National Park Service
U.S. Department of the Interior

Wind Cave National Park
South Dakota

Environmental Assessment for the

Project to Replace the Deteriorated Cave Lighting System

May 2005

Boxwork Formation inside Wind Cave

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EXECUTIVE SUMMARY

SUMMARY

The National Park Service is proposing to replace the lighting system within Wind Cave in order to protect cave resources, enhance the visitor appreciation of the unique geology within the cave, protect public health and safety, and strengthen park operational efficiency and sustainability.

The existing cave lighting system illuminates approximately one mile of paved tour routes within the cave. The system components are approaching the limits of their serviceable life, having been installed between the 1930s, 1950s, and the 1980s. The system is no longer up to date with current professional practice and is generally considered unsafe from an operations and maintenance perspective. The incandescent lights presently used promote algal growth on cave surfaces, they do not inhibit vandalism, nor do they provide adequate access lighting, all of which pose a long-term threat to cave resources.

Two alternatives are analyzed in this environmental assessment:

Alternative A, the No Action Alternative: This alternative is the continuation of current management. The No Action Alternative would leave in place the existing cave lighting system, without significant changes to maintenance or operation of the system. No major efforts would be undertaken to minimize the safety hazards of the existing system. Ongoing minor repair activities would continue, although these would not address the critical design flaws that pose health and safety hazards and negatively impact cave resources.

Alternative B, the Preferred Alternative: The Preferred Alternative would replace the deteriorated cave lighting system, including the entire power distribution system, lighting control system, and lighting fixtures, with a new system that meets current professional practices for operation and safety.

The alternatives analyzed in this environmental assessment would not result in major environmental impacts or impairment to park resources or values.

PUBLIC COMMENT

If you wish to comment on the environmental assessment, you may mail comments to the name and address below. This environmental assessment will be on public review for 30 days. Comments may also be submitted through the National Park Service planning website: http://parkplanning.nps.gov. From this website, follow the links to Wind Cave National Park. Please note that the names and addresses of people who comment become part of the public record. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment. We will make all submissions from organizations, from businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses available for public inspection in their entirety.

This document will be on review for 30 days. Please address written comments to:
Superintendent
Wind Cave National Park
RR 1, Box 190
Hot Springs, SD 57747-9430

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PURPOSE AND NEED

INTRODUCTION

The primary purposes of the project are to provide the public and park staff with a safe and reliable cave lighting system; to protect cave resources; to improve visitor understanding and appreciation of the unique geology of Wind Cave; and to improve the operational efficiency associated with the lighting system.

The existing cave lighting system provides trail and feature illumination along approximately one mile of paved tour routes within the cave. The system consists of 650 incandescent lights that are remotely activated at the beginning of each tour day, remain on during the day, and are shut off at the close of visitation hours. During the off-season, lights are kept off in areas that are closed to visitation except when needed for restoration or maintenance work. The system components were installed from the 1930s through the 1980s, using a variety of methods and materials. The system is no longer up to date with current professional practice, and is considered unsafe from an operations and maintenance perspective. The incandescent lights are inefficient and create heat that promotes algal growth on cave formations, which interferes with visitor appreciation, increases maintenance work, and may damage formations over the long term. (For a detailed description of the existing system, see "Alternative A, the No Action Alternative" section of this document.)

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The proposed lighting system rehabilitation would be consistent with objectives expressed in the park's enabling legislation and in the 1994 *Final General Management Plan/Environmental Impact Statement*. These objectives were identified by NPS staff in initial project planning phases and must be achieved for the project to be considered a success.

Purpose:

- The project would protect the unique Wind Cave environment.
- The project would protect public health, safety, and welfare by providing a safe, reliable lighting system within Wind Cave.
- The project would facilitate and enhance visitor understanding and appreciation of the unique geology and formations within Wind Cave.
- The project would reduce the park's energy consumption and improve park operational efficiency.

Need statements:

- The lighting system currently promotes growth of algae and other lamp flora that pose a long-term threat to cave formations.
- The lighting system is aging and no longer meets professional standards for safety and reliability. Park staff is exposed to increased hazards during repair and maintenance, and visitors could potentially be affected by exposure to high-voltage electrical lines.

- The pathway and cave features are all lit by the same type of fixtures and lamps. This can lead to difficulty in discerning features from hazards or narrow trail sections, which can direct attention away from low overheads, narrow trail sections, or steps.
- The current fixture placement and lamp type (incandescent) is not optimal for promoting visitor appreciation and understanding of the cave environment.
- The existing lighting system has no backup power source for egress in the event of a commercial power outage, which happens frequently during summer thunderstorms when visitation into the cave is highest.

PURPOSE AND SIGNIFICANCE OF THE PARK

Description of the Park

Wind Cave National Park is located in western South Dakota, on the southern edge of the Black Hills. The park was established in 1903 to protect Wind Cave from commercial exploitation (NPS 1994). The cave is one of the world's longest and is well known for its outstanding display of boxwork, an unusual cave feature composed of thin blades of calcite that resemble honeycombs (NPS 2004a). In addition, the park contains over 40 other, smaller caves (NPS 2004a). Since its original designation, the purpose of the park has been expanded from cave preservation alone to protection of both surface and subsurface resources. One of the primary features of the park remains the cave, recognized worldwide as a significant site.

Aboveground, Wind Cave National Park encompasses 28,295 acres of prairie ecosystem. The surface features of the park include expanses of mixed-grass prairie, ponderosa pine, and riparian ecosystems. The gently rolling landscape of the park is a transition zone between plains and mountains, and supports a great diversity of plant and animal species (NPS 1994). The park is well-known for its resident bison herd, as well as for opportunities to view mule deer, pronghorn, elk, prairie dogs, wild turkey, raptors, and a variety of other wildlife.

The cultural resources of Wind Cave National Park include evidence of prehistoric and Plains Indian cultures, records of early cave exploration and tourism, and Civilian Conservation Corps structures. The National Register of Historic Places lists the Wind Cave National Park Administrative and Utility Area Historic District along with several related historic properties.

The park is seven miles north of Hot Springs, South Dakota, and bounded by Custer State Park on the north, Black Hills National Forest on the west, and by private property on the south and east. The park is one of a variety of destinations for Black Hills visitors. Attractions in the immediate area include Mount Rushmore National Memorial, Jewel Cave National Monument, Crazy Horse Memorial, the Mammoth Site in Hot Springs, and Badlands National Park (Figure 1).

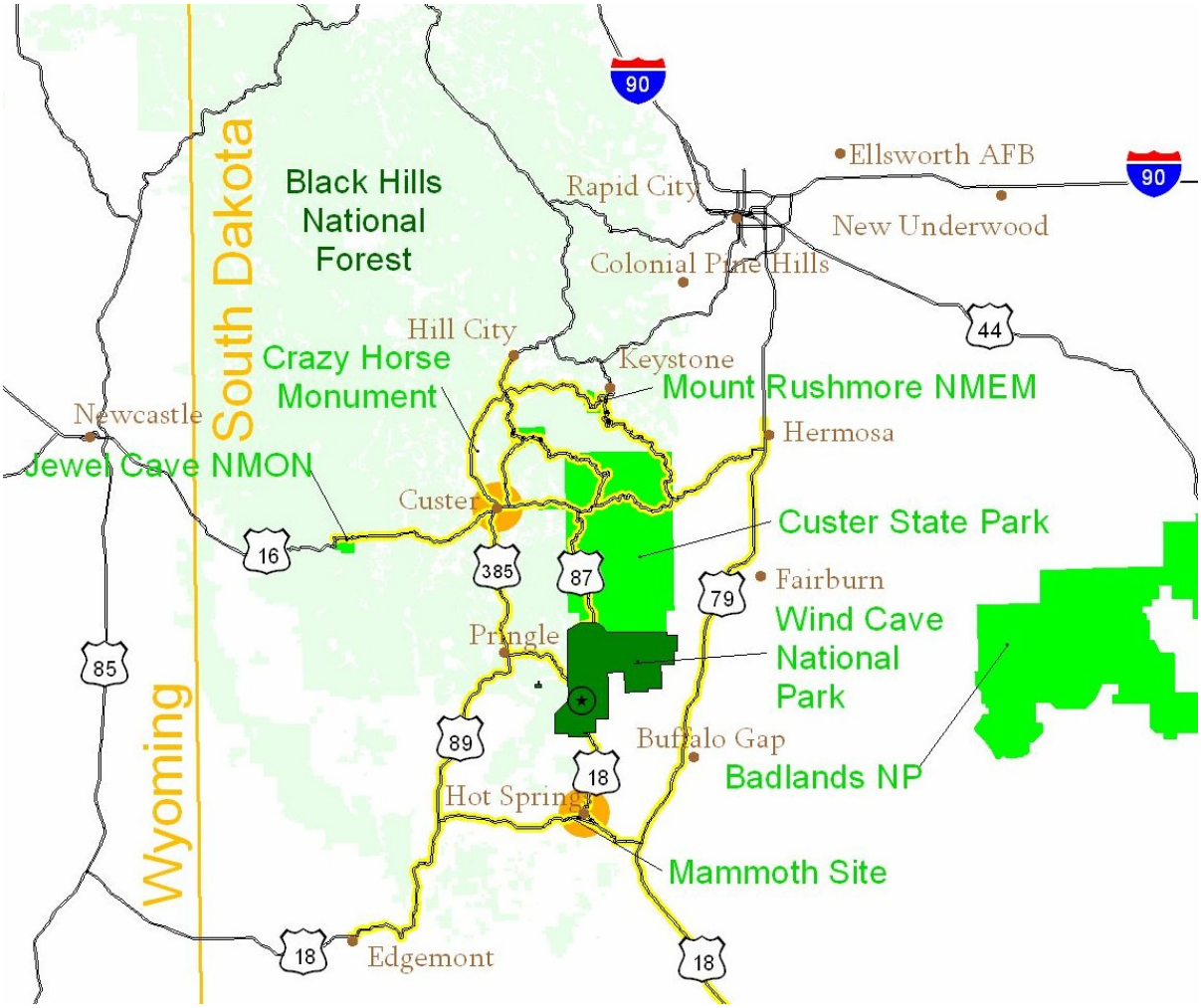

FIGURE 1. REGIONAL MAP OF WIND CAVE NATIONAL PARK

Significance and Legislation

Wind Cave National Park was established in January 1903 (32 Statute 765) as a 10,532-acre area to protect Wind Cave and the underground resources of this unique site. It was the eighth national park and the first created to protect a cave. The original legislation applied only to the cave and surface developments needed for the management and care of the cave (NPS 1994). The parklands at that time were small and included no bison, elk, or pronghorn. These big game species were introduced later, as park boundaries expanded.

The purpose of Wind Cave National Park has evolved from cave preservation to protection of both subsurface and surface ecosystems. In 1912, establishment of the Wind Cave National Game Preserve provided a permanent range for bison and "such other native American game animals as may be placed therein." Herds of bison and elk were re-established as the need to preserve and protect big game species was realized. In 1935, management of the game preserve was transferred from the Department of Agriculture to Wind Cave National Park. Through a series of expansions, by 1946, the park encompassed over 28,000 acres to

maintain a viable population of a variety of big game, especially pronghorn. Additional legislation in 1978 added approximately 228 acres to the southern end of the park (NPS 1994).

PROJECT BACKGROUND

The cave lighting system is an integral part of interpreting the unique geology of Wind Cave to park visitors. The lighting system in the cave was originally installed in 1931; rehabilitation occurred in 1955, 1980, and 1988. The system is deteriorating and approaching the end of its serviceable life. In addition, the basic design of the system is no longer consistent with professional standards for safety and poses health and safety risks to park employees and visitors. The primary power system distributes very high voltage (2400 volts) throughout the cave. The cables carrying this power are inadequately protected and are often located in close proximity to the public trail routes (NPS 2003).

All high-voltage primary cables are connected together in a daisy-chain configuration, so a cable failure anywhere would result in a loss of all cave lighting. There is also insufficient grounding for the existing power, control panels, and light fixtures, which present a risk to visitor and park maintenance staff in the moist cave environment. There is no backup power system in the event of a power system failure. When the commercial power goes out, the cave goes dark and visitors must be evacuated by flashlights. Because the existing power distribution system in the cave is 2400 volts, providing emergency backup power by generator is not feasible (NPS 2004b).

Due to the age of the system, lighting controls and switches have become unreliable, and many replacement parts are no longer available. Cave interpreters turn off the lights along certain sections of the tour so visitors can experience the natural total darkness of the cave. The lighting control circuits used to perform these “blackout” demonstrations often malfunction (NPS 2003). In these instances, either the lights do not turn off or the lights fail to turn back on. When the latter occurs, visitors must be taken to the next lighted section of the cave by flashlight. This is unsafe because of the risks to visitors as well as the potential for damage of cave resources from visitors touching the formations while trying to navigate through the cave in the dark.

The artificial light and heat introduced into Wind Cave by the existing lighting system promotes algal growth problems in the cave. To eliminate cave algae, resource specialists currently apply a weak solution of bleach and water to cave surfaces. This practice is undesirable because of the potential to negatively impact natural cave biota and formations.

Description of the Project Area

The project area for this proposed action includes the lighted cave tour routes, surface and subsurface structures that contain electrical system components, areas within the cave used for cable and wiring placement, and an area where a communication system would be routed. Cave tours that are lighted include the Garden of Eden, Natural Entrance, and Fairgrounds Tours. Outside the cave, the system is comprised of the existing conduit and elevator shaft in the elevator building and the system’s electrical enclosure located in the equipment room adjacent to the elevator building. There would also be a trenched communication system that would connect from the visitor center to the elevator building and would be about two feet

wide and two to three feet deep. This trench would lie within an area previously impacted by the installation of other utilities, including power, telephone, water, and sewer. Inside the cave, lighting equipment includes primary and secondary cables, light fixtures, lighting control panels, and transformers.

Lighted portions of the cave comprise approximately one mile of the over 110 miles of surveyed cave (see Figure 2 for a map of the tour routes). The cave is primarily famous for its complexity and intricate cave formations, especially the boxwork found protruding from the cave's walls, ceilings, and occasionally the floors. Boxwork is extremely rare, and nowhere else in the world is such a large display known. Other formations, such as popcorn, frostwork, moonmilk, and dogtooth spar can also be found along cave tour routes (NPS 2004a).

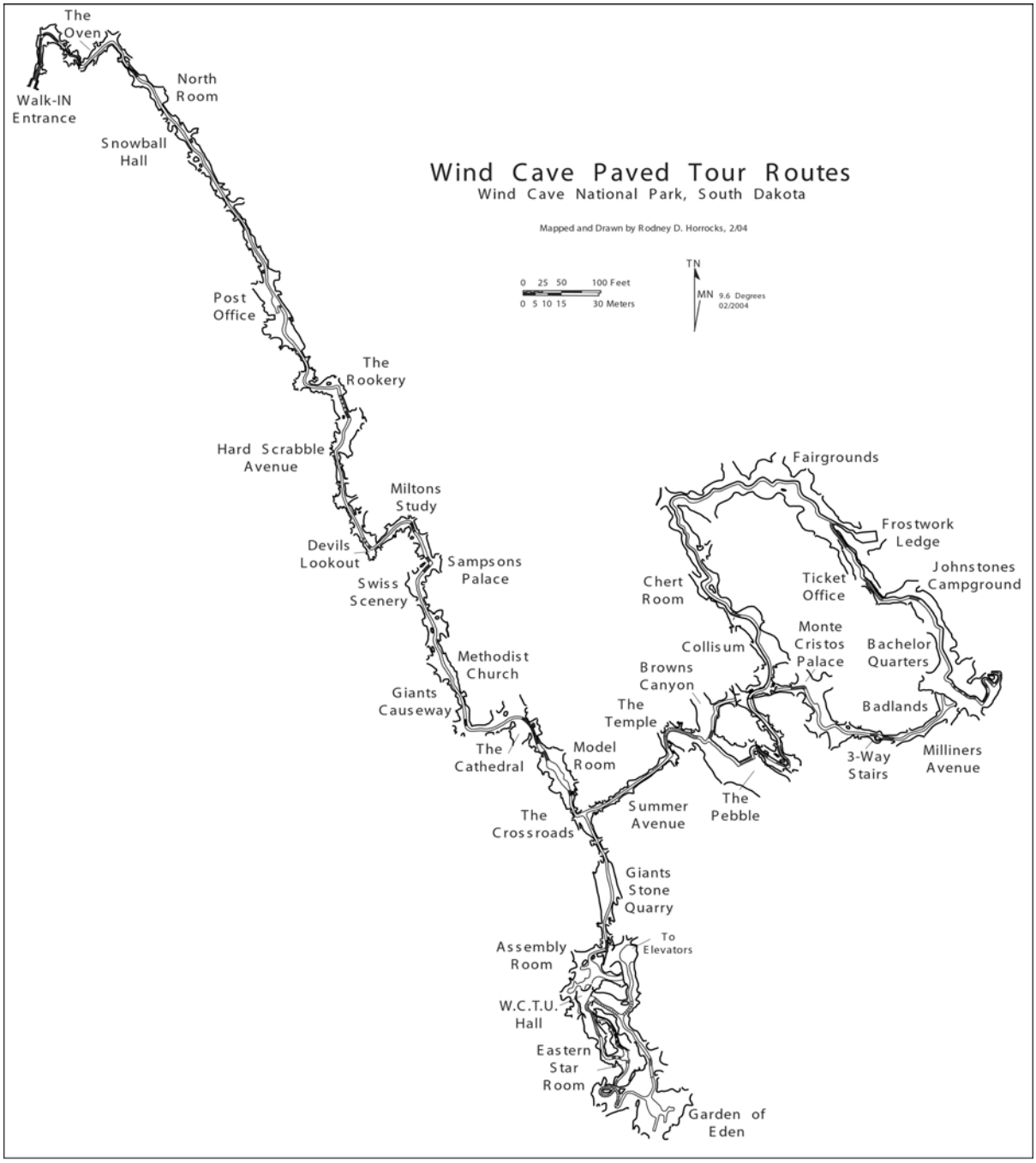

FIGURE 2. WIND CAVE TOUR MAP

The elevator building provides entry into the cave for the Garden of Eden, Fairgrounds, Candlelight, and Wild Cave Tours and houses the elevator shaft, the location where the primary power is fed into the cave. The elevator building, completed in 1938, was constructed by the Civilian Conservation Corps and is listed in the National Register of

Historic Places. It is located about 225 yards south of the visitor center and is built of sandstone blocks, taken from a nearby quarry, concrete blocks, yellow-tan stucco, and adzed timber. Although the equipment on the elevators themselves has been modernized, the overall appearance of the building both inside and out has changed very little since the days of the Civilian Conservation Corps (NPS 2004a).

