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STATE OF CALIFORNIA

Energy Resources Conservation and Development Commission

In the Matter of: APPLICATION FOR CERTIFICATION FOR THE PALEN SOLAR ENERGY GENERATING SYSTEM	DOCKET NO. 09-AFC-7C

INTERVENOR CENTER FOR BIOLOGICAL DIVERSITY

Exhibit 3144

Rebuttal Testimony of K. Shawn Smallwood, Ph.D.

I reviewed testimony submitted in June 2014 on the matter of the Petition to Amend the Certification for the Palen Solar Energy Generating System. Herein I provide rebuttal testimony, mostly on Exhibit 1134, which was Erickson and Levenstein's Supplemental Opening Testimony on biological resources impacts and mitigation. My qualifications were stated in my Opening Testimony, Exhibit 3128, which was later corrected in Exhibit 3140. My CV was attached to Exhibit 3128.

When discussing a table comparing fatalities among three solar projects with different technologies (Exhibit 1133), Erickson and Levenstein (Exhibit 1134, page 2) wrote, "*While there are differences in data collection methods and the quantity and quality of the data, they provide some information on the similarities or possible differences in the species and taxa composition among the different technologies*." Erickson and Levenstein then proceeded to speculate that adaptive management techniques might be able to mitigate impacts caused by solar flux. However, Erickson and Levenstein provided no connections between the fatality lists in Exhibit 1133 and their conclusion that there will be adaptive management solutions to solar flux injuries and death; that is, the fatality lists in Exhibit 1133 had nothing to do with remainder of the testimony in Exhibit 1133. The only argument they made for an adaptive management solution was the following, "*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*." This conclusion was based on hopeful speculation, but had no basis in the fatality lists in Exhibit 1133.

There is always the possibility that the ability to manage stowing positions might help reduce fatalities, but there is no evidence that it will. This type of suggested solution reminds me of so many claims about how avian and bat fatalities could be reduced at

wind projects. I was intensely involved in the largest adaptive management effort ever attempted at wind resource areas for longer than a decade, while I was a member of the Alameda County Scientific Review Committee (SRC) for five years, and as a researcher and consultant for four years prior to the formation of the SRC and for the four years since I departed from the SRC. Many of the measures that were speculated to be effective, or that were promised or implemented, were summarized in Smallwood (2008). Of all of these measures, including measures I initially thought might work, the only one that measurably showed any promise was the removal of wind turbines known or predicted to cause disproportionate numbers of fatalities.

The wintertime curtailment measure for wind turbines was an example of a measure that was advanced by hopeful speculation. Mr. Wally Erickson (an author of Exhibit 1133) proposed this measure to me in 2005, and I advocated for it. It was implemented in 2005 in an experiment that was designed by Erickson and implemented initially by his consulting firm. Erickson and WEST left the project within two years of implementation, so did not see it through to the end, but I did. Erickson's crossover design did not generate useful results due to confounding effects and because the fatality search interval was too long relative to the treatment periods. Now in 2014, the wintertime curtailment measure continues to be implemented at thousands of wind turbines in the Altamont Pass, but with no agreement among SRC members that it has ever been effective. For nine years the wind companies had to shut down their wind turbines over the winter months even though there has been no convincing evidence that the wind companies' sacrifice of energy generation reduced fatalities.

It is easy for some to claim that some speculated measure will be effective, or that adaptive management will somehow overcome project impacts for which we have no idea how to mitigate at this time. I have gone through this process, so I can attest to the frustrations among all parties when operation costs mount while arguments drone on fruitlessly over whether somebody's idea for mitigation was effective. For adaptive management to be effective, mitigation measures should not be thrown at the decision-makers at the last minute and without founding evidence that they might work. To be effective, a suite of plausible measure should be listed in advance of the project, and all parties should agree that the listed measures are plausible. Then proper experimental designs to test the measures are essential. For example, I am testing whether a new wind turbine model will reduce fatalities, so to do this I am implementing a before-after, control-impact study design (funded by the California Energy Commission's PIER program) and I am necessarily leaving some collision risk in the project to be able to test the effects of the new wind turbine. Once experiments are designed and thresholds of success decided upon by the stakeholders in a transparent process, then plausible alternative mitigation measures need to be listed as the potential next steps in adaptive management.

