical University of Munich, Germany, 1991

PROFESSIONAL HISTORY

Pless Environmental, Inc., Principal, 2008–present

Environmental Consultant, Sole Proprietor, 2006–2008

Leson & Associates (previously Leson Environmental Consulting), Kensington, CA, Environmental Scientist/Project Manager, 1997–2005

University of California Los Angeles, Graduate Research Assistant/Teaching Assistant, 1994–1996

ECON Research and Development, Environmental Scientist, Ingelheim, Germany, 1992–1993

Biocontrol, Environmental Projects Manager, Ingelheim, Germany, 1991–1992

REPRESENTATIVE EXPERIENCE

Air Quality and Pollution Control

Projects include CEQA/NEPA review; CAA attainment and non-attainment new source review; prevention of significant deterioration ("PSD") and Title V permitting; control technology analyses (BACT, LAER, RACT, BARCT, BART, MACT); technology evaluations and cost-effectiveness analyses; criteria and toxic pollutant and greenhouse gas emission inventories; emission offsets; ambient and source monitoring; analysis of emissions estimates and ambient air pollutant concentration modeling. Some typical projects include:

- Provided expert support for intervention in California Energy Commission ("CEC") proceedings for numerous power plants including natural gas-fired, integrated gasification combined-cycle, geothermal (flash and binary) solar (thermal and photovoltaic) facilities with respect to air quality including emission reduction credits, hazards and hazardous materials, public health, noise, and biological resources.
- Critically reviewed and prepared technical comments on the air quality, biology, noise, water quality, and public health and safety sections of CEQA/NEPA documents for numerous commercial, residential, and industrial projects (*e.g.*, power plants, airports, residential developments, retail developments, university expansions, hospitals, refineries, slaughterhouses, asphalt plants, food processing facilities, slaughterhouses, feedlots, printing facilities, mines, quarries, landfills, and recycling facilities) and provided litigation support in a number of cases filed under CEQA.
- Critically reviewed and prepared technical comments on the air quality and public health sections of the Los Angeles Airport Master Plan (Draft, Supplement, and Final Environmental Impact Statement/Environmental Impact Report) for the City of El Segundo. Provided technical comments on the Draft and Final General Conformity Determination for the preferred alternative submitted to the Federal Aviation Administration.
- Prepared comments on proposed PSD and Title V permit best available control technology ("BACT") analysis for greenhouse gas emissions from a proposed direct reduced iron facility in Louisiana.
- Prepared technical comments on U.S. Environmental Protection Agency ("EPA")'s *Inhalation of Fugitive Dust: A Screening Assessment of the Risks Posed by Coal Combustion Waste Landfills* prepared for EPA's proposed coal combustion waste landfill rule.
- Prepared technical comments on the potential air quality impacts of the California Air Resources Board's *Proposed Actions to Further Reduce Particulate Matter at High Priority California Railyards*.
- For several California refineries, evaluated compliance of fired sources with Bay Area Air Quality Management District Rule 9-10. This required evaluation and review of hundreds of source tests to determine if refinery-wide emission caps and compliance monitoring provisions were being met.
- Critically reviewed and prepared technical comments on draft Title V permits for several refineries and other industrial facilities in California.
- Evaluated the public health impacts of locating big-box retail developments in densely populated areas in California and Hawaii. Monitored and evaluated impacts of diesel exhaust emissions and noise on surrounding residential communities.
- In conjunction with the permitting of several residential and commercial developments, conducted studies to determine baseline concentrations of diesel exhaust particulate matter using an aethalometer.
- For an Indiana steel mill, evaluated technology to control NOx and CO emissions from fired sources, including electric arc furnaces and reheat furnaces, to establish BACT. This required a comprehensive review of U.S. and European operating experience. The lowest emission levels were being achieved by steel mills using selective catalytic reduction ("SCR") and selective non-catalytic reduction ("SNCR") in Sweden and The Netherlands.

