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BIOLOGICAL ASSESSMENT OF THE EFFECTS OF CONSTRUCTION AND OPERATION OF A DEPLETED URANIUM HEXAFLUORIDE CONVERSION FACILITY AT THE PADUCAH, KENTUCKY, SITE

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NOTATION

The following is a list of the acronyms, initialisms, and abbreviations (including units of measure) used in this document.

ACRONYMS, INITIALISMS, AND ABBREVIATIONS

ANL	Argonne National Laboratory
BA	biological assessment
BCI	Bat Conservation International
DOE	U.S. Department of Energy
DUF_6	depleted uranium hexafluoride
ETTP	East Tennessee Technology Park
GDP	gaseous diffusion plant
HF	hydrofluoric acid
LMES	Lockheed Martin Energy Systems, Inc.
USFWS	U.S. Fish and Wildlife Service

UNITS OF MEASURE

ºC	degree(s) Celsius
cm	centimeter(s)
d	day(s)
ºF	degree(s) Fahrenheit
ft	foot(feet)
ft^2	square foot(feet)
g	gram(s)
ha	hectare(s)
in.	inch(es
km	kilometer(s)
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
µg	microgram(s)
mi	mile(s)
mrem	millirem(s)
oz.	ounce(s)
t	metric ton(s)
yr	year(s)

BIOLOGICAL ASSESSMENT OF THE EFFECTS OF CONSTRUCTION AND OPERATION OF A DEPLETED URANIUM HEXAFLUORIDE CONVERSION FACILITY AT THE PADUCAH, KENTUCKY, SITE

1 INTRODUCTION

The U.S. Department of Energy (DOE) Depleted Uranium Hexafluoride (DUF_6) Management Program evaluated alternatives for managing its inventory of DUF_6 and issued the *Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DUF_6 PEIS) in April 1999 (DOE 1999). The DUF_6 inventory is stored in cylinders at three DOE sites: Paducah, Kentucky; Portsmouth, Ohio; and East Tennessee Technology Park (ETTP), near Oak Ridge, Tennessee. In the Record of Decision for the DUF_6 PEIS, DOE stated its decision to promptly convert the DUF_6 inventory to a more stable chemical form. Subsequently, the U.S. Congress passed, and the President signed, the *2002 Supplemental Appropriations Act for Further Recovery from and Response to Terrorist Attacks on the United States* (Public Law No. 107-206). This law stipulated in part that, within 30 days of enactment, DOE must award a contract for the design, construction, and operation of a DUF_6 conversion plant at the Department's Paducah, Kentucky, and Portsmouth, Ohio, sites, and for the shipment of DUF_6 cylinders stored at ETTP to the Portsmouth site for conversion. This biological assessment (BA) has been prepared by DOE, pursuant to the National Environmental Policy Act of 1969 (NEPA) and the Endangered Species Act of 1974, to evaluate potential impacts to federally listed species from the construction and operation of a conversion facility at the DOE Paducah site.

2 PROPOSED ACTION

DOE proposes to construct and operate a conversion facility at the Paducah site for conversion of the DUF_6 inventory stored at the site. Figure 1 shows the Paducah site and vicinity. The conversion facility would convert DUF_6 into a stable chemical form, uranium oxide (U_3O_8) for beneficial use or disposal. The off-gas from the conversion process would yield hydrofluoric acid (HF), which would be processed and marketed or converted to a solid for sale or disposal. To support the conversion operations, the emptied DUF_6 cylinders would be stored, handled, and processed for disposal. The time period considered is a construction period of approximately 2 years, an operational period of 25 years, and the decontamination and decommissioning of the facility. Current plans call for the construction to begin in the summer of 2004.

The Paducah facility is being designed to convert 20,000 tons (18,000 metric tons [t]) of DUF_6 per year, requiring 25 years to convert the Paducah inventory. The conversion facility would occupy a total of approximately 10 acres (4 ha), with up to 45 acres (18 ha) of land disturbed. Some of the disturbed areas would be areas cleared for railroad or utility access, not adjacent to the construction area.

