SRC Comments on Monitoring Team's Draft Study Plan for Future Monitoring

Altamont Pass Scientific Review Committee

The Altamont Pass Wind Resource Area (APWRA) Monitoring Team produced a draft report, Altamont Pass Wind Resource Area Study Plan for Future Monitoring (M53), in June 2010. Written comments on the draft report submitted by individual members of the Alameda County Scientific Review Committee (SRC) are compiled in this document. This document was updated as comments were received.

Joanna Burger
Jim Estep
Sue Orloff
Shawn Smallwood
Julie Yee

Joanna Burger

TO: Monitoring Team
RE: STUDY PLAN FOR FUTURE MONITORING>

OVERALL: Overall this is a well-thought out plan that has some excellent elements. It is also innovative in its attempt to reduce the sampling effort, while answering the overall question of annual mortality in the Altamont. The secondary objective of being able to assess the effects of management, including HRT, seasonal shutdown, and repowering may need more specific attention, particularly with respect to demonstrating their effects. It might also be useful to state, wherever possible, the rationale for a particular method, and whether it is modeled after California guidelines or federal ones (with appropriate references).

The questions of post-repowering monitoring and SRC/Monitoring Team monitoring of repowering needs addressing somewhere. This includes 15 day vs. 30 day search intervals, implications and how they would be compared.

SPECIFIC COMMENTS: (Done section by section)

Goals (page 1):

Current Program. It should be clear that the overall goal of the plan remains to determine overall annual bird mortality, and for the four focal species. Then the other goals come into play. Repowering needs to be added as a potential management option.

2011 Program. Again, repowering needs to be added.

Morality Sampling Design (page 2)

Current Program:

It is not clear why you use 5000 turbines here when elsewhere you use the 4000+ that remain.

It would help if on Table one you gave totals at the end of the table 2

The SRC had an extensive discussion of what turbines to leave out (top of page 4), and it seems to me that except for the Polenko and Windmatic turbines, all must be represented. They are still present in high enough numbers to be important.

The question of inclusion of Santa Clara needs further explanation (since we can't affect it with management).

**The question of how to factor in changes in turbine removal is important. Whereas we are analyzing the turbine addresses for the purposes of determining management, we may also want to calculate the fatality rates by MW.

A bit more explanation of the rolling panels may be necessary.

Some terms need to be defined, and you might add a glossary. For example, fixed stations and so on could be clearly defined (p 5).

The grid (map before page 6): We need to think more about how to grid the Altamont. Should it be smaller block (to represent more of the variability), or re-oriented blocks (in the direction of the strings), or blocks that capture string groups? Do you want a stratified sample, a stratified random, or a random sample for the rolling panels? The current one even splits up strings.

Finally, you need the write in the rationale for whatever you decide to do. Why are you using a particular plan?

Mortality Sampling Protocol (p 6).

Changes to Protocol. It is not clear how you will do the bias correction.

I don't think you want to use different housing if it means more travel time.

Protocol Parameters (page 6): I have for quite some time been worried about the different search radius measurement used for different turbines. The radius has always seemed a bit arbitrary. And I wonder if there should be a subset where you use a large radius (larger than will be used for the repowered turbines) to be able to compute the rate of finding different types of carcasses at different distances, and to finally allow a comparison among the different turbine types.

This then brings up the question of the 120 m filter. In any case, some rationale should be given.

I am still a little worried about variation in searcher efficiency. Do we have a handle on how much variation this accounts for?

Page 8: predator identification. Is evidence given, such a predator tracks, teeth marks or so on?

How are incidental fatalities included in any analysis? Do we have any idea whether these are mainly the same species we find in the searches?

Is there any attempt to make sure the same people don't search the same place each time (is there rotation?)

Bird Observations: Need to flesh out this section. Exactly what will be recorded, what is the rationale, and what management or biological question will it address?

Bird Behavior Monitoring: Again, we need to see the exact data to be collected. And it might be a good idea to append the data sheets.

