S20_ALAMEDA COUNTY SCIENTIFIC REVIEW COMMITTEE REPLIES TO THE PARTIES' RESPONSES TO ITS QUERIES AND TO COMMENTS FROM THE CALIFORNIA OFFICE OF THE ATTORNEY GENERAL

3 April 2007

The purpose of this document is to clarify SRC scientific issues with the settlement and the parties' replies submitted previously, as well as with concerns raised by the AG's Office.[1] Given the SRC's charge and in the spirit of full disclosure, the SRC wants to ensure that the parties to the settlement are fully aware of SRC concerns and the scientific challenges associated with the margin of error, management strategies, incorporating repowering data, the baseline, and other factors. The SRC welcomes a response to additional queries in writing or through a meeting which can be set up through the County of Alameda staff.

Note that in most cases the SRC did not copy the Parties' response verbatim. Instead, the main arguments were usually summarized to express the point the SRC thought the Parties were trying to make. Also, several of the SRC's queries during the 5 February 2007 meeting were not summarized in writing by the County and forwarded to the Parties. The SRC expected responses to these queries, nevertheless, and notes from the meeting indicated Parties would respond to them. These queries are repeated below. And finally, some of the Parties' responses were to queries that were not asked by the SRC or the AG's Office. Rather than point out these instances herein, the SRC refers the Parties to an assessment at the following hyperlink: S16_Smallwood's Replies to the Parties' Response to Queries from the SRC and the…Attorney General (3/9/07).

50% Reduction Target

> SRC Query 1: How will the parties respond to a 55% reduction estimate it if is qualified by a ±10% confidence interval?[2]
>
> Parties' Response: The parties will accept the point estimate of the percentage mortality reduction achieved.

For scientific purposes, the SRC will consider the point estimate in the context of the uncertainty term associated with it, such as the confidence interval. If the mortality reduction is estimated as 50% ±10%, then the SRC will conclude the actual mortality reduction was likely somewhere between 40% and 60%, but will not be able to conclude a 50% reduction was achieved with any reasonable scientific certainty. This has been elaborated in a memo to the Parties (Attachment 1).

Relocation Criteria

> SRC Query 2: Will the relocation criteria differ among turbine types? If so, what will be these criteria?

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[1] Letter of California Office of Attorney General to Mr. Chris Bazar and Ms. Gina Bartlett, March 1, 2007.

[2] The 55% value appearing in our query was merely an example. Other examples of values near 50% could include 52%, 50%, 48%, etc.

> Parties' Response: The relocations of turbines will have to be made to existing towers that will fit those particular turbines, resulting in a like-for-like replacement, albeit at less risky locations. The Parties acknowledged Exhibit A provides no relocation criteria by turbine type, but state the SRC is free to make recommendations to "help reduce or avoid avian mortality."

The criteria in Exhibit A do not guarantee that turbines will be relocated to "less risky locations" for birds. The relocation criteria in Exhibit A disallow relocations within specified distances from slopes with certain features and percentage rates of change in elevation.[3] However, the slope conditions are vague, and subject to a wide range of interpretations. For example, Exhibit A does not specify where on a slope its rate of elevation change should be measured. What constitutes a dip, notch, draw or canyon to one person will not necessarily be considered so by another. The SRC also notes Exhibit A gives the Companies sole discretion over determining whether relocation criteria are met. This is of concern to the SRC because the Companies may not be using the most appropriate selection criteria that provide the least possible risk to birds.

Additionally, the way they are written, neither the settlement agreement nor Exhibit A disallows replacement of turbines at other sites (besides certain percentage slopes and slope features) that were considered relatively more dangerous by Smallwood and Thelander (2004). Such sites include the ends of rows in relatively low terrain, relatively isolated sites, or sites next to artificial rock piles, as examples. There is no requirement in section 5(c) of the settlement agreement or Exhibit A for the Companies to consult with the SRC, except for cases when the Companies decide that the slope criteria in Exhibit A are not met. But again, this decision over whether slope criteria are met is the Companies' alone.

