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**RE: ENERGY COMMISSION STAFF REBUTTAL TESTIMONY
PALEN SOLAR ELECTRIC GENERATING SYSTEM
DOCKET NO. (09-AFC-7C)**

Enclosed for filing is staff's rebuttal testimony for the Palen Solar Electric Generating System (09-AFC-7C).

Sincerely,

CHRISTINE STORA
Compliance Project Manager
Siting Transmission and Environmental
Protection

**STATE OF CALIFORNIA
Energy Resources Conservation
And Development Commission**

In the Matter of:

Application for Certification for the
**PALEN SOLAR ELECTRIC
GENERATING SYSTEM**

Docket No. 09-AFC-07C

ENERGY COMMISSION STAFF REBUTTAL TESTIMONY

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INTRODUCTION

Christine Stora

Palen Solar Holdings, LLC (PSH) has filed a Petition for Amendment of the Palen Solar Power Project (PSPP) which was approved by the Energy Commission on December 15, 2010 (Order No. 10-1215-19, the “Final Decision”, 09-AFC-7). The Petition proposes to eliminate the use of solar parabolic trough technology and replace it with BrightSource’s LPT solar power tower technology. The proposed amended project is referred to as the Palen Solar Electric Generating System (PSEGS).

The Committee held evidentiary hearings on the proposed amendment in October and November of 2013, and issued the Presiding Member’s Proposed Decision (PMPD) on December 13, 2013. The PMPD recommends denial of the amendment without prejudice. The committee granted Petitioner’s Request for a Delay in the Schedule filed on December 23, 2013. At the January 7, 2014 Committee Conference, the Committee provided PSH an opportunity to supplement the record. After providing additional information, PSH filed a Motion to Reopen the Evidentiary Record on March 21, 2014.

The Committee granted Petitioner’s Motion in an order docketed on May 21, 2014.

Per the Committee’s Order Granting the Petitioner’s Motion to Reopen the Evidentiary Record, these evidentiary hearings are limited to the following topics:

- a. Avian impacts;
- b. Flying invertebrate species (insects);
- c. Curtailment provision;
- d. Avian deterrent strategies;
- e. Visual Resources (glint and glare)¹;
- f. Alternatives (PPA milestone status and economic feasibility);
- g. Overriding considerations;
- h. Natural gas consumption; and
- i. Cultural Resources mitigation (Condition of Certification **CUL-1**).

A revised scheduling order was docketed on June 2, 2014 requiring all parties to file testimony by June 23, 2014 and rebuttal testimony by July 18, 2014 (enclosed herein). Staff’s rebuttal testimony is organized into the following topics:

- a. Biological Resources (includes testimony on avian impacts, flying invertebrates, curtailment provisions and avian deterrents);
- b. Cultural Resources;
- c. Traffic and Transportation (includes testimony on glint and glare effects on pilots); and
- d. Overriding Considerations-Thermal Energy Storage

¹ Please note that the most appropriate technical area to discuss the issue of glint and glare impacts to pilots is Traffic and Transportation. Testimony on this issue will be found in the Traffic and Transportation section.

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I. BIOLOGICAL RESOURCES

Rebuttal Testimony of Chris Huntley, Carol Watson, Geoff Lesh, and Brett Fooks

INTRODUCTION

Staff reviewed the opening testimony provided by the Petitioner and intervenors, as well as documents filed by the public, and provides the following rebuttal testimony. Staff and Petitioner agree that impacts to avian species will occur, however there remains disagreement on the magnitude of the impact, the applicability of data collected at ISEGS and other project sites to be predictive of impacts at PSEGS, and the appropriate level of monitoring and mitigation to reduce impacts to avian species.

TESTIMONY OF PALEN SOLAR HOLDINGS (PSH)

DETERRENTS

Staff previously responded to the efficacy of potential deterrents and hazing methods offered by the Petitioner, and currently believe many of the methods would be ineffective at PSEGS. Implementation of deterrents that preclude birds from entering areas with dangerous levels of flux such as long range acoustical devices may be effective; however it is uncertain if these technologies would prevent birds from flying through large invisible areas of damaging flux at PSEGS. Staff has not seen enough evidence that the use of these devices for other applications would result in effective avoidance of impacts at PSEGS. Testing of these devices under circumstances similar to PSEGS would demonstrate the level of effectiveness and provide staff with a greater sense of whether impacts to birds could be reduced to a level of insignificance through use of deterrents.

Staff provides the following summary of and response to the specific methods offered by the Petitioner in their opening testimony.

Ex.1141 - Biological Resources Supplemental Opening Testimony of Elwood G. Norris – Description of HyperSound Technology (TN 202489)

The Petitioner supplied information regarding an emerging technology, called Hypersound™. The HyperSound™ technology projects a beam of silent ultrasound energy into the air (TN 202489 page 2). The document states “An important by-product of the technology allows for controlled directionality – the communication of sound clearly and efficiently over long distances in a manner that is extremely directional. In other words, receptors (such as humans and animals) within the energy beam projected by the equipment will hear the sound. Receptors outside of this narrow beam will not hear the sound directly and will only hear audible sound waves that may be reflected by objects within the ultrasonic beam. Moreover, the wide frequency response means

similar deterrence strategies could be applicable to the full range of species, from birds and bats, to mammals.” (TN 202489 page 3)

Staff Response

Staff is unable to provide specific rebuttal regarding the efficacy of this technology. The brochure identifies HyperSound™ as “a description of a technology under development that could have application at the Palen Solar Electric Generation System (PSEGS) (09-AFC-7C) or similar projects as an avian deterrent technology.” (TN 202489 Page 1)

The brochure states that “Hyper Sonic Sound will maintain intelligibility for hundreds of feet, far more than any conventional speaker system.” (TN 202489 Page 13) However, the Petitioner did not indicate how the device will be operated at PSEGS, if the system is currently being used to effectively deter birds from projects similar to the magnitude of PSEGS, or what is the effective range of the system. In order to assess the effectiveness of this system staff would require the following types of information:

- Has this technology been tested on wildlife in a similar scenario to PSEGS?
- Can the system be effectively aimed at a moving target, or must the target be stationary?
- Has the system been demonstrated to be effective deterring flocks of birds, or just solitary targets?
- How far will the beam of sound travel before it attenuates?
- How loud is this sound?
- When will this technology be available?

Ex.1140 - DeTect Testimony on Deterrent Method

This filing consists of a technical bulletin, a company brochure on “Merlin” technology, and a reference paper describing the use of the system to reduce avian deaths at the Canadian Natural Resources Limited’s (CNRL) Horizon Oil Sands Project at Fort McMurray in Alberta, Canada.

This technology was originally developed for the United States Air Force for bird-aircraft strikes prevention and can provide real-time, tactical bird detection and tracking out to six miles. (TN 202488 Page 4) When birds are detected the system may activate a variety of deterrent or hazing methods. The information from the technical bulletin and study include the use of long range acoustic and visual (laser) deterrent systems with ranges of over one kilometer.

The filing identifies two key limitations with deterrent and radar systems: “Habituation is a key concern with wildlife control programs and can be a particular concern with automated systems” and “Radar does not identify the targets it tracks by species.” (TN 202488 Page 34)

Staff Response

The Merlin system and associated deterrence equipment has been demonstrated to be effective in deterring birds from a variety of structures and facilities including airport runways and waste ponds. This technology was used at the CRNL Horizon Oil Sands Project at Fort McMurray, Alberta in spring 2009 and the data suggested the system was effective in reducing avian mortality during the limited period the study was completed (approximately 24 mornings). The CRNL study highlighted an effort to prevent birds from landing at the oil fields and was designed to determine if birds *landed* not how or if their flight pattern, speed, or trajectory was altered by the system.

What is uncertain is how this technology will be effective in preventing birds from flying into invisible high energy flux fields. Deterring landings at PSEGS would reduce collisions with project features and some birds would likely avoid portions of the project site. However to be effective the system must have the ability to prevent birds from entering concentrated flux zones and to ensure that altering birds' flight paths does not have the unintended consequences of diverting them into the second heliostat field or towards towers, as opposed to off the project site. The Petitioner did not indicate how the device will be operated or provide enough evidence that the system would be effective for PSEGS. Staff welcomes specific information on how such a system might be designed for PSEGS and evidence that the system would be effective in this role. Without this information staff can make no prediction as to what percent of injuries or mortalities may be avoided.

The feasibility or efficacy of deterrents is difficult to predict given the shape and size of the flux field. Birds escaping a deterrent device could flee into an area of higher flux. Staff modeled the three dimensional volume of the PSEGS and ISEGS power towers with their representative solar flux fields to illustrate the relative sizes between the two solar power tower plants (Attachment A: Assessment of Relative Risk to Avian Species Between Ivanpah and Palen Projects). Figure 1 presents a partial cross-section of each solar field, which illustrates the PSEGS flux field occupies a greater volume and land area relative to the ISEGS flux field. As shown in this figure, the area where mortality would be expected to start increasing is 454 m from each tower, or a distance of 1,500 feet. To effectively reduce risk, a deterrent, or combination of deterrents, must exclude birds from the entire area, including where concentrated flux fields no longer exists. This is due to the fact the height of the flux field is higher than the tower during standby, and roughly the height of the tower during operation. Birds must be excluded from the entire area where flux is concentrated to reduce mortalities, however, that may not be possible considering the scale and physical characteristics of the flux field (i.e., largely invisible to birds).

Staff previously stated and continues to believe that hazing or deterrents should be developed through the scientific Technical Advisory Committee (TAC) developed for the project, and composed of the Petitioner's and responsible agency representatives. This will ensure that data for the specific project is taken into consideration. Staff is concerned that pre-determining a deterrent method may improperly limit the ability to select the most effective deterrent methods.

Potential Impacts Associated with Proposed Avian Deterrent Strategies

Following is a list of deterrent methods provided by the Petitioner.

Visual Deterrents:

- Balloons/Tethered Kites (TN 201838)
- Effigies/Scarecrows (TN 201838, TN 202488)
- Robotic Birds (TN 201838, TN 202488)
- Strobes (TN 202488)
- Eagle Eye (TN 201838)
- Lasers (TN 201838, TN 202488)
- Lights (TN 201838)
- UV Reflective Paint (TN 201838)

Auditory Deterrents:

- Air Cannons/Pyrotechnics (TN 201838, TN 202488)
- Propane Cannon (TN 202488)
- Long Range Bioacoustic Unit (TN 202488)
- Distress Signals (TN 201838)
- UltraSonics (TN 201838)
- Omni-directional speakers (TN 202488)
- Bioacoustics (TN 202488)

Active Pursuit Deterrents:

- Dogs (TN 201838, TN 202488)
- Trained Falcons (TN 201838, TN 202488)
- Drones (TN 201838)

Passive Deterrents:

- Habitat Management (TN 202488)
- Exclusion (TN 202488)
- Operational Controls (TN 202488)

Detect and Deter Systems:

- Bird Avert (TN 201838)
- BSTAR (TN 201838)
- Furuno Model Radar (TN 201838)
- LRAD & Merlin (TN 201838)
- DTBIRD (TN 201838)
- Bird Strike Defense Robot (TN 201838)
- DeTect Testimony on Deterrent Method (Ex. 1140)
- Biological Resources Supplemental Opening Testimony of Elwood G. Norris – Description of HyperSound Technology (Ex. 1141)

Other Types:

- Irritant Fogging (TN 201838)
- Magnetism (TN 201838)

Staff considered whether these deterrent methods would result in potential impacts for each subject area. The only subject areas to identify potential impacts with certain deterrent methods are Biological Resources, Cultural Resources, Visual Resources, and Traffic and Transportation.

Biological Resources

Staff reviewed these deterrent methods for possible impacts to biological resources and provided an overview of them in “Energy Commission Staff Supplemental Staff Assessment and Testimony” (TN 202480 Pages 21-22). Staff found that many of the deterrent methods submitted by the Petitioner have the potential to result in direct and indirect impacts to sensitive plants and wildlife depending on how they are utilized. Hazing methods that occur off the project site or that degrade habitat values in off-site locations or result in the displacement of non-target species may warrant additional mitigation.

Cultural Resources (Thomas Gates, Mike McGuirt, and Lorey Cachora)

General

To the extent that some wildlife are considered contributing attributes of the Chuckwalla Valley portion of the Pacific to Rio Grande Trails Landscape (PRGTL), affects to wildlife constitute affects to the landscape.

Specific

Balloons and kites, Robotic Birds, Strobes, Eagle Eyes, Lasers, Lights and Drones would add visual elements to PRGTL that are non-conforming with the setting, feeling and associations related to PRGTL integrity.

Balloons and Kites that break loose from anchors may litter off-project areas of PRGTL (or other unspecified historical resources), further compromising PRGTL integrity. Placement of support structures for Balloons and Kites, Effigies, Eagle Eyes, Lasers, and Lights may require ground disturbances that could impact surface or subsurface archaeological resources.

Air or Propane Cannons, Pyrotechnics, Distress Signals, and Omni-directional speakers (and potentially drones) would add auditory elements to PRGTL that are non-conforming with the setting, feeling and associations related to PRGTL integrity.

Placement of support structures for Air or Propane Cannons, Pyrotechnics, Distress Signal, or Omni-directional speaker devices, may require ground disturbances that could impact surface or subsurface archaeological resources.

Cultural Resources staff does not have enough information on the following technologies to determine a potential impact: Long Range Bioacoustic Unit, Ultrasonics, Bioacoustics, Dogs, Trained Falcons, Bird Avert, BSTAR, Furuno Model Radar, LRAD & Merlin, DTBIRD, Bird Strike Defense Robot, and Magnetism.

Visual Resources (William Kanemoto)

For all of the proposed avian deterrent concepts, the project-specific implementation has not been described in any way. Hence the proposed number, size, extent and distribution of all of the concepts is not known. Without more specific information, a reliable determination of impacts for many or most of the proposed measures cannot be made.

However, because the immediate impact to the surrounding middle-ground viewshed (up to several miles from the project site) was assumed in the Staff Assessment to be strong and therefore potentially significant, the additional impact of the various proposed measures would not change the fact that visual impacts in those areas are already assumed to be significant. If the question is posed as 'would the proposed measure result in significant impacts where there otherwise are none,' the answer for all measures would most likely be 'no.' Significant impacts are already anticipated in the area surrounding the project; additional impacts would add to those, but would not create significant impacts where there are none. The exception to this conclusion would be where visual deterrents are deployed in any area *beyond* a middle-ground distance from the proposed project. Measures employed beyond middle-ground distance from the project could potentially cause significant impacts where there are now none.

If the question posed is 'would the proposed measure be significant on its own in the absence of the proposed project,' then the answers would likely vary. However, *all* of the proposed Visual Deterrents, with the possible exception of UV reflective paint, could *potentially* represent a significant visual impact on their own, depending upon the location, number and extent of their implementation/distribution.

Similarly, if the question posed is, 'regardless of anticipated project-related significant impacts, would any of the deterrent measures contribute *additional substantial* visual impact,' then *all* of the proposed Visual Deterrents, with the possible exception of UV reflective paint, could *potentially* represent a substantial additional visual impact, depending upon the location, number, extent, etc. of the implementation. In other words, CEQA impact conclusions would remain as in the Staff Assessment, but adverse impacts could have greater intensity/severity.

Visual impacts from auditory and active pursuit measures would not be likely to have unavoidable significant visual impacts.

In all cases where the listed deterrents could have an adverse effect, Visual Resources staff is in agreement with the preliminary conclusions of Cultural staff, i.e., that the greatest visual concerns and sensitivities would be from a cultural resources/historic integrity point of view. The threshold of significant adverse effect on cultural resources

would be lower, often substantially lower, than for visual impacts per se. This is because visual intrusions can potentially represent a significant disturbance to the cultural integrity of a historic setting at much lower levels of visual change than those which would represent a significant adverse visual change using the CEC staff or BLM visual methodologies. However, the preliminary conclusions summarized in the paragraphs above refer ONLY to significant visual impacts under CEC staff's visual impact methodology, independent of cultural resource considerations.

Traffic And Transportation (Andrea Koch and Gregg Irvin)

Staff reviewed these deterrent methods for possible impacts to the traffic and transportation system near PSEGS and found that the only potential concerns were for drones and lasers. Drones flying at high altitudes could potentially cause collision hazards to aircraft, especially considering the site's proximity to several Department of Defense military training routes. However, staff determined that impacts from lasers would be less than significant. Laser power would be optimized at the range effective for deterring birds and would decline with distance as the laser beam diverged. It would be unlikely for an aircraft or vehicle to intercept the laser beam, but if interception were to occur, the intercepted beam would be low power and would not cause distracting glare. Lasers used as bird-deterrents are designed to be eye-safe, so retinal damage would not occur to viewers at any range.

Noise (Shahab Khoshmashrab)

Staff reviewed these deterrent methods for possible noise impacts and determined that as long as the deterrent methods comply with Condition of Certification **NOISE-4**, the impacts would be less-than-significant.

CURTAILMENT

Ex.1137 - Biological Resources Supplemental Opening Testimony of Gustavo Buhacoff – Heliostat Operations at ISEGS and PSEGS (TN 202485)

The Petitioner supplied information responsive to the Committee's questions regarding the feasibility of curtailment to avoid or minimize adverse impacts. Mr. Buhacoff indicated, "It takes a heliostat 30 minutes to move from vertical to horizontal or vice versa. To move the heliostats from stow position to standby position takes each heliostat anywhere from 5 to 30 minutes." (TN 202485 Page Two) The information also noted: "If I am called upon to stop generating flux at the receiver (for instance, the turbine has tripped or some form of maintenance needs to be initiated), it would take 30 minutes to move all the heliostats from tracking to stow." (TN 202485 Page Three)

Staff Response

Staff supports the use of temporary or seasonal curtailment as a method to avoid mortality to birds from exposure to solar flux if it proves to be effective (TN 202480 Page 16). The effectiveness of curtailment is a function of detecting target birds and flight paths from adequate distances in order to allow the facility time to re-position the mirrors such that dangerous flux levels (1.3 kW/m² and above) are eliminated.