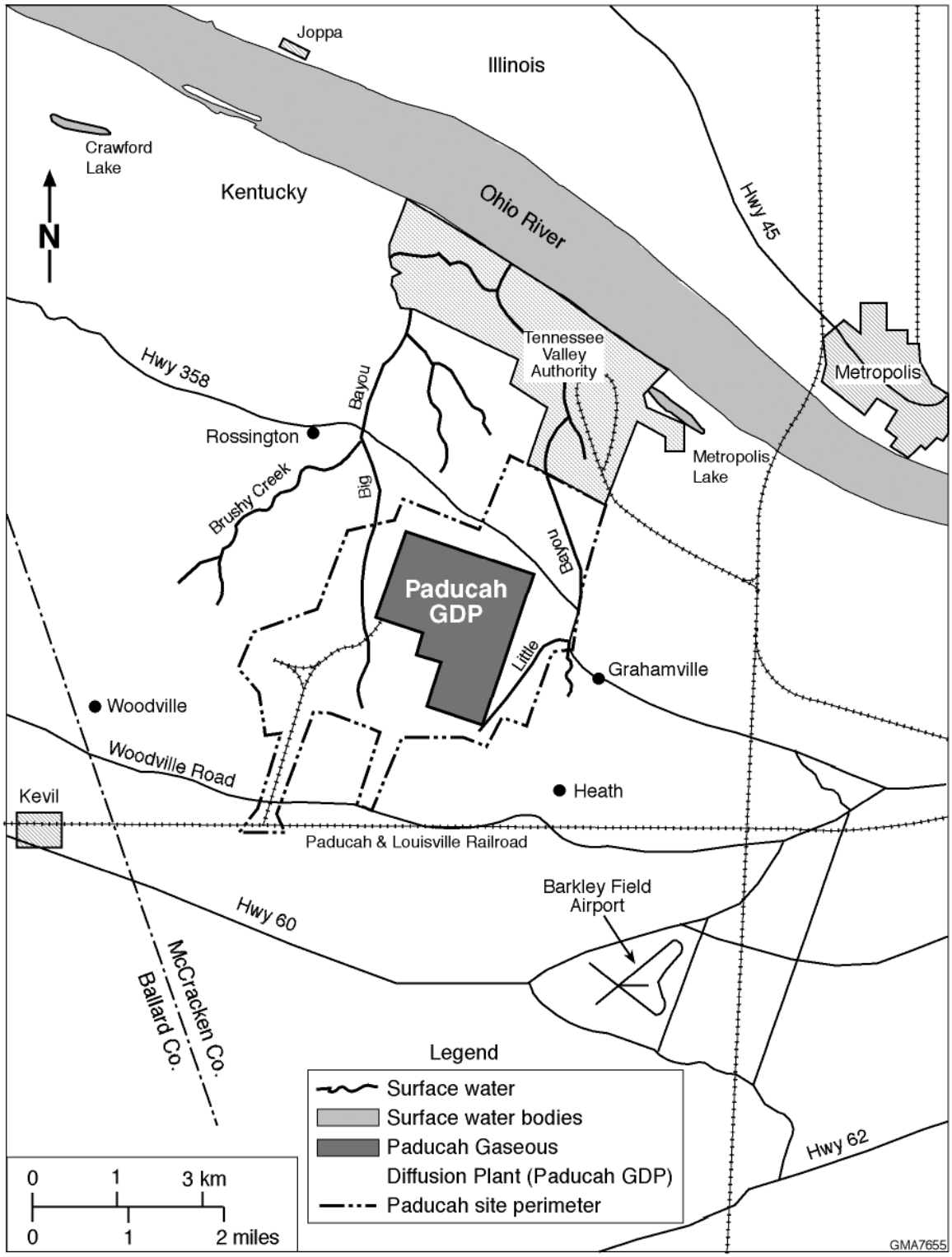

FIGURE 1 Regional Map of the Paducah Site Vicinity (Source: Adapted from Lockheed Martin Energy Systems, Inc. [LMES] 1996)

This BA evaluates the construction and operation of the conversion facility at one primary location within the Paducah site and two alternative locations. The three candidate locations identified at the Paducah site, denoted Locations A, B, and C, are shown in Figure 2. Location A is the preferred location for the conversion facility and is shown in more detail in Figure 3. This BA evaluates the proposed action at Location A as the base case analysis. Locations B and C are evaluated as alternative locations for the conversion facility within the Paducah site.

2.1 DESCRIPTION OF THE ACTION AREA

The Paducah site is located in rural McCracken County, Kentucky, approximately 10 mi (16 km) west of the city of Paducah and 3.6 mi (6 km) south of the Ohio River. The Paducah site consists of 3,556 acres (1,439 ha) currently held by DOE (DOE 2001). The site is surrounded by the West Kentucky Wildlife Management Area, which comprises an additional 2,781 acres (1,125 ha) conveyed by DOE to the Commonwealth of Kentucky for use in wildlife conservation and for recreational purposes. The counties surrounding the site are primarily rural, with industrial uses accounting for less than 5% of land use.

The Paducah Gaseous Diffusion Plant (GDP) occupies a 750-acre (303-ha) complex within the Paducah site and is surrounded by a security fence. The Paducah GDP, previously operated by DOE and now operated by the United States Enrichment Corporation (USEC), includes about 115 buildings with a combined floor space of approximately 8.2 million ft^2 (0.76 million m^2). The Paducah GDP has operated since 1955.

The Paducah site has 15 yards, 12 of which store cylinders of DOE-managed DUF_6. The yards store a total of 36,191 DUF_6 cylinders. Nine of the Paducah storage yards have gravel bases. One yard is located on a former building foundation, three yards were recently constructed with concrete bases, while two other cylinder yards have been rebuilt with concrete bases.