Whereas the Companies appear to have sole discretion over wind turbine relocations, the SRC understands it is free to recommend relocation criteria. The SRC will likely make such recommendations.

Moving Rock Piles and Derelict Turbines/Towers

> SRC Query 3: Will the settling parties, subject to Exhibit G-1, be required to move rock piles and removing end of row turbines / derelict turbines, as required in Exhibit G-2?
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> Parties' Response: The question was not answered directly, but the parties instead used peripheral statements that together suggest the Parties do not plan to remove rock piles or derelict towers/turbines as required in Exhibit G-2.

If this interpretation of the Parties' response is correct, then the Parties need to understand the collective mitigation measures they have thus far committed to using will be less likely to achieve a 50% reduction in mortality (see Attachments 2 and 3). At this time the only mitigation measures directed toward the 2,500 wind turbines in the SRC's monitoring program are half-winter shutdown and permanent shutdown and relocation of some of the Tier 1 and Tier 2 turbines (there has yet to be a confirmed determination by the SRC that Tier 1 and 2 turbines

[3] It is unclear from what source the slope conditions in Exhibit A are derived. These conditions do not appear to have been drawn from Smallwood and Thelander (2004) or any other source with which we are familiar.

have been moved or shut down). FPLE is requesting credit toward shutdown of Tier 1 and Tier 2 turbines, and the blade painting experiment remains uncertain and no experimental design has been submitted to the SRC. Even a full winter shutdown, let alone a half-winter shutdown, standing alone is not expected to achieve a 50% mortality reduction (Smallwood and Spiegel 2005a; also see Attachment 3).

The SRC understands it is free to recommend additional mitigation measures. In order to pursue the Settlement Agreement's goal of at least 50% reduction of raptor mortality, the SRC will likely recommend additional measures, possibly including (but not limited to) moving rock piles and removing derelict turbines and/or derelict towers.

Comparability of Mortality Estimates (Baseline Mortality, Accuracy of Mortality Adjustment Factors, Whether 2.5 is a Cap on Mortality Adjustment Factor, Inclusion vs. Exclusion of Repowering Projects)

The Parties' responses to the last SRC Query and first three AG Queries have raised concerns about the comparability between baseline mortality and 2007-09 mortality estimates. These concerns are described jointly below.

> AG Query 1: Does the settlement agreement misstate the baseline number based on the 2004 Smallwood/Thelander Report?
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> Parties' Response: No. The settlement identifies the baseline for all raptors as 1300, but it does not specify a baseline for the 4 target species. The Parties intend for the SRC to use the number 1130.2 as the baseline for the 4 target species. The 1300 number controls for all raptors but not for the 4 target species.
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> AG Query 2: What is the relationship between observed deaths and adjustments for searcher efficiency and scavenger removal?
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> Parties' Response: The mortality adjustment factor of 3.15 used by Smallwood and Thelander (2004) was incorrect (i.e., likely too high) because the fatality search intervals were too long and perhaps due to searcher inefficiency. Another reason it was incorrect was because it was applied to all 5 years of data as if this aggregated set was one year of data. A higher scaling factor in these prior years was likely more appropriate at a time when the frequency and efficiency of the monitoring was reduced as compared to now.
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> AG Query 3: What is the meaning of the number "2.5" as used in the settlement agreement?
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> Parties' Response: The settlement agreement does not establish a cap on the scaling factor at 2.5. It is incorrect to claim the SRC lacks discretion in establishing the scaling factor. If the SRC decides that the future mortality adjustment factor should be greater than 2.5, then the Parties, in consultation with the SRC, will renegotiate the baseline or the percentage mortality reduction requirement.
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> Parties' Additional Response to AG Query 2: Diablo Winds provided the best real-world example to the Parties at the time of the settlement. The scaling (mortality adjustment) factor for Diablo Winds was 1.64. A critic has suggested the scaling factor should be 1.98. In either event, the scaling factor for Diablo Winds was much smaller than the factor used in Smallwood and Thelander (2004).
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> SRC Query 4: Will the Buena Vista and Diablo Winds Repowering projects be measured as part of the 50% reduction?

