RE: Berry Energy, Inc. Gas Well –B – 800 Project
Findings relative to Indiana bat effects.
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On February 20, 2008, I received a copy of a Decision Memo and Biological Evaluation (BE) for the Berry Energy Inc., Gas Well B-800 Project on the Monogahela National Forest (MNF), West Virginia.

The Proposed Federal Action is the approval of the location of the gas well site, access road and land application site (sediments) for the gas well. The affected area is approximately 3.5 acres (2.5 acres drill site and 1,100 foot access road). Tree clearing and earthwork consisting of road construction (15 foot plus clearing limits), construction of a 100 x 200 ft drill pad (and drill hole) and excavation of a pit 80 x 120 ft by 8-11 ft deep will occur on surface lands owned by the Monogahela National Forest.

Issues identified in Biological Evaluation:

Indiana Bat: (MNF finding is "May effect, not likely to adversely affect")
Virginia Big-eared Bat: (MNF finding is "May effect, not likely to adversely affect")

- Forest Plan Revision (FPR) 2006 identifies:
  - Hibernacula: caves or mines that are occupied by IB in hibernation period.
  - Primary Range: land areas within 5 miles of IB hibernacula intended to be managed to provide basic habitat components needed by Indiana bats over time.
  - Key Areas: lands which provide mature forest habitat near IB hibernacula (at least 150 acres in size with 20 acres older growth forest).
  - Maternity Sites: areas with lactating females and/or juveniles prior to August 15.
  - Project activities within these areas require consultation with the U. S. Fish and Wildlife Service (FWS).
- Biological Evaluation identifies
  - BE -Page 13 states "the proposed project area is located within a stand identified as part of the key area associated with Big Springs Cave". Page 14 BE states "the proposed well site is within 5 miles of hibernacula, the area is considered part of the primary range". Page 15 BE states "survey data also was collected at several sites in the vicinity of the maternity colony, located approximately 6 mi. southeast of the proposed well site" and "Given the importance of Big Springs Cave as a hibernacula for the Indiana bat . . . potential indirect effects of the proposed project to the cave environment must be considered".
- Big Springs Cave (BSC) is located approximately 0.5 miles from project area. This cave has West Virginia Natural Heritage status of LE/G2/N2/S1 (Globally imperiled, Nationally and State critically imperiled). This cave has been identified as significant and has been gated to protect hibernating bats.
- Two Lick Run Cave is within 3-4 miles, is designated significant and is signed for protection.

Cave and Karst Resources:

- The proposed well site and road are located in karst. Surficial bedrock includes cavernous limestone.
- Karst features, including closed bottom sinkholes and water disappearing into the subsurface within intermittent and ephemeral stream channels are present within the B-800 well site and access road location.
- Ground water emerges at two major springs approximately 3,300 feet NE of and at lower elevation than well site. The nearest known underground passage within Big Springs Care is approximately 2000 feet and at lower elevation than well site.
- A hydrologic connection is indicated between the lower spring (emerging from BSC) and an open bottom sink that takes water during heavy rain located approximately 600 feet from and down hill from the well site.
- Hydrogeologic setting poses potential for water quality degradation within BSC and the associated springs and streams as well as changes to cave air flow and temperature.
- Sedimentation of groundwater and streams.
- Escape of well drilling fluids into groundwater through voids or fractures.
- Drilling pit content escaping into groundwater or surface water.
- Changes to long-term upper spring flow associated with activities.

My scientific findings follow:

Based on the biological and geological information contained in the MNF BE and my scientific and professional opinion, activities associated with drilling Gas Well B-800 have at least moderate potential to either indirectly or directly alter or disturb habitats and/or individual Indiana bats (*Myotis sodalis*) and Virginia Big-eared bats (*Corynorhinus townsendii virginianus*). Potential effects described below relative to Big Springs Cave would pertain to both species, due the greater potential to affect Indiana bats, I will focus my findings on that species.

My opinion is based on personal knowledge of Indiana bat ecology and behavioral patterns as well as reviews of scientific literature. Specifically, my concerns and rationale for findings follow in order of descending risk to the species.

Pertinent Regulations:

As defined in 50 CFR ξξ 17.31, 17.21 and Sec. 7 & 9 of the Endangered Species Act, *private individuals and federal agencies* are prohibited from "taking" endangered wildlife species. "Take" in the Act includes direct and indirect "harm" and has been defined by FWS regulation to include habitat modification or degradation which impacts essential behavioral patterns, including breeding, feeding and sheltering.