Assuming an average flight speed of 20 miles per hour,² a bird can travel five miles in 15 minutes. However, avian flight speeds are species and task dependent (i.e., is the bird soaring, foraging, migrating) and velocities are often much lower than 20 miles per hour. If a bird flying 20 mph is detected five miles out, which appears possible using Merlin Radar (TN 202488 Page 4), it would fall within the range of time to move the heliostats from stow to standby position (5 to 30 minutes), but not within the 30 minute period required to stop generating flux at the receiver and move all the heliostats from tracking to stow.” (TN 202485 Page 3) “Even if birds are detected in flight the Merlin system does not identify the targets it tracks by species.” (TN 202488 Page 34) The system may be capable of discerning large birds from small birds (such as raptors) however the decision to implement curtailment would likely be given priority to large flocks of birds, state or federally listed or protected species, and fully protected species such as golden eagles. Given the limits of visually detecting these species with optics (often less than 100 yards in good conditions for small birds and up to 500 yards for some large raptors or vultures) there may not be adequate time to implement curtailment. Spotting scopes are difficult to use to track birds in flight and may hinder the ability of the searcher to identify a given species of bird. If birds were detected at closer ranges or flying at elevated velocities the time available to curtail flux would be further reduced.

Ex. 1136 – Bio Supplemental Opening Testimony of Matt Stucky, Chris Morris and Charlie Turlinski – Infeasibility of Curtailment (TN 202284)

The Petitioner supplied information regarding the feasibility of curtailment and the economic effect it would have on obtaining financing for PSEGS. Specifically the Petitioner stated “As will be explained below, a curtailment condition would result in almost all circumstances in a non-financeable project. Before beginning that discussion, however, we would note that the testimony provided here is focused on the practical and economic limitations associated with the curtailment concept. However, as a threshold matter, PSH does not agree with the premise that curtailment of operations is an appropriate mechanism to respond to potential avian impacts associated with the project. PSH has filed other testimony (Exhibit 1134) that addresses the magnitude of potential avian impacts, as well as minimization and mitigation measures that address the issue of avian impacts in a much more targeted and effective manner than that which would result from a curtailment condition.” (TN202484 Page 2) The Petitioner provides additional testimony in regards to long interval (time - or calendar-based curtailment) and short interval event-triggered curtailment in regards to the economic and feasibility of these actions.

Staff Response

Biological resources staff has no comment on financing or feasibility of obtaining project funding with respect to curtailment as a mechanism to reduce impacts to avian species. As described in response to TN 202485 (Exhibit 1137-Biological Resources Supplemental Opening Testimony of Gustavo Buhacoff – Heliostat Operations at ISEGS and PSEGS) staff supports the use of temporary or seasonal curtailment as a

² (<http://www.npwrc.usgs.gov/resource/birds/migratio/speed.htm>)

method to avoid mortality to birds from exposure to solar flux if it proves to be effective. However, staff remains uncertain if curtailment would be feasible and will not be recommending revisions to Condition of Certification **BIO-16** to include a curtailment plan.

OPENING TESTIMONY

Ex.1134 - Biological Resources Supplemental Opening Testimony Wally P. Erickson And Dr. Ken Levenstein – Avian Impacts (TN 202482)

The Petitioner presents testimony on avian mortality data and the Fish and Wildlife Life Office of Law Enforcement memo titled Avian Injury and Mortality Data Reported at Solar Energy Projects and dated February 14, 2014 (Exhibit 1154 TN 202522) and attempts to put the risk to birds from PSEGS into context with other technologies and existing threats. The testimony includes a brief discussion on curtailment, provides an overview on the development of a Draft Bird and Bat Conservation Strategy (BBCS), which includes a Risk Assessment, and the benefits of adaptive management and the use of deterrents. The document also provides testimony on the use of performance standards and recommended mitigation strategies that would be employed at PSEGS.

This testimony summarizes many other reports and references multiple exhibits including the updated Avian Comparison Table (TN 202481), United States Fish and Wildlife memo (TN 202522), Table Comparing Solar Project Capacity and Acreage (TN 202524), Draft Bird and Bat Conservation Strategy (BBCS) (TN 202487), Anthropogenic Sources of Avian Mortality (TN 202506), Pre-Construction Field Survey Efforts Conducted at PSEGS Project (TN 202527), Fall Diurnal Raptor Plot (TN 202529), Flux Projections at PSEGS (TN 202530), among others.

Staff Response

Staff has provided previous testimony on many of the points presented in Petitioner's testimony and there remains disagreement on a number of areas including but not limited to the conclusions presented by the Petitioner regarding the magnitude of the impact to birds, the value of existing data to provide predictive modeling of impacts at PSEGS, the efficacy of deterrents proposed, and the approach to mitigation. Staff considers many of the statements and assumptions presented in this testimony to downplay the risk to birds from PSEGS and rely on incomplete data or unproven assumptions on the effectiveness of deterrents. Staff has provided specific responses to key areas of the Petitioner's testimony where additional rebuttal is needed for clarification.

Heliostat Fields vs. PV and Solar Trough Fields

The Petitioner states that, "heliostat fields may pose a reduced risk to birds relative to PV or solar trough facilities due to less dense spacing and multi-axis mobility. Compared to PV panels and parabolic troughs, heliostats also offer the greatest potential to employ adaptive management techniques involving different stowing positions to reduce avian collision impacts at PSEGS."(TN 202482 Page 2-3).

The Draft BBCS noted this is related to nighttime stowing of the heliostats or during windy conditions. As stated by the Petitioner: “What positioning of heliostats at night results in the least impact to birds as determined by an experimental test of heliostat positioning regimes?” (TN 202482 Page 11) Correct positioning of heliostats may reduce collision impacts for some birds at night. However, many of the nocturnal migrants typically fly at elevations well above the heliostats. In any event, the less-dense spacing and multi-axis mobility does nothing to reduce the added risk of exposure to solar flux which is not present at other technologies.

Other Anthropogenic Sources of Avian Mortality

In an attempt to reduce the significance of mortality caused by PSEGS, the Petitioner provides mortality numbers from wind farms, hunting, feral cats, and a suite of other anthropogenic sources (See Exhibit 1157 TN 202506). The Petitioner states: “It is very important to put these numbers into some context. In fact, the most significant concern over impacts to many wildlife populations, including birds, is over the effects of climate change (Foden et al. 2013) and habitat loss (BirdLife International website).” (TN 202484 Page 4)

Staff is aware of the risk to birds from the anthropogenic sources provided by the Petitioner and global climate change. However, staff believes referencing nationwide mortality estimates and comparing avian loss to low-risk, managed species such as ducks (non-sensitive species that are extensively managed and regulated by resource agencies) or loss from collisions with windows or vehicles obfuscates the risk to birds from PSEGS. Many of the species present in the PSEGS area are sensitive and regulated by state and or federal agencies because their populations have declined or are at risk of extinction. The Petitioner suggested that “Studies like Longcore et al. (2013) and Erickson et al. (2014, in review) suggest that avian mortality cumulatively from thousands of communication towers and wind turbines for the great majority of waterfowl, songbirds, and waterbirds, is a relatively minor source of mortality for individual species populations.” This statement may be true for robust common species but does not account for local populations of sensitive birds where the removal of a small number of birds may affect the persistence or recovery of a local population. It is inappropriate to dilute impacts to species that may be subject to mortality at PSEGS by comparing them to nationwide mortality estimates.

Assertions by the Petitioner that PSEGS has lower risk factors (TN 202484 Page 5-6) because the facility does not appear to be in a high bird use area, does not have guy wires, and the towers are solid rather than composed of lattice steel is overstated. The towers are approximately 750 feet tall and structures such as these represent a documented collision risk. The use of intermittent red lighting on the towers is a requirement and while this would reduce collision risk it would not eliminate collision events. Staff believes the contention that PSEGS has lower avian use is misleading. The data collected by the Petitioner is extremely useful and represents a solid effort to collect data. However, one year of surveys cannot fully account for the migratory use of the PSEGS region. Migration counts are often highly variable, from hour to hour, day to day, and year to year, in large part due to variability in weather conditions that provide

lift for raptor migration or concentrate birds in certain landscape features. More importantly surveys conducted by the Petitioner documented 185 species of birds including 32 species considered sensitive at the state or federal level. Some of these include the state listed Swainson's hawk, bank swallow, willow flycatcher, and Gila woodpecker. Two fully protected species including the golden eagle and peregrine falcon were also observed. Six federal priority shorebirds were observed at the ponds adjacent to the PSEGS. At a minimum this demonstrates the area is used by a wide variety of resident and migratory species.

Draft Bird and Bat Conservation Strategy and Risk Assessment

The Petitioner provides an evaluation of risk to birds from the operation of the PSEGS, referencing updated avian mortality data from ISEGS (Exhibit 113 TN 202481), field surveys conducted at PSEGS (Exhibit 1158 TN 202527), flux projections at PSEGS (Exhibit 1160 TN 202530), and mortality data from ISEGS (Exhibit 1161 TN 202533 and Exhibit 1162 TN 202534). In this testimony the Petitioner indicates: "This risk region takes the form of a cylinder 100 m in radius extending from 176 to 280 m above ground level. As shown on Exhibits 1161 and 1162, which plot the ISEGS avian data, this level of highly concentrated flux is consistent with the mortality data collected at ISEGS where, as indicated by the distribution of flux damaged carcasses, the vast majority of flux damage appears to be taking place near the tower." (TN 202482 Page 7) The Petitioner then overlaid flight paths from surveys conducted in the Fall of 2013 and "[u]sing these data, we estimated the number of flight paths potentially passing through the region of risk." (TN 202482 Page 7)

Using a risk model similar to that of the USFWS fatality prediction model for eagles, the Petitioner "estimated that approximately 665 to 1228 flight paths of birds would be exposed to solar flux within the danger zone per year under a no avoidance or no attraction assumption." (TN 202482 Page 8)

Staff agrees the data demonstrates there is a significant increase in risk of exposure to elevated levels of solar flux as a bird approaches the tower. However, staff considers the area of risk to be greater than that presented by the Petitioner in their testimony. As evidenced in Figure 1a and 1b, mortalities have been detected across the site, and off the site as far as two miles. Staff acknowledges the Petitioner developed the risk analysis in an attempt to provide an estimate of avian mortality for the PSEGS. However, based on a review of the Petitioner's surveys, mortality data for ISEGS, and flux models for PSEGS developed by staff, the mortality estimates provided by the Petitioner appear low and do not represent the correct scale for a project such as PSEGS. Staff modeled the three dimensional volume of the PSEGS and ISEGS power towers with their representative solar flux fields to illustrate the relative sizes between the two solar power tower plants (Figure 1. Attachment A: Assessment of Relative Risk to Avian Species Between Ivanpah and Palen Projects). Based on a review of Figure 1, the PSEGS flux field occupies a substantially greater volume and area relative to the ISEGS flux field. Therefore the area where birds would be exposed to dangerous levels of solar flux has not been adequately assessed by the Petitioner in their risk analysis. Staff is concerned that the avian flight data will not reflect conditions at the PSEGS site

and that assuming only birds with singed feathers have suffered exposure to solar flux underestimates mortality figures. Each of these points is addressed below.

The Area of Damaging Flux is Larger for PSEGS

There are several important differences between the ISEGS flux fields and those expected for PSEGS. The PSEGS towers are substantially larger and the heliostat fields would be configured in a different shape from ISEGS. These factors would result in a much different shape of the flux field than what was portrayed (Exhibit 1160 TN 202531). Given the scale of the field, staff believes the Petitioner formulated their risk analysis on incorrect assumptions. Figure 1 (Attachment A: Assessment of Relative Risk to Avian Species Between Ivanpah and Palen Projects) demonstrates the different scale of the flux fields which is substantially larger at PSEGS, in both height and width, compared to ISEGS. The volume of high risk of injury proposed by the Petitioner ranges from 25 kW/m² to 50 kW/m² or greater flux. This would result in a cylinder 100 m in radius extending from 176 to 280 m above ground level. The petitioners proposed high risk zone appears to have been determined by overlaying a predicted PSEGS flux density map over a map of the ISEGS mortality data. This area would cover only 0.45 percent of the total solar field area. However, staff contends using a threshold of 25 kW/m² is too low and that counting only birds that have visible evidence of solar flux damage (i.e., singed feathers) underrepresents true mortality figures as explained below.

The Assumptions of Damaging Levels of Solar Flux are Too Conservative

The Petitioner notes the vast majority of visually identifiable flux damage appears to be taking place near the tower.” (TN 202482 Page 7) Staff acknowledges this area contains elevated levels of flux that would be expected to result in rapid feather damage and appears to be where the majority of birds with singed feathers are found based on current sampling protocols at ISEGS. Staff has stated in previous testimony that birds would likely suffer damage from elevated levels of solar flux and may either fly off the site or suffer lethal levels of exposure (TN 200442 Page 4.2-154-155). Staff has also stated that the potential for injury depends on a variety of factors including the size and type of the bird, length of exposure, and the level of solar energy flux (TN 202449 Page 4.2-155). The Forensics Laboratory report noted: “overlapping portions of feathers and light colored feathers were often spared.” (Exhibit 3107 TN 202538 Page 12). This suggests the color of the bird may also be a risk factor. That feather color is a factor in flux intensity tolerance for damage, and that overlaying feathers would be protective of covered feathers is consistent with staff’s prior testimony and staff’s model of flux-heating of feathers to the point of damage.

Staff has analyzed the distribution of avian mortality within the solar field for ISEGS for the months of March through May 2014 for two categories: singed and non-singed birds. When corrected for factors such as survey intensity the data indicates the rate of mortality per unit area of solar field increases with proximity to the receiver tower. The data suggests the trend is not consistent with Petitioner’s assumption that there is a critical flux intensity below which no increased risk of mortality exists. Nor is the data consistent with an assumption the risk of avian mortality without visibly detectable

feather damage is uniform over the solar field. The data strongly suggests that risk for avian mortality without visibly detectable feather damage also increases with proximity to the solar receiver tower.

If flux-related mortality is limited to only birds with visible evidence of feather damage, the distribution of dead birds with no visible evidence of feather damage should be evenly distributed across the project site. This is because collisions, outside of those occurring with project features such as the tower, power block, and fences, and other non-flux-related deaths would be expected to be randomly scattered across the heliostat fields. Instead, as shown in Figure 3 (Attachment A: Assessment of Relative Risk to Avian Species Between Ivanpah and Palen Projects), the avian mortality per acre increases toward the towers, which suggests other factors are contributing to mortality.

This may be the result of non-visible damage from exposure to solar flux. Based on basic physiologic principles, any bird exposed to more than one sun is likely subject to some form of thermal stress, even for limited periods of time. Safe exposure levels for humans are extremely low and range from 1.4 kW/m² to 5 kW/m² (TN 200442 Page 4.2-154). Staff has previously stated that mortality or the lethal dose is related to the time and intensity of the flux and that even low level exposure of flux may be damaging if the bird remains exposed for too long. Staff is aware that the Forensic Lab Report noted that: “skin or internal organ damage from exposure to high temperatures in solar flux may not be a major cause of the observed mortality.” (TN 202538 Page 19) This may be true for some heat related injuries but does not explain the concentration of birds with non-visible injuries and scientifically peer reviewed experiments on living birds exposed to solar flux have not been conducted.

Monitoring, Adaptive Management, Deterrents and Performance Standards

The Petitioner stated: “The BBCS also includes a comprehensive monitoring plan to quantify the levels of impact from the project, and focus additional monitoring, research and mitigation through an adaptive management process which will include testing and updating of the risk assessment. The monitoring plan will be designed to estimate Project impacts to birds and bats, and will incorporate measures to adjust the data for uncertainty.” (TN 202482 Page 8) Staff recommends the monitoring plan in a BBCS be more robust than the plan currently in place at ISEGS and would provide specific recommendations to that plan through formal comments on the Draft BBCS. At this time staff believes there remains too much uncertainty as to the risk to birds from the PSEGS, and monitoring protocols should not be restricted to the limited data sets and assumptions proposed by the Petitioner. A final BBCS monitoring plan should be designed to generate substantive data that will inform the adaptive management process, allowing the TAC to clearly understand what additional monitoring, research and mitigation may be needed.

The Petitioner also states: “Data from ISEGS do not appear to support the hypothesis that monitoring will significantly underestimate mortality due to birds being impacted by the project and landing outside the search areas.” (TN 202482 Page 9) Staff has written

extensively on the limitations of current monitoring protocols at ISEGS in previous testimony and above under “The Assumptions of Damaging Levels of Solar Flux are Too Conservative” section. A more robust monitoring plan for PSEGS would reduce the likelihood of underestimating mortality. Staff contends that there is enough information from the Ivanpah mortality data to reject a hypothesis that staff’s assumptions on flux-related risk are too conservative or there may be some critical threshold in the range of 25 to 50 kW/m². Based on this data staff contends it is now prudent to allow for the absence of some critical threshold of flux intensity in designing data collection and survey protocols for PSEGS, and most importantly for driving the design of potential mitigation strategies.

It is important to understand staff’s concern with the basis of the Petitioners assumptions as it is central in securing the project owner’s commitment to developing a comprehensive monitoring and deterrent scheme. Considering the difference in scale between the two projects, their geographic locations, differences in bird use and abundance, and that there appears to be a correlation between certain areas of solar flux and large numbers of bird mortality exhibiting non-visible feather damage, a BBCS monitoring plan should be substantially more robust than the ISEGS plan, including a broader range of 100 percent survey area around the towers. In addition, the Draft BBCS appears to ignore some of the recommendations of the Forensic Lab Report and does not include any monitoring or reporting requirements for insects. For example the Forensic Lab Report recommends the installation of video cameras on the towers and increased daily searches of the area below the towers.

It also appears the Petitioner would test only a limited set of deterrents. Specifically the Petitioner stated “In order to further research in the area of detection and deterrent technologies and to evaluate the effectiveness of these systems in mitigating impacts to birds at PSEGS, PSH is committed to testing two different detection technologies and two different deterrent technologies at the Project.” (TN 202487 Page 65) The inclusion of additional monitoring, use of cameras, and a variety of deterrent technologies should be a requirement of a BBCS.