Parties' Response: The 50% mortality reduction target applies APWRA-wide, and although each repowered project has separate monitoring requirements, the results will be incorporated into the 50% reduction requirement. The Parties also expect the NCCP will consider these issues as well.

The SRC believes it is extremely important to use achieve comparable methodologies when comparing the percent reduction between post-mitigation mortality and baseline mortality. Since mortality estimates are proportionally related to the adjustment factors for searcher efficiency and scavenger removal, then the comparability of two mortality estimates is based on the comparability of the methods used to derive the corresponding adjustment factors. Comparability can also be affected by the selection of turbine sites where fatalities are searched. The Settlement has introduced the possibility of actions by the Parties that can potentially compromise the comparability between baseline and post-mitigation comparisons.

Comparability of Adjustment Factors The SRC has not evaluated the accuracy of the adjustment factor, 3.15, used by the Parties to select the baseline mortality for the Settlement. It is important to remember that the 3.15 adjustment factor was not directly derived from data collected at the APWRA and consequently may not be an accurate representation of the scavenging removal rates at that time. It's possible that a lower adjustment factor will be found to be more appropriate, as the Parties' response has implied.[4] This should justify a readjustment to the baseline, however there is no contingency in the Settlement that allows for a change to the baseline in the event of a lower-than-expected adjustment. The only contingency is in the event that the adjustment to 2007-09 mortalities is >2.5.[5] Otherwise, there is no indication by the Parties' to reconsider the baseline.[6] If the baseline dictated by the Settlement turns out to be too high because the Settlement's baseline does not change, while 2007-09 mortalities are accurate, then the perceived percent reduction would be an overestimate.

As an example, assume the same level of fatality search effort produces the same number of fatalities of the 4 target species during 2007-09 compared to 1998-2003, or 359.2 fatalities per year.[7] Adjusting this number of fatalities by a factor of 1.64 (as the Parties state was used by Diablo Winds) would yield an annual mortality estimate of 589 during 2007-09. This number would be compared to the settlement agreement's baseline estimate of 1130.2 fatalities per year (assuming the SRC can use this number instead of the stated number of 1300), which was derived from the pooled adjustment factor of 3.15. Therefore, because the mortality adjustment factors differ between studies, mortality would appear to have been reduced 48% while the actual reduction was 0%. The SRC intends to report the most accurate estimates of percent reduction based on comparable methodologies.

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[4] Parties' Response to AG Query 2.
[5] Parties' Response to AG Query 3.
[6] Parties' Response to AG Query 1.
[7] Even if the search interval is reduced from an average of 53 days to 30 days, this fatality count could be obtained with no change in actual mortality because scavenger removal trials demonstrate little difference in removal rates between 30 days and 53 days. See K. Shawn Smallwood (2006) R34_Biological Effects of Repowering a Portion of the Altamont Pass Wind Resource Area, California: The Diablo Winds Energy Project.

Comparability of Turbine Samples The Parties state that the 50% mortality reduction target applies APWRA-wide.[8] The SRC understands fatality monitoring at Buena Vista has yet to begin, nearly three months after power generation began. Neither the SRC nor the monitoring team has any influence over the fatality monitoring at Buena Vista. Likewise, the SRC has no influence over the fatality and relative bird abundance monitoring at Diablo Winds. Consequently, it is premature to conclude that the Alameda County monitoring team/SRC can incorporate the results from these projects into the "APWRA-wide" mortality reduction estimate, as the results may not be comparable due to disparate methodologies.[9]