The highly developed Paducah GDP has few natural vegetation communities. The DOE property between the Paducah GDP and the surrounding West Kentucky Wildlife Management Area consists primarily of open, frequently mowed grassy areas. The DOE property also includes several small upland areas of mature forest, old-field, and transitional habitats. The banks of Big and Little Bayou Creeks support mature riparian forest with river birch, black willow, and cottonwood (ANL 1991). The West Kentucky Wildlife Management Area contains wooded areas, from early and mid-successional stages to mature forest communities, as well as restored prairie. Nonforested areas are managed by controlled burns, mowing, and planting to promote the development of native prairie species.

Location A (Figure 2) is approximately 35 acres (14 ha) in size and includes previously disturbed and undisturbed areas. The northern portion of Location A is relatively level and previously contained facilities during the initial construction of the Paducah GDP. This portion now supports an open vegetation cover of grasses maintained as mowed lawn. The southern portion of Location A is relatively undisturbed and primarily supports a mature deciduous

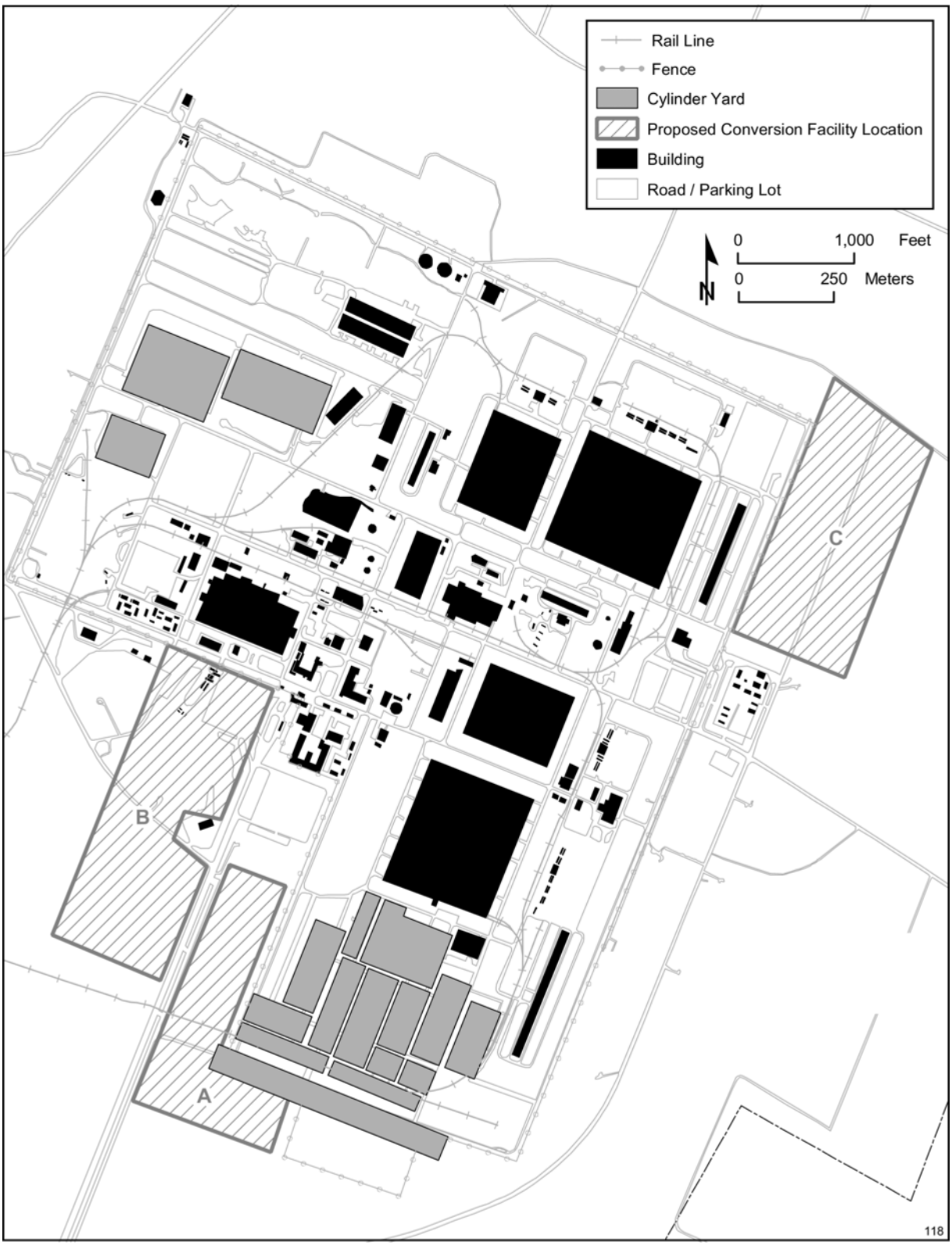

FIGURE 2 Locations of Conversion Facility Candidates and Cylinder Yards at the Paducah Site That Are Used to Store DOE-Managed Cylinders (Source: Adapted from DOE 1999a)