We need to figure out how to automate this so that the data are available soon.

What information on flight height, and distance to turbines is given?

Detection Probability Monitoring (p 11)

Quality Control Protocols: This is an important and very key section. Need to add that they can be removed by predators.

Can you give some indication of what 2% of the fatality searches means?

It seems critical to mean to know what individual searcher efficiency is – is this a major source of error? How many of the people have what level (or years) of experience?

Significantly more attention needs to be devoted to the background mortality searches. This is VERY important, but needs to be done right. That is, small open areas between large turbine areas may be different from large open areas among large turbine areas. Whether open areas are on hills or valleys matters. We want to try to select sites for this analysis that are comparable to the areas with turbines in as many ways as possible. This may be especially true for Burrowing Owls. I might suggest some discussion with the SRC about selecting these specific places.

It may also be possible to select these in a way that tells us something about the importance of patch size.

Data Analysis (p 12)

Adjustment Factors: Very important to have everything defined.

Measurement of Treatment Effects (page 13)

We need to somehow integrate Repowering (not necessarily the requirement for repowering post-monitoring). Overall, it would help to have a further discussion (perhaps in a phone call) of exactly how to make sure we can measure these effects before sampling starts.

Hazardous Turbine Removal: Critical, especially for our response to the adaptive management plan

Winter Shutdown. I still think we should try for a shorter clearance before the winter shutdown. Need to reduce it to a week or less. How can this be put in the plan so it is feasible?

Jim Estep

General Comment

Overall, I like the approach to a revised monitoring strategy including the concept of rotating panels around fixed locations. In general, I am all for revising the monitoring program and reformulating the goals of continued monitoring to be more appropriate for and adaptable to a changing APWRA; and hopefully to release us from the constraints of arbitrary mortality reduction targets and the requirement of measuring off of an incomparable baseline.

Introduction

In this section it might be useful to indicate that the 3-year monitoring program effectively ended in November 2009 as per the Settlement Agreement. Because monitoring results indicated that the goals established in the Settlement Agreement were not met and in the absence of a timely adaptive management plan as specified under the Settlement Agreement, monitoring has continued since then at the same level of effort under the recommendation of the SRC.

The statement is made in the last paragraph that Alameda County asked the monitoring team to develop a revised monitoring program in order to reduce costs. While this may be true, the monitoring program was subject to modification anyway as a result of the development of an adaptive management program, the change in focus as a result of repowering efforts, and because of the issues identified over the last 3 years that raised concerns over the effectiveness of the current monitoring program relative to accurately measuring and estimating the effects of management measures on mortality.

Mortality Sampling Design

2011 program, page 4, first paragraph.

While it make sense to remove turbine groups that have been demonstrated through past monitoring to account for a minimal proportion of mortality relative to their frequency on the landscape, its unclear why these turbine groups would be removed given that they constitute 7% of the turbines but 12% of the fatalities. It seems like that would be reason for retaining them. This needs further explanation.

Page 4, forth paragraph. Minor detail, but I think you mean the search interval would be not be ‘increased’ rather than ‘decreased’.

Page 4, Table 2

How was the percent of turbines and the number of turbines monitoring annually with each turbine type category derived?

Page 5, second bullet

This suggests that trends can only be determined at the fixed locations. Can’t trends also be determined using the overall approach – fixed and rolling locations – to provide mortality trend across the APWRA landscape?

Page 5, second paragraph

How will the fixed locations be selected? Stratified random?

Page 5, last paragraph

The last sentence is a bit unclear. How can the same ‘spatially balanced approach’ be used for both fixed and rotating stations.

General Comment on the Sampling Design

I like the concept of the rotating panels around fixed locations. But the methodology needs more development.

Mortality Sampling Protocol

Page 6, last paragraph

I continue to have issues with rationale for the search radius. We should clearly describe our rationale for a search radius and the rationale that addresses the assumption about the relationship between turbine size and carcass location, which results in a scaling of search radius based on turbine size.