If the SRC concludes the results from these studies cannot be incorporated into its larger effort, then the baseline mortality estimate used in the settlement will need to be revised because Smallwood and Thelander's (2004) estimates included fatality data from the wind turbines that composed the Buena Vista and Diablo Winds projects prior to repowering. About 350 turbines composed these projects during the Smallwood and Thelander study, and 1,951 fatality searches were made among them (one fatality search is one search around one turbine). Overall, the raptor fatalities found per search were about 9% fewer among these turbines than among the remainder of the turbines searched by Smallwood and Thelander throughout the rest of the APWRA.[10] Because the original Buena Vista and Diablo Winds turbines were grouped with all the others when making mortality estimates, they contributed to a lower overall mortality rate per turbine than would have been reached without them. Consequently, if the SRC cannot incorporate the fatality data from the new (repowered) turbines composing the Buena Vista and Diablo Winds projects, then it will have to recalculate baseline mortality used in the settlement to exclude Buena Vista and Diablo Winds. This would be done by excluding the fatalities from the original turbines in these repowered project areas in order to accurately compare mortality estimates before and after implementation of Alameda County avian protection measures. In other words, the APWRA-wide mortality comparison would not be accurate if the SRC compared the existing baseline estimate used in the settlement, which includes these original turbines, to a 2007-09 estimate which excludes these turbines.

Also, the SRC will have to address the absence of the Northwind turbines from the current monitoring program because Northwind Energy has refused to participate. Smallwood and Thelander made 268 fatality searches at those turbines during 2002-2003. These searches produced 35% more raptor fatalities per search than did the searches throughout the rest of the APWRA. Again, to make an accurate comparison, the baseline mortality used in the settlement will need to be recalculated without the Northwind turbines and the resulting comparison of mortality estimates will not be APWRA-wide.

Whether the 50% Reduction will be Real

AG Query: Is the 50% reduction requirement real?

Parties' Response: Yes. The Parties established the baseline and the mortality adjustment provisions to prevent any gaming of the system.

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[8] Parties' Response to SRC Query 4.

[9] The SRC also understands the repowered projects are separate projects from those subject to the conditional use permits of concern to the SRC. Buena Vista and Diablo Winds were not mitigation measures. The SRC points this out as a matter of record.

[10] Only the fatalities used in the estimation of mortality were considered in this comparison. These were the fatalities determined to have been caused within 90 days of discovery.

The AG's Office presented the SRC with a quantitative assessment of the consequences of comparing mortality estimates based on different adjustment factors. Whereas the Parties may have intended to prevent gaming of the system by setting parameters within which the SRC must compare mortality estimates, the settlement agreement appears to give the Parties the power to override the SRC and to force a comparison of mortality estimates based on different adjustment factors. The Parties need to understand that this sort of comparison would be unscientific and misleading, despite good intentions.

The NCCP

> SRC Query 4: Will the Buena Vista and Diablo Winds Repowering projects be measured as part of the 50% reduction?
>
> Parties' Response: The 50% mortality reduction target applies APWRA-wide, and although each repowered project has separate monitoring requirements, the results will be incorporated into the 50% reduction requirement. The Parties also expect the NCCP will consider these issues as well.

The utility of an NCCP as a tool to help achieve the 50% reduction through repowering or other means remains unclear. While potentially contributing to a reduction in mortality, the decision to repower is based primarily on economic considerations of the wind energy companies, which would be beyond the scope of an NCCP. In addition, the process to develop and approve an NCCP is likely beyond the required timeframe for mortality reduction as specified in the Settlement Agreement. The SRC has no control over whether an NCCP developed at a future date will consider whether Buena Vista and Diablo Winds repowering projects can or should be measured as part of the 50% mortality reduction.

Additional Mortality Adjustment Factors

At its February 5th meeting, the SRC asked the Parties whether it will be restricted to the two mortality adjustment factors referenced in the settlement. An answer may have been provided in the meeting of February 5th, but that answer remains unclear to the SRC. The SRC will plan on using additional mortality adjustment factors as needed.

Limiting the Winter Shutdown

At its February 5th meeting, the SRC asked the Parties about the scientific value in shortening the previously required duration of the winter-time shutdown. Why did the Parties feel the SRC needed consistency in the inter-annual duration of the winter-time shutdown? The SRC may have been given an answer during the February 5th meeting, but remains unclear about the answer. The SRC will consider the duration of future winter-time shutdowns as potential mitigation measures, and will make recommendations shortly.