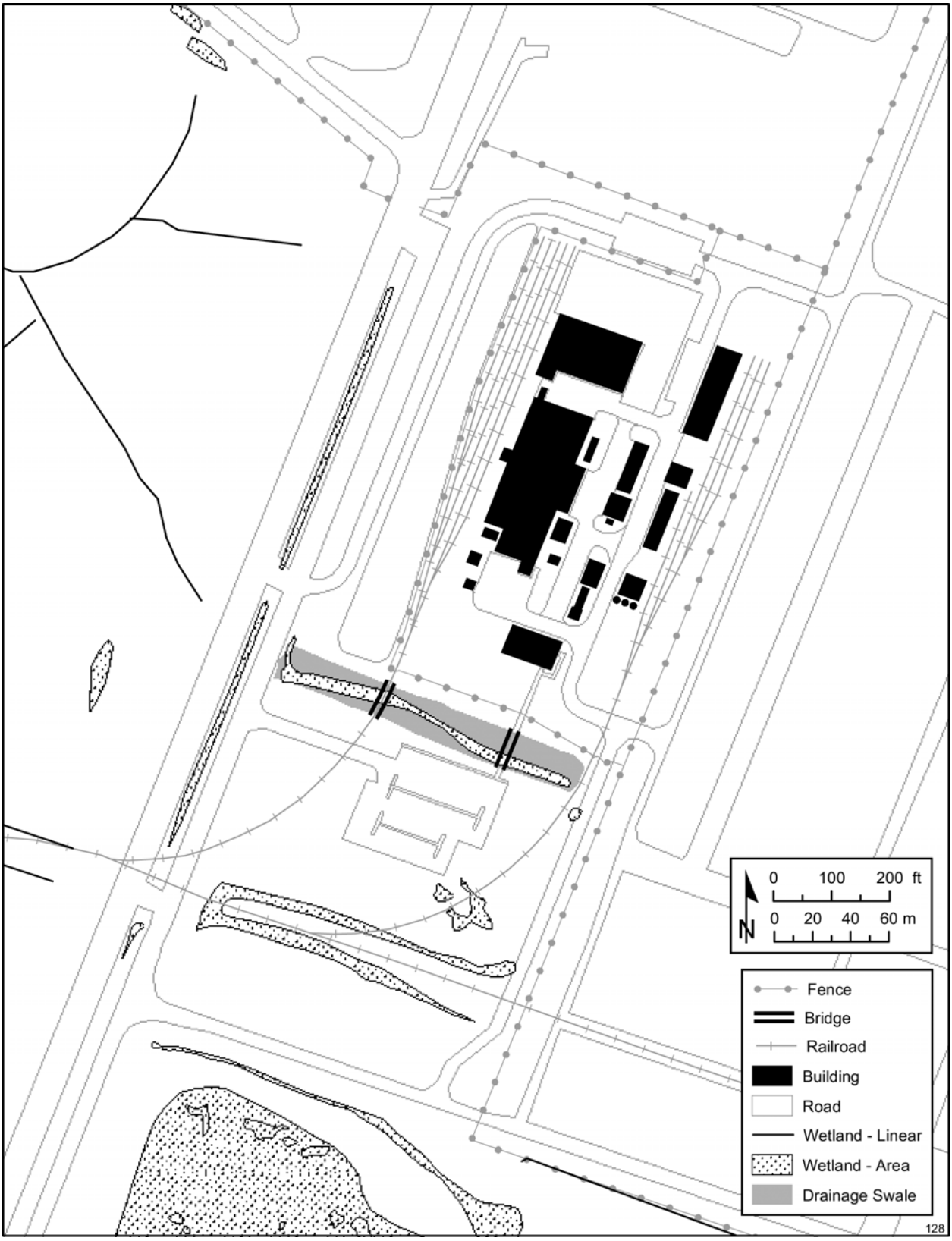

FIGURE 3 Proposed Facility Design at Location A

hardwood forest community of about 10 acres (4 ha). The dominant species in the forested area are red maple, sweet gum, cherry bark oak, and pin oak; swamp chestnut oak, swamp white oak, and hickories are also present (Pennington 2001). Saplings of red maple, American elm, green ash, white ash, and sweet gum are the primary species of the shrub layer. Vines are primarily Virginia creeper and poison ivy, while the dominant species of the herbaceous layer are stiff marsh bedstraw, blunt broom sedge, narrow-leaved cat tail sedge, Japanese chess, swamp rose, and water parsnip. A grassland community lies immediately south of the forested area within the electric power line right-of-way. A small area of shrubs is located adjacent to the forest and extends into the grassland.

