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TECHNICAL MEMORANDUM

Date: November 25, 2024

To: Julianne Randazzo, Lucas Reid, Justin Landau, David Meiners, and Craig Giesmann, Ameren Missouri

From: Steven Gabrey, Kate MacEwan, and Rhett Good, Western EcoSystems Technology, Inc. (WEST)

Subject: High Prairie Renewable Energy Center Fall Post-Construction Monitoring Report

INTRODUCTION

Ameren Missouri (Ameren) acquired the High Prairie Renewable Energy Center (High Prairie or Project) in 2021. High Prairie, located in Schuyler and Adair counties, Missouri, consists of 175 turbines (163 V120 2.2-megawatt [MW] and 12 V112 3.45-MW) with an approximate 400-MW operating capacity. High Prairie received an incidental take permit (ITP) for the federally and state listed as endangered Indiana bat (*Myotis sodalis*), the federally and state listed as endangered northern long-eared bat (*M. septentrionalis*), and the little brown bat (*M. lucifugus*) on May 14, 2021.

The ITP covers the operation of wind turbines. Based on the number of Indiana bats found during past surveys, the ITP allows the Project to operate at wind speeds above 8.0 meters per second (m/s) during nighttime hours in the bat active seasons. Ameren voluntarily ceased nighttime operation of 125 of the 175 turbines during the spring migration season (April 1 – May 14). The remaining 50 turbines operated at night when wind speeds were above 8.0 m/s. Ameren further limited nighttime operations at the 50 turbines to those periods when no bat calls were detected by the EchoSense smart curtailment technology.

On April 28, Turbine G-08 collapsed unexpectedly, and due to safety concerns, all turbines at High Prairie were curtailed (during the day and night) from April 28 – May 15 (Table 1). After safety concerns from Turbine G-08 were addressed, all turbines were released for daytime operations on May 16, 2024. Nighttime operations also resumed at the 50 turbines on May 16, 2024, and 28 additional turbines began nighttime operations over several weeks as detailed in Table 1. These 78 turbines continued to operate through the afternoon of June 10. All turbines operated at night when the wind speeds were above 8.0 m/s and when no bat calls were detected by EchoSense.

Following a discovery of a fatality of a potentially covered species[1], the entire site was again paused on June 10, 2024. The pause was instituted so Ameren could investigate the situation. Ameren subsequently determined that EchoSense operated correctly. Since the technology performed as designed, Ameren voluntarily stepped down operations on June 11, 2024, to 48 of the 78 previously operated turbines so as not to potentially negatively impact Indiana bat maternity colonies (Table 1).

These 48 continued operating at night through the morning of August 25, 2024, when Turbine B-11 collapsed unexpectedly. Due to safety concerns, all turbines were curtailed (day and night) immediately. During the investigation, Ameren determined the risk was related to the V120 models, and released the 12 V112 models for daytime-only operations on August 30, 2024. After further investigations, Ameren determined that the 161 V120 model turbines could be released for daytime-only operations on September 10, 2024. No turbines operated at night between August 25, 2024, and the end of the monitoring period on October 31, 2024 (Table 1). Monitoring turbines ceased on October 15; however, no turbines operated at night through October 31.

Table 1. Summary of nighttime operations at the High Prairie Renewable Energy Center, Adair and Schuyler counties, Missouri, during the spring, summer, and fall monitoring seasons (April 1 – October 31, 2024).

Season	Date Range	Number of Turbines Operating at Night	Number of Turbines Not Operating at Night
Spring	April 1 – April 27	50	125
	April 28 – May 14	0	174
Summer	May 15	0	174
	May 16 – May 28	50	124
	May 29 – June 2	75	99
	June 3 – June 9	78[1]	96
	June 10	0	174
	June 11 – August 15	48	126
Fall	August 16 – August 24	48	126
	August 25 – October 31	0	173

[1]. Three turbines (E-10, E-11, H-07) were operating at night but were not searched due to access constraints. Three turbines (J-05, J-12, and R-04) were released for nighttime operations and searched as replacements.