Turbine Shutdown Exemptions

As pointed out during the February 7th meeting, the settlement agreement exempts wind turbines used in the blade painting experiment from both the winter-time and permanent shutdowns. Therefore, if these turbines are also to be included in the monitoring sample of 2,500 turbines,

their shutdown exemptions will add another source of variation that could complicate the subsequent hypothesis-testing by the monitoring team and SRC. Their inclusion would also decrease the sample size of turbines used to test the effectiveness of the winter-time shutdown measure. If the turbines used in the blade painting experiment are to be included in the monitoring sample of 2,500 turbines, then it would be much less complicated to treat these turbines the same as the other turbines in all respects other than the painting treatment (i.e., include them in the winter shutdown). The SRC asked whether the Companies could transfer the shutdown exemptions applied to the turbines used in the blade painting experiment to other turbines the monitoring team and SRC will not be monitoring.

Representatives from the Companies said they would confer with their colleagues and give the SRC an answer. The SRC reminds the Parties about its query and requests an answer soon.

ATTACHMENT 1

To: Chris Bazar, Planning Director, County of Alameda

From: Altamont Pass Scientific Review Committee

Date: March 5, 2007

Re: Precision Memo for the Settling Parties

cc: Sandra Rivera, County of Alameda
Gina Bartlett, Center for Collaborative Policy

The SRC recommends sharing this memo with the parties to the Settlement Agreement.

As a follow-up on the topic of precision that came up during the February 5, 2007, meeting with representatives of the Settlement Parties, this memo is intended to promote a common understanding of the inherent variability when measuring mortality reduction based on data collected from survey samples, and what it means with respect to the Settlement Agreement. In science, we rarely have perfect certainty, and results are typically reported with a margin of error or a bracketed confidence interval. Sampling variation in a survey-based estimate of mortality reduction is attributable to the random selection of turbines, the variability of bird occurrence, and the randomness of mortality events themselves. While it is possible to reduce sampling variation by increasing the sampling effort, it is not practical and nearly impossible to set a level of sampling effort that would eliminate it completely. The recommendations by the SRC aim to achieve a scientifically acceptable 10% margin of error on the estimation of mortality reduction. In other words, the measured percent change in mortality is anticipated to be determined confidently within plus or minus 10 percentage points [i.e., possible results might be an estimate of 55% with a confidence interval of 45-65%, or a 42% estimate with a confidence interval of 32-52%]. If the interval overlaps with the goal of 50% (i.e. 32-52%), then we can't be confident that the goal was met because the actual reduction may have been as low as 32% or as high as 52%. If there is no overlap and the interval completely exceeds 50% (i.e. 52-72%), then we are confident that actual reduction was at least 50% or more and the settlement conditions were met. If there is no overlap and the interval completely misses 50% (i.e. 24-44%) then we are similarly confident that the conditions were not met.

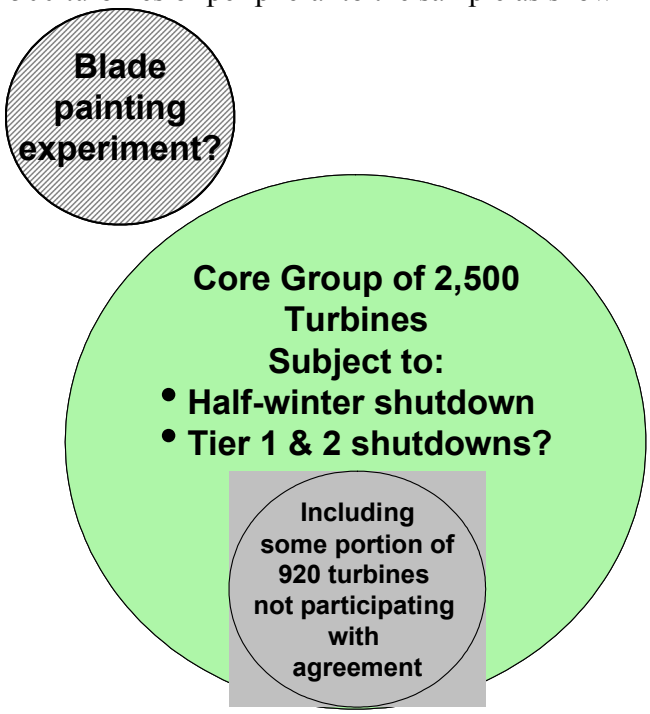
Finally, the SRC has taken it under advisement that the Settlement Parties will look to the SRC to evaluate some aspects of the Settlement Agreement, such as the baseline mortality.