Also, I’m assuming that this protocol (with the exception of the clearing searches), unlike the current protocol, requires the surveyor to document only those birds that are found within the standard search radius.

I would lose the dog-handling team. Seems like clearing searches could be effectively accomplished with a team of humans. Also, haven't you inserted a bias into the formula if you use dogs in some places but not others?

Page 7, first complete paragraph

What happens if additional fatalities are detected while revisiting the flagged locations to process the marked remains? Its not part of the standard search, so would it be included?

Page 7, second complete paragraph

What is the rationale for 5 tail feathers? Why would 4 tail feathers be less likely a turbine-related fatality? We need to establish a benchmark, but we might also want to include more explanation and rationale for these assumptions or determinations. The 4 versus 5 example seems arbitrary. And if our new approach is to estimate trends, is it as important to create 'rules' for fatalities to this extent? Can't we create new rules that have a bit more certainty?

Page 9, forth complete paragraph

Presumably incidental finds are not included in mortality calculations. Might want to state this.

Bird Observations

Page 9, First paragraph

I thought the primary objective for collecting data on relative bird use was to correlate those data with mortality data to investigate the influence of variable bird abundance on mortality estimates. And I thought the primary objective for collecting data on bird behavior was to investigate the relationship of bird behavior with collision mortality to inform the turbine removal/relocation process with respect to risk factors and to inform the citing process during repowering.

Page 9, Bird Use Monitoring

How will the observation points be selected? How many will be used and how is the number of OPs determined?

Page 10, Bird Behavior Monitoring

There may be some practical issues here, but is it not possible to record behavior data on the same birds that are being recorded for bird use? The concept of moving from a 20 minute behavior survey to a 10 minute bird use survey seems confusing. Is it possible to consolidate and simplify this by using a 10 or 20 minute interval to record data (both use and behavior) on all birds observed?

Detection Probability Monitoring

Page 11

This could use some additional detail and rationale. Perhaps a description of the practical and analytical problems associated with the current approach and how this would resolve them.

Page 11, last paragraph

It seems that a representative background mortality survey area would include perches. Perches are used to eat captured prey and birds perching or roosting may be more likely to be predated. I would think that the 'background' mortality found in similar non-turbine habitats with perches and without perches would be substantially different. Since birds use the turbine fields as perches to eat captured prey, it seems like the potential for underestimating background mortality using a site without perching substrates is high.

Measurement of Treatment Effect

Page 13, third paragraph under Hazardous Turbine Removal

Are we really 'testing' for the effects of hazardous turbines or are we simply monitoring annual mortality trends and assuming that any reductions can be at least in part attributed to the removal of high risk turbines (at least once other factors are addressed, such as changes in bird abundance)? This just seems like an outcome of the basic trend monitoring approach that is proposed.

Page 14, second paragraph

How does this characterization of background mortality differ from that described under Detection Probability Monitoring?

There were other confounding issues associated with the winter shutdown, including the effect of feathering turbines and the effect of bird habituation.

Sue Orloff

Because I was not able to attend the last meeting and a previous conference call I may be at a slight disadvantage. So please bear with me, I may be asking questions that have been previously addressed and I may have missed some relevant discussions that would have informed some of my concerns.

Mortality Sampling Design (pages 4-5):

I think a lot of effort went into designing this innovative plan to reduce costs while still maintaining sufficient sampling power. However, there was no rationale presented why this approach was chosen and what specific benefits (or limitations) it offers. If I understand your approach correctly, a representative subsample of spatially balanced turbines would be selected from a much larger group of turbines and monitored on a randomized rotation basis. This larger group of turbines includes turbines that have not been sampled before, some turbines currently sampled, and some of the baseline turbines (Table 2).

Although this first sounds like a well balanced comprehensive sampling approach, I have some concerns that we would lose the continuity and consistency with the previous 5 years of monitoring data. It almost seems like we would be starting over from scratch (this probably would have been a great plan from the beginning). This also has the potential of causing some of the same problems we had with comparisons to the old baseline (i.e., comparisons with different turbine representations). If one of the main goals of future monitoring is to track changes in fatality rates overtime, then wouldn't the future plan have more comparability and less variability if we continued to monitor the same turbine strings (at some reduced level of effort). The high interannual variability already makes it difficult to interpret the data, so why add another confounding layer to the analysis?