Location B (Figure 2) covers about 59 acres (24 ha) and consists of a previously disturbed open area in its northern half and mature deciduous hardwood forest in its southern half. The northern portion of Location B (north of Curlee Road), as well as the northeastern area of the southern portion, is flat to gently sloping and is vegetated primarily with grasses maintained as mowed lawn. Two open woodland groves occur in the northern portion and are also mowed. A number of drainage channels within the northern portion are bordered by steep banks supporting a mosaic of upland herbaceous and immature woodland communities, which include willows, maples, sycamore, sweet gum, tulip tree, milkweed, dogbane, poison ivy, and fleabane. A large mature deciduous hardwood forest is located in the southern portion of Location B, south of Curlee Road, and it extends south and west of Location B. Dominant species in the forested area are oaks and hickories, with sassafrass and sweet gum also common. Virginia creeper and honeysuckle are common vines within the forested area.

Location C (Figure 2) is approximately 53 acres (21 ha) in size and is relatively level throughout. The western half has been previously disturbed and now supports a deciduous hardwood forest that includes many young trees and saplings. The dominant species are oaks and hickories. The western margin of this area is located under electric power lines and consists of an open grassland area that is periodically mowed. A margin of shrubs and saplings borders the western edge of the forested area. The eastern half of Location C consists primarily of an open old-field community with scattered groves of mature deciduous trees, primarily oaks. The vegetation of the open field is predominantly herbaceous and consists primarily of grasses such as fescue and broom-sedge.

2.2 LISTED SPECIES IN THE ACTION AREA

The U.S. Fish and Wildlife Service (USFWS) provided information regarding federally listed endangered or threatened species that may occur in the vicinity of the Paducah site (Barclay 2002). The USFWS indicated that the site lies within the range of the Indiana bat (*Myotis sodalis*), federally listed as endangered.

The Indiana bat was federally listed as an endangered species on March 11, 1967 (USFWS 1967). The Indiana bat is also listed as an endangered species by the Commonwealth of Kentucky. Critical habitat, consisting of 11 caves and 2 mines in 6 states that are used as winter hibernacula, was designated in 1976. The USFWS published a recovery plan for the Indiana bat in 1983, and a draft revised recovery plan in 1999 (USFWS 1999). The current range of the

Indiana bat includes 23 states, covering most of the eastern half of the United States. The total population size, based on 1995 to 1997 surveys, is estimated at about 353,000. The largest winter hibernation populations occur in Indiana, Kentucky, and Missouri, comprising more than 85% of the total population. Half of all hibernating Indiana bats occur in Indiana (USFWS 1999).

The Indiana bat is a small to medium-sized bat, approximately 1.6 to 1.9 in. (41 to 49 mm) in length, and 0.2 to 0.4 oz. (5 to 11 g) in weight (USFWS 1999; BCI 2001). The fur is a dull grayish chestnut brown on the back and somewhat lighter on the chest and belly. The Indiana bat is a migratory species, overwintering in hibernacula and dispersing to summer roosting areas in spring.

Hibernacula consist mostly of large caves, but also include abandoned mines, and they are principally located in areas of limestone karst. Relatively few sites provide the conditions required by Indiana bats for hibernation; thus, suitable hibernacula often support large numbers of Indiana bats. Suitable sites maintain a stable low temperature during winter, ideally between 37º and 43°F (3° and 6°C). Indiana bats emerge from hibernation in late March and April and migrate to summer roosting areas, where they arrive in mid-April or May (BCI 2001). In August, Indiana bats slowly begin the return migration to hibernacula, which may be 300 mi (500 km) or more from summer roosting areas, and enter hibernation in late September and October. Individual bats generally return to the same hibernaculum each year (USFWS 1999; BCI 2001).

During summer, males generally roost singly or in small groups throughout the range of the species. Females form maternity colonies of about 25 to 50 individuals, but may include as many as 100 individuals. Female Indiana bats return to the same summer roosting areas each year. Collection data suggest that many female Indiana bats may migrate north in the spring. Woodlands in the glaciated Midwest may have a higher density of maternity colonies compared with the other portions of the species' range, although further studies are needed to confirm this (USFWS 1999).

Indiana bats typically roost beneath the bark of large dead or dying trees with loose exfoliating bark, or live trees with loose bark, such as shagbark hickory. Cavities and crevices in trees may also be used. A variety of roost trees are needed within the traditional summer range of a maternity colony. A maternity site generally contains one or more primary roost trees (used by a majority of the bats throughout the summer), with a number of alternate roost trees (used intermittently and by fewer bats) generally located nearby. Optimal maternity roost trees are over 16 in. (40 cm) in diameter at breast height. Individual bats within the maternity colony move among roost trees during a season, and from year to year if a roost tree becomes unavailable. Roost trees may be lost or become unsuitable, for example, because of loss of bark. Most roost trees may be usable for only 2 to 8 years (USFWS 2002).