The Petitioner stated: “An extensive series of mitigation measures and advanced conservation practices (ACPs) will be incorporated into the construction and operation phases of the Project to reduce any risk that might be posed by the facility to birds and bats.” (TN 202482 Page 9) Staff has provided previous testimony regarding the implementation of adaptive management and deterrent methods and encourages the use any effective system that does not result in significant un-mitigated impacts to other resources or to species off the project site. However, staff remains unconvinced that all deterrents and management practices will be effective and that the Petitioner can significantly reduce all risks to birds, bats, and insects during construction and operation of PSEGS.

The Petitioner stated: “We agree that performance standards or adaptive management thresholds are a useful tool that has been used in other similar contexts for implementing management actions at wind projects. However, it is important to note

that the traditional use of performance standards is to ensure that impacts do not rise above the threshold of significance set for evaluation under the California Environmental Quality Act (CEQA).”... “With that in mind, we believe that the best approach to incorporate performance standards would be to propose performance standards that can be modified and implemented by the Technical Advisory Committee (TAC) as appropriate.” (TN 202482 Page 11)

Staff concurs the TAC would be an effective forum to determine effective monitoring and mitigation approaches for the PSEGS. In “Staff’s Response to the Petitioner’s Motion to Reopen Evidentiary Record,” staff stated that thresholds or triggers requiring additional mitigation based on the collection of additional data would be valuable but was clear that setting discrete thresholds (i.e., a given number of birds or each species) would be extremely difficult and potentially arbitrary (TN 202480 Page 18). In this document, staff provided proposed thresholds for target birds. Staff believes that specific language should be included in a BBCS to ensure impacts to state and federally listed or proposed threatened or endangered species and state designated fully protected species require the implementation of focused mitigation efforts to ensure these at risk populations are provided mitigation to off-set mortality from PSEGS.

Revisions to Condition of Certification BIO-16b

In consideration of the PSEGS project, and the potential to impact significantly more insects, birds, and bats than the ISEGS project, staff has recommended edits to Condition of Certification **BIO-16b**. Staff revised the monitoring period from three to five years. Based on variables such as weather, drought, vagaries in avian migration timing and flight path, staff believes this timeline would allow the petitioner to identify and correct any bias or faults in the monitoring program and statistical analysis of the data to ensure the information accurately represents impacts of PSEGS. Staff revised language to include low-intensity monitoring of the site during operations as directed by the TAC. The Petitioner would be required to remove carcasses from the site on a routine basis to reduce the attractiveness of the site to avian scavengers such as ravens. This would allow for detection and response to any large-scale mortality events, and the information from this effort would be useful in adaptive management. Staff’s intent in this proceeding is to recommend that monitoring and adaptive management of the site would occur throughout operations to some degree in order to be responsive to impacts and changing conditions at the site.

Condition of Certification **BIO-16b (Avian and Bat Protection Plan)** has been revised since the FSA and changes are shown with new text in **bold underline** and deleted text in ~~strikethrough~~:

AVIAN AND BAT PROTECTION PLAN

BIO-16b The Project owner shall prepare a Bird and Bat Conservation Strategy (BBCS) and submit it to the CPM for review and approval, in conjunction with BLM, CDFW, and USFWS for review and comment or, if available, shall implement a standard monitoring protocol as developed by the BLM,

USFWS, CDFW, and Energy Commission staff. The BBCS, whether developed by the project owner or the regulatory agencies, shall provide for the following:

- Survey and monitor onsite and offsite avian use and behavior to document species composition on and offsite, compare onsite and offsite rates of avian and bat use, document changes in avian and bat use over time, and evaluate the general behavior of birds in and near the facility.
- Implement an onsite and offsite (if feasible) avian and bat mortality and injury monitoring program to identify the extent of potential avian or bat mortality or injury from collisions with facility structures or from elevated levels of solar flux that may be encountered within the facility airspace, including:
 - assessing levels of collision-related mortality and injury with heliostats, perimeter fences and power tower structures;
 - calculating rates of solar flux-related avian mortality and injury, if any;
 - documenting seasonal, temporal, and weather-related patterns associated with collision- or solar flux-related mortality and injury, if any;
 - documenting flight spatial patterns that may be associated with collision- or flux-related mortality and injury, if any, and.
 - documenting spatial patterns that may be associated with avoidance of the facility.
- Identify specific conservation measures and/or programs to minimize impacts and evaluate the effectiveness of those measures.
- Implement an adaptive management and decision-making framework for reviewing, characterizing, and responding to quantitative survey and monitoring results.

BBCS Components

The project owner shall prepare and implement a BBCS adopting all requirements applicable to solar generation in current guidelines recommended by the USFWS (currently 2012 USFWS Land Based Wind Energy Guidelines). The BBCS shall include the following components:

1. Preconstruction Baseline survey results. A description and summary of the baseline survey methods and results.

2. Formation of a technical advisory committee (TAC). The TAC will consist of a single representative of the BLM, CEC, CDFW, USFWS, one representative of the Project Owner involved in operation of the project and one representative of the Project Owner with environmental compliance responsibilities. The representatives of the Project Owner will not have voting rights on the TAC. The TAC will facilitate concurrent project owner, CPM, and state and federal wildlife agency review of seasonal and annual survey results development of a decision-framework for evaluating, the effectiveness of the adaptive management measures implemented by the project owner, modification of the surveys in response to the results, if necessary, and the identification of additional mitigation responses that are commensurate with the extent of impacts that may be identified in the monitoring studies. A meeting schedule for the TAC will be identified, for regular review of avian and bat injury and mortality monitoring results, and recommend to the CPM for approval any necessary changes to monitoring, adaptive management, and appropriate dissemination of mitigation funds per BIO-16a #2. The TAC will also assist the CPM in implementing the following provisions #3 - #8 and the CPM will have the authority to require independent, third-party monitoring, if it determines that the project owner is not monitoring consistent with the approved BBCS and the project owner fails to timely cure such inconsistency after reasonable advance notice from the CPM.
3. Avian and bat use and behavior surveys. Avian and bat site-use behavior surveys shall be conducted during construction and operation. The program will outline survey methodology and field documentation, identification of appropriate onsite and offsite survey locations, control sites, and the seasonal considerations. Prey abundance surveys will also be conducted to identify the locations and changes in the abundance of prey species. Bat acoustic sampling may be implemented depending on results of the baseline study.
4. Golden eagle nest surveys and monitoring. Results of annual pedestrian and/or helicopter surveys of golden eagle nesting sites within a 10-mile radius of the project site, including a summary of available information concerning golden eagle nesting activity in the project vicinity.
5. Avian and bat mortality and injury monitoring: An avian and bat injury and mortality monitoring program shall be implemented during construction and operation of the project. The results of avian monitoring data shall be reported directly to the CPM and the project owner, as well as all raw data and field notes. Monitoring activities will include:
 - (a) Onsite monitoring that will systematically survey representative locations within the facility, at a level that will produce statistically robust data; account for potential spatial bias and allow for the extrapolation of

survey results to unsurveyed areas and the survey interval based on scavenger and searcher efficiency trials and detection rates.

- (b) Offsite monitoring, to the extent that access can be reasonably and feasibly obtained by the project owner, of one or more locations adjacent to the project facilities using the same or comparable methods as implemented for the onsite monitoring to identify which avian species potentially injured by collisions or solar flux within adjacent areas.
- (c) Low-visibility and high-wind weather event monitoring to document potential weather-related collision risks that may be associated with the power towers at the facility, including foggy, highly overcast, or rainy night-time weather typically associated with an advancing frontal system, and high wind events (40 miles per hour winds) are sustained for period of greater than 4 hours. The monitoring report shall include survey frequency, locations and methods.
- (d) Scavenger and searcher efficiency trials to document the extent to which avian or bat fatalities remain visible over time and can be detected within the project area and to adjust the survey timing and survey results to reflect scavenger and searcher efficiency rates.
- (e) Statistical methods used to generate facility estimates of potential avian and bat impacts based on the observed number of detections during standardized searches during the monitoring season for which the cause of death can be determined and is determined to be facility related.
- (f) Field detection and mortality or injury identification, cause attribution, handling and reporting protocols consistent with applicable legal requirements.

6. Flying Insect Use and Behavior Monitoring. An insect behavior and mortality monitoring program shall be implemented during construction and operation of the project. The results of insect monitoring data shall be reported directly to the CPM and the project owner, as well as all raw data and field notes. Monitoring activities will be designed with the goal of answering the following questions:

- **Identify if state or federally protected insects are subject to mortality;**
- **Document mortality rate of migratory and non-migratory species, particularly declining and migratory species such as monarch butterflies;**

- Evaluate the effects of project features such as the solar tower, solar receiver, and heliostats as potential attractants to insects;
- Evaluate the potential for project effects substantially contribute to the decline of any threatened, endangered, or special status insect species;
- Conducting multi season surveys to account for seasonal variations in insect populations and assemblages;
- Perform surveys in off-site locations in up and downwind areas;
- Account for the irruptive ecology of most insects by performing surveys during normal or above average rain years; and
- Evaluate the effectiveness of adaptive management upon insects impacted at the project site.

7. Survey schedule and period. All surveys and monitoring studies included in the BBCS shall be conducted for at least ~~three~~ **five** years following commercial operation and approval of the BBCS by the CPM. At the end of the ~~three~~ **five**-year period, the project owner, the TAC and the CPM shall meet and confer to determine whether the survey program shall be continued for subsequent periods. The monitoring program may be modified with the approval of the CPM in response to survey results, identified scavenging efficiency rates, or other factors to increase monitoring accuracy and reliability or in accordance with the adaptive management decision-making framework included in the BBCS. The individuals conducting the surveys and monitoring shall be available to the CPM or Energy Commission biological resources staff to answer questions on monitoring status, survey methods or the results of monitoring studies, and shall not be precluded from sharing their full and complete knowledge of the monitoring program, incidental observations, and results with the CPM or responsible Energy Commission staff.

At the conclusion of the survey program, the TAC shall determine if a long-term monitoring plan is warranted. The level and intensity of surveys will be such that any large-scale mortality events would be detected, and consist of minimal monthly or seasonal sampling of the site. Carcasses would be documented and photographed, and then removed as prescribed by the BBCS.

8. Adaptive management. An adaptive management program shall be developed to identify and implement reasonable and feasible measures that would reduce any biologically significant levels of avian or bat mortality or injury attributable to project operations and facilities. **The program shall also consider the potential to reduce or minimize any biologically significant level of mortality of threatened or endangered insects.** Any such impact reduction measures must be

commensurate (in terms of factors that include geographic scope, costs, and scale of effort) to the level of avian or bat mortality or injury that is specifically and clearly attributable to the project facilities. The adaptive management program shall include the following elements:

- (a) Reasonable measures for characterizing the extent and significance of detected **avian, bat, and insect** mortality and injuries clearly attributable to the project and ensuring adequate funding for wildlife rehabilitation activities necessary for injuries clearly attributed to the project or wildlife found on site and approved by the CPM, in conjunction with the USFWS and CDFW. The Designated Biologist or Biological Monitors shall identify and photograph the injured or dead birds or bats in-situ, as well as a fullframe dorsal, ventral and head view using a camera with an automatic GPS and time/date stamp. The record(s) will be provided to the CPM in the monthly compliance report during construction and operation.
- (b) Measures that the project owner will implement to adaptively respond to detected mortality and injuries attributable to the project, including passive avian diverter installations along the perimeter or at other locations within the project to avoid site use, the use of sound, light or other means to discourage site use consistent with applicable legal requirements, onsite prey or habitat control measures consistent with applicable legal requirements, and additional perch and nest proofing of project facilities, **or use of deterrent mechanisms in concert with radar or other advance-warning system.**

9. Eagle Protection Plan (EPP): The project owner shall prepare and implement an Eagle Protection Plan adopting all requirements applicable to solar generation as outlined in guidelines recommended by the USFWS (currently 2012 USFWS Land Based Wind Energy Guidelines 2011b). The EPP may be prepared as a stand-alone document or included as a chapter within the BBCS. The EPP shall describe all available baseline data on golden eagle occurrence, seasonality, activity, and behavior throughout the project area and vicinity. The EPP shall outline a study protocol consistent with Item 5 above to include annual pedestrian and/or helicopter surveys of golden eagle breeding sites within a 10 mile radius of the project site, to be reviewed and approved by the CPM, in consultation with the USFWS, BLM, and CDFW. The EPP shall describe all proposed measures to prevent death and injury of eagles from (1) collisions with facility features including the heliostats, power towers, and gen-tie line towers or transmission lines, (2) electrocutions on transmission lines or other project components, and (3) concentrated solar flux created over the solar field. The EPP shall describe efforts taken pursuant to BIO-16a.

The EPP shall also include any feasible adaptive modifications to heliostat positioning during operation (including day time and night time) in order to minimize collisions and/or risk of exposure to concentrated solar flux. Any such adaptive minimization measures must be commensurate (in terms of factors that include geographic scope, costs, and scale of effort) to the level of avian or bat risk that is specifically and clearly attributable to the project facilities. The EPP shall provide a reporting schedule for all monitoring or other activities related to bird or bat conservation or protection during project construction or operation. The EPP shall be subject to review and approval by the CPM in consultation with CDFW, BLM, and USFWS, and shall be incorporated into the project's BRMIMP and BBCS, and implemented.

Verification: The BBCS (and EPP if submitted under separate cover) shall be submitted to the CPM for review and approval and to CDFW, BLM, and USFWS for review and comment no less than 60 days after start of construction. The project owner shall provide the CPM with copies of any written or electronic transmittal from the USFWS, BLM, or CDFW related to the BBCS within 30 days of receiving any such transmittal. Survey reports shall be submitted to the CPM after each season and in an annual summary report throughout the course of the ~~three~~ **five**-year study period and as set forth in the approved monitoring study plan. The reports will include all monitoring data required as part of the monitoring program, such as photographs, GPS locations, observations, and other information required by the CPM.

Methods and results of the Monitoring Study shall be submitted to the CPM in Monthly and Annual Compliance Reports throughout the course of the study, or as otherwise directed by the CPM. Mortality or injuries of special status species shall be reported to the CPM via phone and email within one working day of discovery. The Monitoring Study shall continue until the CPM, in consultation with CDFW, BLM, and USFWS, concludes that the cumulative monitoring data provide sufficient basis for estimating long-term bird mortality for the project. The reports will include all monitoring data required as part of the monitoring program.

The reports shall also summarize any additional wildlife mortality or injury documented on the project site during the year, regardless of cause, and assess any adaptive management measure implemented during the prior year as approved by the CPM. After the ~~third~~ **fifth** year of the monitoring program, the CPM shall meet and confer with the TAC to determine if the study period shall be extended based on data quality and sufficiency of analysis, or if needed, to document efficacy of any adaptive management measures undertaken by the project owner. If a carcass of a golden eagle or any state or federally listed threatened or endangered species is found at any time by the monitoring study or project operations staff, the project owner, Designated Biologist, or other qualified biologist that may be identified by the Designated Biologist shall contact the CPM, CDFW and USFWS by email, fax or other electronic means within one working day of any such detection.

Mitigation

The Petitioner stated: "PSEGS has voluntarily committed compensatory mitigation funds to help offset bird mortality that occurs due to operations at the Project. These funds will be directed to programs that benefit birds of taxa similar to those impacted by the project. For example, if songbirds incur fatalities, contributions will be made to programs that benefit songbirds." (TN 202482 Page 11)

Staff has provided previous testimony regarding the development of mitigation to reduce impacts to resident and migratory birds and recommends the TAC be used to focus mitigation efforts for target species. Implementing mitigation such as spaying or neutering of feral cats (TN 202482 Page 13) would reduce impacts to some groups of birds but staff cautions many of the bird deaths reported likely occur in urban areas where many sensitive native species have already been displaced. Mitigation efforts may be better focused on habitat creation or bird management activities.

Exhibit 1139 - Draft Bird and Bat Conservation Strategy (TN 202487)

The Petitioner submitted a Draft BBCS which is used to support Exhibit 1134 - Biological Resources Supplemental Opening Testimony Wally P. Erickson and Dr. Ken Levenstein – Avian Impacts (TN 202482). The BBCS references many of the same exhibits presented in Exhibit 1134. As stated by the Petitioner: "The purpose of this Bird and Bat Conservation Strategy (BBCS) is to:

- Describe the use of the site by avian and bat species prior to project construction, as determined by pre-construction surveys
- Describe the monitoring program that is tailored to identify potential avian impacts associated with the facility
- Develop performance standards to guide a decision making framework
- Describe the formation and roles of a technical advisory committee
- Describe the adaptive management program, including the identification of deterrent methods that may be employed to reduce avian injury and mortality
- Satisfy CEC Condition of Certification BIO-16b." (TN 202487 Page 1)

The BBCS includes a summary of previous avian surveys conducted at PSEGS previously submitted to staff, a risk analysis based on predictive modeling of flight patterns and maps of solar flux, avoidance and minimization measures, monitoring protocols, data analysis with fatality estimates, and adaptive monitoring and management (TN 202487 Table of Contents Pages i-iv).

Staff Response:

A Bird and Bat Conservation Strategy (BBCS) is a requirement of Condition of Certification **BIO-16b** and will be reviewed and revised by the Compliance Project Manager and resource agencies if the project is approved. The USFWS, one of the review agencies, will be providing guidance to developers such as the Petitioner, to guide the development of a BBCS.

There remains significant disagreement between staff and the Petitioner on numerous sections of the Draft BBCS including the assumptions and conclusions of the risk analysis, descriptions of the flux fields, mortality thresholds (i.e., safe levels of solar flux), use of predictive flight paths as a proxy for mortality estimates based on this data, use of deterrents, and mitigation. Please see staff's response to Exhibit 1134 - Biological Resources Supplemental Opening Testimony Wally P. Erickson and Dr. Ken Levenstein – Avian Impacts (TN 202482).

TESTIMONY OF CENTER FOR BIOLOGICAL DIVERSITY (CBD):

Exhibit 3128 Testimony Of Smallwood And CV (TN 202499)

The Center for Biological Diversity (CBD) submitted testimony prepared by Dr. Shawn Smallwood who: “reviewed the Revised Staff Assessment (RSA), Final Staff Assessment (FSA), and related documents to assess project impacts, mostly as they are caused by collisions and thermal injuries to birds.” (Exhibit 3128 TN 202499 Page 1) Dr. Smallwood provided comments addressing avian mortality estimates, curtailment, deterrents, mitigation, and adaptive management in addition to general comments on the project analysis.