I may be missing an important point somewhere, but it seems that comparisons between a new baseline (a consistent long-term database) and future monitoring should not be compromised with a totally new approach and almost an entirely new set of turbines. Also, the current SRC recommendations for the adaptive management plan states that to evaluate if a 50% reduction in mortality has been achieved we should use the first 3 years of the current monitoring program as the new baseline. Shouldn't future monitoring be as comparable to the new baseline condition as possible?

Having just read the draft conference call notes from June 28th (a call that I missed) it appears that the Team was trying to reallocate the sampling effort to ensure even representation of geography and turbine types. But is it worth achieving even representation at the expense of continuity and comparability. Furthermore, I am not sure we understand all the pertinent spatial attributes that contribute to mortality to be able to select representative turbines that will be comparable to the currently monitored turbines.

I also read in the conference call notes that there was concern about determining the age of the carcasses at the strings that have not been sampled before, even given that there would be clearing searches. It was also mentioned that there may be "other unpredictable wrinkles" with this plan. It seems to me that with every new study plan the Team develops and the SRC approves there are unpredictable wrinkles that typically aren't recognized until way down the road (often too late to fix). I'm not sure this is a good time to be experimenting with new plans, especially with the possibility of new field crews, new managers, and less SRC involvement.

Your proposal says that to address trends in fatality rates though time that "some" of the currently monitored turbines would be fixed stations that will be monitored throughout the plan period. And that about 50% of the future monitored turbines will be from these fixed stations, which will comprise both currently monitored turbines and other turbines that are needed for spatial balance. Do you know how many of the fixed turbines/strings will be from currently monitored turbines? What analyses have you done to determine that this will be sufficient to detect annual changes in mortality?

Reducing the number of sampled turbines by subsampling is very reasonably, but including a new set of sample turbines seems a bit precarious. Would it be possible to use the same rolling panel design but only with the existing set of monitored turbines?

I also think it might be important to insure that there are a number of sites that will be monitored both pre and post repowering so that we can continue to document the reduction in mortality under different situations.

Although I think it's ok to exclude the Enertechs, Howdens, and other older generation turbines from the new monitoring program, I don't think they should be excused from conducting post-repowering monitoring. It sounds like this "project-by-project basis" will allow the companies to do whatever they want or don't want to do. I also think that the overall Altamont wide mortality rates should account for the benefits of repowering at these sites. It was hard to tell in your paper if these sites were just going to be entirely dropped from all analyses and excluded from the expanded calculations of site-wide mortality.

Mortality Sampling Protocol (page 6):

Also I didn't see any reference to using computerized data recording in the field which was suggested by the SRC.

I also thought the SRC agreed that the use of dogs would not be appropriate.

Shawn Smallwood

The monitoring team devoted considerable thought to future monitoring and came up with some good ideas. The team faced a serious challenge in being asked to develop this plan without first having a management plan in place. I find it absurd to develop a monitoring plan ahead of a management plan, but I can see how the monitoring team justified proceeding on the monitoring plan based on the momentum of the past four years of monitoring. However, in the plan I saw evidence of assumptions that certain management actions will take place and that repowering will not take place for years to come. Repowering is treated as an afterthought and interim management actions appeared to be the focus of the future monitoring plan.

After reading Julie Yee's and Joanna Burger's comments, and given the short time to prepare my comments, I opted to restrict my comments to issues that I did not notice were raised by Julie or Joanna. I largely agree with the comments made by Julie and Joanna. Also, my comments that follow are directed toward the aspects of the plan I thought needed improvement, so I did not comment on the many aspects I found favorable. I think the monitoring team did a good job at preparing this plan.