Erickson and Levenstein proposed no explanation as to why flexibility in stowing positions would reduce project impacts. Do birds and bats die at the other types of solar projects because PV panels and parabolic troughs cannot stow in the same manner as heliostat mirrors in a power tower project? The argument lacks any clear logic from premise to conclusion.

Later in their testimony, Erickson and Levenstein (page 4) wrote, "*Based on our risk assessment and a comparison of species composition data amongst current studies, which is included in the Draft BBCS (Exhibit 1139), the mortality from an average wind energy project is not unlike what is estimated for this solar facility*." In the paragraph preceding this statement, Erickson and Levenstein described a typical 500 MW wind project as yielding 1,700 avian deaths per year. Erickson and Levenstein then dismissed this number of dead birds because combatting climate change is more important. However, Erickson and Levenstein failed to mention that 500 MW of PV panels on rooftops and blacktops would achieve the same climate benefits without killing any birds or bats, and without destroying thousands of acres of wildlife habitat. They also failed to mention that wind projects do not destroy terrestrial habitat in the same manner as industrial solar projects, although there are avoidance impacts (displacement from habitat for some species) and some habitat disturbance caused by grading for access roads and turbine pads.

Erickson and Levenstein also failed to explain how they arrived at their conclusion that 1,700 avian deaths per year will likely result from Palen. They failed to explain that wind project impacts vary greatly from place to place. In fact, I would argue that there is no such thing as an "average wind energy project." Furthermore, the data coming out of routine searches at Ivanpah suggest a very different outcome than what is predicted by Erickson and Levenstein. As Erickson is aware, the numbers of found fatalities must be adjusted for the proportion of fatalities not found by searchers. These adjustments tend to be large, so finding 101 birds in April and 82 birds in May on 20% of the project area can easily translate to project estimates of >2,000 birds per *month*, which is many more than 1,700 per *year*. Consider that Erickson and Levenstein's predicted number of fatalities would translate to 142 birds per month (1,700 deaths ÷ 12 months), or only 50 birds more per month than what is being found at Ivanpah. Because Ivanpah is only 74% of the capacity proposed for Palen, the monthly finds at Ivanpah would need to be divided by 0.74 to be comparable to Palen's capacity. This adjusted number would be 124 birds per month, or only 18 birds per month fewer than predicted by Erickson and Levenstein. According to Erickson and Levenstein's predicted impact, the proportion of fatalities not found by searchers would have to be 0.145 and the adjustment factor would be 0.855. This adjustment factor might work for turkey vultures, but there is no basis for it for adjusting the fatality rates of small birds. In summary, Erickson and Levenstein's predicted impact of 1,700 birds per year is not believable.

Beginning on page 4 and continuing through page 5, Erickson and Levenstein argued that the Palen impacts will be minimal in light of other anthropogenic causes of wildlife mortality, such as dogs and cats and cars and buildings. The argument made by Erickson and Levenstein appeared intended to downplay the impacts solar energy generation on avian species, but actually helped make the case that Palen's project impacts will be cumulatively considerable. I agree that the anthropogenic impacts described by Erickson and Levenstein are devastating, but I disagree that they justify the deaths of thousands of birds and unknown numbers of bats at the Palen project.

According to Erickson and Levenstein (page 5), "*Based on the extensive pre-construction survey data for PSEGS, the project does not appear to be in a high bird use area*." However, bird use, as often characterized by Erickson at proposed wind projects, has failed to predict fatality rates at wind projects, and has yet to be verified at any level among industrial solar projects. Bird behavior is more predictive of wind project impacts, but also suffers from not knowing yet how bird behaviors will change in the face of industrial solar projects. Territorial males seeing their images in heliostat mirrors might fly into the mirrors at rates that could never be predicted by their relative numbers counted in "use" surveys, unless it was known in advance that males of that species would perform that behavior. Characterizing the project area as not a high bird use area was unhelpful of Erickson and Levenstein because bird use does not translate directly to levels of impacts among birds. Moreover, earlier testimony shows that there are relatively high bird use areas in close proximity to the Palen site (E.g., Exhibit 3001 (Anderson Testimony), Exhibit 3019 (Lake Tamarisk E-Bird hot spot information), Exhibit 3037 (Flannagan Testimony), Exhibit 3038 (information on birds banded at the Salton Sea), and Exhibit 3027).