Concerns and scientific rationale relative to bats and their habitat components:

- Land disturbing activities:

  The proposed activities include surface land disturbance in known karst topography. Recently, surface related changes (associated with FR 701) with impacts to the hydrology of the BSC were documented (Refer to memo from Linda Tracy dated August 12, 2003). Sediment associated with a newly opened sinkhole below FR 701 was determined to be a likely source of turbid water emerging from BSC. Although the

sinkhole referenced in the memo is outside the current project area, it is part of the same karst system that would potentially be impacted by the proposed activities. Additionally, FR 701 will provide access to the proposed activities including transport of drill rigs and other heavy equipment that will be used to conduct the proposed surface activities. The access road to be constructed to the drill site intersects FR 701 within approximately one mile of the documented sinkhole collapse and proceeds NE towards the collapse site.

- Significant Indiana bat hibernacula:

  The proposed activities will be conducted < 0.5 miles from BSC; a West Virginia designated significant hibernacula for Indiana bats. Additionally, the proposed activities are within 5 miles of two other hibernacula, Two Lick Run (significant), and Coal Run cave. The USFS gated BSC in 1973 to protect hibernating bats. The 2006-07 winter count conducted by Craig Stihler (West Virginia Dept. of Natural Resources) indicated approximately 300 Indiana bats were present.

  The BE indicates that approximately 94% of West Virginia's hibernating IB population (~15,000) use 13 caves and that one cave in Pendleton County accounts for nearly 90%. Based on these figures, BSC provides winter shelter for approximately 2% of the state's wintering population. However, considering a single cave less than 50 miles from BSC houses 90%, the population in BSC represents approximately 20% of the remaining population. There is considerable evidence of movements by IB between hibernacula during the breeding season and warmer periods during the winter. IB's have exhibited fidelity for hibernation locations, returning to the same cave or mine to hibernate every year. They use cool caves with stable temperatures and high relative humidity levels. Long-term data collected in Missouri caves (Elliot and Clawson 1999) documented roost switching, where an entire colony will arouse from torpor to seek more suitable hibernation conditions. Alternative swarming and hibernation sites within close range are an important population component from both a winter habitat and biological (genetic diversity) perspective.

  Disturbance during hibernation causes arousal from torpor or interruptions of hibernation, in Indiana bats (Humphrey 1978; Thomas 1995). A single arousal can use the same amount of stored energy as 68 days of uninterrupted hibernation, so arousals are very costly to the energy budget (Thomas et al. 1990). If an IB's energy reserve is consumed during the course of hibernation, the bat may die or experience reproductive failure due to the lack of energy to maintain pregnancy. Protection of hibernating colonies from disturbance has been the main purpose of cave entrance gates.

- Summer/Maternity Habitat and MNF designated "Primary range" and "Key areas":

  Bat surveys conducted in 2004 documented a maternity colony of Indiana bats immediately adjacent to MNF lands east of Otter Creek Wilderness. Subsequent surveys in 2005/06 also documented summer use of the area by male Indiana bats. Craig Stihler captured 69 individuals in the vicinity of Big Spring Cave between June and November 1997. Individuals roosted near the hibernacula throughout the summer. Anabat recordings also indicate summer use of MNF areas near this hibernacula.

  The revised 2006 MNF FPR designated areas within 5 miles of IB hibernacula as "Primary range" (Indiana bats presumed present from April 1 to Nov 15) intended to be managed to provide basic habitat components for this species and requires ESA Sec. 7

consultation with FWS (page 12, BE). The proposed project area is located within a "key area" associated with BSC (programmatic level) but based on current management needs, an alternate stand has been designated to provide mature forest habitat. The Programmatic Biological Opinion for the FPR states "surface occupancy for federal mineral activities is not allowed within 200 feet of a hibernacula, or within key areas but may be allowed within primary zones and within maternity areas on a case by case basis".

Several recent investigations (NY; PA) suggest that female Indiana bats from smaller hibernacula use summer areas within relatively short distances of their winter sites. The bats using the MNF in the summer period may live in the vicinity year round. The importance of landscape features year round should be included in the analysis. Indiana bats display strong between-year fidelity to hibernacula, summer colony areas, roosts, commuting corridors, and foraging sites. For example, 41% of banded adult females at one colony in Michigan were recaptured at or near the initial banding site in subsequent years (Kurta and Murray 2002), and bats from this colony used a wooded fenceline as a commuting corridor. Roost trees often are reoccupied by a colony in subsequent seasons, with many examples of trees being used for 2–6 years (Gardner et al. 1991; Gumbert et al. 2002). Although Indiana bats are faithful to their home area, exact roosting sites must change frequently, due to the natural decay of roosts. One colony in Michigan shifted the focal point of its roosting activity by 2 km in 3 years but maintained the same home range. Most roosts were located in or near foraging areas or commuting corridors; features of the home range are probably less ephemeral than individual roosts (Murray and Kurta 2004).