Comments on specific text

On page 1, third paragraph, fifth line, I would insert the phrase "repowering and" before "management actions." Repowering remains the SRC's leading recommendation for reducing fatalities.

The first sentence of the second paragraph under Current Program on page 1 should be expanded. It was not only inter-annual variability that confounded attempts to evaluate the effectiveness of specific management actions. It was also lack of information on when actions were taken as well as some inadequate execution of monitoring to detect effects.

The paragraph under Current Program on page 2 presents incorrect numbers of strings involved in the monitoring program.

At the top of page 4, I agree with ceasing monitoring at the Howden, Polenko, and Windmatic turbines, but not the WEGs, Enertechs, and KVS-33 turbines. In the second paragraph, I suggest reconsidering the continued monitoring of the Vestas V-47 turbines, as these have been monitored for 5 years already and operations will not change. However, if budgeting was not an issue, then I would favor the continued monitoring of the Diablo Winds turbines. In the most recent meeting, I suggested that continued monitoring of the Santa Clara turbines might be reconsidered, assuming they are exempt from management actions as claimed by the County, but these turbines have a history of killing large numbers of raptors. If the 50% reduction goal is to be achieved, then I recommend actions be taken at the Santa Clara site. If actions might be taken there, then I have to recommend continued monitoring of those turbines.

On page 14, I disagree with some of the changes that have been made to the double survey approach (termed in the plan as "quality control" yet again). The approach appears to have been modified from two teams to one team and a single individual searching only 2% of the turbines that are searched by the other team. This level of effort will prove inadequate. I recommend that the second team consist of half the number of searchers as the first team and that it searches a subset of half the turbines searched by the first team. The double survey approach needs to be taken seriously if it is to be effective at replacing the searcher detection and scavenger removal trials needed for adjusting fatality rate estimates.

Julie Yee

Goals
Page 2. The 2011 monitoring program should be able to inform decisions required in the adaptive management plan (P163), such as whether a 50% reduction occurred. And although there is limited ability to conclusively determine the effects of specific management actions, the goals should mention that this program will continue measuring these effects to the extent possible (as outlined on pages 13-14).

Mortality Sampling Design
Page 3 – Current Program. It would help to add a reference for the document explaining that the current survey had been based on a BACI design (R29).

Page 4 – 2011 Program. There needs to be better clarification on the role of this monitoring program as it relates to repowering. If repowering is the best way to reduce mortalities, and as long as the monitoring program is supposed to measure changes, then the two are not separable. I don't agree with the statement that "Changes in mortality rates associated with repowering will be addressed through the permitting and planning process on a project-by-project basis, and are not directly related to the long-term APWRA mortality monitoring program or this study design."

Page 4 – 2011 Program – Rolling-panel design. This is a good approach for ensuring complete spatial coverage, short of performing censuses. I would like to see additional detail on the clearing searches so that we can be sufficiently confident that fatality evidence at newly rotated panel plots is comparable to plots that are regularly searched every 30 days. I don't want the efficiency of the clearing search to compromise the ability to compare between rotating panel plots versus fixed plots within the new monitoring plan, nor across the new and current monitoring plans. Clearing searchers should be completed close to 30 days prior to the first survey for a newly rotated panel.

Page 4 – last full paragraph on p. 4. I recommend clarifying the term "complete census." I think what is meant in this context is a search of all turbines every 30 days. This can be considered a "complete census" in the sense of surveying all turbines, but it is not a complete census of fatalities. In other words, this design might control the error to within

10% when expanding from the proposed sample of 1,372 turbines to the full set of 4,018 across the APWRA (numbers taken from Table 2), but the error in estimating actual fatalities is still going to be substantially large, due to the usual uncertainty in collecting data at 30-day intervals.

Page 5 – first full paragraph. The grid panel system reminds me of a form of geographic stratification, where the analysis might also be conducted in strata. If this is the case, then I would advocate that the strata be defined into geographically-distinct panels (rather than grid squares). If, instead, this is just a tool for guiding spatially-even sampling, and where the panels have no bearing on the extrapolation, then I don't see a problem with the grid panel system.

