

Exhibit C (Explicitly Used in Conjunction with the Wind Energy Cooperative Agreement)

**Protocols to Monitor Bat & Bird Mortality at Industrial
Wind Turbines Sites**

**Commonwealth of Pennsylvania
Pennsylvania Game Commission
February 23, 2007**

Post-Construction Mortality Monitoring

I. Duration and Frequency of Monitoring:

All mortality monitoring should take place daily for the period between April 1 and November 15 for 2 complete years following construction, unless other mortality information is available and the PGC can adequately justify a reduced monitoring effort. For higher risk golden eagle migration routes, as designated in page 11 of Exhibit A, additional monitoring may be requested. Mortality monitoring should commence at sunrise and an appropriate number of surveyors must be hired to complete surveys of all turbines within 8 hours. Turbines that are being chosen for monitoring should be determined with the initial proposal so the location of acoustic monitoring devices can be coordinated to occur at the same locations.

II. Number of Turbines to Monitor:

The number of turbines monitored will follow the guidelines below as per “Standard Mortality Transect Survey”, and will include at least one validation procedure to correct bias. Validation procedures can include, but are limited to the use of nets, the use of dogs, thermal imaging, or night optical device. Monitored turbines shall be identified in consultation between the parties and based upon pre-determined bat and bird risk assessment. A minimum of 10 turbines will be sampled, or a maximum of 20% of the turbines in the project area (whichever is greater). If the project contains less than 10 turbines, all turbines in the project area will be sampled unless otherwise agreed to by the Commission.

III. Mortality Monitoring Procedure

Carcass removal and searcher efficiency trials will be performed, and the duration, frequency and number of turbines to monitor are the same.

At each turbine to be monitored, a rectangular plot that is 120 meters by 120 meters will be centered on the turbine. Although evidence suggests that > 80% of the bat fatalities fall within ½ the maximum distance of turbine height to ground (Erickson 2003a,b) search areas vary and often do not allow surveys to consistently extend to this distance. Therefore, the searchable area underneath turbines will be delineated and mapped, and estimates of mortality will be produced. Maps are to be constructed illustrating all turbine locations, a designated numbering system for turbines, 120 meter plot, boundaries of survey areas, and searchable areas (broken down into visibility classes and transect numbering if performing standard transect surveys).

- 1) Times spent surveying each turbine should be recorded daily and remain consistent.
- 2) All information gathered (i.e. specimen location, species, transect/net grid number, etc.) should be entered on data sheets provided. Any mortality that occurs to state listed endangered or threatened species should be reported to the PGC within 72 hours.
- 3) Any large mortality events (> 50 total animals) or mortality of any eagle, or threatened or endangered species that occur outside of the survey periods are to be reported to the PGC within 72 hours.
- 4) Separate data sheets will be used for each date of survey completed. All carcasses are to be picked up and bagged upon discovery. They are to be identified, handled, and labeled properly, in accordance with the special use permit, with the date, turbine number, transect number, and unique specimen number.
- 5) All specimens located should have an azimuth **from** tower and distance to turbine, and recorded on data sheet. It is appropriate to use a numbered flag for each specimen and record distance and azimuth upon completion of transect searches, so long as flags are removed after each day/turbine.
- 6) All carcasses are to be properly identified, labeled, frozen daily, and submitted with data sheets every 2 months to the local regional office of the PGC.
- 7) A summary report of this monitoring, including all data sheets and maps are to be submitted with the annual reports (due December 31) until monitoring is complete. A complete set of post-

construction bat mortality data sheets, all acoustic data sheets with passes/hour, species identification charts, etc. should be included.

Standard Mortality Transect Surveys:

The basis for the methods to be followed for this procedure are set forth by Erickson 2003a, 2003b, Bats and Wind Energy Cooperative 2005 final report, and Kerns and Kerlinger 2004. Areas defined for surveys should be mapped and depict not only prominent structures and area, but in addition to previous studies, label search areas into 1 of 4 visibility classes. All visibility classes represented should be included in the map and proportion of each noted in report. Each visibility class will be equally tested with a minimum of 200 trials using carcasses returned by the PGC.

Visibility Classes: Each turbine will have the vegetation in the searchable area defined into one of the following 4 classes and mapped for submission.

Class 1 (easy): Bare ground 90% or greater; all ground cover sparse and 6 inches or less in height (i.e. gravel pad or dirt road).

Class 2 (moderate): Bare ground 25% or greater; all ground cover 6 inches or less in height and mostly sparse.

Class 3 (difficult): Bare ground 25% or less; 25% or less of ground cover over 12 inches in height.

Class 4 (very difficult): Little or no bare ground; more than 25% of ground cover over 12 inches in height.