- For a California petroleum coke calciner, evaluated technology to control NOx, CO, VOCs, and PM10 emissions from the kiln and pyroscrubbers to establish BACT and LAER. This required a review of state and federal clearinghouses, working with regulatory agencies and pollution control vendors, and obtaining and reviewing permits and emissions data from other similar facilities. The best-controlled facilities were located in the South Coast Air Quality Management District.
- For a Kentucky coal-fired power plant, identified the lowest NOx levels that had been permitted and demonstrated in practice to establish BACT. Reviewed operating experience of European, Japanese, and U.S. facilities and evaluated continuous emission monitoring data. The lowest NOx levels had been permitted and achieved in Denmark and in the U.S. in Texas and New York.
- In support of efforts to lower the CO BACT level for power plant emissions, evaluated the contribution of CO emissions to tropospheric ozone formation and co-authored report on same.
- Critically reviewed and prepared technical comments on applications for certification ("AFCs") for numerous natural-gas fired, solar, biomass, and geothermal power plants in California permitted by the California Energy Commission. The comments addressed construction and operational emissions inventories and dispersion modeling, BACT determinations for combustion turbine generators, fluidized bed combustors, diesel emergency generators, etc.
- Critically reviewed and prepared technical comments on draft PSD permits for several natural gas-fired power plants in California, Indiana, and Oregon. The comments addressed emission inventories, greenhouse gas emissions, BACT, case-by-case MACT, compliance monitoring, cost-effectiveness analyses, and enforceability of permit limits.
- For a California refinery, evaluated technology to control NOx and CO emissions from CO Boilers to establish RACT/BARCT to comply with BAAQMD Rule 9-10. This required a review of BACT/RACT/LAER clearinghouses, working with regulatory agencies across the U.S., and reviewing federal and state regulations and State Implementation Plans ("SIPs"). The lowest levels were required in a South Coast Air Quality Management District rule and in the Texas SIP.
- In support of several federal lawsuits filed under the federal Clean Air Act, prepared cost-effectiveness analyses for SCR and oxidation catalysts for simple cycle gas turbines and evaluated opacity data.
- Provided litigation support for a CEQA lawsuit addressing the adequacy of pollution control equipment at a biomass cogeneration plant.
- Prepared comments and provided litigation support on several proposed regulations including the Mojave Desert Air Quality Management District Rule 1406 (fugitive dust emission reduction credits for road paving); South Coast Air Quality Management District Rule 1316, San Joaquin Valley Air Pollution Control District Rule 2201, Antelope Valley Air Quality Management District Regulation XIII, and Mojave Desert Air Quality Management District Regulation XIII (implementation of December 2002 amendments to the federal Clean Air Act).
- Critically reviewed draft permits for several ethanol plants in California, Indiana, Ohio, and Illinois and prepared technical comments.

- Reviewed state-wide average emissions, state-of-the-art control devices, and emissions standards for construction equipment and developed recommendations for mitigation measures for numerous large construction projects.
- Researched sustainable building concepts and alternative energy and determined their feasibility for residential and commercial developments, *e.g.*, regional shopping malls and hospitals.
- Provided comprehensive environmental and regulatory services for an industrial laundry chain. Facilitated permit process with the South Coast Air Quality Management District. Developed test protocol for VOC emissions, conducted field tests, and used mass balance methods to estimate emissions. Reduced disposal costs for solvent-containing waste streams by identifying alternative disposal options. Performed health risk screening for air toxics emissions. Provided permitting support. Renegotiated sewer surcharges with wastewater treatment plant. Identified new customers for shop-towel recycling services.
- Designed computer model to predict performance of biological air pollution control (biofilters) as part of a collaborative technology assessment project, co-funded by several major chemical manufacturers.
- Experience using a wide range of environmental software, including air dispersion models, air emission modeling software, database programs, and geographic information systems.