Erickson and Levenstein (page 5) speculated that Palen would cause relatively few fatalities because "*...guy wires at communication and meteorological towers appear to be a very significant risk factor for birds*" and ..."*No guy wires are associated with the PSEGS solar power towers*." While it was true that guy wires would not abound at Palen if built, the same could have been said about Ivanpah, where many birds are being found dead in scientific monitoring. Guy wires had nothing to do with the fatality counts at Ivanpah.

According to Erickson and Levenstein (page 5), "*In addition, according to the meteorological data and our experience on the site, the area doesn't experience frequent foggy conditions, thereby decreasing the potential for a large avian fatality event*." But again, the same could have been said about Ivanpah.

On page 6, Erickson and Levenstein explained, that curtailment of individual wind turbines has been implemented and considered feasible (by nobody who was identified in the argument). However, I have seen no evidence that fatality rates at wind projects were reduced due to this type of curtailment. It is misleading to suggest that a mitigation strategy works when no evidence is provided in support of the suggestion.

Risk Assessment

Erickson and Levenstein (page 7) summarized a risk assessment based on field data collected in fall 2013. Whereas I endorse risk assessments even in the face of high uncertainty, I must point out that this one was based on data collected from only a single season of a single year. In the results section, Erickson and Levenstein report on annual exposures of birds flying through the zone of solar flux, but annual exposures were not obtainable from data collected within a single season of a single year. A risk model based on such a limited time period and applied to a much longer time period was scientifically indefensible.

According to Erickson and Levenstein, "*In lieu of any comparable model for 'collision' with the concentrated flux zone (or, non-avoidance) we adopted a frame work similar to that of the USFWS fatality prediction model for eagles (USFWS 2013).*" However, I must point out that there is no evidence that the USFWS's model has been effective at predicting golden eagle fatalities. I do not believe the model will be effective because after trying many times to predict eagle fatalities using utilization rates (the basis of the USFWS model), I have been unable to see any consistent pattern in the data.

The avoidance terms used by Erickson and Levenstein were based on some speculated avoidance by birds due to visual cues associated with the power tower, the light associated with the zone of solar flux, and with deterrent methods (balloons?). The same visual cues related to the zone of solar flux and the power tower would have occurred at Ivanpah, so the only difference between Palen and Ivanpah in this risk assessment would be deterrent technologies. The only basis for having any confidence in a hopeful outcome of this risk assessment would be the effectiveness of the deterrent technologies, which Erickson and Levenstein have yet to establish. Without the deterrent technologies turning out to be effective, there is no reason to expect that birds will behave any differently or will die any less often at Palen as compared to what happens at Ivanpah. The most effective risk assessments rely on what has already happened under similar circumstances, and the least effective are those that ignore what has already happened under similar circumstances.

The risk assessment concluded, "*With assumptions of 50%, 75%, 90%, 95% and 99% avoidance, the number of estimated fatalities is reduced in a proportional progression.*" Which was what? No levels of reduction were reported, which indicates to me that the results were not very encouraging.

Erickson and Levenstein wrote, "*...it has also been hypothesized that some birds may be slightly injured from exposure to highly concentrated flux and then fly offsite before they die. The same concern is associated with wind energy facilities where birds injured from collision may fly or walk away outside the search area depending on their condition and go undetected by searches.*" It is disturbing to me to see this suggestion that crippling bias (Smallwood 2007) is nothing more than a hypothesis. I have personally found many mortally wounded birds outside the search areas at wind energy projects. I saw one of these birds collide with a wind turbine blade and get thrown to the edge of the fatality search area, where it then flew another 125 m beyond the search area and died. It is not a hypothesis that this happens; it is factual. Similarly, some unknown number of birds injured by heliostat mirrors or the zone of solar flux will leave the project site on their own volition and will escape detection by fatality searchers. Some other wounded birds will remain on site and will have to be transported for care at rehabilitation facilities.

Monitoring Plan

On page 9, Erickson and Levenstein wrote "*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. Exhibit 1162 shows*

a superimposed picture of concentrated solar flux modeled for Palen and the flux injury fatalities at ISEGS based on the information provided in the monthly reports through April 2014. Very few of the carcasses landed outside the estimated area of concentrated solar flux and most of those that did were close to the edge of the area." The problem with this argument is that the birds and bats that survived long enough to land outside the search area were the ones that were not mapped within the search area. The ones falling within the search area were the ones that immediately died. Injured animals might make it much farther away before dying. In fact, injured birds or bats might not die for days or weeks after being injured.

