

APPENDIX B. SIDEBOARDS FOR SMART TECHNOLOGY STRATEGIES TO ACHIEVE AVOIDANCE FOR TRICOLORED BAT.

Algorithm-Based Informed Curtailment (ABIC) Approach (Option 2)

1. Sideboards

- a. Acoustic detectors should be located on a minimum of 15 percent of the project's turbines (ABIC turbines) (FAQ #16 for more details).
- b. Acoustic detectors should be placed at the nacelle height or within the rotor-swept zone (RSZ). Additional detectors can be placed on the ABIC turbine tower (~20 meters (m)) and ground (3 m), however, these do not count towards the 15 percent of turbines unless the tower microphone detection distance is within the RSZ. Data from ground (~3 m) and tower detectors below the RSZ can be incorporated into the ABIC approach to increase the sample size and is strongly recommended in most locations. Coordinate with the local Field Office on their site-specific recommendations. Additionally, other species' calls can be used to supplement tricolored bat (TCB) calls and increase sample size (e.g., all recorded calls >40 kHz). If tower (i.e., below the RSZ) and/ or ground-based acoustics data are collected, call files must be paired with the closest turbine's 10-minute rolling average temperature and wind speed data (i.e., collected on the nacelle).
- c. Predictor data collected should include wind speed, temperature, date, and time of night measured over 10-minute intervals.
- d. Carcass trigger: If a TCB carcass is found when implementing an ABIC program, all turbines must stop operation under Option 2 and go back to Option 1 (blanket curtailment) until 1.d.ii below can happen.
 - a. The fatality must be reported to the local Field Office within 1 day (24 hours) of discovery.
 - b. Consult with the local Field Office regarding the ABIC program and if additional ABIC adjustments can be made, including but not limited to:
 - i. Designing an ABIC strategy for all bat calls versus only TCB calls.
 - ii. Collecting additional acoustic data, including data from the turbine with the fatality.

2. Program Development

- a. Before Year 1, your ABIC development plan (i.e., number of turbines, placement of acoustic detectors, and project layout), needs to be reviewed and approved by the local Field Office. Approval is the issuance of a Technical Assistance Letter (TAL) that will include the details specific to the project. The following items should be included as part of the development plan. The local Field Office may request additional information.
 - a. Projects should provide 1) GIS files of all project turbines and ABIC turbines (i.e., turbines that will be fitted with acoustic detectors), 2) acoustic detector and microphone information (including but not limited to

the make and model, the anticipated detection distance for low and high-frequency calls) to the local Field Office.

- b. Layout approval will be based on the distance to suitable TCB habitat and ensure that ABIC turbines are spread throughout the project site (i.e., a stratified randomized approach).
- b. A minimum of one year of acoustic and predictor data should be collected for the development of a project specific ABIC program. During development, turbines will be operating using Option 1.
- c. At the end of Year 1, an ABIC program proposal should include at a minimum the following information. The local Field Office may request additional information.
 - a. The ABIC strategy for the project must include all identified TCB acoustic call files from Year 1 (determined by Service-approved auto-ID programs¹ and manually vetted²) and must be as equally protective as Option 1 (i.e., demonstrate that, under the proposed strategy, all turbines would be feathered during all periods when TCB calls (or >40 kHz calls) were detected, at minimum, under the conditions [season, temperature, wind speed, etc.] specified in Option 1).
 - b. A brief CV highlighting the qualifications of the person(s) vetting call files should be included in the proposal.
 - c. The program (e.g., EchoPitch, etc.) is used to generate the ABIC strategy.
 - d. We recommend that projects include Tables and/or Figures showing the seasonality of TCB and all bat activity and the corresponding 10-minute rolling average temperature and wind speed collected at the turbine nacelle.

3. Program Structure and Implementation

- a. **Year 1** All turbines will operate under blanket curtailment regime (Option 1) and subset of turbines will collect acoustic data and predictor data (see below for more information).
 - a. Acoustic detectors should be scheduled to turn on 30 minutes before sunset and turn off 30 minutes after sunrise daily.
 - b. Post-construction mortality monitoring (PCMM) should occur in Year 1 at the approved level of effort described under #4.b.i. in the TCB Wind Avoidance Guidance. Report all PCMM data as described under #5 of the TCB Wind Avoidance Guidance.
 - c. At the end of Year 1, projects will create an ABIC program proposal using data collected (e.g., acoustic data, temperature, windspeeds, etc.) in Year 1

¹ [Automated Acoustic Bat ID Software Programs | FWS.gov](#). Note, all auto-ID programs are considered candidates in portions of ND, SD, MT, NE, and KS. In these areas two auto-ID programs should be used and the results cross-referenced. This process and a depiction of these areas are available in the Service's 2023 Range-Wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines (page 8, step 6).