Staff Response:

Staff recognizes the expertise of Dr. Smallwood and values his knowledge of avian monitoring, plan formulation, and statistical analysis. Staff has provided responses to key areas of the testimony from CBD where additional information is needed for clarification or to respond to specific points of contention.

- 1) CBD provides a summary of the mortality and searcher efficiencies for the Solar One project in Dagget and using these estimates states: “Relying on these adjustments and extending them to the 500 MW size of Palen, then I predict that Palen will kill 10,787 birds per year (80% CI: 3,573 to 18,000). These fatality rates would equal or exceed the fatalities estimated at the Altamont Pass Wind Resource Area, which has become infamous worldwide as the most dangerous wind project in the world.” (Exhibit 3140 TN 202698 Page 6)

Staff Response:

Dr. Smallwood has provided mortality estimates that are substantially larger than those presented by the applicant for the PSEGS in the Draft BBCS (Exhibit 1139 TN 202487). In previous testimony staff noted that based on a review of the Petitioner's surveys, mortality data for ISEGS, and flux models for PSEGS developed by staff, the mortality estimates provided by the Petitioner appear low and do not represent the correct scale for a project such as PSEGS (See Figure 1 Attachment A: Assessment of Relative Risk to Avian Species Between Ivanpah and Palen Projects) Staff is concerned that avian flight data identified in the Draft BBCS will not reflect conditions at the PSEGS site and that assuming only birds with singed feathers have suffered exposure to solar flux underestimates mortality figures. Staff previously

indicated that if flux-related mortality is limited to only birds with visible evidence of feather damage, the distribution of dead birds with no visible evidence of feather singeing should be evenly distributed across the project site. This is because collisions, outside of those occurring with project features such as the tower, power block, and fences, and other non-flux-related deaths would be expected to be randomly scattered across the heliostat fields. Instead, as shown in Figure 3 (Attachment A: Assessment of Relative Risk to Avian Species Between Ivanpah and Palen Projects), the avian mortality per acre increases toward the towers, which suggests other factors are contributing to mortality. Staff contends that based on basic physiologic principles, any bird exposed to more than one sun is likely subject to some form of thermal stress, even for limited periods of time.

Mitigation Measures

- 2) CBD states: “The impacts caused by Palen if permitted and constructed will be larger and more complex than can be reasonably expected to be handled by a designated biological monitor and CEC compliance monitor. A Technical Advisory Committee (TAC) should be established, and the TAC members should be composed of experts on scientific monitoring and mitigation. The TAC meetings, documents, and activities should be fully transparent to the public including being publicly noticed and accessible and provide an opportunity for public input.” (Exhibit 3140 TN 202698 Page 8)

Staff Response:

In “Energy Commission Staff's Rebuttal Testimony with Attachments,” dated October 21, 2013 staff provided revisions to Condition of Certification **BIO-16b** that clarified the use of independent monitors and provided for greater public access to the process. Specifically section 2 of **BIO-16b** was revised to include: “The TAC will also assist the CPM in implementing the following provisions #3 - #8, and will have the authority to require independent, third-party monitoring, if determined advisable.” And the verification was modified to state: “After the third year of the monitoring program, the CPM shall meet and confer with the TAC to determine if the study period shall be extended based on data quality and sufficiency of analysis, or if needed, to document efficacy of any adaptive management measures undertaken by the project owner. If a carcass of a golden eagle or any state or federally listed threatened or endangered species is found at any time by the monitoring study or project operations staff, the project owner, Designated Biologist, or other qualified biologist that may be identified by the Designated Biologist shall contact the CPM, CDFW and USFWS by email, fax or other electronic means within one working day of any such detection.” (TN 201233 Page 19)

- 3) CBD states: “Other than one utilization survey effort in Fall 2014, I did not see any description of preconstruction bird and bat surveys to predict collision rates with heliostat mirrors in the RSA or FSA, to guide the siting of the facilities to minimize collision risks, or to serve as a baseline against which to measure displacement or attraction impacts after construction.” (Exhibit 3140 TN 202698 Page 8) CBD provided comments on pre-construction surveys, estimating bird elevations, their use

in predictive mortality estimates, and provided recommendations for additional studies and the use of sophisticated infrared cameras.

Staff Response:

Staff provided previous testimony regarding the use of avian data to develop the risk analysis for the PSEGS. Please see staff's response to the Petitioner's Exhibit 1134 - Biological Resources Supplemental Opening Testimony Wally P. Erickson and Dr. Ken Levenstein – Avian Impacts (TN 202482) and Exhibit 1139 - Draft Bird and Bat Conservation Strategy (TN 202487). Staff considers the use of infrared cameras a useful tool when conducting nocturnal surveys for avian species.

- 4) CBD states: "Very little is known of the types or magnitudes of impacts on wildlife caused by industrial solar projects. Qualified biologists should be funded to search the ground between arrays of heliostat mirrors on a weekly basis (every two weeks at the longest) for at least three years to determine the magnitude of collision fatalities. Searches should be done on foot. I suggest searching randomly or systematically selected arrays of heliostat mirrors to the extent that equals 33% or more of the project, including all ground between the power towers and the nearest array of heliostat mirrors." (Exhibit 3140 TN 202698 Page 10) CBD provides recommended methods to standardize field monitoring efforts and indicates: "Also, found carcasses should not be used in scavenger removal trials because estimating time since death is highly inaccurate and attempting to do so results in the placement of carcasses that are no longer attractive to vertebrate scavengers. Not using fresh killed or fresh frozen carcasses will result in fatality rate estimates that are biased low." (Exhibit 3140 TN 202698 Page 14)

Staff Response:

Please see staff's response to the Petitioner's Exhibit 1134 - Biological Resources Supplemental Opening Testimony Wally P. Erickson and Dr. Ken Levenstein – Avian Impacts (TN 202482) and Exhibit 1139 - Draft Bird and Bat Conservation Strategy (TN 202487). Considering the difference in scale between the two projects, their geographic locations, differences in bird use and abundance, and the apparent correlation between certain areas of solar flux and large numbers of bird mortality exhibiting non-visible feather damage (i.e., not visible to the naked eye), staff recommended a PSEGS BBCS be substantially more robust than the ISEGS plan, including a broader range of 100 percent survey area. Staff concurs with the use of fresh carcasses if this results in an increased ability to evaluate scavenger rates.

- 5) CBD states: "If Palen is built, the responsible thing to do would be to provide an annual payment to local rehabilitation facilities. The amount paid would need to cover the number of birds and other wildlife being brought from the project, and it would need to cover sufficient time for the rehabilitators to give the injured animals a chance at recovery rather than a quick needle. The funding should also include an amount that is regarded as a donation for the use of deceased birds that will be needed in detection trials as part of fatality monitoring." (Exhibit 3140 TN 202698 Page 14)

Staff Response:

In “Energy Commission Staff's Rebuttal Testimony with Attachments,” dated October 21, 2013 staff provided revisions to Condition of Certification **BIO-16b** that included funding wildlife rehabilitators to manage injured birds from PSEGS. Specifically Section 7(a) of **BIO-16b** stated: “(a) Reasonable measures for characterizing the extent and significance of detected mortality and injuries clearly attributable to the project, and ensuring adequate funding for wildlife rehabilitation facilities approved by the CPM, in conjunction with the USFWS and CDFW.” (TN 200980 Page 21)

Measures To Reduce Impacts

- 6) CBD stated: “Mitigation Measure BIO-16 was named the Avian Protection Plan. Its formulation, however, was deferred to a time subsequent to public participation with this proceeding on Palen.” And indicated:” In short, the summary of the Avian Monitoring Plan was uninformative and unacceptable.” (Exhibit 3140 TN 202698 Page 15)

Staff Response:

Please see “Energy Commission Staff's Rebuttal Testimony with Attachments,” dated October 21, 2013, where staff provided revisions to Condition of Certification **BIO-16a and BIO-16b** that provided additional specificity regarding the approach to mitigation and the development of the proposed monitoring plans. (TN 200980 and TN 201233)

- 7) CBD commented on the use of curtailment for PSEGS. Specifically: “If the fatality patterns observed at Solar One remain consistent at Palen, then curtailment would apply to only 30% of the fatalities.” (Exhibit 3140 TN 202698 Page 15)

Staff Response:

Staff provided previous testimony on the effectiveness and feasibility of curtailment. Please see response to the Petitioner’s Exhibit 1137 - Biological Resources Supplemental Opening Testimony of Gustavo Buhacoff – Heliostat Operations at ISEGS and PSEGS (TN 202485) and Exhibit 1136 – Bio Supplemental Opening Testimony of Matt Stucky, Chris Morris and Charlie Turlinski – Infeasibility of Curtailment (TN 202284). Staff supports the use of temporary or seasonal curtailment as a method to avoid mortality to birds from exposure to solar flux if it proves to be effective. However, staff remains uncertain if curtailment would be feasible and will not be recommending revisions to **BIO-16** to include a curtailment plan.

- 8) CBD provides comments on the avian deterrent strategies provided by the Petitioner and states: “It was misleading to suggest that any of these bird deterrent strategies could contribute to an effective adaptive management program.”

Staff Response:

Staff provided previous testimony on the effectiveness of deterrent strategies. Please see response to the Petitioner’s testimony on Exhibit 1141 - Biological Resources Supplemental Opening Testimony of Elwood G. Norris – Description of HyperSound

Technology (TN 202489) and Exhibit 1140 - DeTect Testimony on Deterrent Method (TN 202488).

Title: Exhibit 3093. Pratt Testimony, Declaration & CV (TN 202492)

CBD submitted testimony prepared by Dr. Gordon Pratt addressing impacts of the PSEGS to flying invertebrate species. Dr. Pratt provided comments addressing the importance of insects to the environment, likely insect and butterfly diversity at the Palen site, the potential for the PSEGS to attract insects, and a discussion of sand dune insects.

Staff has provided responses to key areas of the testimony from CBD where additional information is needed for clarification or to respond to specific points of contention.

Summary Of Testimony

- 1) CBD stated: "The proposed project will be detrimental to numerous insects, some of which may be very rare and endemic. Due to lack of surveys for invertebrates in general, it is impossible for me to fully evaluate the impacts to the insects. (Exhibit 3093 TN 202492 Page 1)

Staff Response:

Staff reviewed a variety of regulatory databases during the preparation of the PSA and FSA. No listed or sensitive species of insects were noted from the area. Therefore focused surveys for invertebrates were not conducted.

- 2) CBD stated: "It is my opinion that the proposed project will attract insects to the bright lights created by the focused mirrors, and kill or wound them when they enter into the intense radiation. The attraction and loss of so many insects could create an ecological cascade effect on the landscape that affects many other local species including plants that rely on flying insects for pollination and animals that rely on insects for food. The proposed project in itself as well as in conjunction with other cumulative projects will further imperil already rare species driving them closer to extinction and may result in the need for additional species to be safeguarded under the Endangered Species Act protection." (Exhibit 3093 TN 202492 Page 1)

Staff Response:

Staff stated in "Energy Commission Staff Supplemental Staff Assessment and Testimony," that "[t]he risk to insects varies on a number of factors. Insects may be attracted to the facility resulting in the facility acting as a population sink. It is also possible that insects are passively carried through the flux field on prevailing winds. Some insects such as dragonflies and beetles are attracted to polarized light and may drop out of the air column misidentifying the heliostats for bodies of water. To address the risk to insects staff recommends the development of monitoring protocols within the context of **BIO-16.**" (TN 202480 Page 15)

Staff believes that the potential impact to insects is too speculative to find that the impacts will be significant. However, staff believes that given the incidental

information that has been provided from the operations at ISEGS, insect monitoring would be very helpful to further the understanding of insect ecology in the PSEGS area and to better understand the interaction of insects and this technology. Similar to birds, staff believes impacts to insect species would likely follow the scaling factor of 3.7, and therefore PSEGS would have greater impacts to insects than ISEGS.

Following evidentiary hearings for the PSEGS project, the condition, as originally presented in the PMPD (TN 201434) was altered based on stipulations between staff and the petitioner (TN 201233) Staff has retained this stipulated language, incorporated it into the Condition of Certification **BIO-16b**, and then augmented the condition with language regarding insects, in response to the Committee's request (TN 202362). Staff believes that undertaking attempts to quantify and understand impacts to insects would be valuable, and that insect impacts should be considered when evaluating adaptive management techniques for the project.

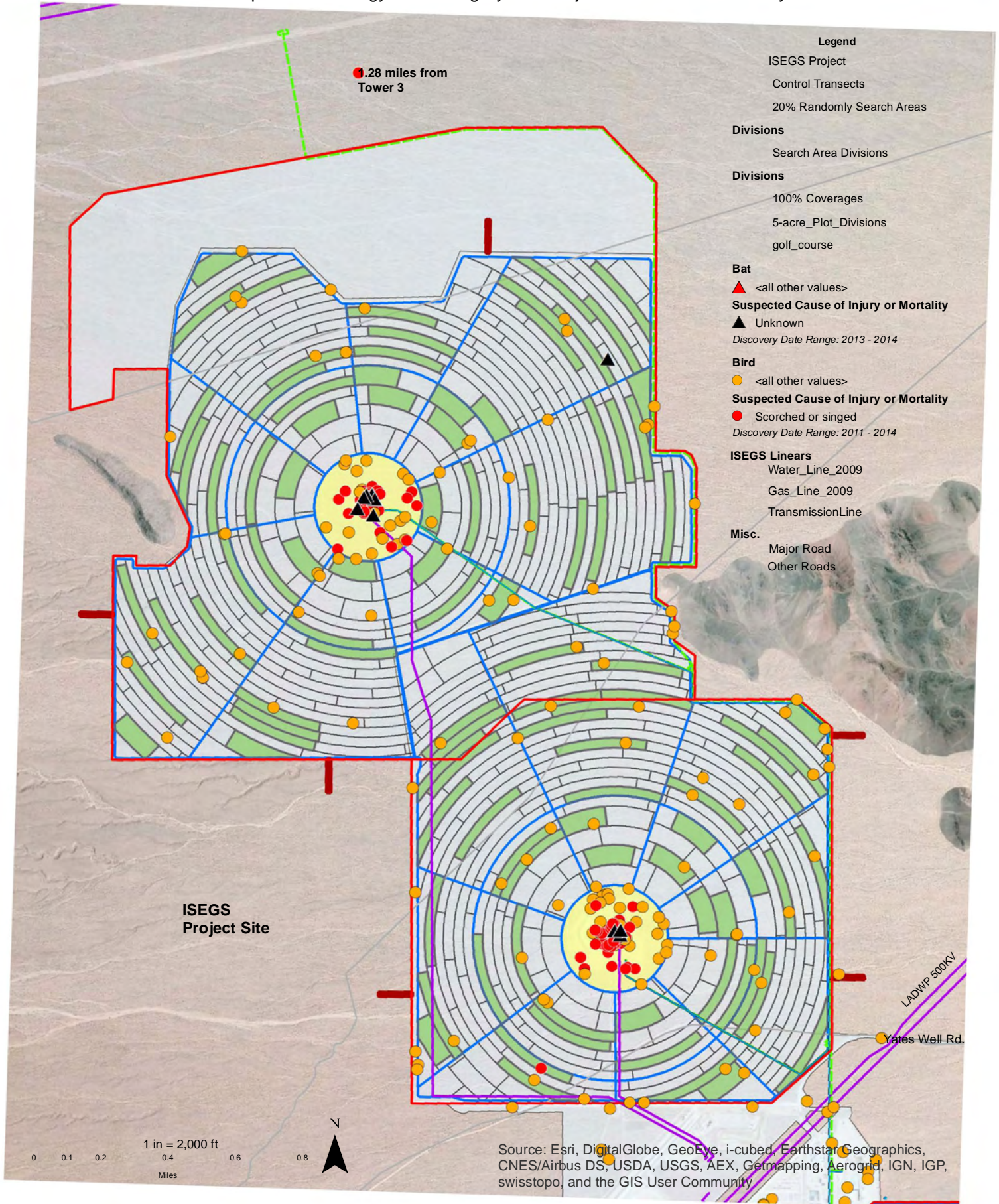
INCORPORATED BY REFERENCE

Biological Resources staff hereby incorporates by reference the testimony provided in Attachment A to CEC Staff's Response to Petitioner's Motion to Reopen the Evidentiary Record (TN 202210).