The Natural Entrance Tour begins near the natural opening of the cave, which was first officially documented in 1881. The larger, more accessible entrance used today was constructed in 1936 by the Civilian Conservation Corps and is located approximately 200 yards north of the visitor center. The original wooden stairs leading from this entrance to the lower level of the cave were also replaced with concrete steps in 1936, portions of which were rebuilt/replaced in 1988. A revolving door was added in 1991 to slow artificial air exchange (NPS 2004a).

The tour routes were surveyed for biota in 1992 and 1995 (Moore 1996). Surveys identified bacteria, fungi, amoebae, protozoa, nematodes, collembolans (springtails), mites, deer mice, woodrats, and one bat species. The mammals were concentrated near entrances, with most bats found within 500 yards of the natural entrance. Some of the invertebrates are highly-specialized and cave-adapted species (NPS 2002).

Related Projects and Plans

The 1993 *Wind Cave Resource Management Plan* and the 1994 *Final General Management Plan/Environmental Impact Statement* outline the direction for proposed actions to be taken for protecting park resources and enhancing visitor experiences at the park. Table 1 summarizes specific plans that relate to the actions proposed in this environmental assessment.

TABLE 1: PROJECT'S RELATIONSHIP TO OTHER PLANS

Management Activity	Relationship to Proposed Action
Relocate wastewater treatment facility.	The park is planning to relocate the wastewater treatment facility to a location that does not restrict size and allows a greater evaporation rate to fully remove inputs of wastewater and precipitation. Implementation of the project would protect cave resources from exposure to organic pollutants.
Construct a new visitor center parking lot and associated stormwater management system.	The park is replacing the deteriorated asphalt parking lot with a new concrete structure and installing a new stormwater collection and treatment system to prevent polluted runoff from entering the cave. This project will reduce hydrocarbon contamination within the cave.

TABLE 1: PROJECT'S RELATIONSHIP TO OTHER PLANS	
Develop a cave and karst management plan.	The park is developing a comprehensive plan to manage, protect, and interpret cave resources. This project is consistent with resource protection goals and objectives, including projects to restore developed portions of the cave. The plan is analyzing the future management direction of the cave, including existing and future uses, such as the potential for re-lighting the Blue Grotto Loop, a section of the cave that was lit in the past but the lighting system has since been removed.

The project to replace the deteriorating lighting system represents a continued commitment to preserve valuable park resources and meet established standards of public health and safety. The proposed action alternative would not conflict with any ongoing or planned management activities within the park.

Scoping

Scoping is the effort to involve agencies and the public in determining the issues to be addressed in the environmental evaluation. Among other tasks, scoping determines important issues and eliminates issues that are ultimately unimportant; allocates assignments among the interdisciplinary team members and other participating agencies; identifies related projects and associated documents; identifies permits, surveys, or consultations required by other agencies; and creates a schedule that allows adequate time to prepare and distribute the environmental document for public review and comment before a final decision is made. An internal scoping meeting held at the park in January 2004 identified the main issues and impact topics to be addressed in this environmental assessment.

At a minimum, National Park Service agency scoping includes input from the State Historic Preservation Officer, the U.S. Fish and Wildlife Service, and Native American tribes interested in the park. During development of this environmental assessment, the park contacted the South Dakota Historic Preservation Officer, the U.S. Fish and Wildlife Service, and interested tribes by letter. A summary of the scoping activities undertaken prior to development of this environmental assessment can be found in the "Consultation and Coordination" section. Copies of consultation letters may be found in Appendix A.

Issues

Issues and concerns regarding this proposed project were identified by the planning team early in the project. The main issues include the following:

- Lighting system installation and maintenance should be conducted in a manner to minimize the impact on cave resources. Workers performing the installation must have sensitivity toward protection of cave resources.
- The lighting system should enhance the visitor experience by emphasizing the complexity of cave resources and intricate boxwork. The system design should incorporate the ability for cave interpreters to present the "blackout" experience to visitors on each tour route.

- The lighting system design should be energy efficient, reliable, and should incorporate the best professional standards for safety and operation.
- The new power distribution and lighting system should provide egress lighting in the event of a power failure.
- Public and employee health and safety should be maintained throughout project implementation.
- The lighting system should discourage the artificial growth of algae and reduce resource damage from visitors.
- A high-quality visitor experience should be maintained throughout project implementation.

Impact Topics

Derivation of Impact Topics

Impact topics were used to focus the evaluation of the potential environmental consequences of the alternatives. Candidate impact topics were identified based on legislative requirements, executive orders, topics specified in *Director's Order #12 and Handbook* (NPS 2001), *Management Policies 2001* (NPS 2000a), guidance from the National Park Service, input from other agencies, public concerns, and resource information specific to Wind Cave National Park. A brief rationale for the selection of each impact topic is given below, as well as the rationale for dismissing specific topics from further consideration.

Impact Topics Included in this Document

Public health and safety and visitor use and experience at national parks are managed in accordance with the Organic Act of 1916 and NPS *Management Policies 2001.* These topics were retained because Wind Cave receives approximately 89,000 visitors annually, and the installation of a new lighting system would occur within and adjacent to the cave, potentially impacting the visitor experience and public safety. In addition, the project's primary objectives are to increase public health and safety and enhance visitor understanding and appreciation of the unique geology in the cave.

Cave resources were retained because the proposed action would directly affect the cave and its resources during installation and would enhance protection of cave resources over the long term. The regulations and polices relevant to this impact topic include the Federal Cave Resources Protection Act of 1988, 43 CFR Part 37 Cave Management, and NPS *Management Policies 2001*.

Ethnographic resources were retained because of the significance of Wind Cave to Native American tribes associated with the park. Regulations and policy related to this topic include those listed below for archeological resources as well as: Executive Order 13175, Native American Graves Protection and Repatriation Act, Presidential Memorandum on Government-to-Government Relations (1994), and NPS *Management Policies 2001*.

Park operations were retained because of the potential improvements in efficiency of park operations and the potential for impacts during installation and life-cycle maintenance of the new system. This topic is addressed in accordance with NPS *Management Policies 2001*.

Energy requirements and conservation potential at national parks are managed in accordance with NPS *Management Policies 2001*. This topic was retained because energy efficiency could be affected by a new lighting system. A primary objective of the project is to reduce energy consumption and increase efficiency.

Impact Topics Dismissed From Further Analysis

The resource topics described in this section will not be evaluated any further in this environmental assessment. These impact topics were not identified during scoping as being of concern. Additional reasons for their dismissal are provided below.

Aboveground natural resources, including soils, vegetation, and wildlife: The proposed action would generate only a small amount of surface disturbance for the installation of communication and control wiring in a common trench, in the previously disturbed utility corridor between the elevator building and the visitor center. Any effects to soils and vegetation from the proposed action would therefore be negligible. No effects to wildlife would be anticipated. Effects to biota within the cave were evaluated under the impact topic "Cave Resources."

Cultural resources

*Cultural landscapes***:** This project lies within the Wind Cave National Park Administrative and Utility Area Historic District, an area that contains 16 buildings, the historic Civilian Conservation Corps cave entrance and stairs, plus several miscellaneous landscape features that are considered eligible for the National Register of Historic Places. The National Park Service is completing a cultural landscape report (CLR) for the park. The Draft CLR listed small-scale features within the cave, including lights, electric cabling, transformer boxes, telephone boxes, metal gates, some handrails, aluminum steps, benches, and trash receptacles as non-contributing features of the cultural landscape of Wind Cave National Park.

The Preferred Alternative would have only a negligible, short-term impact on vegetation along the utility corridor because excavation for the new lighting system cables would occur in a previously disturbed area that would be rehabilitated shortly after the project. This project would not affect cultural landscape features listed in or eligible for the National Register of Historic Places so this topic is dismissed from further analysis.

*Archeological resources***:** Human use of the area around Wind Cave in the Black Hills of South Dakota dates back thousands of years, and prehistoric and protohistoric archeological sites are known throughout the park. Although prehistoric peoples used available caves and rock shelters, no archeological evidence of Native American use of the interior of Wind Cave has been found. This is not to say, however, that Native Americans never used the cave because Wind Cave is known to be an important part of Native American history and religious beliefs. For this reason, the topic of ethnographic resources will be included in this environmental assessment (see above).

Most of the objects associated with historic use of the cave from the 1890s to the late 1930s already have been removed, and no impacts to significant historic features or artifacts from this project are anticipated. However, best management practices would ensure that if previously unknown archeological resources were discovered, they would be protected and preserved in place, and mitigation measures, as appropriate, undertaken.

Excavation for the new lighting system would be conducted in a previously disturbed utility corridor where the potential for finding *in* situ National Register-eligible archeological resources would be virtually nil. For the reasons indicated above, the topic of archeological resources will be dismissed in this document.

*Historic structures***:** The historic cave entrance was developed following the cave's discovery and is a contributing element of the Wind Cave National Park Administrative and Utility Area Historic District. This entrance was modified by the Civilian Conservation Corps in 1936 by setting large stones along the entrance portal, creating a new entrance tunnel to the existing tour route, installing a thick slab wood door and iron gate, and building up a slope of earth fill to match the nearby roadway. A revolving door was installed in 1991. The historic entrance and stairs are illuminated by the cave lighting system, but installation of the system components would have no effect on these structures.

The Preferred Alternative would install a new conduit in the elevator shaft for the new power so the 2400-volt system could be kept in operation while the new lighting system is being completed. Once the new 480-volt system is up and running, the 2400-volt system would be disconnected and the wires pulled out of the conduit. The old conduit would be left in place as a spare for future use. New communication and control wiring would be installed in an existing conduit in the shaft that now carries the cave phone lines.

The elevator building is one of the park's historic structures considered eligible for the National Register and is contributing to the Administrative and Utility Area Historic District. However, the interior of the elevator building "has been modernized and does not retain historic integrity" (NPS 1995b). New wiring for this project (as described above) would be installed in the elevator building in an area that has undergone numerous modifications over the years. The new conduit would not be visible to visitors, nor would the installation have any irreversible impacts on the historic structure itself. The project would adhere to guidance included in the Secretary of the Interior's *Standards for Treatment of Historic Properties* (NPS 1995a).

The elevator equipment and electrical room was modernized in 1998. There would be no effect on the historic fabric or exterior appearance of the building and the historic character of this property would be retained and preserved. Samples of representative historic lighting cables, fixtures, and equipment have been collected and stored by park facilities personnel. Thus, there is little if any potential for the proposed action to affect resources potentially eligible for the National Register of Historic Places. Therefore, historic structures are dismissed from further analysis.

*Museum collections***:** Museum collections (prehistoric and historic objects, artifacts, works of art, archival documents, and natural history specimens) are generally ineligible for listing in the National Register of Historic Places. The Preferred Alternative would have no effects on the park's museum collections; therefore, museum collections are dismissed as an impact topic in this environmental assessment.

Conflicts with land use plans, policies, or controls: Whenever actions taken by the National Park Service have the potential to affect the planning, land use, or development patterns on adjacent or nearby lands, the effects of these actions must be considered. The project area for the cave lighting project is almost entirely within Wind Cave. Therefore,

neither of the alternatives addressed in this assessment would have the potential to affect other land use plans, policies, or controls beyond the park boundary.

Ecologically critical areas or other unique natural resources: The proposed action would not affect any designated ecologically critical areas, wild and scenic rivers, or other unique natural resources, as referenced in the Wild and Scenic Rivers Act, *Management Policies 2001* (NPS 2000a), 40 CFR 1508.27, or the 62 criteria for national natural landmarks.

Economics: Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), 40 CFR 1500, require economic analyses of federal actions that will affect local or regional economies. None of the alternatives described in this environmental assessment would have notable effects on local or regional economic activities.

Endangered or threatened species and their habitats: Four federally listed threatened, endangered, or candidate animal species are known or have the potential to reside in the park. These include black-footed ferret (*Mustela nigripes*), American burying beetle (*Nicrophorus americanus*), bald eagle (*Haliaeetus leucocephalus*), and black-tailed prairie dog (*Cynomys ludovicianus*). None of these species occur in the project area; therefore, there would be no effects to endangered or threatened species and their habitats resulting from any of the alternatives.

Environmental justice: Executive Order 12898, General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that all federal agencies address the effects of policies on minorities and low-income populations and communities. None of the alternatives analyzed in this assessment would have disproportionate effects on populations as defined by the U.S. Environmental Protection Agency's 1996 guidance on environmental justice.

Floodplains and wetlands: Executive Orders 11988 and 11990, Floodplain Management and Wetlands, respectively, require analysis of impacts on floodplains and regulated wetlands. The historic entrance to Wind Cave, situated near the natural entrance, is located within the 100-year floodplain of Wind Cave Canyon; however, none of the alternatives would have any effect on this floodplain. There are no wetlands regulated under the provisions of Section 404 of the Clean Water Act, or areas designated as wetlands using the classification system of Cowardin *et al*. (1979), within the areas of potential effect.

Indian trust resources: Indian trust assets are owned by American Indians but are held in trust by the United States. Requirements are included in the Secretary of the Interior's Secretarial Order 3206, American Indian Tribal Rites, Federal – Tribal Trust Responsibilities, and the Endangered Species Act, and Secretarial Order 3175, Departmental Responsibilities for Indian Trust Resources. According to Wind Cave National Park staff, Indian trust assets do not occur within the park. Therefore, there would be no effects on Indian trust resources resulting from either of the alternatives.

Natural or depletable resource requirements and conservation potential: As directed by NPS *Management Policies 2001*, the National Park Service strives to minimize the short- and long-term environmental impacts of development and other activities through resource conservation, recycling, waste minimization, and the use of energy-efficient and ecologically responsible materials and techniques. Each of the action alternatives requires energy and

materials for construction and day-to-day operations. The use of energy is analyzed under the impact topic "Energy requirements and conservation potential." Specific impacts to the natural environment are addressed by impact topic.

Prime and unique agricultural lands: The Council on Environmental Quality 1980 memorandum on prime and unique farmlands states that prime farmlands have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Unique agricultural land is land other than prime farmland that is used for production of specific high-value food and fiber crops. No such agricultural sites are found in Wind Cave National Park due to the rocky terrain, arid environment, and short growing season.

Wilderness: Wind Cave National Park does not contain nor is it adjacent to any designated or proposed wilderness areas. Wind Cave National Park is not under consideration for wilderness designation under the 1964 Wilderness Act, Director's Order 41, or NPS *Management Policies 2001*.

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ALTERNATIVES CONSIDERED

A range of alternatives designed to address the shortcomings of the existing cave lighting system were evaluated by the National Park Service during the Value Analysis/Choosing by Advantages session held in April 2004 (NPS 2004b). During the session, an interdisciplinary team analyzed the advantages and drawbacks of each design option. Five of the original options were rejected because they did not meet project objectives or have the potential to produce an unacceptable level of adverse environmental or visitor use impacts. The alternatives dismissed from consideration are addressed in the section "Alternatives Considered but Dismissed."

Although the option of continuing current management / no action does not solve the cave lighting issues, current conditions are used as the baseline against which action alternatives are analyzed. This is the context for determining the relative magnitude and intensity of impacts (NPS 2001). The no action alternative is referred to as "Alternative A, the No Action Alternative" in this environmental assessment.

The design concept analysis for this project led to the development of one action alternative, which is analyzed in this assessment. This alternative was developed consistent with the National Park Service mandate in NPS *Management Policies 2001* to minimize the short- and long-term environmental impacts of development and other activities through the use of energy-efficient and ecologically responsible materials and techniques. The action alternative includes removing the existing deteriorated lighting system, including power lines, lighting control and distribution panels, and light fixtures, and replacing it with a new, energy-efficient lighting system. The new lighting system would consist of a new power distribution system, including new primary and secondary conductors, conduit, and accessories, a new lighting control system, with distribution and control panels, disconnects, and transformers, and new lighting fixtures for trail and cave feature lighting. Additionally, communication and control wiring in a common trench would be installed between the elevator building and the visitor center. This proposed action is referred to as "Alternative B, the Preferred Alternative."

THE NO ACTION ALTERNATIVE (ALTERNATIVE A)

The No Action Alternative would leave in place the existing cave lighting system, without significant changes to maintenance or operation of the system. No major efforts would be undertaken to minimize the safety hazards of the existing system. Ongoing minor repair activities would continue, although these would not address the critical design flaws that pose health and safety hazards and negatively impact cave resources. Maintenance activities associated with the existing system that would be included in the No Action Alternative include repair or replacement of failed or worn lighting control panels, switches, breakers, power transformers, primary and secondary cables and conduits, and lighting fixtures and bulbs.

The existing cave lighting system uses the same lights to address safety, egress, and feature lighting along approximately one mile of concrete paved trails within the cave. Lighting was first installed in the cave in 1931, and many modifications occurred to the system thereafter. The Civilian Conservation Corps performed improvements to the system in the 1930s, and

later rehabilitation occurred in 1955, 1980 and 1988 when much of the system's components were replaced (NPS 2003 and Schrempp 2004a).

The park's primary electrical service (7200 volts) is provided by Black Hills Power and Light through overhead lines and is converted to 2400 volts through three pole-mounted transformers. The 2400 volts of power are fed into the cave through a pipe installed in the elevator shaft to the lower access level. There is a lighting contactor (master switch) adjacent to the elevator building that activates the entire lighting system and is switched on and off daily. This contactor contains polychlorinated biphenyls (PCBs), which are known to be hazardous.

Primary power cables (6000 linear feet) distribute power to six different transformers throughout the cave. These cables were generally laid along the cave floor, with most of the cable exposed or covered with a single layer of rocks (see Figure 3). Much of the cable runs off trail, often through delicate passages that are difficult to access. The deteriorated condition of the primary cable insulation poses a hazard to cave explorers and electrical staff who may come in contact with the cable, and the high voltage (2400 volts) of the primary system makes this hazard even more severe. Presently, due to the high voltage, trained servicemen working on the cable do not make contact with the primary power lines, even when the cables are not energized, unless they are wearing thick rubber gloves. The existing primary and secondary cabling lacks proper physical protection from the severe moisture conditions in the cave and from the sharp edges of the rocks and stones to which it is exposed (see Figures 4 and 5). Near the entrance of the cave, the primary cable is also subject to damage from rodents. The 2400-volt cables are almost identical in appearance to the 120-volt cables feeding the lighting fixtures and in many cases are installed in close proximity to these cables (see Figure 6). Furthermore, the 2400-volt cables are connected to the transformer primaries in a daisy-chain fashion with short circuit protection at one point only, at the beginning of the cable run. Due to a lack of redundancy, a failure of any one cable along the 6000-foot length results in loss of power to the entire cave (NPS 2003).