ATTACHMENT 2

S15_ESTIMATED EFFECTS OF PROPOSED MEASURES TO BE APPLIED TO 2,500 WIND TURBINES IN THE APWRA FATALITY MONITORING PLAN

Shawn Smallwood
March 8, 2007

The following diagram summarizes the extent of the mitigation measures likely to be implemented among the 2500 wind turbines to be monitored to estimate the effectiveness of the mortality reduction measures. The blade painting experiment remains uncertain due to a patent issue, although a smaller experiment might be implemented among some of the 920 wind turbines owned by a company not participating with the settlement. If the larger blade painting study is implemented, the SRC has yet to agree whether it will be implemented within the monitoring sample of 2500 turbines or peripheral to the sample as shown in the diagram below.



If additional mitigation measures are implemented, the SRC has yet to decide how the affected turbines will be incorporated into the monitoring program, or whether they will be treated peripherally to the monitoring sample. Electric distribution pole retrofits cannot be considered because they have no bearing on turbine collision-caused mortality. Ceasing rodent control also cannot be considered because the SRC does not know whether landowners continued with rodent control, and the SRC will have no power over the landowners' decisions on this matter. According to recent information from the Parties to the settlement, the Companies will not remove artificial rock piles or derelict turbines or derelict towers. It does not appear additional mortality reduction measures will be implemented until 2010.

Assuming the extent of the avian mortality reduction measures is accurately portrayed in the diagram, the following assessment estimates the effectiveness of the measures. To arrive at

point estimates of percent fatality reduction gained by shutting down turbines in tiers 1 & 2 in Group C of Smallwood and Spiegel (2005c), the following steps were taken:

$$F_{-C} = \left(\left(F_{4074} - F_C\right) \div F_{4074}\right) \times F_{APWRA}$$

$$F_{-C,-W} = F_{-C} - \left(F_{-C} \times 0.146 \times \frac{O_W}{E_W} \right)$$

$$Percent\ fatality\ reduction = \left(F_{APWRA} - F_{-C,-W}\right) \div F_{APWRA} \times 100\% .$$

F_{-C} is the estimated annual fatalities in the APWRA after turbines in Group C tiers 1 through 2 are shut down, where the fatalities documented at these turbines, F_C, are subtracted from the fatalities among the 4,074 turbines used in Smallwood and Spiegel (2005c), or F_{4074}, and where this difference is used to calculate the proportion of the APWRA's fatalities that would remain after shutdown. For this exercise, the annual fatalities were those adjusted for scavenger removal and searcher detection error (i.e. the upper end of the uncertainty range reported in Smallwood and Thelander (2004: 73-74)), which is consistent with the values the Parties used. This approach did not factor in relative abundance of birds.

$F_{-C,-W}$ is the estimated annual fatalities remaining in the APWRA after turbines in Group C tiers 1 & 2 are shutdown and after the remaining turbines are shut down during half the winter. The value 0.146 is the proportion of the year comprising half the winter (winter was defined as 15 November – 28 February), and the ratio of observed to expected values represent the number of fatalities in the winter as a multiple of the number expected based on a uniform rate of fatalities throughout the year. O_W and E_W represented observed and expected fatalities during the winter, respectively.

The results are as follows.