The ITP and HCP requires seasonal summaries of post-construction monitoring results be submitted to the United States Fish and Wildlife Service (USFWS). The following summary fulfills the fall (August 16 – October 31) reporting requirements. As agreed, by USFWS and MDC, post-construction monitoring included turbines that were operational at night during the fall monitoring period. However, during the temporary operational shutdowns, Ameren voluntarily continued PCM efforts according to the pre-shutdown schedule (Table 2).

METHODS

Post-construction monitoring consisted of three primary survey components: 1) standardized carcass searches (carcass searches) of turbines, 2) searcher efficiency (SEEF) trials to estimate

[1] This fatality was confirmed through DNA analysis to be a female Indiana bat on June 26, 2024.

the probability searchers found a carcass, and 3) carcass persistence (CP) trials to estimate the average length of time a carcass remained in the search plots for possible detection. The methodologies of each of these components and associated analyses are described below.

Standardized Carcass Searches

Carcass searches were conducted between August 16 and October 15, 2024. Search areas under turbines consisted of full plots (a 60-m radius circle centered on the turbine) or road and pad plots (all gravel areas and one-m buffer within a 95-m radius of the turbine). Full plots were searched by humans or by detection-dog teams (one detection dog and one dog handler). Human searchers walked north-south or east-west oriented transects spaced from five to six[2] m apart while searching for carcasses out to three m on either side of the transect. Dog-assisted searches were conducted along transects perpendicular to the wind direction; transect width varied according to wind speed and vegetation density. Road and pad searches were conducted by human searchers only. Human searchers at full plots and road and pad plots walked at a rate of 45-60 m per minute.

Throughout the fall season, 69% (n = 33) of turbines were searched as full plots and 31% (n = 15) as road and pad plots (Table 2). Dog-assisted searches were conducted at 15 full plots and human-only searches were conducted at 18 full plots (Table 2). Each turbine was searched four times per week from August 16 to September 15 two times per week thereafter (Table 2).

Table 2. Number of turbines assigned to plot types and searched at the High Prairie Renewable Energy Center, Adair and Schuyler counties, Missouri, during the fall monitoring season (August 16 – October 31, 2024).

Date Range	Turbines Searched	Human-searched Full Plots	Road and Pad Plots	Dog-assisted Full Plots	Search Frequency (per week)
August 16 – September 15	48	18	15	15	4
September 16 – October 15	48	18	15	15	2
October 16 – October 31	0	0	0	0	0

Western EcoSystems Technology, Inc. (WEST), personnel trained in proper search techniques conducted carcass searches and documented all bat carcasses detected. All carcasses were photographed and identified to species or species group in the field. Species identification for all bat carcasses was verified by a WEST USFWS-permitted biologist. All bat carcasses were collected after processing, and then labeled, bagged, and stored in a freezer on site.

Bias Trials

The objective of SEEF trials was to collect data to estimate the probability that searchers detected bat carcasses. A bias trial administrator placed SEEF trial carcasses (SEEF carcasses) in search plots in the early morning prior to scheduled searches. Searchers were unaware of when and

[2] Beginning September 9, 2024, transect width was decreased to five m to increase searcher efficiency rates.

where the SEEF carcasses were placed. Bat carcasses were used to estimate SEEF during all fall trials.

The objective of CP trials was to determine the length of time a bat carcass remained in the field and was detectable. Possible means of carcass removal included avian and mammal predators and scavengers, insects, and agricultural activities. CP trials were checked on the following days after placement: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 21, and 30, or until it was missing for two consecutive checks. Bat carcasses were used for all CP trials during fall.