Roost trees are generally located in riparian forest, bottomland floodplain forest, and upland forest. Primary roosts are typically located at forest edges and in openings, or in forested areas with open canopies and open understories, and receive direct solar exposure (USFWS 1999). Alternate roosts may be located in forest interiors or in the open. Roost trees may be occupied by maternity colonies from mid-April to mid-September (USFWS 2002).

Indiana bats forage between dusk and dawn on flying insects. They forage in and around the tree canopy and use a variety of habitats for foraging, primarily riparian forest and floodplain forest (such as forested stream corridors and impounded water bodies), but also use upland forest, forest edges, old-fields, and pastures with scattered trees. Foraging areas used by pregnant and lactating females are generally within 1.5 mi (2.5 km) of their roost (USFWS 1999).

Indiana bat population declines have primarily been associated with disturbances to hibernacula. Human disturbances causing bat mortality have included arousal during hibernation, which reduces limited fat reserves, and vandalism. The construction of gates at cave entrances, thereby excluding bats or causing disruptions in cave air flow that result in temperature changes, has also resulted in population declines. In addition, flooding of hibernacula, ceiling collapse, or unusually cold winter temperatures have resulted in losses of Indiana bats. Population declines may also possibly result from the loss or degradation of summer roosting or foraging habitat, or exposure to pesticides, through consumption of prey or foraging in recently sprayed areas, although further study of these factors is needed (USFWS 1999).

The Indiana bat has been found near the confluence of Bayou Creek and the Ohio River, 3 mi (5 km) north of the Paducah GDP. Extensive floodplain forests occur along that portion of the Ohio River. A 1994 study of the Paducah site indicated that potential roosting habitat for this species occurs on the Paducah site outside the GDP and in adjacent wooded areas of the West Kentucky Wildlife Management Area (U.S. Department of the Army 1994) (Figure 4). Areas considered good-quality habitat contained large trees, provided a dense canopy cover, and were located within 0.25 mi (0.4 km) of potential foraging areas along water bodies. Poor-quality habitat contained less mature trees, provided minimal amounts of canopy cover, and was greater than 0.25 mi (0.4 km) from potential foraging areas. Fair-quality habitat met some of the requirements for good-quality habitat. Areas within 1,640 ft (500 m) of paved roads were not considered potential Indiana bat habitat (U.S. Department of the Army 1994).

Large areas of good-quality and fair-quality Indiana bat habitat occur along the Ohio River north of the Paducah site. Potential habitat for the Indiana bat has not been identified at any of the conversion facility candidate locations (see Figure 4). The mature forest areas of Location B, near Bayou Creek, may provide good-quality summer roosting sites; however, their proximity to roads reduces their suitability. Trees in other wooded areas of the locations may have the potential to be used by Indiana bats; however, their proximity to roads, their distance from foraging areas, and the presence of higher-quality habitat in the vicinity reduce their potential for being used. The nearest potential Indiana bat habitat is west of Bayou Creek, about 0.15 mi (0.24 km) from Location B and 0.35 mi (0.56 km) from Location A. However, it is rated as having poor potential habitat quality. Another area slightly farther south is rated as having fair potential habitat quality (U.S. Department of the Army 1994).