Erickson and Levenstein promised that an adaptive management plan will be prepared to implement the following four measures:

- *"Detection and deterrent methods to determine the most effective technologies for implementation at the Project.*
- *An experimental test of heliostat positioning regimes*
- *Potentially modifying the lighting scheme at the Project*
- *Direct compensatory mitigation funds proportional to species/taxa groups Impacted."*

There's no sound evidence that any of the first three measures will minimize or reduce fatalities at Palen. The fourth measure would not be typical of an adaptive management plan, because it would not test any hypotheses as it would not be intended to reduce or minimize fatalities. Compensatory mitigation is a different and additional requirement to off-set project impacts. What is proposed would not be consistent with adaptive management.

The claim on page 10 that the adaptive management plan would provide a net benefit to wildlife in the area is preposterous. Erickson and Levenstein presented nothing in their supplemental opening testimony that would benefit wildlife so much that the benefits would outweigh the costs of killing more than 20,000 birds per year and destroying several thousand acres of sensitive desert habitat. Playing with heliostat stowing positions will not provide a net benefit to wildlife, nor will placing balloons or some other intended deterrents, nor will modifying the lighting regime.

Deterrent Methods

According to Erickson and Levenstein (page 10), "*Avian deterrent technology is developing rapidly*..." However, most of the deterrent methods listed in Exhibit 1130 were around long before I became an ecologist. Beginning in the 1970s I worked in agricultural fields where my job was to deter birds from raiding crops. In my graduate studies I worked in the Animal Damage Control Lab at UC Davis. I even co-authored a paper on vertebrate pest control methods, including on deterrents (we referred to them as scaring devices). We knew then (Van Vuren and Smallwood 1996), and we still know today, that the effects of hazing tend to be temporary because birds are smart and quickly habituate to the hazing.

Also, as I explained in my opening testimony, implementing hazing devices could place birds at greater risk of injury than leaving the birds alone. Sounding off loud noises or flashing lights as birds approach might scare them into heliostat mirrors or into the zone of solar flux. Hazing also cannot be done without consulting with the US Fish and Wildlife Service because it is illegal to harm birds protected by the Migratory Bird Treaty Act in the absence of an exemption issued by the Secretary of the Interior.

Mitigation

Erickson and Levenstein identified a series of measures that will be funded to reduce impacts to the types of animals that will be killed by Palen. These measures included marking fences, neutering cats, marking power lines, marking windows, and retrofitting power poles. However, there was little in the way of any nexus described between the conservation benefits of these measures and the project impacts caused by Palen. Will enough cats be neutered to save as many birds as will be killed at Palen? Will they benefit the same species or populations? Will power pole retrofits prevent as many raptor electrocutions as the number of raptors that will be killed at Palen? The costs of compensating project impacts might be far too high to achieve anywhere close to the level of mitigation that would be needed to offset the impacts at Palen. At a minimum, the decision-makers should have been provided realistic cost estimates and a realistic summary of the benefits that would be realized from the compensatory mitigation.

As an example, Erickson and Levenstein promised that the applicant would commit $300,000 for retrofitting power poles. Assuming a cost of $500 per pole (which is based on cost estimates I obtained from the utilities in about 2003, but which is much lower than the cost cited by Erickson and Levenstein, page 12), the promised mitigation fund would achieve 600 power pole retrofits. Having led a research effort that searched for electrocuted birds among 10,000 poles in California during 2005 (funded by a CEC PIER grant), I can estimate the benefits achieved from retrofitting 600 poles (Smallwood and Karas, unpublished data, 2005). After adjusting the fatality finds for carcass persistence and searcher detection, I estimated 0.83 raptor electrocutions per 100 poles per year (80% CI: 0.49-1.16). At this rate, retrofitting 600 poles would protect 5 raptors per year. The mitigation fund would go further by targeting poles with lightning arrestors and riser elements, as poles with these types of equipment electrocute raptors at a rate that is 16 times other than expected. However, retrofits of riser elements and lightning arrestors last for only a few years before they degrade to the point of losing all effectiveness. Without funds committed to maintaining the retrofits, the benefits would count for only a few years, so perhaps only 15 raptors would be saved. Would this number of raptors equal the number of raptors that will be killed over the life of the Palen project? I doubt that there is a nexus that can be defended between the Palen impacts and the promised power pole retrofits. In addition, power poles that are adversely affecting raptors should be retrofitted by the utility companies that are responsible for the lines; having such power poles retrofitted as mitigation for a different project does not truly add mitigation value.