REFERENCES

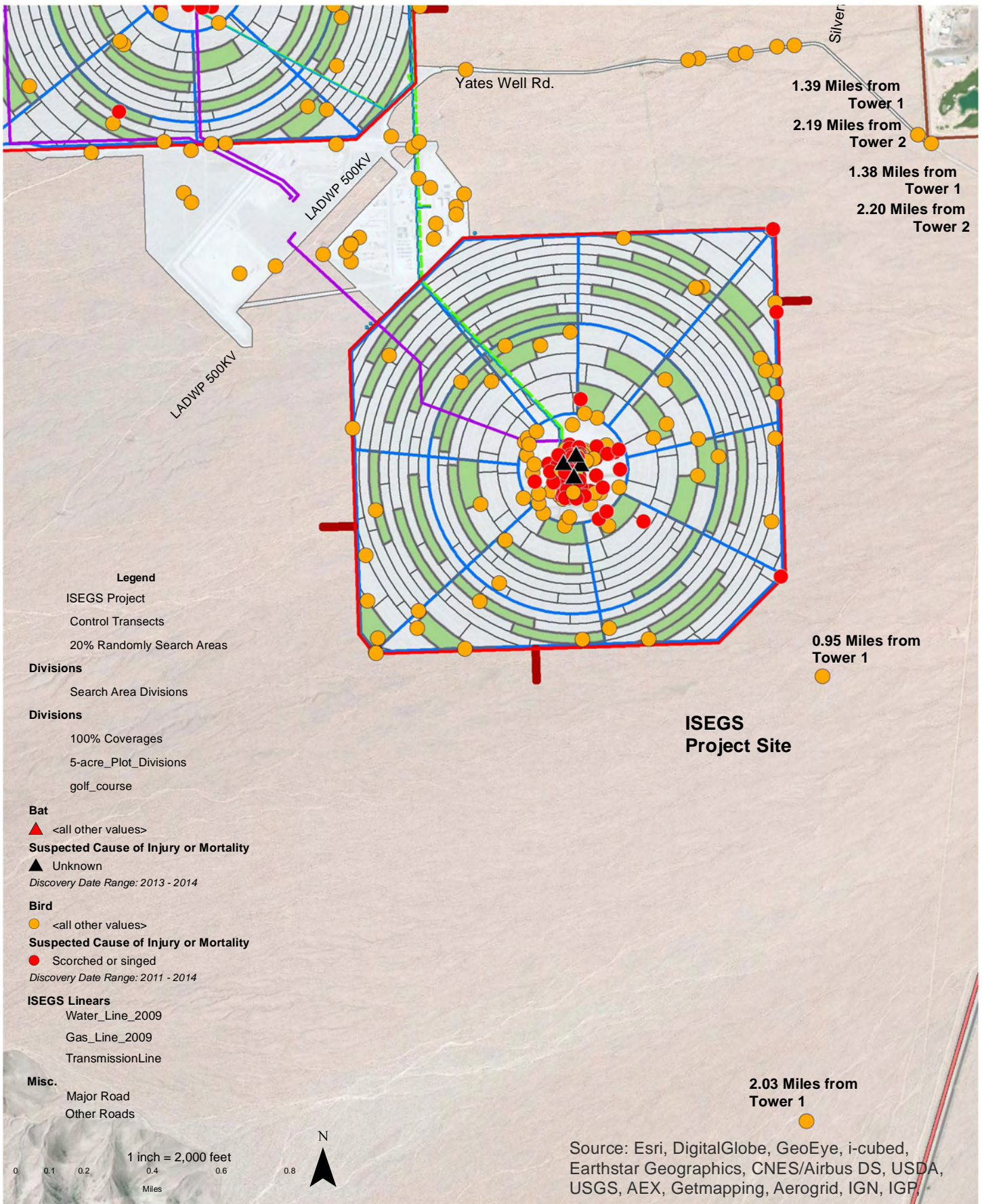
CEC 2014- California Energy Commission/ Darlene Burgess (TN 202210). Committee Order Granting Petitioner's Motion to Reopen the Evidentiary Record and Setting Revised Schedule, Dated May 21, 2014. Docketed May 21, 2014.

BIOLOGICAL RESOURCES - FIGURE 1A
 Ivanpah Solar Energy Generating System Project - Bird and Bat Mortality



CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION
 SOURCE: Facility's Monthly Compliance Report (MCR).

BIOLOGICAL RESOURCES - FIGURE 1B
 Ivanpah Solar Energy Generating System Project - Bird and Bat Mortality



II. BIOLOGICAL RESOURCES ATTACHMENT A: ASSESSMENT OF RELATIVE RISK TO AVIAN SPECIES BETWEEN IVANPAH AND PALEN PROJECTS

Geoff Lesh PE CSP and Brett Fooks PE

SUMMARY OF CONCLUSIONS

The first Avian & Bat Monitoring Plan Winter Report from the Ivanpah Solar Electric Generating System (ISEGS) facility has been submitted to the California Energy Commission (Energy Commission) for review. The report contains the number of avian deaths recorded on site via incidental detection or through standardized searches, for a limited time period and during intermittent operations (Harvey 2014). With this information, staff has been able to revisit and examine the effect of avian exposure to concentrated solar radiation. The data provided by the monitoring plan is limited, but a clear correlation between the avian exposure to solar radiation and the distribution pattern of deaths has been found. In addition, the data supports staff's previous analysis that death from flux exposure is both dependent on flux intensity and dose, and further dispels the theory that a 50 kilowatts per meter squared (kW/m^2) (or even $25 \text{ kW}/\text{m}^2$) is a reasonable hazard threshold. The data also suggests that the Palen tower would have a relative avian mortality risk of 3.7 times compared to an Ivanpah tower. On a project comparison basis, PSEGS would have a 2.5 times greater relative avian mortality risk compared to ISEGS.

FLUX RELATED MORTALITY

Staff's analysis indicates that solar flux is the source of mortality for not only singed birds, but it is likely that solar flux is the source of mortality for a significant amount of non-singed birds as well. All avian species are impaired by flux exposure once the birds enter the heliostat fields around ISEGS, but the heliostat field is less toxic on a per-area basis the farther from the tower. The risk of collision or other non-flux sources of death would be expected to be equal across the project site. However, the data illustrates that non-singed bird mortality increases closer to the tower, just as singed bird mortality increases.

Hazard Threshold

PSH contends that $50 \text{ kW}/\text{m}^2$ flux (at 30 seconds of exposure) is the hazardous threshold because it is the only published data available although the study only exposed bird carcasses to flux. However, the applicant has decided to use $25 \text{ kW}/\text{m}^2$ flux as a more conservative hazardous threshold.

Staff disagrees with these conclusions based on the data collected at ISEGS and staff's independent analysis of it. Staff found that collected avian species experienced visible flux damage or singed feathers within a 300 meter radius of the central tower an area having an average flux density of $1.3 \text{ kW}/\text{m}^2$ and above. Staff's earlier modeling of bird flight and feather heating due to flux exposure indicated that feather damage would

occur between 3-5 kW/m². However, staff's current analysis does not indicate that there is a safe threshold for flux (above ambient conditions) that does not produce some risk of avian mortality.

PSEGS Has A Larger (By Volume) And Taller (By Height) Flux Field Than ISEGS

Based on Staff's analysis at ISEGS, Palen Solar Electric Generating System (PSEGS) will have a solar flux field that is vertically two times taller than at ISEGS and have two times the flux field area due to the larger field size because of the larger radius. While flux levels (minimum to maximum) will be the same at ISEGS and PSEGS, there will be more volume at higher fluxes at PSEGS. Staff expects that flux related bird kills will occur at across a much larger volume (higher elevations and greater distance from the tower, on average) than at Ivanpah. Palen has a 3.7 times greater mortality risk per tower relative to an Ivanpah tower.

ANALYTICAL APPROACH

Staff's analysis includes the following analytical steps in establishing a correlation between avian exposure to solar radiation and the number of deaths:

- a. Solar Flux Model – a 3-D model that relates the average intensity of solar flux from the heliostat field (in kW/m²) as a function of radius from the center of the ISEGS power tower.
- b. Avian Mortality Analysis – all of the available avian data including the first ISEGS Avian & Bat Monitoring Plan Winter Report was aggregated from the three towers and then graphed as a function of radius.

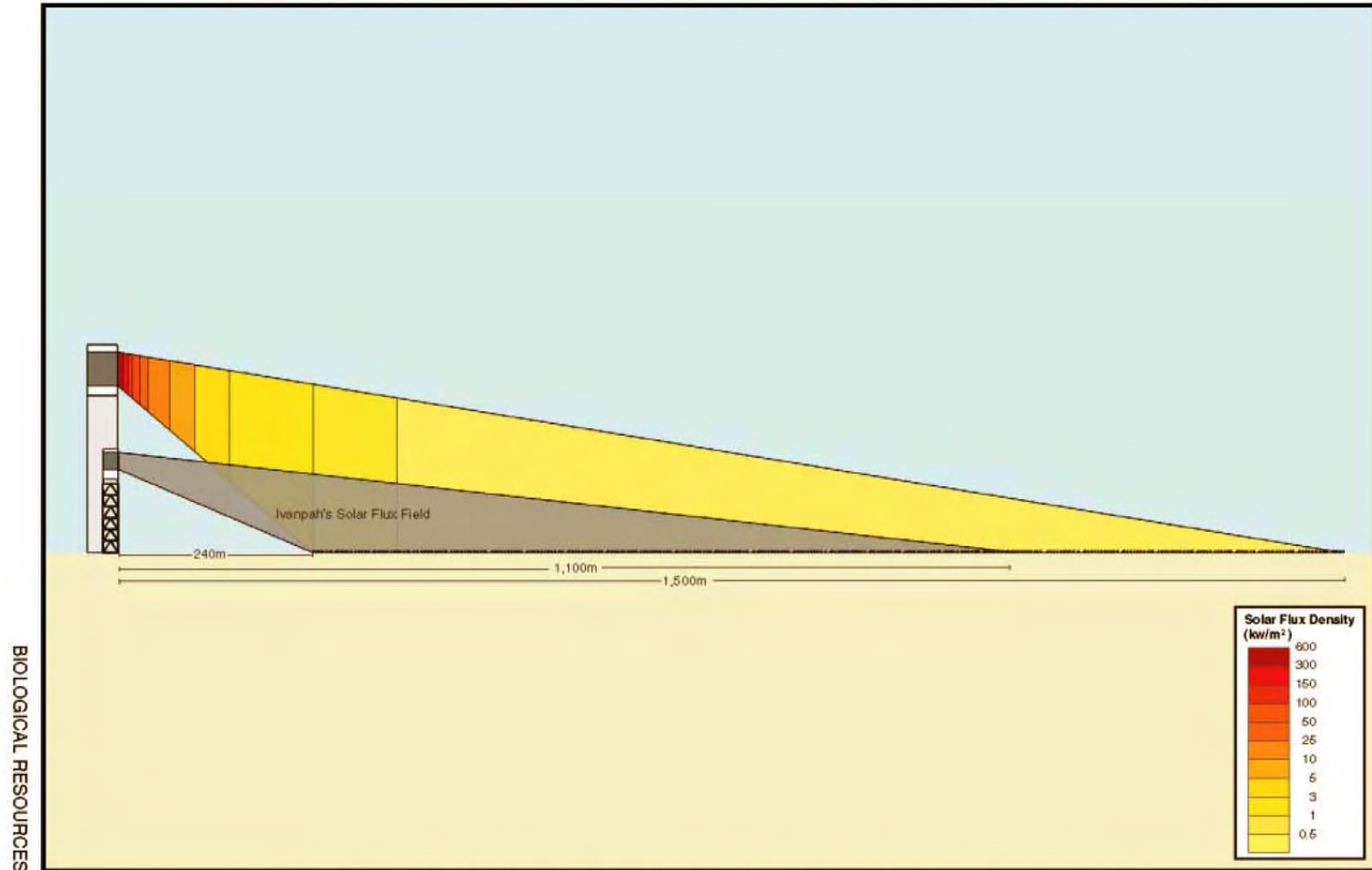
SOLAR FLUX MODEL

Staff used the fact that the amount of power, in terms of solar flux, projected onto ISEGS power tower Units 1, 2, and 3 must be equal to the area of the boiler face multiplied by the flux density, defined as the amount of flux per unit of cross-sectional area, projected by the heliostat field. With this equation and the assumptions listed below, a geometric relationship can be established between the average flux density at any radius within the heliostat field. The assumptions made to create the geometric relationship are:

- a. The total flux (and thus power) from the heliostat field is constant inside of the inner most mirror field.
- b. The total power from the heliostat field is based on the designed electrical power output of the plant and the plant's total energy efficiency.
- c. The area of the boiler is approximated as a cylinder.
- d. The flux field ranges from 600 kW/m² at the face of the boiler to 0.5 kW/m² at the outer edge of the heliostat field.

Staff modeled the three dimensional volume of the PSEGS and ISEGS power towers with their representative solar flux fields to illustrate the relative sizes between the two solar power tower plants (see Figure 1). Figure 1, showing a cross-section of one half of each solar field, illustrates that the PSEGS flux field occupies a greater volume and land area relative to the ISEGS flux field.

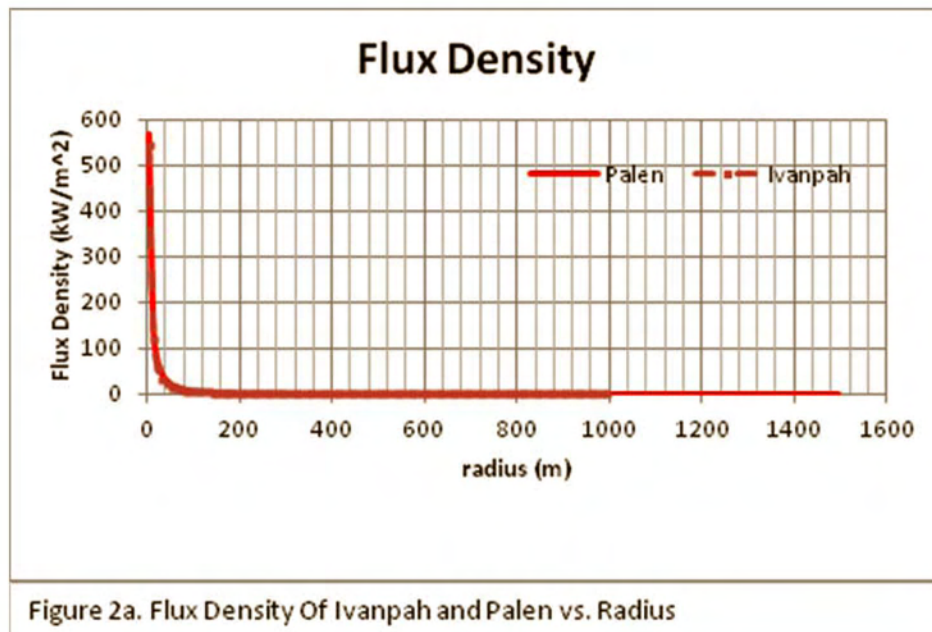
BIOLOGICAL RESOURCES - FIGURE 1
Palen Solar Electric Generating System - Approximate Ivanpah Solar Electric Generating System's Flux Superimposed

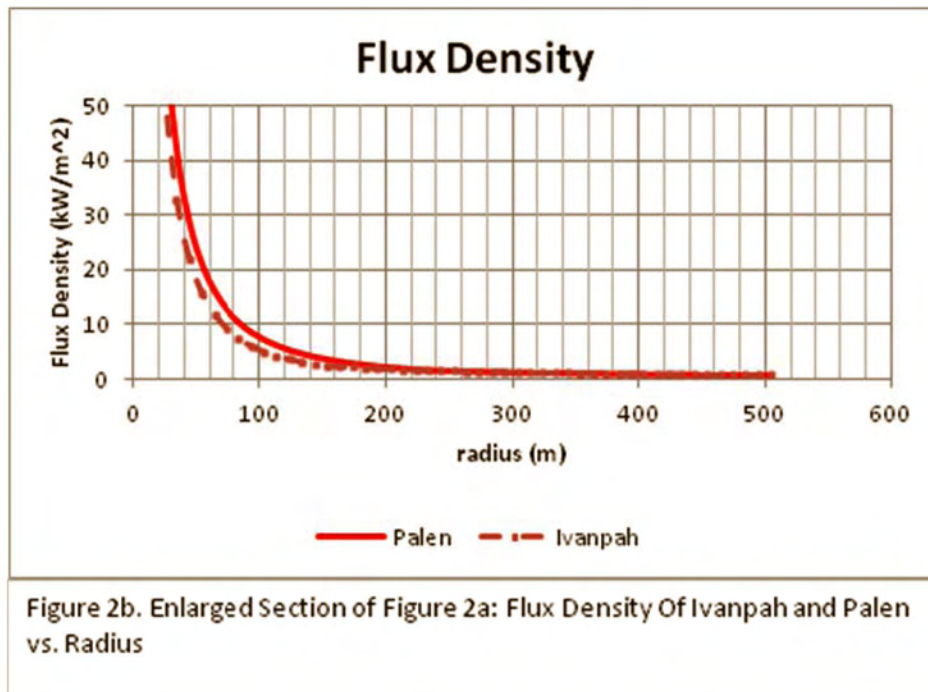


CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION
SOURCE: CEC Staff

These are representations of project flux cross sections – the actual flux fields will vary in shape and concentration at any point due to variations in mirror spacing, undulations in terrain, sun angles, etc. Figure 1 starts the inner radius of the mirror field at 240 meters. The installed high density heliostats that range from approximately 150 meters to 240 meters were not modeled for Ivanpah or Palen because the ratio of the areas between the 2 projects will cancel each other out and the flux contributed to the flux field is small when compared to the rest of the heliostat field.

Staff also modeled the flux density versus the radius for ISEGS and PSEGS and finds the flux density varies as the inverse of the radius (See Figures 2a and 2b). Figure 2b has been added as a blow up of the hockey-stick section (lower left) of the curve in Figure 2a to clearly illustrate the higher flux density of PSEGS versus ISEGS. At locations farther from the power tower, the flux density decreases. While curves are similar, the exposed volumes are different.





AVIAN MORTALITY ANALYSIS

Staff analyzed the collected ISEGS avian mortality data dated from November 27, 2011 through June 9, 2014 – the units were only fluxing later in the period. All of the avian mortality data from each tower was aggregated together to develop a larger dataset for the analysis. Only a small inner area of the site is surveyed 100 percent. The rest of the site is subject to a representative standardized search, where approximately 20 percent of the area is surveyed. The carcass finds outside the inner 100 percent survey zones were multiplied by 5 to account for the partial (20 percent) search zone. The data sets have inherent variability due to searcher efficiency, searcher time period, and search durations for Units 1, 2, and 3. The carcass finds were then graphed against the radius (See Figure 3). The graph illustrated that the carcass finds were increasing with decreasing radius. The carcass finds were then separated into two groups by described features contained in the biologists' notes: visibly singed and non-singed. Accumulations of both of these groups were then graphed against the radius, starting from the outside, of the heliostat field (See Figures 4 and 5).

Mortality Distribution of all Birds at ISEGS

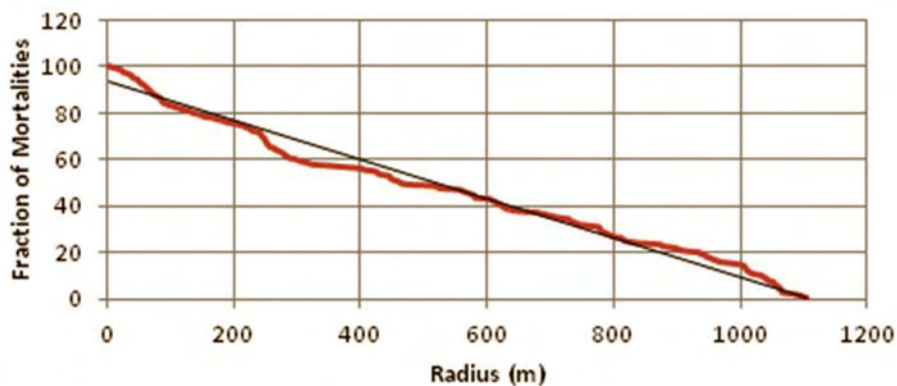


Figure 3. Mortality Distribution of all Birds at ISEGS.