The MNF does not own the subsurface rights and states that the federal action is limited to the terms of the mineral reservation including approval of location of roads on NFS land and the prevention of deterioration of NF streams, lakes, ponds, springs, etc. However, it is not clear in the BE how the MNF made the determination that there were no extraordinary circumstances relative to Threatened and Endangered Species. On page 8 and 19 of the BE a "may effect, not likely to adversely affect" determination was made for both Indiana and Virginia Big-eared bats; this finding usually results in initiation of informal consultation with FWS. Additionally, the watershed of the hibernacula includes areas within the Otter Creek Wilderness, which may also constitute extraordinary circumstances.

- Hydrogeological concerns and associated indirect hibernacula microclimate changes:

Maps provided of the cavern system location indicate the mapped passages extend more than a quarter mile (east/west) with a very complex and extensive intertwined system in the eastern extent. Documented hydrogeological relationships between the karst terrain and water movement from surface and subsurface flow through the cavern system to outlets at two springs emerging from BSC suggests a complex pattern of water, air and sediment exchanges in this system between surface and subsurface features. The mitigation measures targeting the actual drill hole intended to prevent sediment and contaminant movement into the cave system seem attentive to the potential impacts from these sources; however, the impacts from associated activities (ground disturbance) may also affect microclimate. Additionally, air and water movement through geotextile material may affect microclimate conditions, in particular relative humidity, an important component in *Myotis* hibernation sites.

Microclimates within cave systems are affected by factors such as cave entrance size and orientation, cavern structure, airflow through cave systems, and climatic factors (Richter et al. 1993; Tuttle and Stevenson, 1978). Tuttle and Kennedy (1999) analyzed 15 cave systems and found a strong correlation between increasing cave temperatures and declining populations of *M. sodalis*. Most systems that exhibited stable temperatures were found to have consistent or increasing populations. Microclimate temperature and humidity is important to the successful hibernation of *M. sodalis*; and greater population increases may be realized when optimal hibernation conditions are preserved (Thomas et al., 1990; Tuttle and Kennedy, 1999).

Historically, populations of Indiana bats concentrated in caves with structural diversity and relatively constant internal temperatures. Caves are often cooled through chimney-effect airflow (Tuttle and Stevenson 1978). Chimney-effect airflow is accomplished by cooler air entering a cave system through one or multiple cave entrances and becoming trapped as warmer air is pushed out of smaller openings (associated with karst features including sinkholes) at some distance from the entrance. The location, number, and orientation of these features each influence the delicate microclimate balance. Field studies suggest that modification of openings may be a primary cause for increasing internal cave temperatures and changes to humidity regimes (Richter et al. 1993; Tuttle and Kennedy 2002).

Although few studies have targeted changes in hibernacula microclimate specifically, several studies from engineering literature suggest that surface activities can have both short and long-term impacts to hydrogeologic regimes of karst systems. These studies suggest that sediment dynamics and associated moisture regime are influenced by factors including sinkhole drainage area, morphology, and basin sediment yield; changes are influenced by random events including sinkhole collapse. While both the Berry Energy permit application and the MNF-BE identify mitigation measures to reduce the potential of sediment reaching the cave and associated aquifers, air and water movements may or may not be mitigated by the geotextile materials. The unusual circumstances where this particular karst system houses at least one TES species and the existence of Otter Creek Wilderness in the same watershed would suggest that some level of monitoring of the microclimate of the cave or the drainage system pathways would be reasonable. Included in the Berry Energy, Inc. permit documents is a notice to surface owners allowing for well or spring testing within 1000 to 2000 feet of the drill site. In lieu of these tests, it would seem reasonable for USFS to have requested temperature and humidity monitors to be placed in the cave system (in cooperation with West Virginia Department of Natural Resources) to track changes over time. Various modeling approaches are available for assessing impacts to karst systems from surface or subsurface activities over time.

- Cumulative Effects:

Although not specifically identified in the BE, several potential cumulative effects may be inferred from the information provided. The most obvious would be the spatial relationship between summer and winter habitat components used by Indiana bats in this specific area. Another cumulative impact could be inferred from the recent history of activities by Berry Energy, Inc. This company recently acquired the subsurface mineral rights and has previously drilled at least one other exploratory well. If B-800 is unsuccessful, additional wells can be anticipated; if successful, additional activities including pipelines associated with extraction of minerals can be anticipated. While this

decision is focused on a single drill site and as such would have less potential impact to the hibernacula and associated summer habitats, as additional activities are planned, the cumulative effects would compound quickly relative to the potential hydrologic and biological impacts to this hibernacula.

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