FIGURE 3. ROCK COVERED CABLE

FIGURE 4. DETERIORATED CABLE ON DAMP CAVE FLOOR

FIGURE 5. ROCK-BOLTED CABLING

FIGURE 6. GENERAL LAYOUT OF CABLING

There are six 2400-240/120-volt transformers in the cave where the 2400 volts are converted into useable power (240 volts) that energize six lighting control cabinets. The secondary 240/120-volt cable (15,000 linear feet) exits from six lighting control panels, which each have 4 to 10 lighting circuits with switched breakers. A low voltage switching system associated with each of these control panels can turn the lights on and off in selected areas for "blackout" demonstrations. Due to the age of the lighting control system, panels, latching relays, and trail switches, replacement parts are not readily available and maintenance of the system is difficult (see Figure 7).

FIGURE 7. TRANSFORMER WITH OUTDATED POTHEADS

Because of the primitive and unreliable nature of the lighting control system, cave lighting is kept on all day while tours are running during the months of May through September. During the winter season, the Garden of Eden tour is the only active tour and is generally the only tour area where the lights are kept on daily. In recent years, however, restoration and maintenance activities have necessitated the use of lights during the winter along many of the trail routes. This continuous use of lighting and heat energy has promoted the growth of algae within the cave and has led park resource and interpretive staff to resort to applying a bleach solution to cave surfaces to kill the algae biannually.

The existing power, control panels, and light fixtures are not properly grounded and pose a hazard in the moist cave environment. There are no Ground Fault Circuit Interrupter (GFCI) protected outlets in the cave, which protect from electrocution by interrupting the flow of electrical current when an abnormal current flow is detected (for example, GFCIs installed near kitchen and bathroom fixtures). Therefore, employees using electrical equipment for maintenance or cave restoration work are exposed to electrocution hazards. Additionally, the aging transformers within the cave are subject to catastrophic failure from lightning or switching surges in the primary distribution system. In the summer of 1995, lightning has blown out sections of the primary power lines and narrowly missed striking a visitor on the trail. A transformer failure has never occurred in the cave, but the probability increases as the existing system deteriorates. None of the transformers currently in the cave are known to contain PCBs.

Current conditions also place a high maintenance demand on park staff. The junction boxes installed in the past are not water resistant, and due to the moist cave environment, water leaks into them, causing wires to short out and melt. Additionally, there are currently 650 light fixtures in the cave, with the majority of those using an incandescent light source. Incandescent is a relatively hot lamp type, is not very energy efficient, and has a short lamp life (about 3000 to 5000 hours) compared to other lamp types available. The common need for lamp replacement and the overall deteriorated condition of the lighting system makes frequent repairs necessary.

THE PREFERRED ALTERNATIVE (ALTERNATIVE B)

Alternative B was developed by the National Park Service to meet the primary project objectives described earlier. The Preferred Alternative would remove the deteriorated cave lighting system, including the entire power distribution system, lighting control system, and lighting fixtures, and replace it with a new system that meets current professional standards for operation and safety.

The existing power distribution system is 2400 volts, which would be removed and replaced with a 480-volt system. A new 45 kilovolt-ampere transformer would be installed in the electrical room. It would receive power from an existing 240-volt power panel and would step the voltage up to 480 volts. The existing 240-volt panel is currently connected to commercial power and a backup diesel generator through an automatic transfer switch, so the new lighting system would have backup power. The existing diesel generator has enough capacity to power the elevator and new lighting system. The new transformer would be installed in the location of the existing enclosure containing the lighting contactor and potheads. The existing enclosure with the contactor would be removed to allow room for the new transformer. Power would then be fed into the cave through a new conduit installed in

the elevator shaft. Once the new 480-volt system is operational, the 2400-volt system would be disconnected and the wires removed. The existing conduit that carries the 2400-volt wires would be left in place as a spare for future use.

New communication and control wiring would be installed in an existing telephone conduit within the elevator shaft and in a common trench within the previously disturbed utility corridor between the elevator building and the visitor center. The new wiring would be placed in a common utility trench that and would be about two feet wide and two to three feet deep.

The six existing transformers would be replaced with new, properly grounded transformers appropriate for the 480-volt system and with additional lightning/surge protection. The new transformers and other equipment would be designed to provide power into the cave for the long-term, and would be sized to handle potential future lighting expansions. Primary cables would then distribute power to the transformers, where it would be converted to 120 volts and then carried through secondary cables to power outlets, lighting controls, and fixtures. The design of the primary and secondary cables for the new system would provide added protection, by using armored cable or colored cable jackets. The primary and secondary cables would easily be distinguished from one another, yet be unobtrusive in the cave environment. In most portions of the cave, installation activities would be sequenced so that lighted cave tours could still operate while project activities take place. Prior to project implementation, a detailed electrical design for the system and its installation would be developed to allow for any necessary sequencing of project activities.

The new cable would be strategically placed to best protect it from future damage, to blend with the surroundings, and to avoid sensitive cave resources. In many cases, the location would likely be in the existing location or alongside the trail because of previous disturbance. Most cable removal and installation activities associated with the Preferred Alternative would be conducted by park staff because of the sensitivity of the resource.

Alternative B would replace the existing lighting control system with a more modern and energy-efficient system. New lighting control panels and the associated switches or circuit breakers would be installed in previously impacted areas of the cave. The upgraded system would allow sections of the tour route to be lighted independently so that lights would not have to remain on all day. The lighting control panels and any associated switch boxes would be appropriately chosen to withstand the humid cave environment. In addition, the lighting fixtures and lamps would be replaced under the Preferred Alternative with a combination of light-emitting diode (LED) and compact fluorescent fixtures and bulbs. These burn cooler, are more efficient, and have a longer lamp life than incandescent lamps. The new lamp types and lighting control system would reduce the energy requirements of the cave to a fraction of that currently required. (See the impact topic “Energy Requirements and Conservation Potential.”) The lamps would also be reconfigured to highlight the complexity and unique formations of Wind Cave and to guide visitors to appropriate areas and away from sensitive cave resources.

Additional grounding would be added throughout the entire lighting system, and GFCI-protected outlets would be added in certain areas so that employees and restoration workers would have safe electrical outlets when working in the cave.

System components and materials from the replaced system would be removed from the cave and appropriately disposed. There is one oil-filled transformer within the cave that is thought to be PCB-free. However, because there is no official documentation, the contractor removing this transformer would be required to test the oil for PCBs. The handling, transport, and disposal of this transformer, if tested positive for PCBs, and the PCB-containing contactor in the elevator building would comply with hazardous materials regulations set forth under the Toxic Substances Control Act. The storage and disposal of compact fluorescent lamps used under the Preferred Alternative would also comply with state and federal hazardous waste regulations. Mercury-containing lamps would either be recycled at an approved recycling facility or would be disposed at a permitted hazardous waste treatment, storage, and disposal facility consistent with NPS guidance (NPS 2004c).

The Preferred Alternative would occur in incremental stages to minimize impacts on the visitor experience, with most construction or electrical work occurring in the low visitation season from Labor Day to Memorial Day. Replacement of the entire system is anticipated to take up to two years. The approximate cost for implementation of the Preferred Alternative, including the removal and disposal of the existing system and installation of the new system, would be about $2,500,000 (NPS 2004b).

MITIGATION MEASURES OF THE ACTION ALTERNATIVE

Under the Preferred Alternative, best management practices and mitigation measures would prevent or minimize potential adverse effects associated with the project. These practices and measures would be incorporated into the project design and plans.

Resource protection measures undertaken during project implementation would include, but would not be limited to, those listed below in Table 2. The impact analyses in the "Affected Environment and Environmental Consequences" section were performed assuming that these best management practices and mitigation measures would be implemented as a part of project implementation.

TABLE 2. RESOURCE PROTECTION MEASURES

Cave Resources
Minimum-impact caving techniques have been developed by Wind Cave National Park staff and would be applied during project activities. Sensitive cave features, which include, but are not limited to, speleothems, extensive or unique sediments, historical items, or items of biological interest, would be avoided by workers performing removal and installation activities.
All individuals working within the cave would undergo training, which would consist of minimum-impact caving techniques, cave resource protection, off trail caving policies, and NPS mandates and philosophy related to cave management and stewardship.
All project work, prior to implementation, would be approved by the Physical Science Specialist and Facility Manager.
All lighting equipment and project-related refuse would be removed from the cave, including such materials as electrical wires, light bulbs and fixtures, tape, etc.
Tools and materials used for the lighting project would be stored outside the cave when possible. For multi-

day projects, equipment may be stored temporarily inside the cave if along the developed trail and subject to the approval of the Physical Science Specialist and Facility Manager.

All equipment and materials would be cleaned of excess dirt and debris prior to cave entry. Use of chemicals within the cave would be avoided and, if necessary, would only be used upon approval of the Physical Science Specialist.

All bolting, trenching, and digging within the cave must be approved by the Physical Science Specialist, Facility Manager and Park Superintendent.

If any paleontological or cultural artifacts or other features are encountered, all activities would cease and the appropriate personnel immediately contacted. Should historic or prehistoric archeological resources be discovered during project implementation, the park would work with an archeologist meeting the Secretary of the Interior's Standards to ensure that their location would be properly documented, the resource protected, and procedures outlined in 36 CFR 800 implemented including contacting the South Dakota SHPO.

Samples of representative historic lighting cables, fixtures, and equipment have been collected and stored by park curatorial staff. If additional historic resources are identified during project activities, these would be collected and stored in a similar manner.

All workers within the cave would wear appropriate clothing to minimize shedding of lint or fibers. Adequate safety equipment would be used when necessary, including approved helmets, ankle-supporting tread shoes, and additional sources of light.

Public Health and Safety

Park staff would monitor contractor activities to ensure compliance with safety standards.

For safety when working with electricity, only licensed, professional electricians who are experienced in applying professional standards would perform work on electrical equipment. All electricians working on the system would implement standard safety procedures, including processes for locking out and tagging out electrical equipment.

All trucks hauling lighting equipment, debris, and other loose materials out of the park would be covered or would maintain adequate freeboard.

The testing, storage, transport, and disposal of the existing oil filled transformer and fluorescent bulbs for the new system would comply with state and federal hazardous waste regulations. Mercury containing lamps would either be transported to a recycling facility or disposed at a permitted hazardous waste treatment, storage, and disposal facility (TSDF). The PCB-containing contactor would be disposed at a licensed hazardous waste disposal facility consistent with the handling and disposal requirements under the Toxic Substances Control Act.

Visitor Experience

The removal and installation activities associated with the lighting system would not be implemented during high visitor use seasons. Activities would be sequenced to offer visitors access to certain portions of the cave.

Cave tours would be coordinated so that visitors would not encounter project activities. Materials for the project would be stored, to the extent possible, out of high visitor access areas to minimize visual intrusion.

ALTERNATIVES CONSIDERED BUT DISMISSED

Analysis of all design options led to the dismissal of five alternatives. These alternatives included components that failed to meet the project objectives, actions that generated unacceptable levels of resource impacts, or actions that were generally unacceptable under the terms of alternative elimination found in Director's Order #12, Section 4.5.E.6. The nature of the dismissed features, and the rationale for their rejection, are outlined below.

Replace the existing 2400-volt system with a new 2400-volt system. This alternative would have replaced the existing system with a new, upgraded 2400-volt power system. The new system would replace the deteriorating system with very similar components, and there would be no substantial changes to the fundamental design of the system. In addition, this alternative would upgrade the current safety deficiencies to modern standards. This alternative was dismissed from further consideration because of the overall risk to health and safety and to cave resources by having such high voltage distributed throughout the cave.

Replace the existing 2400-volt system with multiple 480-volt systems. The park considered an alternative to replace the existing single power system with multiple 480-volt systems. This would increase reliability (a failure on any one 480-volt feeder would only result in a loss of lighting connected to that feeder) and address current health and safety risks. New service entrances to the cave and outdoor transformers in addition to the existing entrance and transformer would be necessary, depending on the number of systems the park desired. This alternative was dismissed because the surface disturbance and impacts on cave resources that would occur from adding one or more service entrances into the cave was not considered acceptable.

Retire the existing cave lighting system and use flashlights and candles only. The park considered the alternative of abandoning the deteriorating lighting system and running all tours with only flashlights and candles, similar to those currently conducted on the Candlelight Tour. This alternative was dismissed because of inherent safety concerns and it would minimize opportunities for interpretation of Wind Cave to many of the park’s visitors while increasing the risk from vandalism.

Cancel all organized tours within the cave. An alternative was discussed that would cancel organized tours within the cave to protect cave resources and protect public health and safety. This alternative was rejected because it would not allow public use, enjoyment, and interpretation of the unique geology and formations within Wind Cave.

Use an alternative energy source to provide power for the cave lighting system. An alternative was considered to use an alternative energy source, such as solar or wind power, to provide power for the cave lighting system. Black Hills Power and Light, the park’s energy provider, currently produces electricity exclusively using coal-fired power plants. They do not have alternative energy sources as an option to customers. Black Hills Electric Cooperative, a member South Dakota Rural Electric Association, provides alternative wind energy to its customers; however, the park cannot access this grid. In addition, the park’s energy demand would likely be higher than the cooperative could provide.

The park could possibly generate the power needed for the lighting system by using solar panels or windmills, but the amount of electricity needed to operate the cave lighting system would necessitate very large solar panel arrays or a series of windmills that would intrude on

the visual landscape (Richman 2004). Therefore, this alternative was dismissed because the level of impact on the cultural landscape of the park's Historic District and natural resources would be undesirable. In addition, surface disturbance and installation near the visitor center and administrative area would be required.

THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is the alternative that will best promote national environmental policy expressed in the National Environmental Policy Act. The environmentally preferred alternative would cause the least damage to the biological and physical environment, and would best protect, preserve, and enhance historical, cultural, and natural resources.

Section 101(b) of the National Environmental Policy Act identifies six criteria to help determine the environmentally preferred alternative. The act directs that federal plans should:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
- Preserve important historical, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
- Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Continuing the current conditions under Alternative A would be less effective in meeting these criteria. Without replacing the existing lighting system with a more modern system that integrates the best professional safety standards, the National Park Service would not be doing its part to ensure the safest environment possible for visitors and park employees. Without upgrading the system, lighting along the tour routes would continue to remain on all day, and the growth of lamp flora would persist. Continued use of incandescent lighting would not provide the best use of electrical energy. Overall, the proposed action would eliminate public health and safety risks and more efficiently use non-renewable energy sources.

Alternative B would be preferred over the No Action Alternative. With implementation of this alternative, the National Park Service would better be able to:

- Provide visitors and park staff with "safe, healthful. . . surroundings" by eliminating the health and safety risks associated with the high voltage system that is not up to current professional standards for safety,

- Protect sensitive cave resources by reducing algal growth within the cave and improving the NPS' ability to "Preserve important historical, cultural, and natural aspects of our national heritage," and
- Reduce the park's dependence on non-renewable energy from coal-fired electric power plants.

Therefore, Alternative B, the Preferred Alternative, is also the environmentally preferred alternative.

COMPARISON OF ALTERNATIVES

Table 3 shows the ability of the two alternatives to meet the project objectives. This provides a way to quickly compare and contrast the degree to which each alternative accomplishes the purpose or fulfills the need identified in the "Purpose and Need" section above.

TABLE 3. OBJECTIVES AND THE ABILITY OF THE ALTERNATIVES TO MEET THEM

Objective	Alternative A, the No Action Alternative	Alternative B, the Preferred Alternative
Protect the unique Wind Cave environment.	Alternative A would not meet this objective because the deteriorated lighting system would continue to pose a risk to cave resources from the growth of algae, continued vandalism, and the potential for visitors to touch the cave during lighting failures.	The installation of a new lighting system would help protect Wind Cave by reducing the unnatural heat and light that promote growth of lamp flora. The lights would be designed and placed to reduce vandalism. It would also be designed so that power failures would be reduced and, if they did occur, would only cause a loss of power to one segment and back-up power would be provided. This would protect the cave from visitors touching the cave during power failures.
Protect public health, safety, and welfare by providing a safe, reliable lighting system within Wind Cave.	Alternative A would not meet this objective because the high voltage and lack of adequate grounding and cable protection on the existing lighting system would continue to pose a risk to public health and safety. Also, the primary and secondary cables would continue to be the same color and make it difficult for electricians to distinguish between them when working on the system.	Alternative B would help protect public health and safety by installing a new lighting system that meets the best professional standards for safety. The new system would be lower voltage, would have adequate grounding protection, and cables would be distinguishable.
Facilitate and enhance visitor understanding and appreciation of the unique geology and formations within Wind Cave.	Alternative A would not fully meet this objective because the present light sources would not be optimal for highlighting cave features, and visitors would sometimes fail to experience	Alternative B would highlight those things which Wind Cave in known for, such as its boxwork and the cave's complexity. It would utilize light sources with color spectra more

TABLE 3. OBJECTIVES AND THE ABILITY OF THE ALTERNATIVES TO MEET THEM

	"blackout" demonstrations because of the unreliable nature of the lighting system.	appropriate for highlighting cave features, and different light sources (LED, compact florescent) would be chosen to suit the specific setting (e.g., feature lighting or trail marking).
Reduce the park's energy consumption and improve park operational efficiency.	Alternative A would not meet this objective because as the lighting system continues to deteriorate, the demand on park maintenance staff would increase. In addition, the park's energy consumption would not improve without any system upgrading.	Through using more efficient light sources and a new lighting control system that allows control over the areas and duration lights are on, the new system saves 88 percent of the power that the old system consumed. The efficiency of park operations would also improve because the new system would require less maintenance and bulb replacement.

SUMMARY OF IMPACTS

Table 4 briefly summarizes the effects of each of the alternatives on the impact topics that were retained for analysis at Wind Cave National Park. More detailed information on the effects of the alternatives is provided in the "Affected Environment and Environmental Consequences" section.

TABLE 4. SUMMARY OF IMPACTS BY RESOURCE TOPIC

Resource Topic	Alternative A, the No Action Alternative	Alternative B, the Preferred Alternative
Public health and safety	Continuation of current management would expose visitors and park personnel to the hazards of the existing electrical and lighting system. Park personnel would continue to be exposed to electrical hazards during routine maintenance and operation of the system. As a result of the risk posed to park staff and visitors because of the high voltage and design of the existing system, the No Action Alternative would have a long-term, moderate, adverse effect on public health and safety. Flashlight-led evacuations would continue, exposing visitors to increased potential for slipping, falling, and low clearance hazards. This would result in long-term, negligible to minor, adverse effects on public health and safety.	Implementation of Alternative B would result in benefits to public health and safety because park personnel would not be exposed to electrical hazards during routine maintenance and operation of the system, and visitors would not be exposed to deteriorated wiring in damp locations, or the possibility of flashlight-led evacuations which increases the potential for slips and falls, and bumping into cave formations. When complete, the Preferred Alternative would result in long-term, minor to moderate, beneficial effects on public health and safety. Short-term, negligible, adverse effects would occur during installation from the standard risks to health and safety associated with working with electricity.
Cave resources	The No Action Alternative would produce minor to moderate, long-term, adverse effects on cave resources at Wind Cave. These effects would be due to the continued number of maintenance visits to repair and maintain the existing lighting system, enhanced algal growth, and the resultant algal eradication activities.	Alternative B would produce minor to moderate, long-term, beneficial effects on cave resources at Wind Cave. These effects would be due to the overall reduced growth of algae, reduced potential for inadvertent visitor damage, and the reduced physical damage to cave formations resulting from the reduction in maintenance visits.
Ethnographic resources	Cave resources would continue to suffer minor to moderate, long-term, adverse effects from continued and increasingly frequent maintenance visits to repair and maintain the existing lighting system, enhanced algal growth, and the resultant algal eradication activities. These effects would continue to occur in lighted portions of the cave or areas with lighting system components, which comprises slightly less than one percent of known cave passages. Deterioration of cave resources reduces the cave's integrity which also could diminish its ethnographic value, a minor, adverse impact of long-term duration.	The project would help ensure continued preservation of the cave's natural features so that long-term adverse effects on ethnographic resources would be of minor intensity.