Mortality Distribution of Visibly Singed Birds at ISEGS

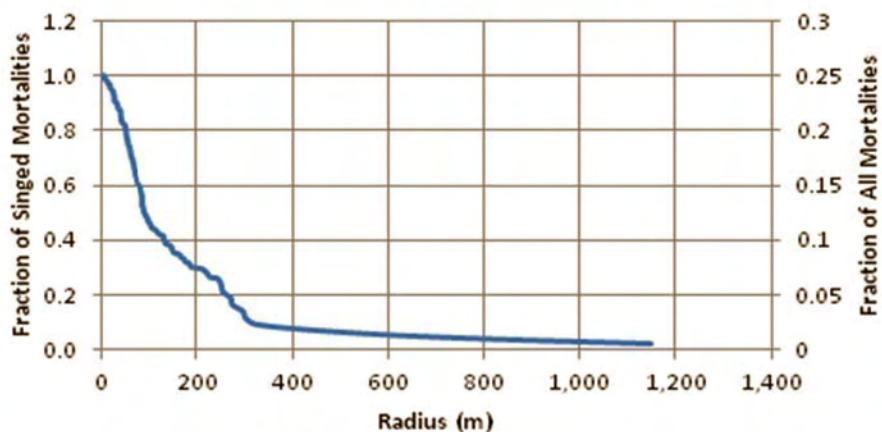
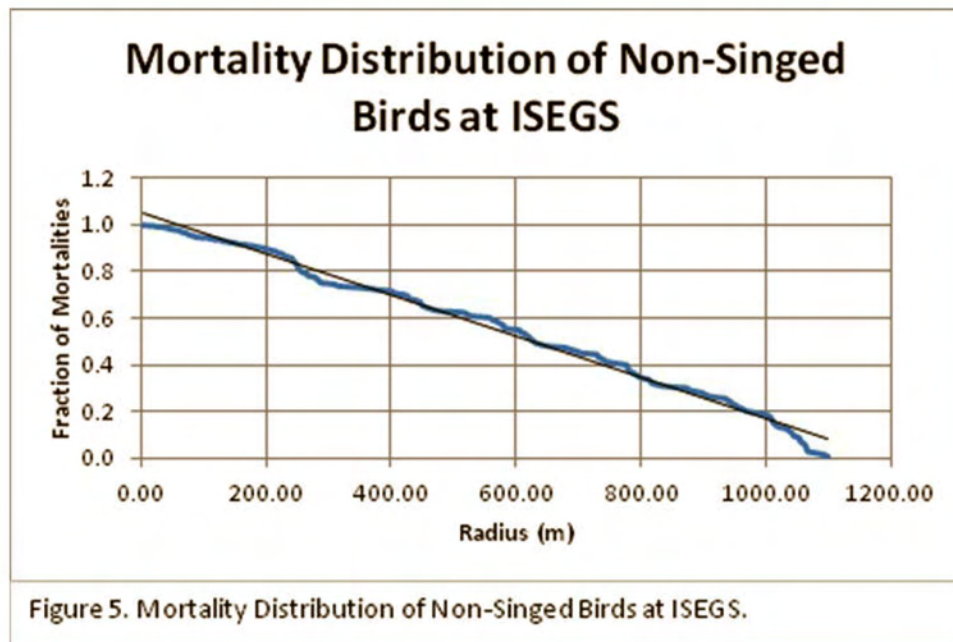


Figure 4 . Mortality Distribution of Visibly Singed Birds at ISEGS.



Summing from the outermost mirror row, the accumulated avian mortality of non-singed birds rises linearly with the radius from the outer radius of the heliostat field to the tower. Due to the fairly uniform density of the mirrors, the probability that a bird will hit one of the mirrors in the heliostat field should be about the the same anywhere in the field, and that other non-flux related deaths would be relatively evenly distributed across the project site. This is supported by mortality information for a photovoltaic and a parabolic trough project, and where carcass finds were fairly uniform (i.e., linear relative to position in the field) across the solar array fields.

The petitioner states that 25 kW/m² is a safe threshold (i.e. 50 kW/m² with a safety margin) of exposure for avian species. The petitioner is suggesting that the effect of flux is a step function, where birds are unaffected by exposures below 25 kW/m² and then, only when feathers are singed are birds impaired. However, if 25 kW/m² were a safe threshold, then the number of deaths should not increase linearly as function of the radius moving from 0.5 kW/m² to 25 kW/m². From Figure 3 the graph shows that the total number of non-singed bird deaths increases as the birds approach the center of the field. This suggests that the toxicity of the heliostat field increases with decreasing distance from the tower. When comparing Figure 5 with Figure 2b it can be inferred that the non-singed are being exposed to an increasing dosage of solar flux the farther into the heliostat field the birds travel. The non-singed avian deaths on a per area basis are increasing as the flux intensity increases toward the ISEGS power tower.

The petitioner proposes a 100 meter cylinder around the PSEGS tower based on the ISEGS mortality data. According to staff's flux model, the average flux density at 100 meters is 5.6 kW/m² for ISEGS and would be 7.2 kW/m², see Figure 2b, at PSEGS. However, from Figure 2, the area density of singed birds starts rapidly increasing at a flux level of 1.3 kW/m². The singed carcasses continue to increase with the intensity of the solar flux field. And the non singed birds also increase with the increasing solar flux

field. It appears that the singed bird density hits 50 percent around an average flux density of 5.0 kW/m². Neither the 100 meters nor 25 kW/m² can be considered safe thresholds for solar flux levels when singed avian species are being found on the ground at flux density levels from 1.3 kW/m² and higher.

THERMAL DOSE MODEL

Various methods have been proposed for predicting risk to avian wildlife posed by new central power tower design. Some of these are summarized in Table 1 (below). While some are mostly basic scaling estimates that don't have defined cause-and-effect events occurring, they scale instead on measureable aspects of the tower and solar field design, such as power produced, heliostat field area, or volume of the flux cone of the solar field.

Other methods posit a rationale such as a specific solar flux density considered to be toxic, and above which feathers are singed and birds are harmed, and below which there is expected to be no harm whatsoever, in essence a sudden step-function response. Such reasoning is inconsistent with longstanding observations and modeling of human and animal exposure to imposed thermal stress caused by flux exposure, and the ISEGS carcass data.

Having substantial field data for the first time (from Ivanpah field surveys), staff modeled using a fundamental causation dose-response model of injury and death caused by flux exposure. The developed includes a representative typical exposure to varying flux levels with exposure durations that are determined by the flux intensities, extents, and field and tower dimensions, and time of exposure.

Staff's dose-response thermal flux exposure model calculates relative dose levels likely encountered by birds found at various locations in the field. The methodology follows that used and reviewed by O'Sullivan and Jagger which is widely used to fit human exposure to thermal radiation.

Basically the method asserts that:

- Dose = flux density^{4/3} x time exposed to flux (from staff's flux field geometric model)
- Consequence (probability of death from exposure) = A + B x log (Dose) (*a probit³ curve*)
- Risk = Consequence x probability of exposure
- Mortality Index⁴ = sum of Risk over all of solar field

³ The probit curve relates dose levels to the response levels (eg. in this case thermal exposure (flux*time) is related to a probability of injury/death).

⁴ This is a comparative mortality figure and is formed as a ratio of two normalized average death rates or counts, and is useful for the purpose of comparing the relative lethality between projects.

The risk curve fitted to Ivanpah mortality data using the above method fits reasonably well for both magnitude and shape of curve with radius in the solar field, and includes reasonable expected causative factors and scenarios.

The recently collected field data enabled staff to determine the shape of the mortality profile across a solar tower heliostat field of known characteristics. Staff was able to calibrate the fundamental causation model to the real-world mortality data, and to determine an expected mortality risk profile related to specific exposure doses.

Using this calibrated model based on Ivanpah, staff applied it using the design parameters of Palen solar towers to generate the expected exposure doses and the resulting mortality risk profile for a Palen solar tower field.

Although the model cannot predict any specific total number of mortalities because both the number of birds presented to, or exposed to flux, at a facility, and the fraction of the presented population that is killed is not known yet for *any* solar field. What it can tell us is the shape of the risk profile of the solar field (i.e. where are the locations where we would expect the most mortality, how does the count change with distance from the tower), and the *relative* risk presented to avian life encountering the solar field, leading to an expected ratio of caused-mortality between two known sites, with the caveat that most important factors remain the same. Factors not controlled-for include the local avian population characteristics such as its numbers, species mix, sizes of its individuals, etc. Additional factors not controlled for between sites include local climate, geography, and topography that might affect avian behaviors.

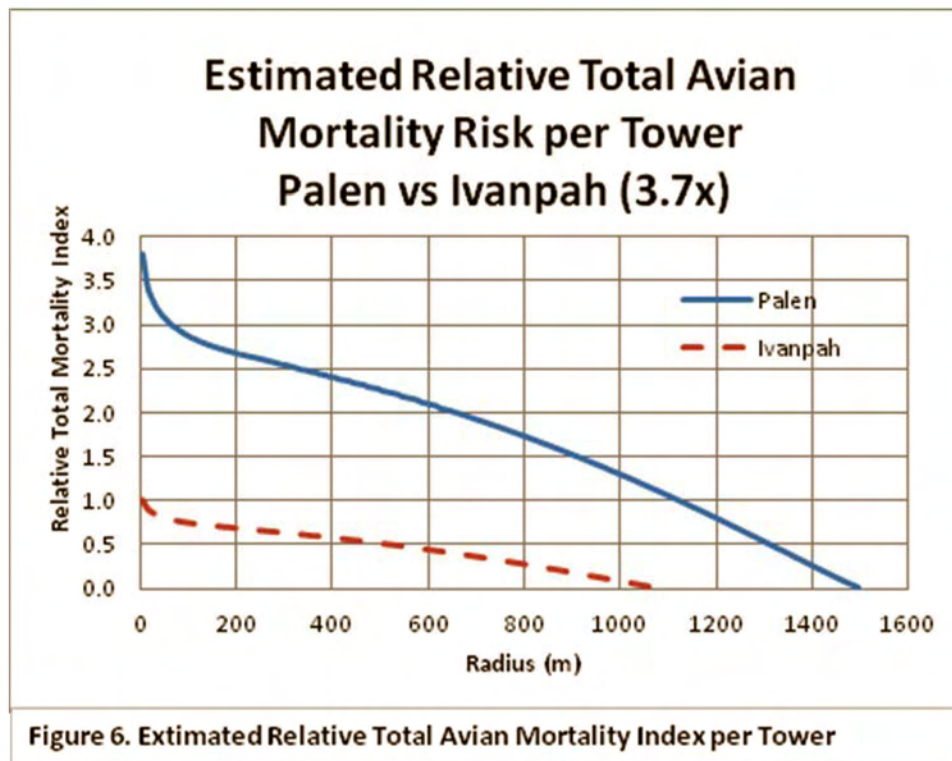
Therefore, absolute number predictions (i.e. numbers of birds killed per period) cannot be attempted until carefully controlled data collection from many more sites has been conducted. The model can however, compare relative risk between solar tower/field designs that are due solely to those design differences (See Tables 1 and 2).

Table 1. - Relative Expected Total Avian Mortality Rate per Tower (by Method)				
Power Tower Type	Radius of Toxic Flux Levels	Power (or solar field area)	Dose-Response	Volume Filled By Flux
Ivanpah (125MW)	1x	1x	1x	1x
Palen (250MW)	1.25x	2x	3.7x	3.8x

Table 2. - Relative Expected Total Avian Mortality Rate per Project

Power Tower Type	Number of Towers	Dose-Response Per Project
Ivanpah (125MW)	3	1x
Palen (250MW)	2	2.5x

Using this Ivanpah fitted model for bird mortality pattern with no changes to model or constants, and applying it to Palen provides a relative expected total avian mortality rate per tower of 3.7x higher mortality at Palen with respect to Ivanpah. The relative expected total avian mortality rate of the Palen site is 2.5x higher with respect to Ivanpah.



CONCLUSIONS

Staff's analysis indicates that all avian species are exposed to solar flux may suffer impairment once the birds enter the heliostat field at ISEGS. Non-singed avian species

can be found anywhere, but the heliostat field is more toxic the closer to the tower you get.

Staff's analysis estimates that the relative avian mortality for PSEGS will be 3.7 times greater than at ISEGS on a per tower basis, and 2.5 times on a per project basis.

REFERENCES

H.T. Harvey & Associates. June 23, 2014. Ivanpah Solar Electric Generating System Avian & Bat Monitoring Plan – 2013-2014 Winter Report. Docket Number: 07-AFC-05C. TN# 202167.

O'Sullivan, S. and S. Jagger. 2004. Human Vulnerability To Thermal Radiation Offshore. Health and Safety Laboratory. HSL/2004/04.

Lees, F.P. 2012. Loss Prevention in the Process Industries, pg. 354-356, Fourth Edition, Butterworths.

III. CULTURAL RESOURCES

Supplemental Testimony of Michael McGuirt, MS, Thomas Gates, and Lorey Cachora

INCORPATED BY REFERENCE

Cultural Resources staff hereby incorporates by reference the testimony provided in Attachment B to CEC Staff's Response to Petitioner's Motion to Reopen the Evidentiary Record (TN 202210).

REFERENCES

CEC 2014- California Energy Commission/ Darlene Burgess (TN 202210). Committee Order Granting Petitioner's Motion to Reopen the Evidentiary Record and Setting Revised Schedule, Dated May 21, 2014. Docketed May 21, 2014.

IV. TRAFFIC AND TRANSPORTATION

Rebuttal Testimony of James Adams, Andrea Koch, and Gregg Irvin, Ph.D.

Since the filing of staff's supplemental Traffic and Transportation testimony, parties to the Palen Solar Electric Generating System (PSEGS) proceeding have filed supplemental testimony on glint and glare, which is relevant to the Traffic and Transportation analysis. Staff has determined that much of the supplemental testimony regarding glint and glare is consistent with staff's previous conclusions that glint and glare from the PSEGS's heliostats in the standby position could cause significant impacts to pilots. Staff's detailed responses to this supplemental testimony are presented below.

It should be noted that in the PSEGS Final Staff Assessment (FSA), staff expected that Condition of Certification **TRANS-7 Heliostat Monitoring and Positioning Plan**, would mitigate pilot glare to less than significant. However, as discussed in staff's supplemental testimony, after viewing the Ivanpah Solar Electric Generating System (ISEGS) in operation after receiving pilot complaints, staff realized that **TRANS-7** as written was not sufficient to mitigate glare impacts to pilots. As a result, in staff's supplemental testimony, staff proposed conceptual modifications to **TRANS-7** to further reduce glare impacts to pilots. In this rebuttal testimony, staff is proposing specific modifications to the language of **TRANS-7**. See the proposed modifications to **TRANS-7** at the end of this section under "Conditions of Certification". Although these modifications to **TRANS-7** could reduce impacts, staff would like to discuss in more detail the methods identified to reduce glare impacts and how such methods could be implemented at PSEGS. Staff requests that the Committee direct the parties to hold a workshop at Evidentiary Hearings, or otherwise discuss at Evidentiary Hearings possible modifications to **TRANS-7** that would result in mitigating impacts to less than significant.

GLINT AND GLARE

The supplemental testimony filed by intervenors and the applicant on the topic of glint and glare is similar to staff's own glint and glare supplemental testimony. The filings do not undermine or contradict staff's supplemental testimony, including staff's conclusion that based on recent experience with the Ivanpah Solar Electric Generating System (ISEGS), it is likely that pilots using the local airspace could experience disabling glare generated by PSEGS.

Staff's individual responses to each supplemental testimony filing are included below.

KEVIN EMMERICH OF BASIN & RANGE WATCH

Basin & Range Watch Opening Testimony (TN 202578):

Basin & Range Watch (BRW)'s Opening Testimony discusses pilot and air traffic controller reports of glare from ISEGS and BRW staff's personal experiences of ISEGS glare. Staff acknowledges the presence of this glare and these reports, as discussed in staff's supplemental testimony.

Basin & Range Watch Exhibits 4001, 4002 and 4003 (TNs 202579, 202575 and 202576):

These exhibits include close-range photos of ISEGS showing glare from the solar power tower and an area of direct solar reflection from a heliostat (DSRH). Staff notes that these photos do not show the concerning type of glare that could have significant impacts to pilots, which is generated by direct solar reflections from heliostats in the standby position. Staff documented this type of glare during a flyover of ISEGS on May 8, 2014. Staff's description and photos of the flyover can be found in Attachments A and B of the supplemental testimony (TN 202480, pages 55-65).

Basin & Range Watch Exhibit 4004, (TN 202577):

While these photos show glare from the ISEGS towers, staff has concluded that glare from the towers themselves is not significant.

Basin & Range Watch Exhibit 4005, (TN 202573):

This exhibit consists of a photo from and a link to a news article in *The Atlantic* about ISEGS. Staff notes that the photos of ISEGS glare in the article are similar to those taken by staff during the May 8, 2014 ISEGS flyover.

Basin & Range Watch Exhibit 4006 (TN 202574):

This exhibit is a satellite photo showing the glare from ISEGS as seen from space. Staff has determined that the type of glare shown, which is glare from the solar power towers, does not pose a significant hazard to pilots. It is glare from heliostats in the standby position that is of most concern.

WINTER KING OF SHUTE, MIHALY & WEINBERGER LLP

Exhibit 8034, Glare Factor: Solar Installations and Airports (TN 202569):

This exhibit consists of an article discussing the FAA's recent use of the Solar Glare Hazard Analysis Tool (SGHAT), developed by Sandia National Laboratories for assessing potential glare from proposed solar photovoltaic (PV) power facilities. The tool can be used to assess the possibility of a solar PV plant causing observers, such as pilots and air traffic controllers, to experience retinal damage or after-images.