² Currently approved programs have some bias in correctly identifying TCB calls to the 0.05 MLE value typically used for Indiana and northern long-eared bats. We recommend that all call files identified as TCB be vetted even if the MLE is below 0.05 to mitigate this bias.

and send to local Field Office for approval (i.e., approval will be an updated TAL). Note, if your project is waiting for an updated TAL (i.e., ABIC approval), the project can continue to operate under Option 1 and does not need to complete additional post-construction monitoring until the updated TAL is received. Year 2 under Option 2 (described below) will start once the project receives an updated TAL.

b. Year 2

- a. In Year 2 all turbines will operate under Service-approved ABIC program developed using data collected in Year 1 and described in the updated TAL.
- b. PCMM should occur in Year 2 at the approved level of effort described under #4.b.ii. in the TCB Wind Avoidance Guidance. Report all PCMM data as described under #5 of the TCB Wind Avoidance Guidance.
- c. Projects may choose to continue to collect acoustic data in Year 2 to help further refine the project's ABIC strategy. If projects choose to collect additional acoustic data, we request the same information as described under Year 1, above.
- d. If ABIC program is effective (i.e., no TCB carcasses detected), operation can continue under this ABIC program at the project.

4. Reporting

- a. Reports should be submitted by January 31, annually as described in the TCB Wind Avoidance Guidance unless otherwise approved by the local Field Office.
- b. Projects should provide the auto-ID output Excel spreadsheets with the following information amended for each bat call file. All bat species should be included.
 - a. A column that shows that the TCB call was vetted. Note vetting of other bat species call files is not required but encouraged especially if other listed species are detected;
 - b. A column that has the name of person(s) who vetted the confirmed TCB call file; and
 - c. Columns with corresponding 10-minute rolling average temperature and wind speed data for each TCB call file³
- c. Projects should provide a brief CV for each manual vetter that describes their experience.
- d. If the project would like to complete requested PCMM in future years, we request the following data to show the relationship between exposed bat calls (all bats) and fatalities.
 - a. Determine the number of exposed bat calls (all species) and relate this to the number of carcasses found. (e.g., graph of the two values and correlation coefficient).

³ See Peterson (2021), Behr et al. (2017), Barré et al. (2023), and others that have implemented ABIC strategies.

Real-Time Acoustic-Activated Curtailment Approach (Option 3)

1. Sideboards

- a. Units should be placed on approximately 10 percent of project turbines (See FAQ #15). Turbines should be assigned to “zones” as determined by the project proponent based on tricolored bat risk and/or other logistic constraints.
- b. Acoustic detectors should be scheduled to turn on 30 minutes before sunset and turn off 30 minutes after sunrise daily.
- c. Carcass trigger: If a TCB carcass is found when implementing Option 3, all turbines must stop operation under Option 3 and go back to Option 1.
 - b. The fatality must be reported to local Field Office within 1 business day (i.e., 24 hours) of discovery.
- a. PCMM should occur in Year 1 at the approved level of effort described under #4.a.i. in the TCB Wind Avoidance Guidance. Report all PCMM data as described under #5 of the TCB Wind Avoidance Guidance.
- b. At end of Year 1, projects will download and analyze acoustic call files (using a Service-approved auto-ID program) and Supervisory Control and Data Acquisition (SCADA) data to address the following questions:
 - c. Did the real-time curtailment system operate as expected? For example, were all turbines feathered within the designated zone when a bat was identified by the smart curtailment program? If not, when did this occur and were there bat carcasses (not TCB) found at these turbines as a result? Can this be avoided in the future?
 - d. Was the smart curtailment system identifying non-bat call (i.e., noise) as bats?
 - e. Was Option 3 equally as protective as Option 1 (i.e., were turbines feathered during all periods when bat calls were detected, at minimum, under the conditions [season, temperature, wind speed, etc.] specified in Option 1)?