Data Analysis

Data collected during fall SEEF trials were used to estimate the seasonal probability that bat carcasses were detected by searchers. SEEF is the probability of a carcass being detected by a searcher given the carcass was available to be found. Estimates were obtained using a logit regression model (Dalthorp et al. 2018) and were calculated separately for dog-assisted searches and human-only searches. For human-only searches, modeling included plot type (full plot, road and pad plot) as a potential covariate (explanatory variable of interest); no covariates were used for dog-assisted searches. Models were selected using an information theoretic approach known as AICc, or corrected Akaike Information Criterion (Burnham and Anderson 2002). The best-supported model was selected as the most parsimonious model (i.e., model with the fewest parameters) within two AICc units of the model with the lowest AICc value.

Data collected during fall CP trials were used to model the amount of time, in days, that carcasses remained available within search plots for the summer season. Bat CP was modeled using an interval-censored survival regression using exponential, log-logistic, lognormal, and Weibull distributions (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018). CP rates were calculated separately for dog-assisted searches and human-only searches. Plot type was included as a covariate in the analysis of human-only searches; no covariates were included in analyses of dog-assisted searches because all dog searches occurred on full plots. The best-supported model was selected as the most parsimonious model (i.e., model with the fewest parameters) within two AICc units of the model with the lowest AICc value.

The change in SEEF between successive searches was defined by a parameter called the *detection reduction factor* (*k*) that ranged from zero to one. When *k* is zero it is implied that a carcass missed on the first search will never be found. A *k* of one implies SEEF remains constant no matter how many times a carcass is missed. The detection reduction factor is a required parameter for GenEst (a generalized estimator of mortality); however, data were not collected to estimate *k*. A single published study has estimated *k* to be 0.67 for bats (Huso et al. 2017) and this value was assumed for this study.

RESULTS

Standardized Carcass Searches

Eight bat fatalities, representing five species, were found during standardized carcass searches and two fatalities were found incidentally during the fall season (Table 3). Two fatalities of a covered species (Indiana bat) were found: one male found incidentally (outside plot boundaries) on September 11, 2024, and one male found inside plot boundaries on September 12, 2024 (Attachment A). Fatalities of two Species of Conservation Concern (SOCC [MDC 2024]; hoary bat and silver-haired bat) consisting of three individuals, were also found during standardized searches (Table 3). Nine of the 10 fatalities were found after the site-wide pause of nighttime operations that began on August 25, 2024. Details of each fatality are presented in Attachment A.

Table 3. Summary all bat fatalities found incidentally and during standardized fatality searches at the High Prairie Renewable Energy Center in Schuyler and Adair counties, Missouri, during the fall monitoring season (August 16 – October 31, 2024).

Species	Number Found During Standardized Searches	Number Found Incidentally*	Total Found (% of total)
big brown bat	0	1	1 (10)
eastern red bat	4	0	4 (40)
hoary bat[2]	2	0	2 (20)
Indiana bat[1]	1	1	2 (20)
silver-haired bat[2]	1	0	1 (10)
Total	8	2	10 (100)

*Incidental finds include fatalities found outside search plot boundaries or during eagle scans, carcass persistence trials, or other actions other than bat-focused searches.

[1] Covered Species per ITP

[2] Species of Conservation Concern (SOCC)

Bias Trials

Sixty-five SEEF trials were conducted during the fall season, including 21 on dog-assisted plots and 44 on human-only plots. SEEF rates were modeled using a logit model and assumed a constant detection reduction factor (k = 0.67). The median SEEF rate was 0.76 (90% confidence interval [CI] = 0.58–0.88) at dog-assisted plots The best-fit model for human-searched plots included plot type as a covariate (i.e., plot type affected SEEF rates). The median SEEF rates at these plots were 0.45 (CI = 0.29–0.63) at human-searched full plots and 0.98 (CI = 0.89–1.00) at road and pads.

Forty-four CP trials were conducted during the fall season, including 15 on dog-assisted plots and 29 human-searched plots. CP for dog-assisted plots was best modeled using an exponential distribution. The predicted median CP rate for these plots was 4.60 days (CI = 2.99–7.07). CP on human-searched plots was best modeled using a Weibull distribution with plot type as a covariate (i.e., plot type affected CP rates). The predicted median CP rate for these plots was 6.41 days (CI = 4.57–8.96) on full plots and 2.42 days (CI = 1.73–3.41) on road and pad plots.