Staff's response is that while this article shows the potential for tools to be developed to assess glare hazards from solar projects, the article is not completely relevant to the PSEGS. For example, the SGHAT model only assesses glare hazards from solar PV facilities, not solar power tower facilities. Also, the SGHAT model focuses on hazards near airports and air traffic control towers and not on glare hazards experienced at higher altitudes further away from airports, as could potentially be experienced near the PSEGS from heliostats in the standby position. Finally, the model assesses glare hazards in terms of retinal damage and after-images, but disabling glare can occur without the presence of either retinal damage or after-images. For these reasons, the model discussed is not directly applicable to assessing glare from the PSEGS.

Exhibit 8032, Federal Aviation Administration (FAA) World Aeronautical Chart Section CG-18 (TN 202567):

FAA Aeronautical Chart Section CG-18 shows relevant aeronautical information for the area near the PSEGS site. As part of staff's glint and glare analysis in the Final Staff Assessment (FSA) for the PSEGS Amendment, staff reviewed the FAA's Los Angeles Sectional Chart, which depicted similar information.

Exhibit 8031, Testimony of Ted Swendra (TN 202566):

Ted Swendra, Airport Manager at the Avi Suquilla Airport in Parker, Arizona, stated that glare from the PSEGS towers has the potential to cause a hazardous distraction to pilots, especially those flying on the nearby heavily traveled airway Victor-16 (V-16). Staff concurs with Mr. Swendra's concerns and agrees that the airspace above the PSEGS site is heavily used, as indicated by the FAA Aeronautical Study for PSEGS discussed in staff's supplemental testimony.

Mr. Swendra also stated that he could find no evidence that the PSEGS applicant filed an FAA Form 7460, "Notice of Proposed Construction", for the project. However, the applicant did file an FAA Form 7460 for each solar tower in March 2013, as discussed in the Traffic and Transportation section of the FSA for the PSEGS Amendment. The FAA responded to the filing on July 18, 2013 with a "Determination of No Hazard to Air Navigation".⁵ The Determination expires on January 18, 2015. Unfortunately, the Determination only evaluates physical hazards to air navigation, and not potential impacts of glint and glare. The FAA does not formally assess glint and glare hazards from solar power tower projects at this time.

Exhibit 8033, The Ivanpah ASRS Report (TN 202568):

This exhibit is a pilot's report of glare at ISEGS. Staff addressed this report in the supplemental testimony.

⁵ This Determination can be found at:

<https://oeaaa.faa.gov/oeaaa/external/searchAction.jsp?action=showSearchArchivesForm>

Search using Signature Control Number 185279790-185985916.

MARIE FLEMING OF GALATI BLEK LLP (REPRESENTING THE APPLICANT)

Exhibit 1142, Clark County Department of Aviation Letter and Filed Pilot Complaints for ISEGS:

This exhibit is a March 10, 2014 letter from the Clark County Department of Aviation (CCDOA) detailing concerns about glare at ISEGS. This letter was the initial trigger for staff conducting the ISEGS fly-over and is discussed in staff's supplemental testimony for PSEGS (TN 202480, page 47).

CONDITIONS OF CERTIFICATION

Staff stated in the PSEGS FSA that Condition of Certification **TRANS-7, Heliostat Monitoring and Positioning Plan**, would mitigate pilot glare to less than significant. However, as discussed in staff's supplemental testimony, after viewing the Ivanpah Solar Electric Generating System (ISEGS) in operation after receiving pilot complaints, staff realized that **TRANS-7** as written was not sufficient to mitigate glare impacts to pilots. As a result, in staff's supplemental testimony, staff proposed conceptual modifications to **TRANS-7** to further reduce glare impacts to pilots. In this rebuttal testimony, staff is proposing specific modifications to the language of **TRANS-7**. Although these modifications to **TRANS-7** could reduce impacts, staff cannot conclude definitively that **TRANS-7** would mitigate disabling glare impacts to pilots to a less than significant level. Staff does not have sufficient information to conclude whether the mitigation methods included in the modifications would be feasible and compatible with operation of the PSEGS.

On July 17, 2014, staff received a report from Sandia Laboratories called "Evaluation of Glare at the Ivanpah Solar Electric System" (TN 202724) as part of the required compliance submittals for the ISEGS plant. The report, which was produced independently of the Energy Commission, is consistent with staff's analysis for PSEGS, stating that the glare from heliostats in the standby position at ISEGS is the major concern, and proposing mitigation measures similar to those proposed by staff below for PSEGS as part of the modification of **TRANS-7**.

See below for staff's specific proposed modifications to FSA Condition of Certification **TRANS-7**. (**Note:** Deleted text is in ~~strikethrough~~, and new text is **bold and underlined.**)

TRANS-7 Heliostat Positioning and Monitoring Plan

To reduce glint and glare from the project, the project owner shall prepare a Heliostat Positioning and Monitoring Plan (HPMP) which includes the following information. The HPMP shall be implemented during installation of the heliostats and during project operation.

1. Identify the heliostat movements and positions (including during normal operations, daytime mirror-washing, removal of solar flux due to high

winds, and all non-normal known operational scenarios and possible malfunctions) that could result in potential exposure of observers at various locations, including pilots, motorists, pedestrians and hikers in nearby wilderness areas, to direct solar reflections from the heliostats (DSRH).

2. Describe within the HPMP how programmed heliostat operation would address potential DSRH events at locations of observers, and how it would maximally limit or avoid potential exposures. This shall include heliostat positioning and transition algorithm exclusion zones that maximally avoid ground-based **DSRH events on the ground and in the air.**
3. **Describe within the HPMP how disabling glare to pilots from heliostats in the standby position would be reduced through methods such as limiting the number of mirrors in the standby position, changing the geometry of the standby ring to disperse reflections, improving calibration and positioning algorithms of the heliostats, providing a “light dump” or receiver for heliostat standby reflections, or use of any other method that would effectively mitigate glare.**
34. Describe how the mirrored surfaces of the heliostats would be covered during construction until the heliostats are properly seated, oriented, and under computer control to avoid exclusion zones.
45. Implement a set of baseline heliostat positioning and control algorithms to minimize DSRH events as soon as realistically possible after heliostat installation. The baseline control algorithms shall initially minimize ground-based DSRH events during site set-up, testing and calibration prior to power generation operations. If this does not work to minimize ground-based DSRH events, the project owner shall modify the perimeter fencing along I-10 to prevent motorists from experiencing DSRH events.
56. Prepare a monitoring plan to quantify the frequency and locations of DSRH events and validate that the DSRH events are minimized by HPMP implementation. **To monitor DSRH events on the ground, This may be implemented with a staring camera system along a known line of sight to ground-based observation points (e.g., I-10) could be used. DSRH events experienced by pilots could be monitored by flying over and photographing or videotaping the PSEGS, and by seeking out pilot reports of glare from sources such as the NASA Aviation Safety Reporting System (ASRS) and nearby airports and aviation agencies.**

The monitoring plan shall be made available to interested parties, including the Department of Defense (DoD), California Department of Transportation (Caltrans), California Highway Patrol (CHP), Federal Aviation Administration (FAA), Riverside County Economic Development

Agency Department of Aviation, the Riverside County ALUC, and the Riverside County Transportation and Land Management Agency. The monitoring plan shall be updated on an annual basis during project construction and for the first 5 years of project operation. The monitoring plan shall be updated and at 2-year intervals thereafter for the life of the project, unless the project owner is released from this requirement as discussed in Section 8 of this condition.

67. Obtain field measurements in candela per meters squared and watts per meter squared to validate that the HPMP avoids the potential for human health and safety hazards consistent with the methodologies detailed in the 2010 Sandia Lab document presented by Clifford Ho, et al., including those studies and materials related to ocular damage referenced within.
78. Provide requirements and procedures to document, investigate and resolve legitimate complaints regarding glint and glare events. This includes establishing a toll-free number for the public to report complaints related to glint and glare and posting this number in the same location as that required in Condition of Certification **COMPLIANCE-119**. If no legitimate complaints are received within the first 5 years of project operation, the project owner can request that the CPM release the project owner from the obligations under Section 6 of this condition after the 5th year of project operations.

~~The project owner shall notify the CPM within 3 days of receiving a glint or glare complaint. The complaint shall be as soon as the complaint has been resolved or within 10 days of the complaint or at another time agreed to by the CPM, at which time the project owner shall submit to the CPM a report in which the complaint(s) as well as the actions taken to resolve the complaint(s) are documented. The report shall include (a) a complaint summary, including the name and address of the complainant; (b) a discussion of the steps taken to investigate the complaint; (c) the reasons supporting a determination of whether or not the complaint is legitimate; and (d) the steps taken to address the complaint and the final results of these efforts. This information shall be included in the Monthly Compliance Reports.~~

~~or not the complaint is legitimate; and (d) the steps taken to address the complaint and the final results of these efforts. This information shall be included in the Monthly Compliance Reports.~~

Verification: 60 days prior to the start of construction, the project owner shall prepare and submit to the CPM for review and approval a plan for baseline heliostat positioning and control algorithms and other methods to minimize DSRH events after heliostat installation and during site set-up, testing, and calibration. 90 days prior to the start of operation of any unit, the project owner shall submit the remainder of the HPMP describing how the above measures will be implemented to reduce glint and glare during project operation, and how monitoring will occur.

If the project owner receives a complaint regarding glint or glare, the owner shall conduct an investigation to determine whether the complaint is legitimate and if the project is the source of such glint or glare. If it is determined that the project is the source of such glint or glare, the project owner shall take all feasible measures to eliminate or reduce the glint or glare. Such measures may include localized screening.

The project owner shall notify the CPM within 3 days of receiving a glint or glare complaint. **The complaint shall be** ~~As soon as the complaint has been resolved or within 10 days of the complaint~~ **or at another time agreed to by the CPM, at which time** the project owner shall submit to the CPM a report in which the complaint(s) as well as the actions taken to resolve the complaint(s) are documented. The report shall include (a) a complaint summary, including the name and address of the complainant; (b) a discussion of the steps taken to investigate the complaint; (c) the reasons supporting a determination of whether or not the complaint is legitimate; and (d) the steps taken to address the complaint and the final results of these efforts. **This information shall be included in the Monthly Compliance Reports.**

If no legitimate complaints are received within the first 5 years of project operation, the project owner can request that the CPM release the project owner from the obligations under Section 6 of this condition after the 5th year of project operations.

~~If no legitimate complaints are received and/or if a legitimate complaint is received and the project owner has resolved the source of the complaint(s) within the first 12 months of project operation, project owner can request that the CPM release the project owner from the obligations under Section 4 of this condition after the 12th month of project operations.~~

REFERENCES

Tiffani Winter (TN 202724). Sandia National Laboratories, Evaluation of Glare at the Ivanpah Solar Electric Generating System, dated July 2014. Submitted to CEC/Docket Unit on July 17, 2014.

V. OVERRIDING CONSIDERATIONS - THERMAL ENERGY STORAGE

Supplemental Testimony of Edward Brady and Shahab Khoshmashrab

INCORPATED BY REFERENCE

Facility Design staff hereby incorporates by reference the testimony provided in Attachment B to CEC Staff's Response to Petitioner's Motion to Reopen the Evidentiary Record (TN 202210).

REFERENCES

CEC 2014- California Energy Commission/ Darlene Burgess (TN 202210). Committee Order Granting Petitioner's Motion to Reopen the Evidentiary Record and Setting Revised Schedule, Dated May 21, 2014. Docketed May 21, 2014.

VII. Declarations & Resumes

**DECLARATION OF
LOREY CACHORA**

I, Lorey Cachora, declare as follows:

- I, am a tribal member of the Quechan Tribe and a member of the Quechan tribal government's Preservation Culture Committee Consultant.
- A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
- I consulted with staff testimony on portions (archaeology and ethnography) of cultural resources section for Palen Solar Energy Generating System Final Staff Assessment, based on my independent analysis of the Application for Certification and supplement hereto, data from reliable documents and sources, and my professional and cultural experience and knowledge.
- It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.
- I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify completely thereto.
- I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: June 25, 2014

Signed: _____



At: Winterhaven, California

**DECLARATION OF
Brett Fooks**

I, **Brett Fooks**, declare as follows:

1. I am presently employed by the California Energy Commission in the Siting, Transmission and Environmental Protection Division as a **Mechanical Engineer**.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I prepared the supplemental staff testimony on **Biological Resources** in the area of **Attachment A**, for the **Palen Solar Electric Generating System (PSEGS) (09-AFC-7C)**, based on my independent analysis of the Petition to Amend and supplements thereto, data from reliable documents and sources, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and, if called as a witness, could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 17, 2014

Signed: 

At: Sacramento, California

BRETT FOOKS, P.E.

SENIOR MECHANICAL & PROFESSIONAL ENGINEER

Visionary, analytical and high-performance engineering professional with a proven record of accomplishment in leading the planning and design of projects including HVAC systems and plumbing systems. Expertise in conducting the research, feasibility, analysis, cost estimation, design, and installation of systems and components to meet project requirements and client specifications. Experienced in various 3D CAD packages, while partnering with interdisciplinary teams in handling system design specifications, resolving coordination issues, and providing technical expertise.

- **Mechanical Engineering**
- **Complex Problem Resolution**
- **Project Management**
- **Systems Concept & Design**
- **Construction Processes**
- **Strategic Planning**

PROFESSIONAL EXPERIENCE

Capital Engineering Consultants, Inc. **Rancho Cordova, CA** **6/2004 - Present**

A leader in mechanical engineering design in Northern California since 1947 specializing in areas including K-12 Education, Higher Education, Civic and Justice, and Healthcare.

SENIOR ENGINEER, ASSOCIATE

Manage the design, project specification, calculations and cost estimations for new and renovated construction projects.

Oversee and supervise the daily workload, mentoring, and quality control for an assigned junior engineer.

- Plan and monitor the workload of projects, while preparing and taking responsibility for the concept of and preliminary engineering solutions for the detailed design phase.
- Implement the detailed design engineering of HVAC systems; code review, heating and cooling load calculations, air-flow requirements, ductwork sizing and layout, piping sizing and layout, equipment selection, and system controls with an emphasis on healthcare facilities.
- Prepare and deliver calculations for Title 24 building compliance.
- Prepare and deliver calculations and documents for project LEED certification.

Select Accomplishments

- Championed the complete set-up of a medical gas code comparison excel spreadsheet allowing engineers to quickly find code information; updated each code cycle.
- Assisted in the implementation and teaching of new 3-D modeling software, CAD-MECH, to team members for the Sutter Health Eden Medical Center.
- Worked with a team to develop the design and energy specifications which included a mix of electric chillers and TES for Load shifting for the Department of General Services Sacramento Downtown Central Plant.
- Worked with co-workers to create and implement standards for plumbing calculations firm wide leading to an increased efficiency.
- Led the effort to test and use Revit as an analytical tool to decrease design time for plumbing.

EDUCATION

STATE OF CALIFORNIA ~ LICENSED PROFESSIONAL ENGINEER

Member ~ ASPE

BACHELOR OF SCIENCE ~ MECHANICAL ENGINEERING (2004)

California Polytechnic State University, San Luis Obispo

Computer Literacy: Proficient in the use of various software applications including Microsoft Office (Word, Excel, PowerPoint, Outlook) AutoCAD 2012/2013, Revit 2013/2014, Visio, NavisWorks, and ProjectWise.

**DECLARATION OF
Gregg Irvin, Ph.D.**

I, **Gregg Irvin**, declare as follows:

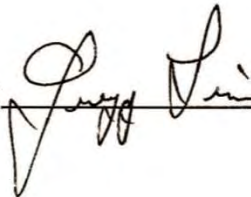
1. I am presently employed by the California Energy Commission in the Siting, Transmission and Environmental Protection Division as a **Glint and Glare Consultant**.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I prepared the supplemental staff testimony on **Biological Resources**, in the area of **Traffic and Transportation**, for the **Palen Solar Electric Generating System (PSEGS) (09-AFC-7C)**, based on my independent analysis of the Petition to Amend and supplements thereto, data from reliable documents and sources, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and, if called as a witness, could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 17, 2014

At: Sacramento, California

Signed: _____

A handwritten signature in black ink, appearing to read "Gregg Irvin", is written over a horizontal line. The signature is cursive and stylized.

**DECLARATION OF
William Kanemoto**

I, **William Kanemoto** declare as follows:

1. I am presently employed by the California Energy Commission in the Siting, Transmission and Environmental Protection Division as a Visual Resources Consultant.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I prepared the supplemental testimony on **Biological Resources** in the area of **Visual Resources** for the Palen Solar Electric Generating System (PSEGS) (09-AFC-7C) based on my staff's independent analysis of the Application for Certification and supplements thereto, data from reliable documents and sources, and their professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 17, 2014 Signed: William Kanemoto

At: Sacramento, California

by
D. Jones

**DECLARATION OF
Andrea Koch**

I, **Andrea Koch**, declare as follows:

1. I am presently employed by the California Energy Commission in the Siting, Transmission and Environmental Protection Division as an **Environmental Planner II**.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I prepared the supplemental staff testimony on **Biological Resources**, in the area of **Traffic and Transportation**, for the **Palen Solar Electric Generating System (PSEGS) (09-AFC-7C)**, based on my independent analysis of the Petition to Amend and supplements thereto, data from reliable documents and sources, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and, if called as a witness, could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 17, 2014

Signed: 

At: Sacramento, California


**DECLARATION OF
Shahab Khoshmashrab**

I, **Shahab Khoshmashrab**, declare as follows:

1. I am presently employed by the California Energy Commission in the Siting, Transmission and Environmental Protection Division as a **Senior Mechanical Engineer**.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I prepared the supplemental staff testimony on **Biological Resources** in the area of **Noise**, for the **Palen Solar Electric Generating System (PSEGS) (09-AFC-7C)**, based on my independent analysis of the Petition to Amend and supplements thereto, data from reliable documents and sources, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and, if called as a witness, could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 17, 2014

Signed: 

At: Sacramento, California

**DECLARATION OF
Michael D McGuirt**

I, **Michael D McGuirt**, declare as follows:

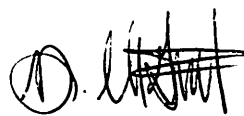
1. I am presently employed by the California Energy Commission in the Siting, Transmission, and Environmental Protection Division as a Cultural Resources Specialist.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I contributed concepts included in staff's supplemental testimony on **Cultural Resources**, for the **Palen Solar Electric Generating System (PSEGS)** amendment (**09-AFC-07C**), based on my independent analysis of the December 2012 Petition to Amend and supplements thereto, data from reliable documents and sources, personal field research, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and, if called as a witness, could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: _____

7/9/2014

Signed: _____



At: Sacramento, California

MICHAEL D MCGUIRT, MA, RPA

SUMMARY OF PROFESSIONAL EXPERIENCE

Over nineteen years of professional academic and cultural resources management experience in western North America, Hawai'i, Central America, and Eastern Europe. Former regulator and present planner with expert knowledge of Section 106 of the National Historic Preservation Act of 1966 (NHPA). Thorough knowledge of the California Environmental Quality Act of 1970 (CEQA), Section 110 of the NHPA, and the US Army Corps of Engineers' Appendix C. Working knowledge of the National Environmental Policy Act of 1969 (NEPA), Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), and the Archaeological Resources Protection Act of 1979 (ARPA). Expert in developing and coordinating historic preservation solutions that comply with complex Federal, state, and local regulatory environments for large-scale energy, transportation, and telecommunications projects. Expert technical skills in geoarchaeology, mapping and spatial analysis, archaeological survey and excavation, and material culture analyses.