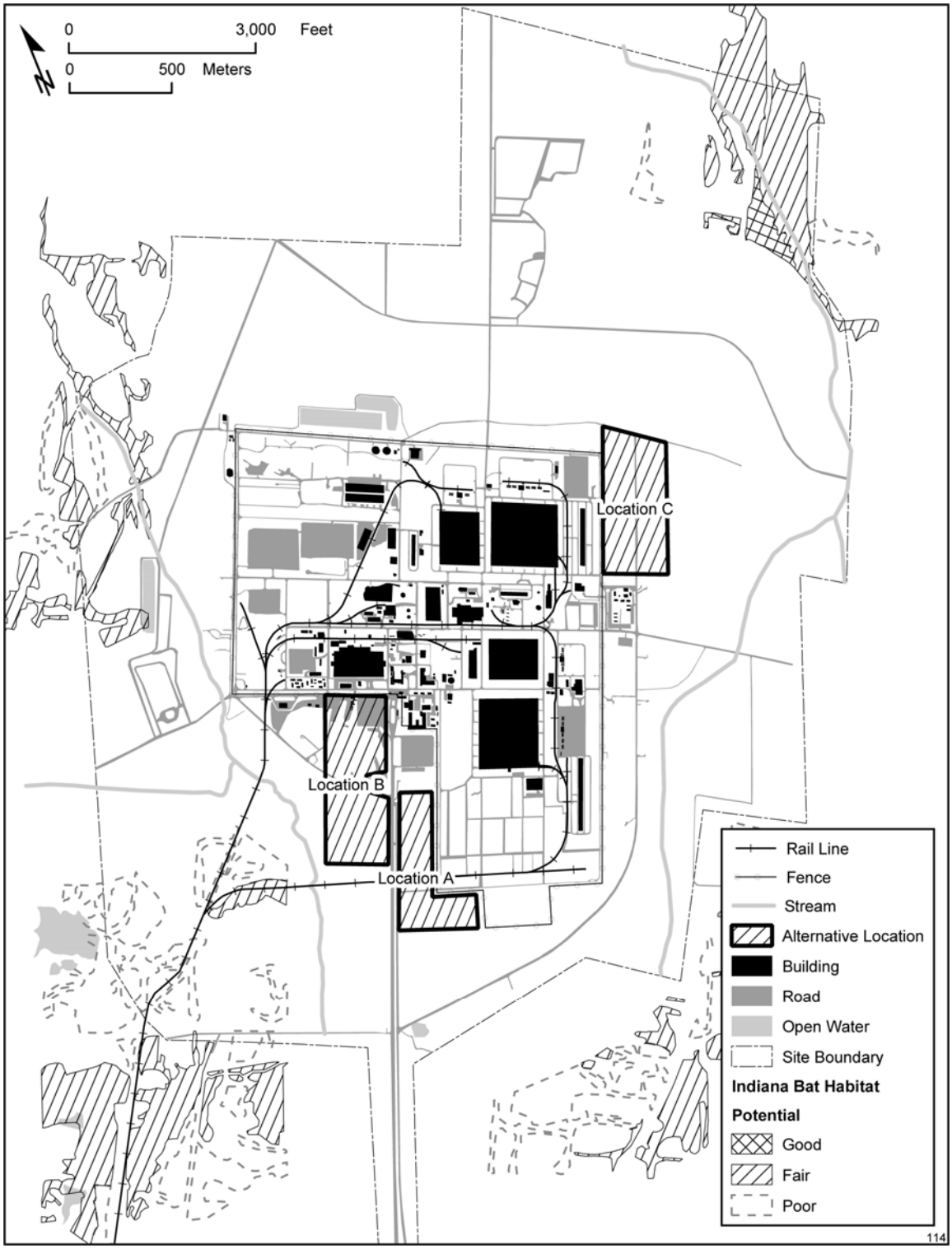

FIGURE 4 Areas of Potential Indiana Bat Habitat (Source: U.S. Department of the Army 1994)

2.3 EFFECTS OF THE PROPOSED ACTION ON LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

Construction of a conversion facility at Location A, the preferred location, would occur in the northern portion of the location and would result in the loss of approximately 10 acres (4 ha) of previously disturbed managed grassland vegetation that is maintained by frequent mowing. The facility would not replace undisturbed natural communities.

Construction of a conversion facility at Location A is not expected to directly or indirectly impact the Indiana bat. Trees are not expected to be removed at Location A during facility construction, and disturbance to the deciduous forest in the southern portion of the location is not expected. The total area of construction-related disturbance, however, would be approximately 45 acres (18 ha). If temporary construction areas, such as lay-down areas, were positioned outside Location A in adjacent, previously disturbed areas, impacts to the wooded area at this location would be avoided during the construction period.

The construction of utility lines and rail lines would extend beyond Location A. Construction of rail lines west of Location A would affect previously disturbed areas supporting both managed grassland and scrub-shrub communities within the existing railroad bed. Trees at the margin of mature deciduous forest adjacent to the railroad bed could be affected by the construction of the new rail line if construction-related activities occur beyond the railroad bed; however, removal of trees during construction is not expected to be necessary. If trees (either live or dead) with exfoliating bark were encountered in areas of disturbance, they should be saved if possible. If necessary, the trees should be cut before April 15 or after September 15 to avoid the period when they might be used by Indiana bats.

Although construction of the conversion facility or new rail lines in Location A could potentially disturb wildlife that may use the forested area in the southern portion of that location, the forested area at Location A has not been identified as potential summer habitat for the Indiana bat. Construction of rail lines adjacent to the mature deciduous forest habitats west of Entrance Highway could also potentially disturb wildlife that may use that area. In addition to trees east of Bayou Creek that may possibly be used by Indiana bats (such as in or near Location B), portions of the forested area west of the creek are identified as potentially fair-quality Indiana bat habitat (Figure 4), with additional areas identified as potential poor-quality habitat. However, Indiana bats using habitat near the Paducah site would be currently exposed to noise and other effects of human disturbance. In addition, Indiana bats have been observed to tolerate increased noise levels from human activities (a summer roosting habitat occupied by an Indiana bat maternity colony is located near Indianapolis International Airport and an interstate highway) (USFWS 2002). Consequently, construction activities would be unlikely to cause Indiana bats to avoid these areas.