CONCLUSION

Ten bat fatalities, including two Indiana bats, were documented during the fall post-construction monitoring period. These results are preliminary, final results will be included in the annual report at the end of the year.

REFERENCES

Burnham, K. P. and D. R. Anderson. 2002. Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach. Second Edition. Springer, New York, New York.

Dalthorp, D. H., L. Madsen, M. M. Huso, P. Rabie, R. Wolpert, J. Studyvin, J. Simonis, and J. M. Mintz. 2018. Genest Statistical Models—a Generalized Estimator of Mortality. US Geological Survey Techniques and Methods, Volume 7, Chapter A2. 13 pp. doi: 10.3133/tm7A2. Available online: https://pubs.usgs.gov/tm/7a2/tm7a2.pdf

Huso, M., D. Dalthorp, and F. Korner-Nievergelt. 2017. Statistical Principles of Post-Construction Fatality Monitoring Design. *In*: M. Perrow, ed. Wildlife and Wind Farms, Conflicts and Solutions. Vol. 2, Onshore: Monitoring and Mitigation. Pelagic Publishing, Exeter, United Kingdom.

Kalbfleisch, J. D. and R. L. Prentice. 2002. The Statistical Analysis of Failure Time Data. John Wiley & Sons, Hoboken, New Jersey.

Missouri Department of Conservation (MDC). 2024. Missouri Species and Communities of Conservation Concern Checklist. Missouri Department of Conservation, Jefferson City, MO. January 2024

Attachment A. Bat Fatalities Found during Post-construction Monitoring at the High Prairie Renewable Energy Center in Schuyler and Adair Counties, Missouri, between August 16 and October 31, 2024

Attachment A. Preliminary data from bat fatalities found incidentally and during post-construction monitoring searches at the High Prairie Renewable Energy Center in Schuyler and Adair counties, Missouri, during the fall monitoring season (August 16 – October 31, 2024).

Carcass ID	Nearest Turbine	Plot Type	Date Found*	Species	Found By	Distance from Turbine (m)	Bearing	Forearm (mm)	Age**	Sex***	Physical Condition
082224-HOBA-D-12-1	D-12	full plot	8/22/2024	hoary bat[1]	DMM	39	277	54	U	U	intact
082824-SHBA-E-01-1	E-01	full plot	8/28/2024	silver-haired bat[1]	AE	51	342	36	U	U	scavenged
090224-ERBA-C-10-1	C-10	full plot	9/2/2024	eastern red bat	AS	31	202	35	U	U	scavenged
090224-ERBA-D-03-1	D-03	full plot	9/2/2024	eastern red bat	AS	27	70	39	A	U	scavenged
090324-ERBA-B-08-1	B-08	full plot	9/3/2024	eastern red bat	AS	53	240	40	A	U	scavenged
090924-BBBA-C-10-1	C-10	incidental	9/9/2024	big brown bat	AS	70[3]	240	46	U	U	scavenged
091124-INBA-C-10-1	C-10	incidental	9/11/2024	Indiana bat[2]	AS	69[3]	185	38.7	U	U	scavenged
091224-INBA-B-08-1	B-08	full plot	9/12/2024	Indiana bat[2]	AS	28	260	36.8	U	M	scavenged
092024-ERBA-K-04-1	K-04	full plot	9/20/2024	eastern red bat	AS	48	44	40	A	U	intact
100324-HOBA-E-04-1	E-04	road/pad	10/3/2024	hoary bat[1]	MDR/ANB	44	337	53	U	U	intact

* All nighttime turbine operations ceased on August 25, 2024.

** U = unknown; A = adult

*** U = unknown, M = male

[1] State-listed as a Species of Conservation Concern

[2] Federally and state listed as endangered

[3] Indicates a carcass found during regularly scheduled searches but outside the 60-m plot radius

m = meter; mm = millimeter