Species	**F_{APWRA}**	**$F_{4,074}$**	**F_C**	**$O_W \div E_W$**	**F_{-C}**	**$F_{-C,-W}$**	**Fatality reduction due to shutdown of selected turbines & all remaining turbines during half the winter**
Golden eagle	116.5	87.4	14	1	97.8	83.6	28.3%
Red-tailed hawk	300.4	225.3	27	1.35	264.4	212.3	29.3%
American kestrel	333.1	249.8	27	1.61	297.1	227.3	31.8%
Burrowing owl	380.2	285.2	16	1.2	358.9	296.0	22.1%
Pooled 4 raptors	1130.2	847.7	84	1.3	1018.2	825.0	**27.0%**
All raptors	1300	975	124	1.27	1134.7	924.3	28.9%
All birds	4721.3	3541.0	200	1.15	4454.6	3706.7	21.5%

Thus, assuming the half-winter turbine shutdown is continued beyond the winter of 2007/2008, and assuming all Tier 1 & 2 turbines are actually shutdown permanently, then the measures might achieve a 27% reduction in the mortality of the 4 pooled raptor species. It remains unlikely the 50% mortality reduction target will be achieved using these measures. It is unlikely it will be achieved by performing experiments on turbines peripheral to the monitoring sample.

ATTACHMENT 3

ESTIMATED EFFECTS OF FULL WINTER SHUTDOWN AND REMOVAL OF TIER I & II TURBINES

Shawn Smallwood
March 19, 2007

The following assessment estimates the effectiveness of the measures committed so far, plus the adoption of a full winter shutdown instead of half the winter. To arrive at point estimates of percent fatality reduction gained by shutting down turbines in tiers 1 & 2 in Group C of Smallwood and Spiegel (2005c), the following steps were taken:

$$F_{-C} = \left(\left(F_{4074} - F_C\right) \div F_{4074}\right) \times F_{APWRA}$$

$$F_{-C,-W} = F_{-C} - \left(F_{-C} \times 0.146 \times \frac{O_W}{E_W} \right)$$

$$Percent\ \ fatality\ reduction = \left(F_{APWRA} - F_{-C,-W}\right) \div F_{APWRA} \times 100\% .$$

F_{-C} is the estimated annual fatalities in the APWRA after turbines in Group C tiers 1 and 2 are shut down, where the fatalities documented at these turbines, F_C, are subtracted from the fatalities among the 4,074 turbines used in Smallwood and Spiegel's exercise, or F_{4074}, and where this difference is used to calculate the proportion of the APWRA's fatalities that would remain after shutdown. For this exercise, the annual fatalities were those composing the upper end of the uncertainty range reported in Smallwood and Thelander (2004). I used these because the Parties used them. This approach did not factor in relative abundance of birds.

$F_{-C,-W}$ is the estimated annual fatalities remaining in the APWRA after turbines in Group C tiers 1 & 2 are shutdown and after the remaining turbines are shut down during the winter. The value 0.292 is winter's portion of the year, where winter is 15 November through 28 February, and the ratio of observed to expected chi-square values represent the number of fatalities in the winter as a multiple of the number expected of a uniform distribution of fatalities through the year. O_W and E_W represented observed and expected fatalities during the winter, respectively.

Species	F_{APWRA}	$F_{4,074}$	F_C	$O_W \div E_W$	F_{-C}	$F_{-C,-W}$	**Fatality reduction due to shutdown of select turbines & all remaining turbines during winter**
Golden eagle	116.5	87.4	14	1	97.8	69.2	40.6%
Red-tailed hawk	300.4	225.3	27	1.35	264.4	160.2	46.7%
American kestrel	333.1	249.8	27	1.61	297.1	157.4	52.7%
Burrowing owl	380.2	285.2	16	1.2	358.9	233.1	38.7%
Pooled 4 raptors	1130.2	847.7	84	1.3	1018.2	631.7	**44.1%**
All raptors	1300	975	124	1.27	1134.7	713.9	45.1%
All birds	4721.3	3541.0	200	1.15	4454.6	2958.7	37.3%

Thus, assuming adoption of a full-winter turbine shutdown, and assuming all Tier 1 & 2 turbines are actually shutdown permanently, then the measures might achieve a 44% reduction in the mortality of the 4 pooled raptor species.

REFERENCES

Smallwood, K. S. and C. Thelander. 2004. Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final Report to the California Energy Commission, Public Interest Energy Research – Environmental Area, Contract No. 500-01-019. Sacramento, California. 531 pp.

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