On a related note, for purposes of informing repowering, I wonder if there is merit to geographically stratifying the APWRA anyway. It might be worth discussing: Will we find that certain geographic areas (i.e. on the scale of these grids) are safer than others? Or will the optimal locations for repowering have more to do with topography at a smaller geographical scale (i.e. avoidance of saddles)?

Detection Probability Monitoring
Page 11.

The pre- and post-survey monitoring presents a uniquely valuable opportunity to collect searcher detection data *in situ*, concurrently with the routine monitoring protocol. But I don't fully understand how this data will be used, and I think there is a problem with the proposed plan in the first 2 sentences of paragraph 3:

> "Fatalities that are found or placed by the field supervisor, missed by the monitoring team, and found again during the subsequent quality control survey will be considered "missed" by the searchers. The proportion of fatalities missed during the regular searches will be used to estimate the searcher efficiency for the program."

The proportion of "missed" fatalities will under-represent the actual proportion of fatalities missed by the monitoring team, because it excludes an additional proportion of fatalities missed by the monitoring team when those fatalities are removed during the period between the monthly MT survey and the subsequent quality control (QC) survey.

I am thinking of a couple of alternative refinements on the QC:

1) The simplest is to use the proportion of all fatalities missed by the MT, *regardless of whether they were ever subsequently found again by QC*. In other words, drop the effort to parse the proportion of missed fatalities attributed to scavenger removal vs. searcher efficiency, and settle for a single adjustment which combines the two factors. One might even model this rate based on a regression (such as a logistic regression) on period length or environmental conditions such as weather and grass length.
2) A more complex approach involves search data obtained in the post-survey QC. If the MT leaves behind any volitionally-placed fatalities, so that the QC team might check their status later, then these fatalities fall into one of four categories:

	Not found in post-survey QC	Found in post-survey QC	Total
Not detected by MT	P_{00}	P_{01}	$P_{00}+P_{01}$
Detected by MT	P_{10}	P_{11}	$P_{10}+P_{11}$
Total	$P_{00}+P_{10}$	$P_{01}+P_{11}$	100%

where P_{00}, P_{01}, P_{10}, and P_{11} are the proportion of fatalities observed in the four categories. For example, P_{00} is the proportion fatalities missed by the MT and not found again by QC. A common strategy in mark-recapture modeling is to express these proportions in terms of their constituent components, r_1, p, and r_2, where

r_1 = proportion of fatalities persisting through pre-survey period (i.e. through date of MT survey)

p = proportion of fatalities detected by MT, given fatalities persisting through pre-survey

r_2 = proportion of fatalities persisting through post-survey period (i.e. through date of post-survey QC search), given fatalities persisting through pre-survey.

The same table and corresponding cells can be re-expressed as follows:

	Not found post-survey QC	Found in post-survey QC	Total
Not detected by MT	$r_1(1-p)(1-r_2)+(1-r_1)$	$r_1(1-p)r_2$	$1-r_1p$
Detected by MT	$r_1p\,(1-r_2)$	r_1pr_2	r_1p
Total	$1-r_1r_2$	r_1r_2	100%

Note that p represents searcher efficiency, and the product r_1p represents the proportion of fatalities detected by the MT. In other words, we could theoretically estimate the number of fatalities by adjusting the raw fatality counts by a multiplier of $1/r_1p$.

If the unknown r_1, p, and r_2 are constants, then they could be estimated via a system of three equations and three unknowns (although there are four expressions in the table, the 4th cell is constrained by the other 3, and they represent only 3 unique equations). Or, as with alternative 1, one can allow covariate effects, for example allowing r_1 and r_2 to covary with period length, and p to covary with weather and grass length.