TABLE 4. SUMMARY OF IMPACTS BY RESOURCE TOPIC

Resource Topic	Alternative A, the No Action Alternative	Alternative B, the Preferred Alternative
Visitor use and experience	The poorly placed lighting fixtures and the use of incandescent lights does not provide visitors the opportunity to fully appreciate the unique geology of Wind Cave. The effects from the amount and intensity of the light promoting the growth of algae, the inaccurate color rendering and necessary bulb replacement, and the existing placement and configuration of the lighting fixtures would be long-term, minor to moderate, and adverse. The existing primary and secondary cables that are visually incompatible with the cave would be a long-term, negligible, adverse effect on visitor use and experience. The potential for incomplete interpretation experiences and the risk of injury while on a tour as a result of a power failure would be considered a negligible to minor, long-term, adverse effect on visitor use and experience.	Under the Preferred Alternative, the reduced risk of injury during evacuation and the more complete interpretive experience represent a long-term, minor, beneficial effect on visitor use and experience. Because continuous and high intensity lighting would no longer be used, algal growth would reduce and improve the visitor experience. The new lighting system would also include a designed lighting system to better highlight geologic features, and would incorporate more color-accurate, longer lasting bulbs that would allow an enhanced appreciation of Wind Cave's formations. The effects of these efforts on visitor use and experience would be minor to moderate, long-term, and beneficial. Short-term, adverse effects to visitor use and experience would occur as a result of project activities during installation. These effects could range up to moderate if the cave needed to be completely closed to visitors.
Park operations	The No Action Alternative would have adverse effects on park operations. Under this alternative, the aging lighting system would allow for the increasing burden on park staff, for replacement and repair of bulbs and parts, the danger and stress of flashlight-led evacuations on tours, and on-going efforts for removal of algae on cave resources. The adverse effects of the No Action Alternative would be minor to moderate, and long-term.	The Preferred Alternative would have beneficial effects on park operations. Under this alternative, the new, more efficient lighting system would reduce the risk of electrocution to park staff, and reduce the need for continual repairs on system parts and bulb replacements. The new system parts would increase reliability of the lighting system when used in "blackout" demonstrations and thereby reduce the number of dangerous and stressful flashlight-led evacuations done each year. The new system would increase visitor access by better addressing access lighting issues. It would also reduce intentional and accidental resource damage from visitors. The new type of bulbs and selective lighting of areas would reduce the growth of algae on important cave resources and lessen the necessity of park staff cleaning algae off of features. Overall, the reduction of both labor demand and risk on park staff resulting from the new lighting system would result in minor to moderate, long-term, beneficial effects.

TABLE 4. SUMMARY OF IMPACTS BY RESOURCE TOPIC

Resource Topic	Alternative A, the No Action Alternative	Alternative B, the Preferred Alternative
Energy requirements and conservation potential	The existing lighting system has deteriorated to a point where it likely requires the maximum amount of energy necessary to light the cave, and no change in energy requirement would be expected. In addition, there is no foreseeable potential for energy conservation within the constraints of the existing system's design. No effects to energy requirements and conservation potential would be expected to occur under the No Action Alternative.	The Preferred Alternative would integrate more efficient light sources, and the new lighting control system would allow the opportunity to minimize the length of time the lights are on in the cave. Incorporating both of these improvements into the new system would allow greater potential for energy conservation over the existing system; therefore, Alternative B would be expected to have a long-term, moderate, beneficial effect to energy requirements and conservation potential.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This section describes the environmental consequences associated with the alternatives. It is organized by impact topic, which allows a standardized comparison between alternatives based on issues. Consistent with NEPA, the analysis also considers the context, intensity, and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate impacts. National Park Service policy also requires that "impairment" of resources be evaluated in all environmental documents associated with resource analysis.

METHODOLOGY

General Evaluation Methodology

For each impact topic, the analysis includes a brief description of the affected environment and an evaluation of the effects of implementing each alternative. The analysis is conducted on actions described in the "Alternatives" chapter. Specifically, this environmental assessment analyzes the No Action Alternative and the replacement of the existing lighting system under the Preferred Alternative; any potential expansion or future changes to the lighting system configuration is considered under cumulative actions. The impact analyses were based on information provided by park staff, relevant references and technical literature citations, and subject matter experts. The impact analyses involved the following steps:

- Define issues of concern, based on internal and external scoping,
- Identify the geographic area that could be affected,
- Define the resources within that area that could be affected,
- Impose the action on the resources within the area of potential effect, and
- Identify the effects caused by the alternative, in comparison to the baseline represented by the No Action Alternative, to determine the relative change in resource conditions.

Characterize the effects based on the following factors:

- Whether the effect would be beneficial or adverse,
- Intensity of the effect: negligible, minor, moderate, or major. (Impact-topic-specific thresholds for each of these classifications are provided in Table 5.) Threshold values were developed based on federal and state standards, consultation with regulators, and discussions with subject matter experts,
- Duration of the effect: short-term or long-term, with specificity for each impact topic,
- Context or area affected by the proposed action: site-specific, local, parkwide, regional, and
- Whether the effect would be a direct result of the action or would occur indirectly because of a change to another resource or impact topic. An example of an indirect impact would be increased mortality of an aquatic species that would occur because an alternative would increase soil erosion, which would reduce water quality.

Cumulative Effects

The Council on Environmental Quality (1978) regulations for implementing the National Environmental Policy Act require an assessment of cumulative effects in the decision-making process for federal projects. Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 *CFR* 1508.7). Cumulative effects are considered for both the no action and action alternative. The cumulative impacts analysis is presented at the end of each impact topic analysis.

Cumulative effects were determined by combining the effects of the alternative with other past, present, and reasonably foreseeable future actions in the vicinity. Therefore, it was necessary to identify other past, ongoing, or reasonably foreseeable future actions within Wind Cave National Park and the region. These identified projects and plans are presented under “Related Projects and Plans” in the “Purpose and Need” section:

- Relocate wastewater treatment facility,
- Construct a new visitor center parking lot and associated stormwater management system, and
- Develop a cave and karst management plan.

Impairment of Park Resources or Values

National Park Service *Management Policies 2001* (NPS 2000a) provides guidance on addressing impairment of park resources. Impairment is an impact that, “in the professional judgment of the responsible National Park Service manager, would harm the integrity of park resources or values, including those that would otherwise be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources that would be affected, the severity, duration, and timing of the impact, the direct and indirect effects of the impact, and the cumulative effects of the impact in question with other impacts.”

Any park resource can be impaired, but an impact would be more likely to result in impairment if it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park,
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- Identified as a goal in the park’s general management plan or other relevant National Park Service planning documents.

An impact would be less likely to result in impairment if it is an unavoidable result, which cannot reasonably be mitigated, of an action necessary to preserve or restore the integrity of vital park resources.

Public health and safety, visitor use and experience, park operations, and energy requirements and conservation potential are not considered park resources for which Wind

Cave National Park was established to protect. Therefore, impairment findings are not included as part of the impact analysis for these topics.

Neither Alternative A (the No Action Alternative) nor Alternative B (the Preferred Alternative) would produce major adverse impacts or impairment of park resources or values.

TABLE 5. IMPACT TOPIC THRESHOLD DEFINITIONS

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Public health and safety	Public health and safety would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on public health or safety.	The effect would be detectable, but would not have an appreciable effect on public health and safety. If mitigation were needed, it would be relatively simple and likely successful.	The effect would be readily apparent, and would result in substantial, noticeable effects on public health and safety on a local scale. Changes in rates of accidents or injuries could be measured. Mitigation measures would probably be necessary and would likely be successful.	The effects would be readily apparent, and would result in substantial, noticeable effects on public health and safety on a regional scale. Effects could lead to changes in the rate of mortality. Extensive mitigation measures would be needed, and their success would not be assured.	Short-term – Occurs only during project implementation. Long-term – Persists beyond the period of project implementation.
Cave resources	No changes would occur or changes in cave formations and biota would be below or at the level of detection, and if detected, would have effects that would be considered slight.	Changes in cave formations and biota may be measurable, although the changes would be small, and the effects would be localized. No cave resource protection measures would be necessary.	Changes in cave formations and biota would be measurable. Formations would be affected by deterioration, altered chemical composition, or changed depositional patterns. The effects would be localized. Cave resource protection measures would be necessary and the measures would likely be successful.	Changes in cave formations and biota would be measurable, would have substantial consequences, and be noticed throughout the cave system. Cave resource protection measures would be necessary and the success of the measures could not be guaranteed.	Caves within national park units are managed as non-renewable resources. All effects to cave formations are considered to be long-term and irreversible. The low-energy cave system would provide a long-term period of recovery for effects to biota.
Ethnographic resources	Effect(s) would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and the affiliated group's body of	Adverse effect – effect(s) would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and the affiliated group's body of practices and beliefs.	Adverse effect – effect(s) would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. Beneficial effect – would facilitate	Adverse effect – effect(s) would alter resource conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's	Long-term – Because ethnographic resources are essentially non-renewable, any effects on these resources would be long-term.

TABLE 5. IMPACT TOPIC THRESHOLD DEFINITIONS

	practices and beliefs.	Beneficial effect – would allow access to and/or accommodate a group's traditional practices or beliefs.	traditional access and/or accommodate a group's practices or beliefs.	practices and/or beliefs would be jeopardized. Beneficial effect – would encourage traditional access and/or accommodate a group's practices or beliefs.	
Visitor use and experience	Visitors would not be affected or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative.	Changes in visitor use and/or experience would be detectable. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.	Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes.	Changes in visitor use and/or experience would be readily apparent and have important consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.	Short-term – Occurs only during project implementation. Long-term – Persists beyond the period of project implementation.

TABLE 5. IMPACT TOPIC THRESHOLD DEFINITIONS

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Park operations	Park operations would not be affected or the effect would be at or below levels of detection, and would not have an appreciable effect on park operations.	The effect would be detectable but would not be of a magnitude that would appreciably change the park operations. If mitigation were needed to offset adverse effects, it would be relatively simple and likely successful.	The effects would be readily apparent and would result in a substantial change in park operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.	The effects would be readily apparent and would result in a substantial change in park operations in a manner noticeable to staff and the public and be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, and their success would not be assured.	Short-term – Occurs only during project implementation. Long-term – Persists beyond the period of project implementation.
Energy requirements and conservation potential	No effects would occur to energy requirements and conservation potential, or effects would be below or at the lowest level of detection.	Effects to energy requirements and conservation potential would be detectable and localized. Effects would not cause changes to energy requirements and conservation potential park wide.	Effects would be readily apparent and would result in changes to energy requirements and conservation potential park wide.	Effects would be readily apparent and would result in changes to energy requirements and conservation potential outside the park on a regional scale.	Short-term – Occurs only during project duration. Long-term – Persists beyond the period of project implementation.

PUBLIC HEALTH AND SAFETY

Affected Environment

Wind Cave National Park receives an average of 767,000 visits per year, with approximately 110,000 visitors stopping at the visitor center, and 89,000 visitors participating in cave tours (Farrell 2004). The cave tours vary in length and degree of difficulty, but all similarly offer visitors the unique cave experience. Visitors participating in cave tours are advised of the degree of difficulty for each tour and about the conditions they will be exposed to while on the tour. These conditions include dimly lighted trails, uneven, wet and slippery trail surfaces, and low cave ceilings that may necessitate stooping or bending. All visitors are also advised to wear low-heeled walking shoes with non-slip soles to prevent slippage. The degree of difficulty for each tour is largely dependent on the number of stairs, which varies among each lighted tour. The Garden of Eden Tour includes 150 stairs, the Fairgrounds Tour includes 450 stairs, and the Natural Entrance Tour includes 300 stairs.

The primary public health and safety concern with the existing lighting system is to provide the public and park staff with safe and reliable cave lighting. Access lighting is supplied by reflecting feature lights off of cave surfaces and back onto the trail. This method creates dark spots on the trail. The existing lighting system illuminates approximately one mile of paved tour routes within the cave. The lighting system is aging and no longer meets professional standards for safety and reliability. Park staff is exposed to increased hazards during repair and maintenance, and visitors could potentially be affected by exposure to high-voltage electrical lines and blackouts due to a power failure or short in the line.

The primary power system distributes very high voltage (2400 volts) throughout the cave, and the cables carrying this power are inadequately protected and often located in close proximity to public trail routes or off-trail routes used by cavers. There is also insufficient grounding for the existing power, control panels, and light fixtures, which presents a risk to visitor and park maintenance staff in the moist cave environment. Due to the age of the system, lighting controls and switches have become unreliable and malfunction when cave interpreters perform “blackout” demonstrations.

When the system malfunctions and the lights do not turn back on, interpreters must escort visitors out of the cave by flashlight. This is a concern because of the safety risks of potential slips and falls, and head injury due to low ceilings. Another concern for safety is the need for frequent light bulb replacements by the staff. The current lighting system uses incandescent light bulbs, which burn out more frequently than other available bulbs. Park staff is not permitted to go into the cave alone to replace bulbs, and the location of some bulbs requires caving experience for access. In these situations, a staff member who has adequate caving skills must be available (Schrempp 2004b).

Impacts of Alternative A, the No Action Alternative

The No Action Alternative would leave in place the existing 2400-volt electrical lighting system and make no substantial improvements to the overall design of the system. Park staff, cavers, and cave visitors would continue to be exposed to the high voltage cables that are inadequately protected. The high voltage, daisy-chain configuration, and insufficient grounding on the lighting system make this hazard even more severe. In addition, park staff

working on the system is at risk because of the difficulty in distinguishing the primary and secondary cables from one another. As a result of the risk posed to park staff and visitors because of the high voltage and design of the existing system, the No Action Alternative would have a long-term, moderate, adverse effect on public health and safety.

When blackouts occur in sections of the cave as a result of system malfunctions, visitors must be escorted to the nearest lighted trail section. The backup generator cannot provide emergency lighting for the existing 2400-volt system when power outages occur; therefore in these instances, visitors must be escorted out of the cave by flashlight. The slip, trip, and fall hazards and risk of head injuries because of low cave ceilings as a result of the unreliable lighting system and lack of backup power would be considered a long-term, negligible to minor, adverse effect.

Cumulative Effects. None of the other plans and projects under consideration would contribute cumulatively to the public health and safety environment inside Wind Cave. Therefore, there would be no cumulative effects as a result of the No Action Alternative.

Conclusion. Continuation of current management would expose visitors and park personnel to the hazards of the existing electrical and lighting system. Park personnel would continue to be exposed to electrical hazards during routine maintenance and operation of the system. As a result of the risk posed to park staff and visitors because of the high voltage and design of the existing system, the No Action Alternative would have a long-term, moderate, adverse effect on public health and safety. Flashlight-led evacuations would continue, exposing visitors to increased potential for slipping, falling, and low clearance hazards. This would result in long-term, negligible to minor, adverse effects on public health and safety.

Impacts of Alternative B, the Preferred Alternative

The Preferred Alternative would include removing the existing deteriorated lighting system, including power lines, lighting control and distribution panels, and light fixtures and replacing it with a new lighting system that meets current professional standards for operation and safety. The existing generator has enough capacity to power the new 480-volt system, so backup lighting would be provided during power outages.

The design of the primary and secondary cables for the new system would be chosen to provide more protection, such as using armored cable and colored cable jackets. They would also be chosen so that the primary and secondary cables can be easily distinguished from one another thus reducing the risk of working on the wrong cable that is carrying a higher voltage. In many cases, the location would be alongside the trail because of previous disturbance; however due to the improved insulation and armoring, risk of damaging the cable would be reduced.

The lighting control panels and any associated switch boxes would be chosen so that they can withstand the humid and moist cave environment and thus reduce the risk of shock during operations and maintenance. Additional grounding would be added throughout the entire lighting system, and GFCI-protected outlets would be added so that employees and restoration workers would have access to safe outlets when working in the cave. The reduced potential for injury to park staff and visitors as a result of installing a low voltage system with improved grounding, distinguishable cabling, independent circuits, and improved

reliability would produce long-term, minor to moderate, beneficial effects to public health and safety.

During construction activities, the contractor and park staff would protect the public health and safety by restricting access in areas where work is being conducted. Passages in which construction takes place would be closed to the public during construction activities. In addition, construction would be undertaken during low visitation times of fall and winter, to reduce the chance of any accidents involving visitors. Park staff would likely perform cable replacement because they are sensitive to the irreplaceable nature of the cave's resources. Professional electricians working on the system would be exposed to standard health and safety risks associated with working with electricity. The short-term, adverse effects during project implementation would be negligible because staff working on the project would be experienced and professionally licensed and visitor access to project areas would be restricted.

Cumulative Effects. None of the other plans and projects under consideration would contribute to the public health and safety environment inside Wind Cave. Therefore, there would be no cumulative effects as a result of the Preferred Alternative.

Conclusion. Implementation of Alternative B would result in benefits to public health and safety because park personnel would not be exposed to electrical hazards during routine maintenance and operation of the system, and visitors would not be exposed to deteriorated wiring in damp locations, or the possibility of flashlight-led evacuations which increases the potential for slips and falls, and bumping into cave formations. When complete, the Preferred Alternative would result in long-term, minor to moderate, beneficial effects on public health and safety. Short-term, negligible, adverse effects would occur during installation from the standard risks to health and safety associated with working with electricity.

CAVE RESOURCES

Affected Environment

Wind Cave is one of the largest barometric wind caves in the United States and is named for the characteristic movement of wind in and out of the entrance as exterior air pressure changes (NPS 1994, NPS 2002, and NPS 2004a). The Black Hills have over 100 known caves (NPS 2002), and Wind Cave is one of the largest and the most complex of these cave systems. In addition to Wind Cave, the park has 43 other known caves (NPS 2004g). None of these caves have been developed. They are not visited by regular tours and are outside the area of effect for the proposed action.