EDUCATION

MASTER OF ARTS, Anthropology, University of Texas at Austin
May 1996

BACHELOR OF ARTS, Anthropology and Archaeological Studies, University of Texas at Austin
December 1990

PROFESSIONAL AFFILIATIONS

Register of Professional Archaeologists
Society for American Archaeology
Society for California Archaeology
National Trust for Historic Preservation
California Preservation Foundation

HONORARY AFFILIATIONS

Honor Society of Phi Kappa Phi

RECENT PROFESSIONAL EMPLOYMENT

ENERGY PLANNER III, California Energy Commission, Sacramento, California
December 2009 to May 2010

Supervised an Energy Commission staff of five professional cultural resources analysts and a varying number of equivalent consultants in the development of CEQA and NEPA analyses of the potential effects that the construction and operation of proposed thermal power plants may have on significant cultural resources, developed and supervised the implementation of agency-wide programs to facilitate agency compliance with Federal historic preservation regulations, and supervised the periodic staff reviews of licensees' actions to ensure compliance with conditions of certification for extant licenses.

ENERGY PLANNER II, California Energy Commission, Sacramento, California
November 2007 to December 2009, June 2010 to present

Develop environmental impact analyses of the potential effects that the construction and operation of proposed thermal power plants may have on significant cultural resources. Apply applicable Federal, State, and local statutes and regulations, as they relate to the consideration of cultural resources. Design and execute cultural resource impact analyses that are appropriate to the specific regulatory context for each proposed project. Gather and evaluate information on projects and on cultural resources in project areas. Develop and maintain agency and public relationships to acquire the most useful data and to elicit input in the development of California Energy Commission conditions of certification. Succinctly convey, orally in different public forums and in different written technical formats, the results of cultural resource impact analyses and proposed conditions of certifications meant to mitigate adverse impacts to significant cultural resources. Periodic reviews of licensees' actions to ensure compliance with extant conditions of certification. Oversight of consultants' who are preparing cultural resource impact analyses.

ASSOCIATE STATE ARCHAEOLOGIST, Office of Historic Preservation, California Department of Parks and Recreation (California State Parks), Sacramento, California
May 2001 to November 2007

Regulator, in the California Office of Historic Preservation (OHP), of the Advisory Council on Historic Preservation's (Advisory Council) process implementing Section 106 of the National Historic Preservation Act (NHPA). Conducted among the most complex Section 106 reviews, and participated in, and often guided, the consultations of which those reviews were a part. Formally advised other OHP units and the California State Historical Resources Commission on the appropriate disposition and treatment of archaeological resources in the context of other State and Federal historic preservation programs that OHP either administers or in which OHP participates. Worked out of class for two consecutive, six-month terms as a Senior State Archeologist, from December 2004 through December 2005, supervising the Project Review Unit for the State Historic Preservation Officer (SHPO). As the Acting Chief of Project Review, managed and trained a staff of eight professionals and one clerical assistant to conduct, on behalf of the SHPO, the review of all Federal agency actions in the State of California under 36 CFR Part 800, the Advisory Council's Section 106 regulation.

ENVIRONMENTAL SPECIALIST III, Jones & Stokes, Sacramento, California
February 1999 to May 2001

Designed, conducted, and managed short- and long-term archaeological projects in California, Nevada, and New Mexico to comply with Sections 106 and 110 of the NHPA. Prepared proposals. Assisted with client contract negotiations. Conducted archaeological record searches and archival research. Directed Phase I pedestrian inventory surveys and test excavations for Phase II evaluations. Analyzed material culture assemblages. Prepared technical reports and regulatory compliance documents including National Register property and district evaluations, and monitoring and discovery plans. Represented clients in consultations with federal and state agencies, and coordinated and managed clients' compliance with federal cultural resource

regulations and the cultural resource regulations of California, Nevada, and New Mexico.

ASSISTANT ANTHROPOLOGIST, Bernice Pauahi Bishop Museum, Honolulu, Hawai'i
August 1996 to June 1998

Assisted with archaeological project design, preparation of proposals, and client contract negotiations, directed Phase I pedestrian inventory surveys, test excavations for Phase I subsurface inventory surveys, test excavations for property evaluations, and data recovery excavations, and assisted with preparation of technical reports on short-term cultural resource management contracts. Analyzed field records, prepared site reports and synthetic report chapters, and analyzed and prepared reports on lithic assemblages for Phases I–III of a long-term federal highway project (Interstate Route H–3). Conducted research in Hawaiian archaeology, and delivered public and professional presentations of that research. Advised on the integration of geoarchaeological methods and techniques into cultural resource management field efforts, and on geoarchaeological interpretations of extant field records, and designed and conducted geoarchaeological components of fieldwork for short-term cultural resource management contracts.

ARCHEOLOGIST I, Archeology Survey Team, Texas Parks and Wildlife Department, Austin, Texas

December 1994 to May 1995

Assisted in the direction of pedestrian inventory surveys, the preparation of cultural resource management plans, and the preparation of state site forms and reports of investigations. Advised on the integration of global positioning system (GPS) technology and the field methods of archaeological survey.

ARCHAEOLOGIST, Lower Colorado River Authority, Austin, Texas

February 1994 to December 1994

Designed and implemented experimental mitigation measures for archaeological sites subject to fluvial and lacustrine erosion. Assisted in pedestrian inventory surveys and evaluation-phase excavations, the preparation of State site forms, the development of the agency's database for its archaeological site inventory, and public education initiatives that included site tours for primary and secondary students, and workshops with field and classroom components to instruct primary and secondary teachers.

RECENT PROFESSIONAL DEVELOPMENT

CULTURAL RESOURCE AND ENVIRONMENTAL LAW

NEPA Compliance and Cultural Resources

Sacramento, California, National Preservation Institute, Joe Trnka
December 2013

Identification and Management of Traditional Cultural Places, The Presidio, San Francisco, California, National Preservation Institute, Claudia Nissley
October 2013

The Section 106 Advanced Seminar: Reaching Successful Outcomes in Section 106 Review

Sacramento, California, Advisory Council on Historic Preservation, Tom McCulloch
March 2011

Renewable Energy Development: Impacts on Cultural Resources

Phoenix, Arizona, National Preservation Institute, Claudia Nissley
February 2011

Thresholds of Significance in Environmental Planning

Sacramento, California, University of California, Davis, Continuing and Professional Education, Terry Rivasplata and Maggie Townsley
February 2011

Successful CEQA Compliance: An Intensive Two-Day Seminar

Sacramento, California, University of California, Davis, Continuing and Professional Education, Terry Rivasplata and Maggie Townsley
June 2009

ACHP - FHWA Advanced Seminar: Reaching Successful Outcomes in Section 106 Review

Vancouver, Washington, Advisory Council on Historic Preservation, Don Klima and Carol Legard; Federal Highway Administration, Mary Ann Naber
October 2007

NEPA Compliance and Cultural Resources

Portland, Oregon, National Preservation Institute, Joe Trnka
October 2007

Section 106: How to Negotiate and Write Agreements

Sacramento, California, National Preservation Institute, Claudia Nissley
November 2004

Consultation with Indian Tribes on Cultural Resource Issues

Sacramento, California, National Preservation Institute, Thomas F. King and Reba Fuller
September 2003

Section 106: How to Negotiate and Write Agreements

The Presidio, San Francisco, California, National Preservation Institute, Thomas F. King
May 2002

Introduction to CEQA

Sacramento, California, University of California, Davis, Continuing and Professional Education, Ken Bogdan and Terry Rivasplata
July 2000

TECHNICAL ARCHAEOLOGY

Introduction to Historic Site Survey, Preliminary Evaluation, and Artifact ID

West Sacramento, California, California Department of Transportation, Julia Huddleson, Anmarie Medin, Judy Tordoff, and Kimberly Wooten; California Department of Parks and Recreation, Glenn Farris, Larry Felton, and Pete Schulz
September 2006

Principles of Ge archaeology for Transportation Projects (Course No. 100246)
Sacramento, California, California Department of Transportation, Graham Dalldorf,
Glenn Gmoser, Jack Meyer, Stephen Norwick, Adrian Praetzellis, and William Silva
October 2006

INFORMATION TECHNOLOGY AND CULTURAL RESOURCE MANAGEMENT

GIS: Practical Applications for Cultural Resource Projects
Sacramento, California, National Preservation Institute, Deidre McCarthy
September 2006

ENVIRONMENTAL ANALYSES, TECHNICAL REPORTS, CONFERENCE PAPERS, AND PUBLICATIONS

ALLRED, SARAH, MICHAEL MCGUIRT, AND KATHLEEN FORREST

2010 **Cultural Resources and Native American Values.** In *Calico Solar Power Project, Supplemental Staff Assessment, Part II* (CEC-700-2010-009-SSA-2, August 2010), edited by Siting, Transmission and Environmental Protection Division, California Energy Commission, pp. C.2-1–C.2-175. Siting, Transmission and Environmental Protection Division, California Energy Commission, Sacramento. On file with the California Energy Commission, Sacramento.

BASTIAN, BEVERLY E. AND MICHAEL D. MCGUIRT

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BLOSSER, AMANDA, MICHAEL D. MCGUIRT, AND BEVERLY E. BASTIAN

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BRAUN, MATTHEW, THOMAS GATES, MELISSA E. MOURKAS, AND MICHAEL D MCGUIRT

2013 **Cultural Resources.** In *Palen Solar Electric Generating System, Part B, Amendment to the Palen Solar Power Project [09-AFC-7C]*. CEC-700-2013-003-FSA-PTB, September 2013, edited by Siting, Transmission and Environmental Protection Division, California Energy Commission, pp. 4.3-1–4.3-244. Siting, Transmission and Environmental Protection Division, California Energy Commission, Sacramento. On file with the California Energy Commission, Sacramento.

DARCANGELO, JENNIFER, JOHN SHARP, MICHAEL D. MCGUIRT, ANDREA GALVIN, AND CLARENCE CAESAR

2004 **Section 106 for Experienced Practitioners: Consulting with the California SHPO (GEV4111)**. Course taught on 8 September 2004 in Oakland to California Department of Transportation cultural resources personnel and private sector cultural resource consultants (8 hours).

DARCANGELO, JENNIFER, JOHN SHARP, MICHAEL D. MCGUIRT, AND ANDREA GALVIN
2005 **How to Consult with the California SHPO**. Workshop presented on 23 April 2005 at the 39th Annual Meeting of the Society for California Archaeology, Sacramento, California (6 hours).

FORREST, KATHLEEN AND MICHAEL D. MCGUIRT

2010 **Cultural Resources**. In *Almond 2 Power Plant Project, Revised Staff Assessment* (CEC-700-2010-011REV, July 2010), edited by Siting, Transmission and Environmental Protection Division, California Energy Commission, pp. 4.3-1–4.3-51. Siting, Transmission and Environmental Protection Division, California Energy Commission, Sacramento. On file with the California Energy Commission, Sacramento.

GATES, THOMAS, AMBER GRADY, AND MICHAEL D. MCGUIRT

2012 **Cultural Resources**. In *Hidden Hills Solar Electric Generating System (11-AFC-2) Supplemental Staff Assessment* (June 15, 2012), pp. 1–101. Siting, Transmission and Environmental Protection Division, California Energy Commission, Sacramento. On file with the California Energy Commission, Sacramento.

JONES & STOKES

1999a **Cultural Resource Inventory Report for Williams Communications, Inc. Fiber Optic Cable System Installation Project, Wendover, Nevada to the California State Line**. Volume 1: Draft Report. July. (JSA 98-358.) Sacramento, California. Prepared for Williams Communications, Inc., Tulsa, Oklahoma.

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1997 ***Archaeological Reconnaissance of Pouhala Marsh, `Ewa District, O`ahu.*** Department of Anthropology, Bishop Museum, Honolulu. (14 pp.) Submitted to Ducks Unlimited, Inc., Rancho Cordova, California. On file with the State Historic Preservation Division, Honolulu.

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1996 ***The Geoarchaeology and Palynology of an Early Formative Pithouse Village in West-Central New Mexico.*** Unpublished M.A. thesis, Department of Anthropology, University of Texas at Austin.

1998 ***50-80-10-2010, 50-80-10-2016, 50-80-10-2088, and 50-80-10-2134.*** In *Activities and Settlement in an Upper Valley: Data Recovery and Monitoring Archaeology in North Hālawā Valley, O`ahu*, vols. 2a and 2b, edited by Department of Anthropology, Bishop Museum, pp. 1–3, 1–44, 1–5, and 1–46. Department of Anthropology, Bishop Museum, Honolulu. Submitted to State of Hawaii, Department of Transportation, Honolulu. On file with the State Historic Preservation Division, Honolulu.

2002 ***Committee Reports, OHP Liaison.*** *SCA Newsletter* 36(3):4–5.

2004 ***Committee Reports, OHP Liaison.*** *SCA Newsletter* 38(2):7, 38(3):6–8.

2006 ***Preservation Archaeology.*** In *California Statewide Historic Preservation Plan: 2006–2010*, edited by Marie Nelson, pp. 8–15. California Department of Parks and Recreation's Office of Historic Preservation, Sacramento. Submitted to the National Park Service, Washington, D.C. On file at the California Office of Historic Preservation, Sacramento.

2007 ***Dealing with Multi-element Cultural Resources under Section 106.*** In *Historic Properties Are More Than Meets the Eye: Dealing with Historical Archaeological Resources under the Regulatory Context of Section 106 and CEQA.* Session presented on 25 April 2008 at the 33rd Annual California Preservation Conference of the California Preservation

Foundation in Napa, California, moderated by Michelle Messinger and Michael D. McGuirt (1 1/2 hours).

2010 **Cultural Resources and Native American Values.** In *Imperial Valley Solar Project (Formerly SES Solar Two), Supplemental Staff Assessment, Part II* (CEC-700-2010-013 SUP, August 2010), edited by Siting, Transmission and Environmental Protection Division, California Energy Commission, pp. C.3-1–C.3-409 plus appendix B (118 pp.). Siting, Transmission and Environmental Protection Division, California Energy Commission, Sacramento. On file with the California Energy Commission, Sacramento.

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MCGUIRT, MICHAEL D. AND LESLIE H. HARTZELL

1997 **50-80-10-2139 and 50-80-10-2459.** In *Imu, Adzes, and Upland Agriculture: Inventory Survey Archaeology in North Hālawā Valley, O`ahu*, vols. 2c and 2d, edited by Department of Anthropology, Bishop Museum, pp. 1–17 and 1–5. Department of Anthropology, Bishop Museum, Honolulu. Submitted to State of Hawaii, Department of Transportation, Honolulu. On file with the State Historic Preservation Division, Honolulu.

1998 **Chapter 1: Introduction.** In *Activities and Settlement in an Upper Valley: Data Recovery and Monitoring Archaeology in North Hālawā Valley, O`ahu*, vol. 1, edited by Department of Anthropology, Bishop Museum, pp. 1–14. Department of Anthropology, Bishop Museum, Honolulu. Submitted to State of Hawaii, Department of Transportation, Honolulu. On file with the State Historic Preservation Division, Honolulu.

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1997 **50-80-10-2256**. In *Imu, Adzes, and Upland Agriculture: Inventory Survey Archaeology in North Hālawā Valley, O`ahu*, vol. 2d, edited by Department of Anthropology, Bishop Museum, pp. 1–9. Department of Anthropology, Bishop Museum, Honolulu. Submitted to State of Hawaii, Department of Transportation, Honolulu. On file with the State Historic Preservation Division, Honolulu.

MIKESELL, STEPHEN, MICHAEL MCGUIRT, AND TRISH FERNANDEZ

2008 **Introduction to the White Papers in State Historical Resources Commission Archaeology Committee White Papers**. *SCA Newsletter* 41(1):18–21.

SHARP, JOHN, MICHAEL D. MCGUIRT, JENNIFER DARCANGELO, AND ANDREA GALVIN

2004 **How to Consult with the California SHPO**. Workshop presented on 18 March 2004 at the 38th Annual Meeting of the Society for California Archaeology, Riverside, California (4 hours).

**DECLARATION OF
Carol Watson**

I, **Carol Watson**, declare as follows:

1. I am presently employed by the California Energy Commission in the Siting, Transmission and Environmental Protection Division as a **Planner II (Staff Biologist)**.
2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.
3. I prepared the supplemental staff testimony on **Biological Resources** in the area of **Biological Resources**, for the **Palen Solar Electric Generating System (PSEGS) (09-AFC-7C)**, based on my independent analysis of the Petition to Amend and supplements thereto, data from reliable documents and sources, and my professional experience and knowledge.
4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed therein.
5. I am personally familiar with the facts and conclusions related in the testimony and, if called as a witness, could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 17, 2014

Signed: 

At: Sacramento, California