2. Program Implementation

- a. Prior to Year 1, the following information needs to be coordinated and approved by the local Field Office. This includes developing a maintenance schedule to ensure that equipment is operating correctly and to replace old or malfunctioning equipment (i.e., microphones and acoustic detectors). We recommend obtaining a Technical Assistance Letter (TAL) for the local Field Office.
 - a. General information about the real-time smart curtailment technology (e.g., DARC/ EchoSense, TIMR), including but not limited to, how the technology will be connected to the turbines’ SCADA system, troubleshooting protocol (e.g., can the project spot check random turbines

- throughout the bat active period), microphone placement, and maintenance schedule of acoustic equipment.
- b. Projects should submit maps and GIS files of all project turbines and turbines that will be fitted with acoustic detectors to the local Field Office.
 - a. Layout approval will be based on the real-time outfitted turbine's distance to suitable TCB habitat and associated "zone" to ensure that turbines and their associated "zone" turbines are grouped based on expected relative risk to TCB. For example, if a project has forests along the east side of the project, we expect at least one turbine to be outfitted with the real-time smart curtailment technology and that turbines on the east side of the project be located in the same zone or multiple zones if more than one turbine is outfitted in this section of the project.
 - c. Projects should also show (e.g., test) that the real-time smart curtailment technology is operating as expected and communicating with the turbine's SCADA system.

3. Reporting

- a. Reports should be submitted by January 31, annually as described in the TCB Wind Avoidance Guidance, unless otherwise approved by the local Field Office. Additional information should also be included in the annual report, below. The local Field Office may request additional information.
 - b. This Auto-identified bat call files (determined by Service-approved auto-ID programs⁴ and manually vetted⁵). Manual vetting only needs to happen for calls auto-identified as TCB using a USFWS-approved software.
 - c. A brief CV highlighting the qualifications of the person(s) vetting call files should be included in the report.
 - d. If the project would like to complete requested PCMM in future years, we request the following data to show the relationship between exposed bat calls (all bats) and fatalities.
- b. Projects should provide the auto-ID output Excel spreadsheets with the following data amended for each bat call file. All bat species should be included.
 - a. A column that shows that the TCB call was vetted. Note vetting of other bat species call files is not required but encouraged especially if other listed species are detected;
 - b. A column that has the name of person(s) who vetted the confirmed TCB call file; and

⁴ [Automated Acoustic Bat ID Software Programs | FWS.gov](#). Note, all auto-ID programs are considered candidates in portions of ND, SD, MT, NE, and KS. In these areas two auto-ID programs should be used and the results cross-referenced. This process and a depiction of these areas are available in the Service's Range-Wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines (page 8, step 6).

⁵ Current approved programs have some bias in correctly identifying TCB calls to the 0.05 MLE value typically used for Indiana and northern long-eared bats. We recommend that all call files identified as TCB be vetted even if the MLE is below 0.05 to mitigate this bias.

- c. A column addressing if the turbine was feathered at the time of this acoustic call (i.e., spinning at less than 1 RPM).
- d. Wind speed data at the turbine at the time of the TCB call(s), if available.

DRAFT

LITERATURE CITED

- Barré, K., J.S. Froidevaux, A. Sotillo, C. Roemer, and C. Kerbiriou. 2023. Drivers of bat activity at wind turbines advocate for mitigating bat exposure using multicriteria algorithm-based curtailment. *Science of the Total Environment*, 866, p.161404. <https://doi.org/10.1016/j.scitotenv.2023.161404>.
- Behr, O., R. Brinkmann, K. Hochradel, J. Mages, F. Korner-Nievergelt, I. Niermann, M. Reich, R. Simon, N. Weber and M. Nagy. 2017. Mitigating bat mortality with turbine-specific curtailment algorithms: A model based approach. *Wind Energy and Wildlife Interactions: Presentations from the CWW2015 Conference*, p.135-160. Springer International Publishing. http://dx.doi.org/10.1007/978-3-319-51272-3_8.
- Peterson, T.S., B. McGill, C.D. Hein, and A. Rusk. 2021. Acoustic exposure to turbine operation quantifies risk to bats at commercial wind energy facilities. *Wildlife Society Bulletin*, 45(4), pp.552-565. <https://doi.org/10.1002/wsb.1236>.
- U.S. Fish and Wildlife Service. 2023. Automated Acoustic Bat ID Software Programs. <https://fws.gov/media/automated-acoustic-bat-id-software-programs>.