Wind Cave is acknowledged by many speleologists (specially trained cave explorers and scientists) as rare and significant. The cave is the fifth-longest known cave, and its intricacy, and multiple levels make it one of the most complicated maze caves in the world. Wind Cave contains many formations, called speleothems, including the majority of the world's known boxwork, a calcite formation resembling honeycomb (see Figure 8). Wind Cave is significant because it contains the most boxwork of any known cave (NPS 2004a). The cave is one of the oldest known caves in the world and has a diverse mineralogical and speleothem assemblage. It was formed over many millions of years by a variety of geologic processes, with the main cave development occurring 40 to 60 million years ago within the Pahasapa

Limestone (NPS 2002 and NPS 2004a). Some of the cave's other impressive formations include popcorn, frostwork, helictite bushes, and flowstone or dripstone.

FIGURE 8. BOXWORK CAVE FORMATIONS

A small portion of Wind Cave has been affected by development to allow visitor access. The opening at the elevator building was created, and two elevators were installed in 1934. Small passages were enlarged to place concrete walkways, electrical service for lighting, and stairways. A 1.4-mile trail is in place, with 0.8 miles of this length surfaced with concrete and lighted (NPS 1994, NPS 2002, and NPS 2004a). The cave hosts approximately 89,000 visitors annually on a variety of ranger-led tours within the two upper levels of the cave. Currently there are five tours within the cave. The Natural Entrance, Fairgrounds, and Garden of Eden Tours are on developed, lighted paths, while the Candlelight and Wild Cave tours are held in less developed or undeveloped portions of the cave.

The tour routes were surveyed for biota in 1992 and 1995 (Moore 1996). Surveys identified bacteria, fungi, amoebae, protozoa, nematodes, collembolans (springtails), mites, deer mice, woodrats and one bat species (NPS 2002). Some of the invertebrates are highly-specialized, cave-adapted species. Protozoa were found throughout the cave, whereas nematodes and arthropods were largely restricted to entrances, tour routes and well traveled corridors. Small mammals and bats were restricted to entrances and small sections of the cave. Moore concluded that the cave ecosystem in Wind Cave was largely detritus-based. He determined there was strong evidence that human activity impacted caves by increasing carbon inputs in the form of lint, thereby increasing access for rodents and bats. This increased carbon input encouraged the colonization of several arthropod species from immediately outside the cave and by accidental introduction by visitors. The increase in species diversity was found to be largely confined to tour routes and entrances.

The cave supports a small population of plant species (Horrocks 2004). There are some very low levels of natural cyanobacteria (blue-green algae) in the cave. However, most of the algae that are present in the cave have been brought in as spores carried in by workers and visitors. The artificial lights and seeping water cause unnatural levels of algal growth along tour routes. Occasionally, some moss associated with the algae will have a plant sprout from

a seed tracked into the cave. These have no pigment and usually die off quickly. Fungal growth is also found on woodrat droppings, wood, and/or organic material left by visitors.

Cave visitors leave behind small amounts of lint, hair, and skin cells, as well as small amounts of dirt from shoes during tours of the cave. This detritus create support for invasive animals and plants and can upset the delicate balance of the natural cave biota. Of the invading plant species, algae pose the biggest problem at Wind Cave, as described above (NPS 2002 and NPS 2004a).

Impacts of Alternative A, the No Action Alternative

Under the No Action Alternative, the existing cave lighting system would be left intact. The existing cave lighting system provides safety, egress, and feature lighting along approximately one mile of concrete paved trails within the cave.

The artificial light and heat energy introduced into Wind Cave by the existing cave lighting system causes moderate to severe algae growth problems in the cave (NPS 2004b). Algal growths are generally associated with lighting provided to illuminate cave formations and walkways. The presence of algae is partly an aesthetic problem. It also creates an artificial food source for cave biota and can secrete weak acids that increase rock dissolution (NPS 1994 and 2002, and NPS 2004a). Algal spores are carried into caves by workers and visitors. Algae generally grows on any moist surface that receives more than 4.2 foot-candles of light for extended periods of time and is a common problem in electrically lighted caves (Aley and Aley 1984 and 1985 and NPS 2004a). Most feature lights show algal growth on featured formations (see Figures 9 and 10). This algal growth is caused by the configuration and intensity of the current lighting system on the featured geological formations. The formations are a non-renewable resource, and this continued condition of algal growth would continue to result in a site-specific, moderate, long-term, adverse effect.

FIGURE 9. ALGAE COVERED ROCK FORMATIONS

FIGURE 10. ALGAE COVERED ROCK FORMATIONS

Aley and Aley (1984 and 1985) recommend that 5.25 percent sodium hypochlorite (household bleach) solutions be used for algal plant control. Sodium hypochlorite seldom, if ever, alters speleothem color or interferes with calcite deposition on speleothems. Spray application followed by a water rinse is only recommended if appreciable amounts of dead plant growth are present. Spraying schedules should be based on plant growth density, light intensity and substrate moisture content. The practice of applying bleach to control algae is highly undesirable because of the potential to negatively impact other natural cave biota. The impact of bleach on natural cave flora and fauna would represent a negligible to minor, long-term, adverse effect.

Visitors sometimes touch the geologic formations, both intentionally and unintentionally. The oil from hands can blacken formations, and grit on hands can wear down and polish cave surfaces (NPS 2004a and NPS 2004e). There is also the possibility that even this small amount of oil may halt the development of some delicate mineral formations. The moonmilk, popcorn, and frostwork formations are particularly susceptible to contact with human hands due to the fact that they grow on all surfaces in some sections of the cave tour routes. In the event of a failure of the lighting system or a flashlight-led evacuation, some visitors may feel around in the dark to avoid bumping their head and inadvertently damage the resource. These types of formations may also be the most sensitive to stunted growth as a result of contact with oil from hands. The impact of visitors intentionally and unintentionally touching the rock and mineral formations would represent a negligible to minor, long-term, adverse effect.

Cave formations are also degraded through the high demand for maintenance created by the current electrical system. The aging and inadequate system causes continued maintenance problems. Portions of the cable are frayed and aging switches and panels need to be constantly replaced, which increases foot and crawling traffic throughout the cave. The increased demand for maintenance created by the current lighting system represents a negligible, long-term, adverse effect.

Cumulative Effects. Under Alternative A, Wind Cave would continue to be affected by the need for constant maintenance due to the aging electrical and lighting system and increased

mitigation of algal growth. This would contribute to minor to moderate, long-term, adverse effects on the cave resources. Proposed construction and management activities at Wind Cave directly influencing cave resources are the parking lot rehabilitation and stormwater management, relocating the wastewater treatment facility, and development of a cave management plan.

The parking lot rehabilitation would increase the cleanliness of storm water that infiltrates into the cave, thus removing potentially harmful hydrocarbons resulting from vehicular traffic and asphalt pavement, and sediment from parking lot runoff. This action will result in minor to moderate, long-term, beneficial effects to cave resources (NPS 2002). Relocating the wastewater lagoons has the potential to decrease contaminants entering unknown cave resources, thus reducing nutrient loading of cave water. This would result in localized, negligible to minor, long-term, beneficial effects to cave resources (NPS 2002). The park is also creating a long-term cave management plan that includes cave restoration activities, such as removal of cave detritus and inhibition of algal growth, and the consideration of re-lighting the Blue Grotto Loop. Although adverse effects would result from additional lighted areas, beneficial effects would result from cave restoration activities and long-term management. The restoration and protection measures resulting from the cave management plan would be offset by the necessity to overcome the constraints of the current cave lighting system before or during any future action.

In concert, these other plans would yield minor to moderate, long-term, beneficial effects to cave resources. The cumulative effect of these plans, in combination with the minor to moderate, long-term, adverse effects of the No Action Alternative, would be minor, long-term, and beneficial. This would result because the benefits of the wastewater treatment and parking rehabilitation projects would not be directly offset by the adverse effects of the No Action Alternative.

Conclusion. The No Action Alternative would produce minor to moderate, long-term, adverse effects on cave resources at Wind Cave. These effects would be due to the continued number of maintenance visits to repair and maintain the existing lighting system, enhanced algal growth, and the resultant algal eradication activities.

Alternative A would not produce major adverse impacts on cave resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other National Park Service planning documents. Consequently, there would be no impairment of cave resources or values as a result of the implementation of Alternative A.

Impacts of Alternative B, the Preferred Alternative

Under Alternative B, the existing 2400-volt power distribution system would be removed and replaced with a 480-volt system. The existing cables would likely be removed and replaced at the same time so that effects to cave resources would be minimized. The new cables would be strategically placed to best protect the cave from future damage, to blend with the surroundings, and to avoid sensitive cave resources. In many cases, the location would likely be in the existing location or along the trail because of previous formation disturbance. Thus increased disturbance during removal and installation activities would be minimized. The

majority of the cable installation and removal activities would be conducted by park staff because of their sensitivity to the irreplaceable cave resources. New lighting control panels and the associated switches or circuit breakers would be installed in previously impacted areas of the cave. All lighting fixtures and lamps would be replaced with new lamps that burn cooler, are more efficient, and have a longer lamp life than incandescent lamps.

The lamps would be reconfigured to highlight the boxwork, passage complexity, and other cave formations associated with Wind Cave. Studies have shown that maximum light intensities reaching moist alcove areas should be less than 0.9 foot-candles while non-alcove areas should be less than 2.8 foot-candles (Aley and Aley 1984). For interpretive or other reasons, algal growth can be minimized or prevented by keeping light intensities reaching moist surfaces at less than 3.6 foot-candles. The tour routes would be divided into numerous circuits, which would substantially reduce the amount of time lights are on, and thus algae growth would be reduced causing moderate, long-term, beneficial effects to cave resources.

The reduction of algal growth would also lead to a decrease in the use of bleach solutions for algal eradication projects. This reduction in bleach applications to algal growth on cave formations would result in minor, long-term, beneficial effects to natural cave flora and fauna.

Installing a safer, more efficient lighting system would also create less detrimental visitor contact with sensitive resources. Sensitive cave resources would not be highlighted, thus reducing the possibility of visitors touching them. The reliability of the new system would reduce the occurrences of power failures, thus reducing the possibility of visitors touching cave formations while navigating by flashlight. These actions would produce minor, long-term, beneficial effects of cave visitors on cave resources.

The new lighting system would reduce the amount of maintenance work needed to keep the new system in working order. This reduction of maintenance activities would reduce the amount of time spent in the cave for repairs, thus reducing the damage to cave formations. This action would lead to minor, long-term, beneficial effects on cave resources. However, the presence of increased traffic in the cave and the consequential increase in detrital input, noise, heat, and carbon dioxide emissions from all construction activities during removal and installation would be negligible, short-term, and adverse.

Cumulative Effects. Implementation of Alternative B would contribute to continued minor to moderate, long-term, beneficial effects on the cave resources. Proposed construction and management activities at Wind Cave directly influencing cave resources are the parking lot rehabilitation and stormwater management, relocating the wastewater treatment facility, and development of a cave management plan.

Improved water quality from the parking lot rehabilitation would result in minor to moderate, long-term, beneficial effects to cave resources (NPS 2002). Reducing organic contamination of the cave by relocating the wastewater lagoons would result in localized, negligible to minor, long-term, beneficial effects to cave resources (NPS 2002). Implementation of the long-term cave management plan and restoration activities, in concert with these other plans would yield moderate, long-term, beneficial effects to cave resources. The cumulative effect of these plans, in combination with the minor to moderate, long-term, beneficial effects of Alternative B, would be long-term, moderate, and beneficial.

Conclusion. Alternative B would produce minor to moderate, long-term, beneficial effects on cave resources at Wind Cave. These effects would be due to the overall reduced growth of algae, reduced potential for inadvertent visitor damage, and the reduced physical damage to cave formations resulting from the reduction in maintenance visits.

Alternative B would not produce major adverse impacts on cave resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other National Park Service planning documents. Consequently, there would be no impairment of cave resources or values as a result of the implementation of Alternative B.

ETHNOGRAPHIC RESOURCES

Affected Environment

A number of Native American tribes have aboriginal, historical, and cultural ties to the land within the Black Hills, which includes Wind Cave. These tribes include: Apache Tribe of Oklahoma, Arapaho Business Committee, Cheyenne River Sioux Tribe, Cheyenne-Arapaho Tribes of Oklahoma, Crow Creek Sioux Tribal Council, Flandreau Santee Sioux Executive Committee, Fort Belknap Community Council, Fort Peck Tribal Executive Board, Lower Brule Sioux Tribal Council, Northern Cheyenne Tribal Council, Oglala Sioux Tribal Council, Ponca Tribe of Nebraska, Ponca Tribe of Oklahoma, Rosebud Sioux Tribal Council, Santee Sioux Tribal Council, Sisseton-Wahpeton Sioux Tribal Council, Standing Rock Sioux Tribal Council, Three Affiliated Tribes Business Council, Yankton Sioux Tribal Business and Claims Committee.

The Black Hills occupy a very special place in the history, creation stories, and religious beliefs of these groups. A study of the history of tribal and European American occupancy of the Black Hills and adjacent areas (Albers 2003) makes it clear that in North America, Native Americans understand caves as "earth centers" – places of origin and metamorphosis for both human beings and animals.

Centuries-old American Indian legends tell of a "hole that breathes cool air" near the Buffalo Gap (NPS 2004a). This "Wind" cave was regarded by Lakota peoples as the site of their origin, and they have many legends about the role the cave played in their culture. Many of the common tribal names for the area describe the landscape or special activities associated with the area. Tribes' sacred names for the Black Hills

> convey something more essential and fundamental about a peoples' relationship to the region: they suggest an intimacy born out of a deep knowledge and experience of the Hills, one created by peoples who had lived there and been nourished by their presence (Albers 2003).

Given a different history for the area that is now Wind Cave National Park, the cave might have remained undeveloped and known only to the tribes who camped and hunted nearby.

However, this was not to be. During the late 1800s the cave was explored by Euro-American settlers, and during the 20th century it was further developed into an important tourist destination where people could come to view some of the most interesting and rare cave formations in North America. Yet, at the same time, Wind Cave has continued to hold deep meaning and significance in Native American belief systems and cultural traditions.

Impacts of Alternative A, the No Action Alternative

Wind Cave is important for both its natural and ethnographic resources. Preservation and protection of both resource types, while at the same time providing for interpretation of cave features for visitors, poses a very real and difficult dilemma.

The cave lighting system exists, and is likely to continue to exist in the future. Improvements in the cave lighting are badly needed for visitor health and safety, and to provide the best possible interpretation of cave resources. Tribal concerns for the cave also are very real and would continue.

A continuation of existing conditions would mean that the cave resources would suffer minor to moderate, long-term, adverse effects because of damage from continued and increasingly frequent maintenance visits to repair and maintain the existing lighting system, enhanced algal growth, and the resultant algal eradication activities. These effects would continue to occur in lighted portions of the cave or areas with lighting system components, which comprises slightly less than one percent of known cave passages. Deterioration of cave resources in these areas reduces the cave's integrity which also could diminish its ethnographic value, a minor, adverse impact of long-term duration.

Cumulative Effects. Modern society continues to make inroads on Native American cultural traditions and religious activities. Incremental changes in resources valued by tribes can diminish the sense of place, the ease of access, or the privacy, and subsequently, the spiritual values of the resource. Continued deterioration of cave resources caused by heat, algae growth and inadvertent visitor damage would contribute cumulatively to the past adverse, moderate impacts from development and use of the cave.

Conclusion. Cave resources would continue to suffer minor to moderate, long-term, adverse effects from continued and increasingly frequent maintenance visits to repair and maintain the existing lighting system, enhanced algal growth, and the resultant algal eradication activities. These effects would continue to occur in lighted portions of the cave or areas with lighting system components, which comprises slightly less than one percent of known cave passages. Deterioration of cave resources reduces the cave's integrity which also could diminish its ethnographic value, a minor, adverse impact of long-term duration.

Alternative A would not produce major adverse impacts on ethnographic resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other National Park Service planning documents. Consequently, there would be no impairment of ethnographic resources or values as a result of the implementation of Alternative A.

Impacts of Alternative B, the Preferred Alternative

As described in the "Cave Resources" section above, new electric cables would be placed to avoid sensitive cave resources, and in many cases the cables likely would be in the existing location or along the trails to minimize disturbance during removal and installation activities. Because of their familiarity with the resources, most of the work would be conducted by park staff. New lighting would be cooler and would not have to be changed as often as the existing

system, helping to avoid repetitive damage to sensitive cave resources. Continued preservation of the cave features is compatible with Native American beliefs about the cavern.

Cumulative Effects. Over the last 125 years, historic events have contributed to numerous changes in Wind Cave as well as the region's ethnographic resource base. Pressures from modern society would continue into the future, diminishing the integrity of ethnographic resources valued by tribes. Implementation of Alternative B would help to reduce physical changes in the cave's natural resources which would, in turn, help to preserve its cultural values. Cumulative impacts would still be adverse and moderate, but the rate of change and deterioration of this one special resource – Wind Cave – would be slowed.

Conclusion. The project would help ensure continued preservation of the cave's natural features so that long-term adverse effects on ethnographic resources would be of minor intensity.

Alternative B would not produce major adverse impacts on ethnographic resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other National Park Service planning documents. Consequently, there would be no impairment of ethnographic resources or values as a result of the implementation of Alternative B.

VISITOR USE AND EXPERIENCE

Affected Environment

NPS *Management Policies 2001* state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks. Part of the purpose of Wind Cave National Park is to offer opportunities for recreation, education, inspiration, and enjoyment. Consequently, one of the park's management goals is to ensure that visitors safely enjoy and are satisfied with the availability, accessibility, diversity, and quality of park facilities, services, and appropriate recreation opportunities. The park is one of a variety of destinations for the Black Hills visitors. Attractions in the immediate area include Mount Rushmore National Memorial, Jewel Cave National Monument, Crazy Horse Memorial, the Mammoth Site in Hot Springs and Badlands National Park to the east.

Wind Cave National Park offers many activities for its visitors, both above ground and below. The park lands consist of more than 114 miles of (known) cave passages and 28,295 acres of mixed-grass prairie and ponderosa pine forest. Visitors enjoy caving, hiking, observing wildlife, camping, picnicking, scenic driving, and interpretive tours. Interpretive rangers lead nature walks in the prairie and offer a campfire program in the summer, which include informative discussions on the natural resources and history of the park. The Elk Mountain Campground has 75 sites. Peak use is during the summer, but the camp is seldom full.