I don't have a strong preference for either of these two alternatives, but I would like to see the analytical methods detailed more than it is now. The latter alternative is more complicated, but I think it would feasible to conduct annually if the model is carefully scripted so that it can easily accept revised data (I would consider the RMark module in the R programming environment). The latter alternative also provides a framework for modeling scavenger removal rates up to 28 day intervals (1-14 days pre-survey and 1-14 days post-survey), whereas the former approach is limited to information from just the 14-day range in the pre-survey period.

Measurement of Treatment Effect – Hazardous Turbine Removal

On page 13, the last sentence under Hazardous Turbine Removal reads:

> "For any turbine type and bird group, we hypothesize that panels with higher relative proportions of hazardous turbines removed will have lower fatalities per megawatt than panels with smaller proportions of hazardous turbines removed"

When taken literally, then the hypothesis is not meaningful when comparing among panels that start with different proportions of hazardous turbines. For example, suppose Panels A and B each have 200 turbines, but Panel A has 20 hazardous turbines of which 10 (50%) are removed, and Panel B has 5 hazardous turbines of which one (20%) is removed. Although Panel A has a higher proportion of hazardous turbines removed than Panel B, it still has more hazardous turbines than Panel B, and there is no reason to expect it to have a lower rate of fatalities per megawatt than Panel B.

I would consider reframing the hypothesis in terms of 1) within-panel changes:

> Example: "For any turbine type and bird group, we hypothesize that panels with higher relative proportions of hazardous turbines removed will have ~~lower~~ greater reductions in fatalities per megawatt than panels with smaller proportions of hazardous turbines removed"

Or 2) among-panel differences which relate to their respective proportions of hazardous turbines:

> Example: "For any turbine type and bird group, we hypothesize that panels with higher ~~relative~~ proportions of hazardous turbines ~~removed~~ will have ~~lower~~ higher fatalities per megawatt than panels with smaller proportions of hazardous turbines ~~removed~~"

These are just examples, and I don't much like either of them. To test the first hypothesis, it's critical to have matching data before and after the remediation, but this kind of matching will be limited at rotating panels. As for the second hypothesis, it doesn't really address removals. More thought should be given to developing a better hypothesis.

Measuring Change

Page 14. Just two minor notes:

1) Change description to reflect the establishment of a new baseline based on three years of data from 2005-2008. (In the June 2010, the SRC decided to recommend just the first 3 years to avoid contaminating that comparison set with later years in which more substantial mitigation actions occurred).

2) Fatality counts and fatality rates are subject to wider variances as the rates increase, which is a problem for standard ANOVA which assumes homogeneous variances. I recommend the ANOVA allow unequal variances, or alternatively implement a generalized linear model which structures the variance to increase functionally with the mean.

No longer searching at vacant addresses?
The proposed monitoring plan apparently excludes vacant addresses from searches. This was not explicitly stated in the monitoring plan, but it appears to draw the sampled turbines from a reduced "population" of installed turbines and then extrapolate to the *installed* capacity of the APWRA (p. 12). For the current monitoring, it was recommended that vacant addresses where turbines were removed continue to be searched, with the anticipation that any change in mortality rates due to turbine removal will be reflected by a drop in fatalities per *nameplate* MW. I'd like confirmation on whether the MT intends to search hazardous turbine addresses after those turbines are removed. Generally I wouldn't have reason to favor either denominator over the other, but in this situation I have a couple of reasons to question the use of the installed capacity denominator. Firstly, the installed capacity can change throughout the year, so how will an appropriate extrapolation be determined for the annual estimate? Secondly, omitting searches at vacant addresses prevents us from refining estimates of fatality reduction associated with turbine removal. Is it a foregone conclusion that turbine-related fatalities will no longer collect there? If we can't make that conclusion, then shouldn't these addresses continue to be searched for comparison with pre-removal surveys? Conversely, if we were to assume that turbine-related fatalities no longer collect there, then that would suggest the possibility of using these locations for background mortality surveys.

Still searching complete strings?
The monitoring plan describes the protocol for allocating and selecting turbines into the sample. I presume that turbines will still be selected into the sample as complete strings, but the monitoring plan leaves this open to interpretation. I'd like clarification on this.