According to Erickson and Levenstein, the number of power pole retrofits that will be achieved by the $300,000 will be 150. This number, based on my research on

electrocutions in California, would protect 1.2 raptors per year for the few years that the retrofits are effective. This number is very small, so it is questionable whether the conservation benefits are worth the mitigation cost, unless the fund will be directed to power poles that are known to kill disproportionate numbers of raptors. If such high-risk poles exist, then the utilities should have already retrofitted them.

However, on page 13 Erickson and Levenstein claimed, "*Retro-fitting high-risk power-poles will provide a benefit to both eagles and other raptors. Based on the above assessment, by retro-fitting 150 high-risk power poles, Palen could mitigate for the loss of 20 raptors (10 eagles and 10 other raptors) and the reproductive value of those 20 raptors over two generations.*" I do not know where these numbers came from, but they are inconsistent with my experience with raptor electrocutions. There might be some special place where these numbers came from, but I am not aware of them. Erickson and Levenstein provided no reference to the source of their incredibly high number.

On page 14 Erickson and Levenstein proposed numbers of songbirds that could be saved by neutering a single female cat. The numbers were very large, and difficult to believe would translate to real birds in the wild. It was a large leap in logic to assume that the number of young never born to a neutered cat would go unreplaced by kittens born to another cat. In other words, the cat population will compensate for some of its members being neutered, just as cat populations have always done this. I am fully supportive of neutering feral house cats, but I think it is misleading to claim that the numbers of birds not killed by the cat's prevented offspring will be spared the cats that are not neutered. Some benefit to birds will be realized by neutering, but not at the levels claimed by Erickson and Levenstein.

Erickson and Levenstein moved on to other mitigation options, including power line marking, "*Several studies have been conducted that have shown significant reductions including up to 90% reduction in bird mortality by use of marking in some cases.*" I have experience with this measure, as well, thanks to funding from the California Energy Commission's PIER program. The line-marking study I helped design and review did achieve close to a 90% collision mortality reduction. I was thoroughly impressed, until I noticed that environmental exposure had caused all of the markers to fail within a couple of years. I saw the same result in South Africa. The coloration on the markers faded, and the markers became brittle and broke, and some got entangled with the lines. Of hundreds of markers installed in one study, only one remained functional upon my follow-up visit and none of thousands of installed markers remained viable after a year of use in South Africa. If line markers are to be effective, then maintenance would be needed throughout the life of the Palen project.

DECLARATION OF K. SHAWN SMALLWOOD, Ph.D.

I, Shawn Smallwood, declare as follows:

1. I am a self-employed ecologist based in Davis, California.

2. My professional qualifications are given in the Curriculum Vitae that was attached to my opening testimony.

3. I prepared the attached rebuttal testimony relating to Biological Resources for the Committee Order Granting Petitioner's Motion to Reopen the Evidentiary Record and Setting Revised Schedule (California Energy Commission Docket Number 09-AFC-7C).

6. It is my professional opinion that the attached prepared testimony is valid and accurate with respect to issues that it addresses.

7. I am personally familiar with the facts and conclusions related in the attached prepared testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct to the best of my knowledge and that this declaration was executed on 18 July, 2014.

18 July 2014

Shawn Smallwood, Ph.D.

REFERENCES CITED

Erickson, W. P. and K. Levenstein. 2014. Ex.1134 - Biological Resources Supplemental Opening Testimony Wally P. Erickson and Dr. Ken Levenstein on Avian Impacts. TN202482, Palen Solar Power Project Compliance, Docket 09-AFC-07C, California Energy Commission, Sacramento, California.

Smallwood, K. S. 2007. Estimating wind turbine-caused bird mortality. Journal of Wildlife Management 71:2781-2791. (Exhibit 3131)

Van Vuren, D. and K.S. Smallwood. 1996. Ecological management of vertebrate pests in agricultural systems. Biological Agriculture and Horticulture 13:41-64.