Over five million people have visited the cave since 1890 (NPS 2004d). In the year 2003, Wind Cave National Park was ranked in the top 25 percent of all park units in the National Park System, for annual visitation (number 78, out of 353). From 1993 to 2003, Wind Cave received an average of 767,458 visits per year. This indicates an increase of 337,092 visitors in the decade (NPS 2004d). (In 1993, the park's public use reporting and counting instructions were changed to provide more accurate estimates of park use.) The park's counting instructions were changed once again in 2004, which resulted in 593,877 recreational visits counted in 2004. The lowest months for visitation are between November and February, with a monthly average of 18,034 visits (based on data from 2000 to 2003). Visitation usually drops by half at the beginning of November (see Figure 11). Peak visitation occurs between May and September with July and August having 195,724 and 187,019 visits respectively in 2003 (see Figure 11). Most visitors are day visitors to the park (60 percent); 20 percent from the local area and 40 percent from outside the local region (NPS 2004d).

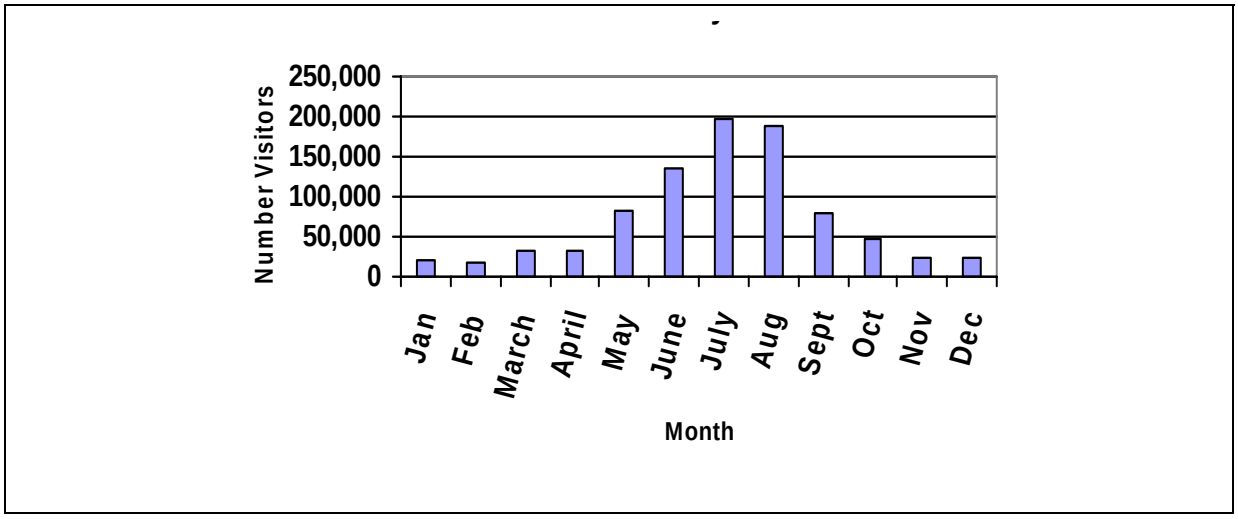

FIGURE 11. PARK VISITATION BY MONTH IN 2003

The visitor center is the principal point of contact where visitors begin tours, view educational exhibits, and gather information for use in their park visit. Approximately 110,000 visitors enter the visitor center each year, and about 89,000 participate in cave tours. Though most visitors to Wind Cave National Park recreate on the park surface, experiencing the cave's interior caverns is still a primary purpose of visiting the park for most non-local visitors. Of the average number of annual visits (767,458), only about 9.8 percent participate in ranger-led cave tours. However, about 80 percent of the visitors that actually stop at the visitor center go on a cave tour. In the high season, as many as 16 interpretive rangers will lead up to 29 tours per day (Farrell 2004). The park offers five different interpretive tours: the Natural Entrance Tour, the Fairgrounds Tour, the Garden of Eden Tour, the Candlelight Tour, and the Wild Cave Tour. All five guided cave tours are offered from June to September, and only the Garden of Eden tour is offered from October to April/May. Based on 2003 Fiscal Year information, the Natural Entrance Tour is the most popular, accounting

for 47 percent of all tours conducted, followed by the Garden of Eden, Fairgrounds, Candlelight, and Wild Cave Tours, respectively (see Figure 12) (Farrell 2004). The tours range in duration and difficulty, from the Garden of Eden Tour that is only 150 stairs and lasts one hour to the four hour Wild Cave Tour through undeveloped sections of the cave. Limited areas of the cave are also accessible to those with limited mobility, accounting for 4 percent of the tours conducted annually (Farrell 2004).

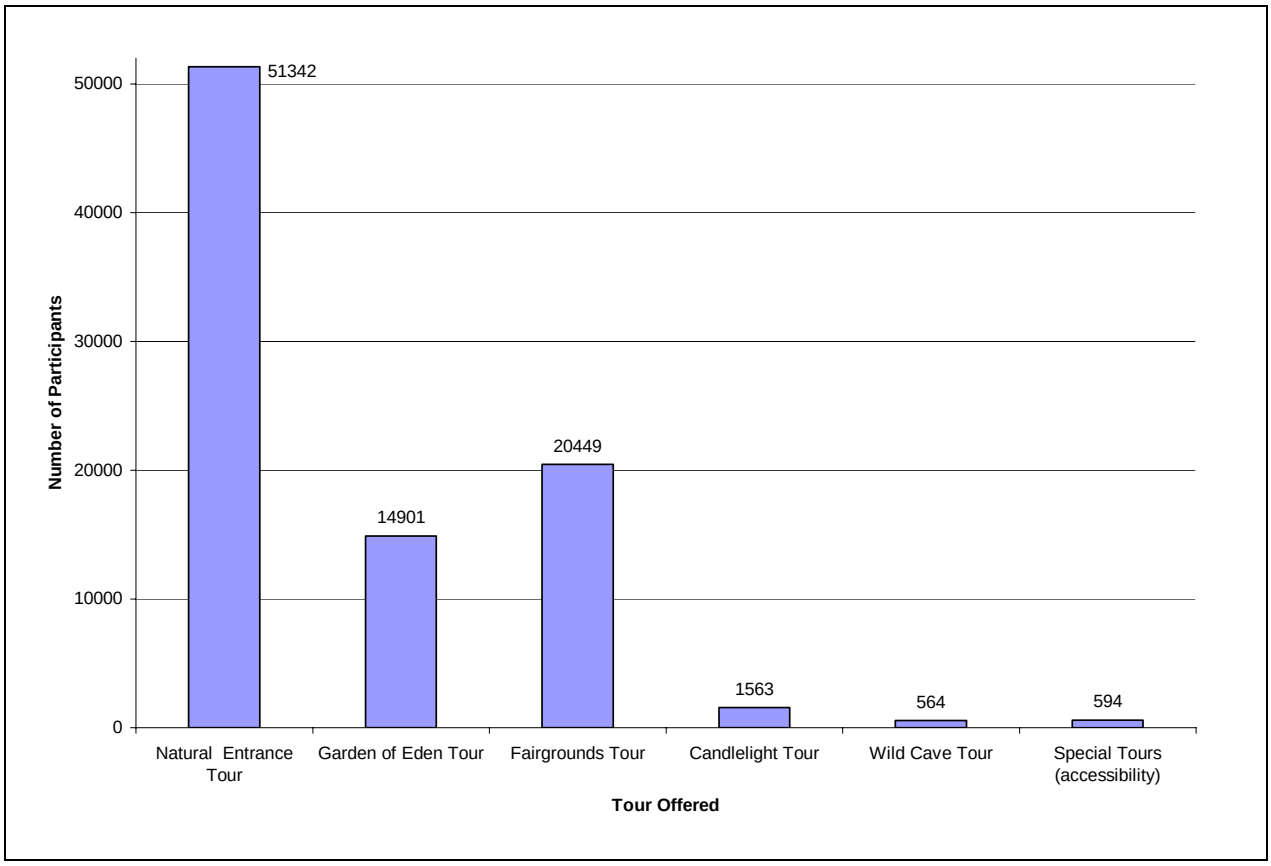

FIGURE 12. FISCAL YEAR 2003 ANNUAL TOUR PARTICIPANTS

Three of the tours (the Natural Entrance, Fairgrounds, and Garden of Eden) are on developed, lighted paths and a fourth, the Candlelight Tour, uses a developed, lighted pathway for part of the tour. A few of the major interpretive stops on the developed tours include: the Post Office, Devils Lookout, Cathedral, Model Room, Assembly Room, Garden of Eden, Eastern Star, W.C.T.U. Hall, Summer Avenue, Temple, Elks Room, Fairgrounds, Low Spot, and Bachelor Quarters. Typical cave formations seen include: boxwork, popcorn, moonmilk, and frostwork. The current lighting system uses incandescent light bulbs, which burn out sooner than other available bulbs. This causes occasional incidences of some lights being out along the tour route, creating dark areas. The replacement of bulbs by park facilities staff is usually done within a few days, but can take up to two weeks if the lamp is located in a place that requires rock climbing to reach (Schrempp 2004b). (The staff members with these skills are not always immediately available.)

All of the lighted tours, except Special (accessibility) Tours, include a “blackout” demonstration where visitors can experience the cave’s natural state of total darkness. When a failure occurs on the lighting system, either as a result of a malfunction during the “blackout” demonstration or a general power failure, visitors are led out of the cave by flashlight or to an area that may still be lighted. Each interpreter leading a cave tour has emergency instructions to follow, which involve gathering the group, moving the group to a safe area one person at a time, getting candles from the nearest candle cache and distributing them, calling the surface for information and further direction, and evacuating the group using flashlights brought from the surface.

Impacts of Alternative A, the No Action Alternative

Under Alternative A, the lighting system in the cave would continue to deteriorate and need on-going maintenance. The continued use of incandescent lamps within the cave would not optimize the visitor appreciation of the unique geology within the cave because incandescent bulbs do not provide an ideal color rendering. The current system would also continue to utilize poor placement and angles of light fixtures. The use of inefficient bulbs under the No Action Alternative would continue to necessitate frequent replacement when bulbs burn out, so there could be instances when a visitor might miss a highlighted feature during the interval between when the bulb burns out and gets replaced. In addition, the use of incandescent bulbs, which is a relatively hot light source, and the continuous lighting in the cave leads to an increase in the growth of algae within the cave. The appearance of algae on cave formations could prevent visitors from viewing the formation’s intricate details and decrease visitor appreciation of the geology of the cave. The effects of continuing impacts to cave resources and visitors’ appreciation of them would be considered minor to moderate, long-term, and adverse.

Some visitors on lighted cave tours would continue to have incomplete experiences of the cave interpretation due to the unreliability of the lighting system during “blackout” demonstrations. The incidence of flashlight-led evacuations would continue to occur and pose a risk of injury and stress on some visitors. The potential for incomplete interpretation experiences and the risk of injury while on a tour would be considered a negligible to minor, long-term, adverse effect on visitor use and experience.

Lastly, the continued presence of uncamouflaged primary and secondary cables along the trails could be noticed by visitors during tours and be perceived as visually incompatible or obtrusive with the natural cave environment. This would be considered a long-term, negligible, adverse effect on visitor use and experience.

Cumulative Effects. Other past, present, and reasonably foreseeable future projects occurring in the park that will affect visitor use and experience in the cave include the cave management plan and the associated restoration activities within the cave. The cave management plan will address several topics that will lead to the continuance or addition of activities that will enhance cave resources enjoyed by visitors. The algal growth mitigation will continue, as well as trash and lint removal activities, and be addressed in the cave management plan. These activities would have a long-term benefit on cave resources, which would improve visitor enjoyment of the cave over the long term in a negligible, beneficial manner. The overall long-term, negligible to minor, adverse effects associated with the No Action Alternative would offset the long-term, negligible, beneficial effects of the cave

management plan. Overall, cumulative effects on visitor use and experience would be long-term, negligible, and adverse.

Conclusion. The poorly placed lighting fixtures and the use of incandescent lights does not provide visitors the opportunity to fully appreciate the unique geology of Wind Cave. The effects from the amount and intensity of the light promoting the growth of algae, the inaccurate color rendering and necessary bulb replacement, and the existing placement and configuration of the lighting fixtures would be long-term, minor to moderate, and adverse. The existing primary and secondary cables that are visually incompatible with the cave would be a long-term, negligible, adverse effect on visitor use and experience.

The potential for incomplete interpretation experiences and the risk of injury while on a tour as a result of a power failure would be considered a negligible to minor, long-term, adverse effect on visitor use and experience.

Impacts of Alternative B, the Preferred Alternative

The Preferred Alternative would include the installation of a new lighting system that meets current professional standards for operation and safety. This new system would be more reliable and eliminate the risk of evacuation led by flashlight on cave tours, and ensure that the lights would operate properly when needed for cave interpretation demonstrations. This alternative also provides backup power to the lighting system for emergency egress. The reduced risk of injury during evacuation and the more complete interpretive experience would represent a minor, long-term, beneficial effect on visitor use and experience.

The new lighting control system associated with Alternative B would allow sections of the tour route to be lighted while others are not, which would reduce algal growth. A reconfiguration of the lights would be done in order to better highlight some geologic features, and turning the lights away from other features needing recovery from algae or those that need to be treated. The new light bulbs would also burn cooler, which would reduce the growth of algae, have a longer lamp life, and provide more accurate color rendering. The effects of these efforts on visitor experience would be minor to moderate, long-term, and beneficial.

The Preferred Alternative would occur in incremental stages in order to minimize impacts on the visitor experience, with most construction or electrical work occurring in the low season, November to February, or, at the earliest, from Labor Day to Memorial Day. Replacement of the entire system is anticipated to take up to two years. Visitors would be prohibited from entering some of the tour routes during electrical work. Access restrictions would adversely affect the quality of the visitor experience on tour routes, but would only be temporary and likely minor in intensity. If electrical work ever necessitated the closure of all tour routes, adverse effects would be short-term, but could range up to moderate.

Cumulative Effects. Other past, present, and reasonably foreseeable future projects occurring in the park that will affect visitor use and experience in the cave include the cave management plan and the associated restoration activities within the cave. The cave management plan will address several topics on management of activities that will enhance cave resources enjoyed by visitors. Restoration activities, such as algal growth mitigation and trash and lint removal, will likely continue and be addressed in the cave management plan. These activities would have a long-term benefit on cave resources, which would improve

visitor enjoyment of the cave over the long term in a negligible, beneficial manner. The overall long-term, negligible to minor, beneficial effects associated with the Preferred Alternative, in conjunction with long-term, negligible, beneficial effects of the cave management plan, would cumulatively result in long-term, beneficial effects of minor to moderate intensity.

Conclusion. Under the Preferred Alternative, the reduced risk of injury during evacuation and the more complete interpretive experience represent a long-term, minor, beneficial effect on visitor use and experience. Because continuous and high intensity lighting would no longer be used, algal growth would reduce and improve the visitor experience. The new lighting system would also include a designed lighting system to better highlight geologic features, and would incorporate more color-accurate, longer lasting bulbs that would allow an enhanced appreciation of Wind Cave's formations. The effects of these efforts on visitor use and experience would be minor to moderate, long-term, and beneficial. Short-term, adverse effects to visitor use and experience would occur as a result of project activities during installation. These effects could range up to moderate if the cave needed to be completely closed to visitors.

PARK OPERATIONS

Affected Environment

The superintendent at Wind Cave National Park is responsible for the full scope of managing the park, its staff and residents, all of its programs, and its relations with persons, agencies, and organizations interested in the park. Park staff provides the full scope of functions and activities to accomplish management objectives and meet requirements in law enforcement, emergency services, public health and safety, science, resource protection and management, visitor services, interpretation and education, utilities, housing, fee collection, and management support.

The staff of Wind Cave National Park totals about 50 people (Schrempp 2004b). The park facilities staff includes eight permanent staff members and eight to ten seasonal staff members. Of these, four are licensed water operators and three are certified wastewater operators. One staff member is a licensed electrician, who is also water and wastewater treatment licensed. This staff maintains the roads, buildings, and utilities of Wind Cave National Park, with the occasional exception of contracted labor. The staff is typically responsible for a variety of tasks, including plumbing, electric, carpentry, masonry, general repairs, road and guardrail repairs, flooring, and animal roundups (Dahlberg 2004).

The current lighting system places a high maintenance demand on park staff. There are currently 650 light fixtures used to light the cave. These lamps are almost exclusively incandescent bulbs. Incandescent is considered a relatively hot lamp type which is not very energy efficient and has a short lamp life in comparison to other lamp types available. The incandescent bulbs currently being used have a life of approximately 3000 to 5000 hours (NPS 2004b). This equates to approximately two to three years of use (Schrempp 2004b). The facilities staff at Wind Cave replaces about two to six light bulbs per week (Schrempp 2004b). The burned out bulbs are first reported by interpretive staff, and the facilities staff typically replaces it within a few days that it is reported. Critical lights (safety or features) are replaced the same day. A clipboard is kept in the interpretive area for rangers to mark the

locations of burned out bulbs that are not in critical areas (i.e., areas where the darkness would cause danger). Once the reported bulb is replaced, the staff looks in the area to check for other needed replacements (Dahlberg 2004). Staff members are not permitted to go into the cave alone to replace bulbs, for safety reasons. Some of the lamp replacement activities require special caving abilities, which results in a one- to two-week delay in their replacement, due to the fact that only some members of the staff have the necessary skill to safely accomplish the task.

The age and the overall deteriorated condition of the lighting system makes frequent repairs necessary, and maintenance staff are responsible to manage an increasing need for repair and replacement of other electric components in the lighting system.. The junction boxes installed in the past are not water tight, and due to the moisture in some sections of the lighted trail, water leaks into them causing wires to short out and melt. The existing wiring is not adequately protected from physical damage. In addition, the high-voltage, primary electrical line is poorly differentiated from other load-carrying lines within the cave. Maintenance personnel must carefully inspect each connecting line to determine its voltage prior to implementing any maintenance actions.

Staff who lead interpretive tours are required to respond to a variety of lighting conditions generated by the unreliability of the current lighting system. In the summer season, there are as many as 24 interpretive rangers who lead tours and two available in the winter season. On an average day, there are four to five tours being conducted simultaneously (Laycock 2004). The occasional failure of the lighting system during blackout demonstrations can be stressful and dangerous for the ranger as well as the visitors.

The current lighting system promotes algal growth on important features of the cave, which are highlighted on the tours. Algae grow on some of the cave's best, most valuable geologic features, because they are the most prominently lit. These areas must be treated periodically by rangers and volunteers with a weak solution of bleach and water, and biannual treatments are necessary for the algae growth to remain under control.

Impacts of Alternative A, the No Action Alternative

Under Alternative A, the cave lighting system would continue to deteriorate and need periodic replacement and repair of its parts. The park staff would be required to continue the amount of work necessary to keep the system functioning and safe, and to meet the increasing future demand for these services. This burden would result in minor to moderate, long-term, adverse effects on park operations.