- 1) Following the establishment of searchable areas, the breakdown of this area into visibility classes, and mapping of each turbine, transects should be established at no greater than 6 meters apart and marked every 10 meters.

- 2) Each transect will be walked with $\frac{1}{2}$ of the distance between transects equal to the distance on each side to be examined by the searcher.
- 3) As transects are searched, carcasses should be bagged and labeled properly (date, turbine number, transect number, carcass number) and a numbered flag placed in their place. At completion of each turbine, the distance and bearing from each turbine should be recorded and then all flags removed.
- 4) Searches will be abandoned if severe weather is present, and continue if it clears. The time spent searching at all turbines will be recorded and should be consistent.

V. Validation Guidelines

Performing carcass removal by scavenger and searcher efficiency are the standard methods performed together to correct for biases in data collection. Below are accepted techniques to perform this correction. However, please note the PGC will consider alternative methods of validation, to include but not limiting to the use of dogs, thermal imaging, night optical devices etc.

Carcass Removal Trials

Because there are numerous variables that may make every turbine unique, we suggest placing an equal number of carcasses per turbine to be monitored for removal by scavengers. Additionally, all 4-visibility classes should have an equal sample size. A random bearing and distance from the turbine should be selected to determine placement of the carcass. For these trials, carcasses must be placed within the surveyed area underneath turbines after sunset and under darkness, and monitored for removal every 12 hours. Ideally, the total number of bird and bat carcasses used should be representative of the actual size and species of killed animals, with no less than 50 specimens monitored per year. These trials should be performed periodically throughout each monitoring session. Before placement, each carcass must be uniquely marked in a manner that does not cause additional attraction and have its location recorded. Records shall include the turbine number, a brief

description of immediate vegetation that may impede visibility, classification using one of the 4 visibility classes described above, and length of time before removal.

VI. Searcher Efficiency Trials

To produce the best estimates of mortality, a high number of searcher efficiency trials will be performed. A minimum of 200 individual trials will be performed to test searchers. The carcasses will be toe clipped to identify and number them. Carcasses missed by searchers will be picked up after their survey is complete and will be used again. Because a number of samples will be collected from all dead bats, each carcass recovered will be submitted to the PGC and the appropriate number needed for testing will be returned. The habitat surrounding turbines may vary considerably and searcher efficiency appears highly correlated to visibility and habitat types. Therefore, the search area defined for each turbine surveyed will be divided into the 4 visibility classes (illustrated on map). An equal number of carcasses will be placed in each visibility class, and will be placed at a random azimuth and distance. Each turbine monitored by searchers should be examined, with an equal number of carcasses placed at each turbine.

Testing should occur sporadically throughout monitoring periods and searchers should not be made aware they are being tested. An effort should be made to test searchers equally during both inclement and good weather, with weather conditions recorded. Carcasses placed should be representative of the percentage and number of species found during the mortality monitoring, and should replicate the manner in which the majority of bats are found in that visibility class (i.e. crawled under vegetation). An effort to maximize the number of carcasses placed is best, with no less than 200 per year.

COMMONWEALTH OF PENNSYLVANIA
Pennsylvania Game Commission
Bureau of Law Enforcement, Technical Services Division
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Section 1 - Cover

IV. WIND FARM PERMITTEE
V. POST-CONSTRUCTION BAT MORTALITY SURVEY
REPORT

Permit Number _____

Project
Name: _____

Company/
Organization/
Permittee Name: _____

Address: _____

Phone: (_____) _____ - _____ Fax: (_____) _____ - _____

E-Mail: _____

Project Supervisor
Name: _____

Supervisor Contact: Phone: (_____) _____ - _____

E-Mail: _____

If this is contracted work, provide the name & address of the
individual/organization work is being performed for:

02/05

Pennsylvania Game Commission

Description of Wind Turbine Searched for Carcasses

Project Name: _____ **Turbine Number:** _____

1. Diameter of Blade Span: _____m **Number of Blades:** _____

2. Blade Height Above Ground- Max.: _____m;
Min.: _____m

3. Surface Area of Search Plot: _____m²

4. Attach map of each turbine with 120 meter plot, search boundaries, location and numbering of transects/area covered by nets, and vegetation classification if applicable on separate sheet.

5. Attach a spreadsheet with weather data collected at 10-minute intervals. Data should include wind speed, temperature, precipitation, cloud ceiling height, and height and altitude of monitoring device.

6. General Habitat Description and Topography within 100 m of Turbine:

7. General Habitat Description and Topography >100m from Turbine:

Daily Search Summary

Page: _____ of _____

Project Name: _____ (*complete each day of search*)