Water Quality and Pollution Control

Experience in water quality and pollution control, including surface water and ground water quality and supply studies, evaluating water and wastewater treatment technologies, and identifying, evaluating and implementing pollution controls. Some typical projects include:

- Evaluated impacts of on-shore oil drilling activities on large-scale coastal erosion in Nigeria.
- For a 500-MW combined-cycle power plant, prepared a study to evaluate the impact of proposed groundwater pumping on local water quality and supply, including a nearby stream, springs, and a spring-fed waterfall. The study was docketed with the California Energy Commission.
- For a 500-MW combined-cycle power plant, identified and evaluated methods to reduce water use and water quality impacts. These included the use of zero-liquid-discharge systems and alternative cooling technologies, including dry and parallel wet-dry cooling. Prepared cost analyses and evaluated impact of options on water resources. This work led to a settlement in which parallel wet dry cooling and a crystallizer were selected, replacing 100 percent groundwater pumping and wastewater disposal to evaporation ponds.
- For a homeowner's association, reviewed a California Coastal Commission staff report on the replacement of 12,000 linear feet of wooden bulkhead with PVC sheet pile armor. Researched and evaluated impact of proposed project on lagoon water quality, including sediment resuspension, potential leaching of additives and sealants, and long-term stability. Summarized results in technical report.

Applied Ecology, Industrial Ecology and Risk Assessment

Experience in applied ecology, industrial ecology and risk assessment, including human and ecological risk assessments, life cycle assessment, evaluation and licensing of new chemicals, and fate and transport studies of contaminants. Experienced in botanical, phytoplankton, and intertidal species identification and water chemistry analyses. Some typical projects include:

- Conducted technical, ecological, and economic assessments of product lines from agricultural fiber crops for European equipment manufacturer; co-authored proprietary client reports.
- Developed life cycle assessment methodology for industrial products, including agricultural fiber crops and mineral fibers; analyzed technical feasibility and markets for thermal insulation materials from natural plant fibers and conducted comparative life cycle assessments.
- For the California Coastal Conservancy, San Francisco Estuary Institute, Invasive Spartina Project, evaluated the potential use of a new aquatic pesticide for eradication of non-native, invasive cordgrass (*Spartina spp.*) species in the San Francisco Estuary with respect to water quality, biological resources, and human health and safety. Assisted staff in preparing an amendment to the Final EIR.
- Evaluated likelihood that organochlorine pesticide concentrations detected at a U.S. naval air station are residuals from past applications of these pesticides consistent with manufacturers' recommendations. Retained as expert witness in federal court case.
- Prepared human health risk assessments of air pollutant emissions from several industrial and commercial establishments, including power plants, refineries, and commercial laundries.
- Managed and conducted laboratory studies to license pesticides. This work included the evaluation of the adequacy and identification of deficiencies in existing physical/chemical and health effects data sets, initiating and supervising studies to fill data gaps, conducting environmental fate and transport studies, and QA/QC compliance at subcontractor laboratories. Prepared licensing applications and coordinated the registration process with German environmental protection agencies. This work led to regulatory approval of several pesticide applications in less than six months.
- Designed and implemented database on physical/chemical properties, environmental fate, and health impacts of pesticides for a major multi-national pesticide manufacturer.
- Designed and managed experimental toxicological study on potential interference of delta-9-tetrahydrocannabinol in food products with U.S. employee drug testing; co-authored peer-reviewed publication.
- Critically reviewed and prepared technical comments on applications for certification for several natural-gas fired, solar, and geothermal power plants and transmission lines in California permitted by the California Energy Commission. The comments addressed avian collisions and electrocution, construction and operational noise impacts on wildlife, risks from brine ponds, and impacts on endangered species.
- For a 180-MW geothermal power plant, evaluated the impacts of plant construction and operation on the fragile desert ecosystem in the Salton Sea area. This work included baseline noise monitoring and assessing the impact of noise, brine handling and disposal, and air emissions on local biota, public health, and welfare.

- Designed research protocols for a coastal ecological inventory in Southern California; developed sampling methodologies, coordinated field sampling, determined species abundance and distribution in intertidal zone, and conducted statistical data analyses.
- Designed and conducted limnological study on effects of physical/chemical parameters on phytoplankton succession; performed water chemistry analyses and identified phytoplankton species; co-authored two journal articles on results.

PRO BONO ACTIVITIES

Founding member of "SecondAid," a non-profit organization providing tsunami relief for the recovery of small family businesses in Sri Lanka. (www.secondaid.org.)

PUBLICATIONS & RECOMMENDATIONS

Available upon request.