Interpretive rangers would experience continued failure of the lighting system with no backup power provided, which would sometimes necessitate evacuation of tours. The continued potential danger associated with flashlight-led evacuations represents a negligible, long-term, adverse effect on park operations.

Algae growing on rock and mineral formations would be treated by park staff with an algae-inhibiting solution as part of an on-going effort to preserve the cave's most highlighted resources. The park currently uses one part-time seasonal employee to at least perform bleach treatments. The No Action Alternative would result in a minor, long-term, adverse effect on park operations due to the additional staff workload.

Cumulative Effects. Other plans and actions occurring in the park that would affect park operations include relocating the wastewater treatment facility and constructing a new visitor center parking lot and stormwater system. Relocating the wastewater lagoons would have a minor, long-term, beneficial effect on park operations due to decreased staff workload related to emergency maintenance procedures. The new visitor center parking lot and stormwater treatment system would reduce the burden on park staff to repair the asphalt parking surface, and only outside contractors would maintain the new stormwater vault and infiltration ditch. This effect on park operations would be negligible to minor, long-term, and beneficial. The minor to moderate, long-term, adverse effects of the No Action Alternative, in concert with the benefits of the upgraded wastewater treatment facility and new parking lot and stormwater system, would ultimately result in a minor, long-term, adverse cumulative effect because the benefit of reduced labor of these two projects only partially offsets the increasing demands on staff generated by the existing lighting system.

Conclusion. The No Action Alternative would have adverse effects on park operations. Under this alternative, the aging lighting system would allow for the increasing burden on park staff, for replacement and repair of bulbs and parts, the danger and stress of flashlight-led evacuations on tours, and on-going efforts for removal of algae on cave resources. The adverse effects of the No Action Alternative would be minor to moderate, and long-term.

Impacts of Alternative B, the Preferred Alternative

The Preferred Alternative would decrease the amount of the park staff's time and resources spent on replacing and maintaining the failing lighting system. The new lighting system would reduce the time needed for continual repairs on system parts. The new system would be better grounded to increase safety. The lighting control panels and switchboxes would be appropriately chosen to withstand the humid cave environment, reducing the likelihood of the system shorting out and injuring a member of the park staff. The new lighting system would also incorporate the use of longer-lasting bulbs, which reduces the number of bulbs used and the amount of time spent replacing bulbs. The reduced amount of hours spent on maintenance and repairs of the lighting fixtures and system, as well as the reduced risk of electrocution to a staff member from unsafe control panels and switchboxes would result in minor to moderate, long-term, beneficial effects on park operations.

Project implementation activities would likely begin after Labor Day, lasting for six to seven months, and resuming the next Labor Day, for six to seven months over two years (Dahlberg 2004). The effort required by park staff to keep visitors safely away from any construction would not be noticeable because most work would be done after the main visitor season. In the winter, the park usually offers tours on only one route, with a maximum of 25 people (Laycock 2004).

The more reliable system would ensure that the "blackout" demonstrations given on interpretive lighted tours would be consistent and backup lighting would be provided during power failures. This reduction of the incidence of lighting failure and the subsequent need for evacuation represents a negligible, long-term, beneficial effect on park operations.

The new control panels would have switches that allow for selective areas of the tour routes to be lighted while others are left unlit. This would create less light (and heat) in the cave throughout the day and, coupled with the use of cooler-burning bulbs, would inhibit the

growth of algae, thereby reducing the amount of staff time dedicated to the removal of algae and the impact of chlorine on cave biota. This would result in a minor, long-term, beneficial effect to park operations by reducing the amount of time spent on algae removal.

Cumulative Effects. Other plans and actions occurring in the park that would affect park operations include relocating the wastewater treatment facility and constructing a new visitor center parking lot and stormwater system. Effects from both of these actions would be beneficial and are the same as those described above for Alternative A. The minor to moderate, long-term, beneficial effects of the Preferred Alternative, in concert with the negligible to minor benefits of the upgraded wastewater treatment facility and new visitor center parking lot and stormwater system, would ultimately result in a minor to moderate, long-term, beneficial effect on park operations.

Conclusion. The Preferred Alternative would have beneficial effects on park operations. Under this alternative, the new, more efficient lighting system would reduce the risk of electrocution to park staff, and reduce the need for continual repairs on system parts and bulb replacements. The new system parts would increase reliability of the lighting system when used in "blackout" demonstrations and thereby reduce the number of dangerous and stressful flashlight-led evacuations done each year. The new system would increase visitor access by better addressing access lighting issues. It would also reduce intentional and accidental resource damage from visitors. The new type of bulbs and selective lighting of areas would reduce the growth of algae on important cave resources and lessen the necessity of park staff cleaning algae off of features. Overall, the reduction of both labor demand and risk on park staff resulting from the new lighting system would result in minor to moderate, long-term, beneficial effects.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Affected Environment

Wind Cave National Park utilizes approximately 700,000 kilowatt-hours of electricity annually, with the lighting system accounting for about 18 percent of this energy usage (NPS 2004f). The remaining amount of the energy is used to provide power to the visitor facilities, administration offices, residences, and maintenance buildings.

The lighting control system in the cave is very primitive compared to the modern technology available today, and the system's design is essentially a basic on/off switching system. The entire lighting system must be either on or off, and then circuit segments can be turned on and off at the circuit control panels. Light switches currently exist near or along the trail and are used only in three areas where blackout demonstrations are conducted. Because of the unreliable nature of the system, during high visitor use seasons (Memorial Day to Labor Day) all of the lights are kept on in the cave for about 11 hours per day. The lights are kept on in the cave for an average of about 8 hours per day throughout the remainder of the year (NPS 2004b).

The cave lighting system uses about 650 incandescent light fixtures and bulbs to light approximately one mile of paved trail within the cave. Of these light bulbs, 569 have a wattage power rating of 65 watts, and the remaining 81 bulbs have a power rating of 30 watts (NPS 2004b). These incandescent bulbs have a typical lamp life of about 3000 to 5000 hours;

however, the lamp life could be slightly longer as a result of the low ambient temperature in the cave and the fact that the lights are only turned on and off once a day (Magnuson 2004). A small amount of energy is also used to power lighting system components, but a specific power rating is unknown. This energy, however, would only represent a nominal fraction of the total power used by the overall lighting system.

Impacts of Alternative A, the No Action Alternative

The No Action Alternative would continue use of the existing lighting system and the corresponding energy requirements (about 125,000 kilowatt-hours) associated with its use. Maintenance actions would continue under this alternative, which would include the replacement or repair of system parts or light bulbs. When the incandescent bulbs reach the end of their lamp life, they would be replaced with equivalent incandescent bulbs that correspond to the existing fixtures. The existing system has already deteriorated to the point that the lights need to be kept on all day and shut off at night as a result of unreliable circuit control switches and the inability to find available replacement parts. Consequently, the system is at a stage where it requires the maximum amount of energy necessary to light the cave, and no change in energy requirement would be expected. In addition, there is no foreseeable potential for energy conservation within the constraints of the existing system's design. No effects to energy requirements and conservation potential would be expected to occur under the No Action Alternative.

Cumulative Effects. Other past, present, or reasonably foreseeable future projects occurring within the park that have the potential to affect energy requirements and conservation potential include the project to relocate the park's wastewater treatment facility. A lift station associated with the wastewater treatment plant would require energy to pump wastewater to new evaporation ponds. The additional amount of energy required to pump wastewater would be considered a long-term, adverse effect of negligible intensity because only a slight increase in energy usage would be expected. The No Action Alternative would have no effect on energy requirements and conservation potential. Therefore, the cumulative effect of both of these actions would result in a long-term, negligible, adverse effect on energy requirements and conservation potential.

Conclusion. The existing lighting system has deteriorated to a point where it likely requires the maximum amount of energy necessary to light the cave, and no change in energy requirement would be expected. In addition, there is no foreseeable potential for energy conservation within the constraints of the existing system's design. No effects to energy requirements and conservation potential would be expected to occur under the No Action Alternative.

Impacts of Alternative B, the Preferred Alternative

The installation of a new lighting system would have potential for energy conservation through both a new lighting control system and the integration of more efficient light sources. The Preferred Alternative would install a new upgraded lighting control system that would allow sections of the tour route to be lighted while others are not; therefore, lighting would not have to remain on all day during certain times of the year. For example, during the high visitor use period from Memorial Day to Labor Day all of the lights would be on within the cave for the entire day because of the high frequency of tours. However, for the times of

the year when either the Garden of Eden Tour or the Natural Entrance Tour are the only tours offered because of low demand, lights would only be on in these sections. This would reduce the number of lights being used by the system annually (by about 260 lights).

Integration of more efficient light sources into the new lighting system would also reduce the energy requirement and increase the potential for energy conservation. A combination of LED (light emitting diode) fixtures and compact fluorescent fixtures would likely be installed; however, a detailed design phase would need to occur if the Preferred Alternative would be implemented. A combination of these light fixtures would allow the use of these types of light sources, which are more energy efficient than the currently used incandescent light sources. Compact fluorescent lights are very efficient and, although the wattage rating that would be necessary varies because a detailed design has not been conducted, ratings that could be used include 13-watt and 26-watt bulbs. A conservative average rating for the lamp life of compact fluorescent lamps is about 12,000 hours. LED lights are considered even more efficient, with a conservative average estimated power rating around 12 watts per fixture and a conservative average estimated lamp life of about 30,000 hours. Although these values are estimated and would vary depending on a detailed lighting design, they indicate that there would likely be a substantial increase on energy efficiency of the system.

The projected energy requirements annually, based off of these estimated averages and taking into account the ability to selectively light certain sections, would be about 15,000 kilowatt-hours (NPS 2004b) (see Appendix B for a detailed table of these calculations). This would reduce the energy requirement for the lighting system by about 8 times (an 88 percent reduction), which would be considered a long-term, moderate, beneficial effect on energy requirements and conservation potential.

Cumulative Effects. Other past, present, or reasonably foreseeable future projects occurring within the park that have the potential to affect energy requirements and conservation potential include the project to relocate the park's wastewater treatment facility. A lift station associated with the wastewater treatment plant would require energy to pump wastewater to new evaporation ponds. The additional amount of energy required to pump wastewater would equal about 8 percent of what the new lighting system would use. This would be considered a long-term, adverse effect of negligible to minor intensity because a small increase in energy usage would be expected. The Preferred Alternative would result in a long-term, moderate, beneficial effect on energy requirements and conservation potential from integrating more efficient light sources and using a system that can minimize the length of time the lights are on in the cave. The increased energy requirements of the lift station would offset some of the beneficial effects of Alternative B; however, because such high energy savings would occur under the action alternative, the cumulative effects of these two projects would still be considered long-term, moderate, and beneficial**.**

Conclusion. The Preferred Alternative would integrate more efficient light sources, and the new lighting control system would allow the opportunity to minimize the length of time the lights are on in the cave. Incorporating both of these improvements into the new system would allow greater potential for energy conservation over the existing system; therefore, Alternative B would be expected to have a long-term, moderate, beneficial effect to energy requirements and conservation potential.

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CONSULTATION AND COORDINATION

Several Native American tribes have demonstrated interest in the areas within Wind Cave National Park. The following tribes were contacted by letter on March 22, 2004, regarding this project. A copy of the letter sent to the tribal representatives can be found in Appendix A.

Apache Tribe of Oklahoma

Arapaho Business Committee

Cheyenne River Sioux Tribe

Cheyenne-Arapaho Tribes of Oklahoma

Crow Creek Sioux Tribal Council

Flandreau Santee Sioux Executive Committee

Fort Belknap Community Council

Fort Peck Tribal Executive Board

Lower Brule Sioux Tribal Council

Northern Cheyenne Tribal Council

Oglala Sioux Tribal Council

Ponca Tribe of Nebraska

Ponca Tribe of Oklahoma

Rosebud Sioux Tribal Council

Santee Sioux Tribal Council

Sisseton-Wahpeton Sioux Tribal Council

Standing Rock Sioux Tribal Council

Three Affiliated Tribes Business Council

Yankton Sioux Tribal Business and Claims Committee

The U.S. Fish and Wildlife Service was contacted regarding this project on March 26, 2004. The Service agreed with the park's finding of no effect on threatened and endangered species. A copy of the letter sent to the U.S. Fish and Wildlife Service and their response is included in Appendix A.

This environmental assessment analyzes impacts of one action alternative and compares the effects to those of continuing current management. This assessment has been prepared in accordance with the National Environmental Policy Act of 1969 and with the regulations of the Council on Environmental Quality (40 CFR 1508.0).

In accordance with the Advisory Council on Historic Preservation regulations, the NEPA process and this environmental assessment will be used to accomplish compliance for both Section 106 and the National Environmental Policy Act (as described in 36 CFR 800.8 (a-c)).

During development of this environmental assessment, the park contacted the South Dakota State Historic Preservation Officer (SHPO) regarding this project on March 22, 2004. A copy of the letter sent to the SHPO can be found in Appendix A. This environmental assessment will be sent to the South Dakota SHPO for review and comment. The State Historic Preservation Officer's concurrence with the National Park Service's definition of the Area of Potential Effect and determination of effect on resources eligible for the National Register of Historic Places will be requested as part of the Section 106 compliance for the project area.

The public was invited to comment on the project in a press release issued on April 6, 2004, and posted the same day on the park's website at www.nps.gov/wica. A copy of the press release and web posting can be found in Appendix A. No new issues were identified by the public as a result of the request for public input.

Planning Team Participants

Linda Stoll	Superintendent	Wind Cave National Park
Steve Schrempp, P.E.	Facilities Manager	Wind Cave National Park
Tom Farrell	Chief of Interpretation	Wind Cave National Park
Jim Dahlberg	Maintenance Foreman	Wind Cave National Park
Dan Foster	Chief of Resource Management	Wind Cave National Park
Rick Mossman	Chief Ranger	Wind Cave National Park
Rod Horrocks	Physical Sciences Specialist	Wind Cave National Park
Mary Laycock	Interpreter	Wind Cave National Park
Mark Davison	Park Ranger	Wind Cave National Park
Rick Steele	Park Electrician	Wind Cave National Park
Walt Graham	Project Manager	NPS, Denver Service Center
Jane Sikoryak	Contracting Officer's Technical Representative	NPS, Denver Service Center
Ron Haller	Electrical Engineer	NPS, Denver Service Center
Tom Wozniak	Electrical Engineer	Arcadis
Erik Magnuson	Lighting Designer	Magnum Design
John Pucetas	Value Analysis/Choosing By Advantages Facilitator	SiteTek Financial Arts, Inc.
Eric Richman	Alternative Energy Specialist	Pacific Northwest National Laboratory

Preparers

Jacklyn Bryant	Environmental Scientist/Project Manager	Parsons
Diane Rhodes	Cultural Resource Specialist	Parsons
Nicole White-Scott	Environmental Scientist	Parsons
Janice Biletnikoff	Environmental Planner	Parsons
Lee Monnens	Geologist	Parsons

LIST OF RECIPIENTS

Federal Agencies and Government

Dept. of Agriculture
- Natural Resources Conservation Service
- U.S. Forest Service
  - Black Hills National Forest
  - Buffalo Gap National Grasslands

Dept. of the Interior
- National Park Service
  - Badlands National Park
  - Geological Resources Division
  - Jewel Cave National Monument
  - Midwest Regional Office
  - Minuteman Missile National Historic Site
  - Mount Rushmore National Memorial
- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency Region VIII

U.S. Congressional Representatives from South Dakota

State and Local Agencies and Governments

Black Hills Parks and Forests Association
City of Custer, SD
City of Hot Springs, SD
Custer County Commissioners
Fall River County Commissioners
The Mammoth Site
South Dakota State Historic Preservation Officer
Tribal Historic Preservation Officer(s)

Native American Tribes

Apache Tribe of Oklahoma
Arapaho Business Committee
Cheyenne River Sioux Tribe
Cheyenne-Arapaho Tribes of Oklahoma
Crow Creek Sioux Tribal Council
Flandreau Santee Sioux Executive Committee
Fort Belknap Community Council
Fort Peck Tribal Executive Board
Lower Brule Sioux Tribal Council
Northern Cheyenne Tribal Council
Oglala Sioux Tribal Council
Ponca Tribe of Nebraska
Ponca Tribe of Oklahoma
Rosebud Sioux Tribal Council

Santee Sioux Tribal Council
Sisseton-Wahpeton Sioux Tribal Council
Standing Rock Sioux Tribal Council
Three Affiliated Tribes Business Council
Yankton Sioux Tribal Business and Claims Committee

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2004b Personal communication between Steven Schrempp, Facility Manager, Wind Cave National Park and Janice Biletnikoff, Environmental Planner, Parsons. September 7-9, 2004.

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APPENDIX A: CONSULTATION CORRESPONDENCE

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United States Department of the Interior

NATIONAL PARK SERVICE
WIND CAVE NATIONAL PARK
RR1, BOX 190
HOT SPRINGS, SOUTH DAKOTA 57747

RECEIVED
MAR 29 2004
U.S. FISH & WILDLIFE SERVICE

IN REPLY REFER TO:

N1621 (WICA-RM)

March 26, 2004

RECEIVED
APR 04 2004
NATIONAL PARK

The U.S. Fish and Wildlife Service concurs with your conclusion that the described project will not adversely affect listed species. Contact this office if changes are made or new information becomes available.

3-31-04
Date
SD Supervisor
USFWS

Scott Larson
U.S. Department of the Interior
Fish and Wildlife Service
Ecological Services Division
420 S. Garfield Avenue, Suite 400
Pierre, South Dakota 57501-5408

Subject: Section ~~106~~ 7 Consultation, Project to Rehabilitate the Cave Lighting System at Wind Cave National Park

Dear Mr. Larson:

Wind Cave National Park (WICA) is planning to prepare an Environmental Assessment (EA) for the project to rehabilitate the cave lighting system and requests an informal consultation on the project. The main objectives of the project are to 1) better protect public health and safety; 2) improve cave resource conditions; 3) enhance the visitor experience; and 4) increase park operational efficiency and sustainability.

The existing cave lighting system illuminates approximately 0.84 miles of developed cave trails. The lighting is used to showcase cave features and light the pedestrian walkway. The system has many operational shortcomings, and is in deteriorated condition. The primary cabling was installed in 1955, and carries 2400 volts throughout the cave. Several transformers within the cave change the current to a usable voltage, and all fixtures are fitted with incandescent light bulbs. There are currently no provisions for providing light in the cave in the event of a power failure (our elevator, however, would be powered by a generator during power loss). In addition, the incandescent lights are encouraging algal growth on cave features, which affects not only the resource, but visitor appreciation and staff maintenance burden.

Our planning efforts are in the early stages. At this time, we are considering two primary alternatives to meet our project objectives: 1) replace the existing 2400 volt system with a new 2400 volt system, or 2) replace the existing system with a new 480 volt system. Installation of either system would be expected to be completed during low visitation season (October through April) over two years.

The park has not yet chosen a preferred solution for the new lighting system. However, any alternative chosen for this project will not result in significant surface disturbance. The vast majority of the work would occur within the cave, along the developed trail system. If a new generator or transformers were required aboveground, they would be placed in previously disturbed areas near existing park infrastructure, and would require only minimal area for installation.

According to our records, no federally listed or proposed species occur within the cave itself. Bats and rodents do occasionally access the cave from the natural and walk-in entrances. Individual animals could experience short-term disturbance during project implementation. However, bats do not generally use Wind Cave for extended periods because cave temperatures are not appropriate for hibernation or nesting.

Wind Cave has determined that the proposed project to rehabilitate the cave lighting system would have no effects on listed or candidate species. We hope you concur with our determination. Please call Dan Foster of my staff at 605-745-1190 if you have any questions. Thank you.

Sincerely,

Linda Stoll

Linda Stoll
Superintendent

United States Department of the Interior

NATIONAL PARK SERVICE
Wind Cave National Park
RR 1, Box 190
Hot Springs, South Dakota 57747

IN REPLY REFER TO:

H4217(WICA)

March 22, 2004

«Salutation» «FirstName» «MI» «LastName» «Suffix», «JobTitle»
«TribeName»
«Address1»
«Address2»
«City», «State» «ZipCode»

Subject: Section 106 Consultation, Rehabilitate the Cave Lighting System at Wind Cave National Park

Dear «Salutation» «LastName»:

The purpose of this letter is to provide you advance notice that the National Park Service is beginning to plan for rehabilitation of the lighting system within Wind Cave. The primary goals of the project are to 1) better protect public health and safety; 2) improve cave resource conditions; 3) enhance the visitor experience; and 4) increase park operational efficiency and sustainability.

The existing cave lighting system illuminates approximately 0.84 miles of developed cave trails. The lighting is used to showcase cave features and light the pedestrian walkway. The system has many operational shortcomings and is in deteriorated condition. The primary cabling was installed in 1955, and carries 2400 volts throughout the cave. Several transformers within the cave change the current to a usable voltage, and all fixtures are fitted with incandescent light bulbs. There are currently no provisions for providing light in the cave in the event of a power failure (our elevator, however, would be powered by a generator during power loss). In addition, the incandescent lights are encouraging algae growth on cave features, which affects not only the resource, but visitor appreciation and staff maintenance burden.

Although we are just beginning to plan and gather information for the project, we believe that its eventual implementation may have the potential to affect properties included in or that may be eligible for inclusion in the National Register because the project is within the Wind Cave National Park Administrative and Utility Area Historic District. Therefore, we are initiating consultation with your office in accordance with 36 CFR 800 and with the 1995 Servicewide Programmatic Agreement among your office, the Advisory Council on Historic Preservation, and the National Park Service.

At this early planning stage, we are considering two primary alternatives to meet our project objectives: 1) replace the existing 2400 volt system with a new 2400 volt system, or 2) replace the existing system with a new 480 volt system. Either of these systems would meet the project goals, and would also measurably reduce the park's energy consumption. Installation of either system

would be expected to be completed during low visitation season (October through April) over two years.

The park has not yet chosen a preferred solution for the new lighting system. However, any alternative chosen for this project would not result in significant surface disturbance. If a new generator or transformers were required aboveground, they would be placed in previously disturbed areas near existing park infrastructure, and would require only minimal area for installation. The vast majority of the work would occur within the cave, along the developed trail system. None of the actions necessary to rehabilitate the lighting system would affect the natural entrance or the adjacent landscape.

The park is aware that American Indians value Wind Cave itself as a very special place, so we want to be sure that the project would not affect it or other ethnographic resources valued by your tribe. A similar letter has been sent to your tribal Chairperson to inform them of the project, to request a response should there be any concerns about ethnographic resources, and to formally initiate Government- to- Government consultation in accordance with legislation, Executive Orders, regulations, and policy, including sections 101 and 106 of the National Historic Preservation Act of 1966 as amended, 36 CFR 800, National Park Service Management Policies and Director's Order 28, Cultural Resources Management (especially Chapter 10, Ethnographic Resources).

In addition to planning work required by Section 106 of the National Historic Preservation Act, we have begun work on an environmental assessment that will study and assess the impacts to natural and cultural resources and determine any required mitigation. The EA will provide detailed descriptions of alternative programs intended to improve the cave lighting and, as required by law, a no- action alternative. The EA also will analyze the potential impacts associated with possible implementation of each alternative and will describe the rationale for choosing the preferred alternative. These details will be reiterated in a Section 106 Summary in the EA. Also contained in the EA will be measures that would help avoid adverse effects on cultural resources.

This letter also serves to notify your office and the State Historic Preservation Office that we plan to use the EA for the project to accomplish compliance for both Section 106 and the National Environmental Policy Act (as described in 36 CFR 800.8 (a- c)).

As soon as the EA is completed, we will send it to you for your review and comment. We look forward to your input on the planning process, and believe that it will continue to result in better planning for cultural resources management as well as helping to ensure that cultural resources valued by your tribe are adequately considered during preparation of the plan and the accompanying EA.

If you have any questions, please contact me or Tom Farrell, our Section 106 Compliance Coordinator. We can both be reached at (605) 745- 4600.

Sincerely,

Linda L. Stoll

Linda L. Stoll
Superintendent

cc: Parsons- Denver- J. Bryant, D. Rhodes

Tim Mentz, Historic Preservation Officer
Standing Rock Sioux Tribe
P. O. Box D
Fort Yates, ND 58538

Jim Picotte, Historic Preservation Officer
Cheyenne River Sioux Tribe
P. O. Box 590
Eagle Butte, SD 57625

United States Department of the Interior

NATIONAL PARK SERVICE
Wind Cave National Park
RR 1, Box 190
Hot Springs, South Dakota 57747

IN REPLY REFER TO:

H4217(WICA)

March 22, 2004

«Salutation» «FirstName» «MI» «LastName» «Suffix», «JobTitle»
«TribeName»
«Address1»
«Address2»
«City», «State» «ZipCode»

Subject: Government- to- Government Consultation, Project to Rehabilitate the Cave Lighting System at Wind Cave National Park

Dear «Salutation» «LastName»:

The purpose of this letter is to provide you advance notice that the National Park Service is beginning to plan for rehabilitation of the lighting system within Wind Cave. The primary goals of the project are to 1) better protect public health and safety; 2) improve cave resource conditions; 3) enhance the visitor experience; and 4) increase park operational efficiency and sustainability.

The existing cave lighting system illuminates approximately one mile of developed cave trails. The lighting is used to showcase cave features and light the pedestrian walkway. The system has many operational shortcomings and is in deteriorated condition. The primary cabling was installed in 1955, and carries 2400 volts throughout the cave. Several transformers within the cave change the current to a usable voltage, and all fixtures are fitted with incandescent light bulbs. There are currently no provisions for providing light in the cave in the event of a power failure (our elevator, however, would be powered by a generator during power loss). In addition, the incandescent lights are encouraging algae growth on cave features, which affects not only the resource, but visitor appreciation and staff maintenance burden.

Our planning efforts are in the early stages. At this time, we are considering two primary alternatives to meet our project objectives: 1) replace the existing 2400 volt system with a new 2400 volt system, or 2) replace the existing system with a new 480 volt system. Either of these systems would meet the project goals, and would also measurably reduce the park's energy consumption. Installation of either system would be expected to be completed during low visitation season (October through April) over two years.

The park has not yet chosen a preferred solution for the new lighting system. However, any alternative chosen for this project would not result in significant surface disturbance. If a new generator or transformers were required aboveground, they would be placed in previously disturbed areas near existing park infrastructure, and would require only minimal area for installation. The vast majority of the work would occur within the cave, along the developed trail system. None of the actions necessary to rehabilitate the lighting system would affect the natural entrance or the adjacent landscape.

The park is aware that American Indians value Wind Cave itself as a very special place, so we want to be sure that the project will not affect it or other ethnographic resources valued by your tribe. Therefore, this letter is to formally initiate Government- to- Government consultation in accordance with legislation, Executive Orders, regulations, and policy, including sections 101 and 106 of the National Historic Preservation Act of 1966 as amended, 36 CFR 800, National Park Service *Management Policies* and Director's Order 28, *Cultural Resources Management* (especially Chapter 10, Ethnographic Resources).

We have begun planning work required by Section 106 of the National Historic Preservation Act, and we have begun work on an environmental assessment that will study and assess the impacts to these features and determine any required mitigation. We believe that your participation will result in better planning for cultural resources management, and will help ensure that cultural resources valued by your tribe are adequately considered during the planning and design process and in preparation of the accompanying environmental assessment. As soon as it is completed, a copy of the draft environmental assessment will be forwarded to your tribe for review and comment. We look forward to receiving your input on our plans and any concerns you have about the project. We would be pleased to discuss this project further, either by telephone or in a meeting.

If you have any questions, please contact me or Tom Farrell, our Section 106 Compliance Coordinator. We can both be reached at (605) 745- 4600.

Sincerely,

Linda L. Stoll

Linda L. Stoll
Superintendent

cc: Parsons- Denver- J. Bryant, D. Rhodes

Duane Big Eagle, Chairman
Crow Creek Sioux Tribal Council
P. O. Box 50
Fort Thompson, SD 57339

White Buffalo Head, Chairman
Ponca Tribe of Oklahoma
20 White Eagle Drive
Ponca City, OK 74601

Alonzo Chalepah, Chairman
Apache Tribe of Oklahoma
P. O. Box 1220
Anadarko, OK 73005

Charles Colombe, President
Rosebud Sioux Tribal Council
P. O. Box 430
Rosebud, SD 57570

Harold Frazier, Chairman
Cheyenne River Sioux Tribe
P. O. Box 590
Eagle Butte, SD 57625

Tex Hall, Chairman
Three Affiliated Tribes Business Council
HC 3, Box 2
New Town, ND 58763

Burton Hutchinson, Chairman
Arapaho Business Committee
P. O. Box 396
Fort Washakie, WY 82514

Michael Jandreau, Chairman
Lower Brule Sioux Tribal Council
P. O. Box 187
Lower Brule, SD 57548

John Morales, Chairman
Fort Peck Tribal Executive Board
P. O. Box 1027
Poplar, MT 59255

Charles Murphy, Chairman
Standing Rock Sioux Tribal Council
P. O. Box D
Fort Yates, ND 58538

Mark Peniska, Chairman
Ponca Tribe of Nebraska
P. O. Box 288
Niobrara,, NE 68760

Geri Small, President
Northern Cheyenne Tribal Council
P. O. Box 128
Lame Deer, MT 59043

Robert Tabor, Chairman
Cheyenne-Arapaho Tribes of Oklahoma
P. O. Box 38
Concho, OK 73022

Roger Trudell, Chairman
Santee Sioux Tribal Council
108 Spirit Lake Ave W
Niobrara, NE 68760-7219

John Yellow Bird Steele, President
Oglala Sioux Tribal Council
P. O. Box H
Pine Ridge, SD 57770

United States Department of the Interior

NATIONAL PARK SERVICE
Wind Cave National Park
RR 1, Box 190
Hot Springs, South Dakota 57747

IN REPLY REFER TO:
H4217

April 21, 2004

Mr. Jay D. Vogt, SHPO
State Historic Preservation Office
Cultural Heritage Center
900 Governors Drive
Pierre, SD 57501

Subject: Section 106 Consultation, Rehabilitate the Cave Lighting System at Wind Cave National Park

Dear Mr. Vogt:

The purpose of this letter is to provide you advance notice that the National Park Service is beginning to plan for rehabilitation of the lighting system within Wind Cave. The primary goals of the project are to 1) better protect public health and safety; 2) improve cave resource conditions; 3) enhance the visitor experience; and 4) increase park operational efficiency and sustainability.

The existing cave lighting system illuminates approximately 0.84 miles of developed cave trails. The lighting is used to showcase cave features and light the pedestrian walkway. The system has many operational shortcomings and is in deteriorated condition. The primary cabling was installed in 1955 and carries 2400 volts throughout the cave. Several transformers within the cave change the current to a usable voltage, and all fixtures are fitted with incandescent light bulbs. There are currently no provisions for providing light in the cave in the event of a power failure. In addition, the incandescent lights are encouraging algal growth on cave features, which affects not only the resource, but also visitor appreciation and staff maintenance burden.

Although we are just beginning to plan and gather information for the project, we believe that its eventual implementation may have the potential to affect properties included in or that may be eligible for inclusion in the National Register because the project is within the Wind Cave National Park Administrative and Utility Area Historic District. Therefore, we are initiating consultation with your office in accordance with 36 CFR 800 and with the 1995 Servicewide Programmatic Agreement among your office, the Advisory Council on Historic Preservation, and the National Park Service.

At this early planning stage, we are considering two primary alternatives to meet our project objectives: 1) replace the existing 2400-volt system with a new 2400-volt system, or 2) replace the existing system with a new 480 -volt system. Either of these systems would meet the project goals,

and would measurably reduce the park's energy consumption. Installation of either system would be expected to be completed during the low visitation season (October through April) over two years.

The park has not yet chosen a preferred solution for the new lighting system. However, any alternative chosen for this project would not result in significant surface disturbance. If a new generator or transformers were required aboveground, they would be placed in previously disturbed areas near existing park infrastructure and would require only minimal area for installation. The vast majority of the work would occur within the cave along the developed trail system. None of the actions necessary to rehabilitate the lighting system would affect the natural entrance or the adjacent landscape.

The National Park Service is aware that American Indians and other traditional groups may have concerns related to cultural sites, so Government-to-Government consultation has been initiated with tribes that have expressed an interest in the park. This consultation is intended to ensure that mutually held goals for management of important natural and cultural resources are met.

In addition to planning work required by Section 106 of the National Historic Preservation Act, we have begun work on an environmental assessment that will study and assess the impacts to these features and determine any required mitigation. The EA will provide detailed descriptions of alternative programs intended to improve the cave lighting and, as required by law, a no-action alternative. The EA also will analyze the potential impacts associated with possible implementation of each alternative and will describe the rationale for choosing the preferred alternative. These details will be reiterated in a Section 106 Summary in the EA. Also contained in the EA will be measures that would help avoid adverse effects on cultural resources.

This letter also serves to notify your office that we plan to use the EA for the project to accomplish compliance for both Section 106 and the National Environmental Policy Act (as described in 36 CFR 800.8 (a-c)).

As soon as the EA is completed, we will send it to you for your review and comment. We look forward to your input on the planning process and believe that it will continue to result in better planning for cultural resources management as well as helping to ensure that cultural resources are adequately considered during preparation of the plan and the accompanying EA.

If you have any questions, please contact me or Tom Farrell, our Section 106 Compliance Coordinator. We can both be reached at (605) 745-4600.

Sincerely,

Linda L. Stoll
Superintendent

National Park Service

National Park Service
U.S. Department of the Interior

Wind Cave

National Park

NEWS

PLANNING BEGINS FOR REPLACEMENT OF CAVE LIGHTING SYSTEM

Date
April 06, 2004

Contact
Tom Farrell, 605-745-1130

Wind Cave National Park is initiating a planning process to prepare an Environmental Assessment (EA) for the rehabilitation of the lighting system within Wind Cave. The lighting is used to display cave features and light approximately one mile of developed cave trails. The current system, with its 1955 era primary cabling carrying 2400 volts throughout the cave, has many operational shortcomings and is in deteriorated condition.

Current alternatives under consideration include replacing the existing 2400 volt system with a new 2400 volt system or replacing the existing system with a new 480 volt system. Either of these systems would meet the project goals of better protecting public health and safety, improving cave resource conditions, enhancing the visitor experience, and increasing park operational efficiency and sustainability. Replacement of the current system would be completed during periods of low visitation over two years.

During this early planning phase, the park is requesting public input regarding possible alternatives, issues or concerns related to the proposed alternatives, and any new alternatives that should be considered. Please send your comments to Wind Cave National Park Superintendent, RR 1 Box 190, Hot Springs, SD 57747 or via e-mail to wica_planning@nps.gov.

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APPENDIX B: PROJECTED ANNUAL LIGHTING-RELATED ELECTRICAL UTILITY COSTS

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PROJECT: REPLACE DETERIORATED CAVE LIGHTING SYSTEM
LOCATION: WIND CAVE NATIONAL PARK, SOUTH DAKOTA

PROJECTED ANNUAL LIGHTING-RELATED ELECTRICAL UTILITY COSTS

EXISTING INCANDESCENT LIGHTING SYSTEM

TYPE	QTY		WATTAGE		HRS/DAY		DAYS/YR		ANNUAL KwHrs		KwHr RATE		COST/YR
Memorial Day to Labor Day													
INCANDESCENT	569	X	65	X	11	X	98	=	39,870	X	$ 0.0541	=	$ 2,157
INCANDESCENT	81	X	30	X	11	X	98	=	2,620	X	$ 0.0541	=	$ 142
Remainder of Year													
INCANDESCENT	569	X	65	X	8	X	266	=	78,704	X	$ 0.0541	=	$ 4,258
INCANDESCENT	82	X	30	X	8	X	266	=	5,235	X	$ 0.0541	=	$ 283
							TOTALS		**126,428 KwHrs**				**$ 6,840**

NEW LIGHTING DESIGN: COMPACT FLUORESCENT / LED

TYPE	QTY		WATTAGE		HRS/DAY		DAYS/YR		ANNUAL LOAD		KwHr RATE		COST/YR
Memorial Day to Labor Day													
FLUORESCENT COMPACT 26W	220	X	26	X	8	X	98	=	4,484	X	$ 0.0541	=	$ 243
FLUORESCENT COMPACT 13W	220	X	13	X	8	X	98	=	2,242	X	$ 0.0541	=	$ 121
LED WASH/FEATURE	220	X	12	X	8	X	98	=	2,070	X	$ 0.0541	=	$ 112
Remainder of the Year													
Natural Entrance Tour:													
FLUORESCENT COMPACT 26W	88	X	26	X	8	X	66	=	1,208	X	$ 0.0541	=	$ 65
FLUORESCENT COMPACT 13W	88	X	13	X	8	X	66	=	604	X	$ 0.0541	=	$ 33
LED WASH/FEATURE	88	X	12	X	8	X	66	=	558	X	$ 0.0541	=	$ 30
Garden of Eden Tour													
FLUORESCENT COMPACT 26W	44	X	26	X	8	X	200	=	1,830	X	$ 0.0541	=	$ 99
FLUORESCENT COMPACT 13W	44	X	13	X	8	X	200	=	915	X	$ 0.0541	=	$ 50
LED WASH/FEATURE	44	X	12	X	8	X	200	=	845	X	$ 0.0541	=	$ 46
							TOTALS		**14,757 KwHrs**				**$ 798**

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As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS May 2005