The specific vegetation communities impacted by construction at Location B would depend on the placement of the facility within the available area. Placement of the facility at the northern end of Location B would primarily result in impacts to areas that are predominantly already disturbed and support managed grassland vegetation. Impacts to the forested area and tree groves at Location B could potentially occur but could likely be avoided. The construction

of a conversion facility in the southern portion of Location B, however, could result in the removal of trees potentially used by Indiana bats. Construction in the southern part of Location B could also potentially disturb wildlife present in adjacent forested areas. However, Indiana bats using habitats near the Paducah site are currently exposed to noise and other effects of human disturbance.

The specific vegetation communities impacted by construction at Location C would also depend on the placement of the facility within the available area. Placement of the facility in the western portion of this location (west of Dyke Road) would primarily impact a previously disturbed immature deciduous forest community. Facility placement in the eastern portion of Location C would primarily impact an open old-field grassland community, with likely impacts to the small groves of mature trees in this area. Impacts to either the forested area or tree groves at Location C could result in the removal of trees potentially used by Indiana bats; however, these areas have not been identified as suitable Indiana bat summer habitat.

Direct impacts to the Indiana bat during operation of a conversion facility at Location A are not expected. Increased noise, lighting, and human presence due to facility operation, and the movement of railcars along the new rail line south of the facility may potentially disturb wildlife; however, the wooded area at Location A has not been identified as suitable summer roosting habitat for the Indiana bat.

Indiana bats have been observed to tolerate increased noise levels (USFWS 2002). In addition, Indiana bats that may be using habitats near the Paducah site are currently exposed to noise and other effects of human disturbance due to operation of the site, including vehicle traffic. Consequently, disturbance related to conversion facility operation would be unlikely to result in avoidance of these areas by Indiana bats. Similarly, noise from railcar movement along the new rail line west of the Entrance Highway would not be expected to result in loss of suitability of these habitat areas.

The operation of a conversion facility at Locations B and C may also potentially disturb wildlife using wooded areas at those locations; however, these habitats have not been identified as suitable Indiana bat habitat. Effects of disturbance would be similar to those at Location A.

During operations, atmospheric emissions from the facility stacks would occur, but these emissions levels would be extremely low. Facility emissions would include trace amounts of uranium. The highest average air concentration of uranium compounds would result in a radiation exposure to the general public (nearly 100% due to inhalation) of 3.9×10^{-5} mrem/yr, well below the DOE guideline of 100 mrem/yr (0.00027 rad/d). Wildlife species are less sensitive to radiation than humans. (DOE guidelines require an absorbed dose limit to terrestrial animals of less than 40,000 mrem/yr [0.1 rad/d] [DOE 2002].) Therefore, impacts to wildlife from radiation are expected to be negligible. Toxic effect levels of chronic inhalation of uranium are many orders of magnitude greater than expected emissions from the conversion facility. Therefore, toxic effects on wildlife, including the Indiana bat, resulting from inhalation of uranium compounds are also expected to be negligible.

The maximum annual average air concentration of HF due to operation of a conversion facility would be 0.004 $\mu g/m^3$. Toxic effect levels of chronic inhalation of HF are many orders of magnitude greater than these expected emissions. Thus, toxic effects to wildlife, including the Indiana bat, from HF emissions would be expected to be negligible.

The cumulative impacts to Indiana bats should be negligible for any alternative considered in this EIS in conjunction with the effects of other activities. Construction of a conversion facility at Location B could potentially result in the removal of trees, and construction at Location C would likely require removal of trees. Natural areas within the West Kentucky Wildlife Management Area surrounding the Paducah site are managed for wildlife habitat, and impacts to potential Indiana bat habitat from other actions in the vicinity of the Paducah site are not anticipated.

3 CONCLUSION

The Indiana bat has been found near the confluence of Bayou Creek and the Ohio River, 3 mi (5 km) north of the Paducah GDP. A 1994 study of the Paducah site indicated that potential roosting habitat for this species occurs on the site outside the GDP and in adjacent wooded areas. Potential habitat was classified as good-, fair-, and poor-quality. Large areas of good- and fair-quality Indiana bat habitat occur in floodplain forests along the Ohio River north of the Paducah site. Potential habitat for the Indiana bat has not been identified at any of the conversion facility candidate locations, although fair- and poor-quality potential habitat are located west and southwest of Locations A and B. Although all three locations contain wooded areas, Indiana bats would be unlikely to use these areas because of the presence of good-quality habitat elsewhere in the vicinity. Facility construction at Location A would not be expected to result in the removal of trees, and avoidance of trees at Location B would likely be possible. Construction at Location C would be expected to require the removal of trees, within either immature deciduous forest or scattered small groves of mature trees; however, these areas have not been identified as suitable Indiana bat summer habitat. If trees (either live or dead) with exfoliating bark were encountered in areas of disturbance, they should be saved if possible. If necessary, the trees should be cut before April 15 or after September 15 to avoid the period when they might be used by Indiana bats. Disturbance of Indiana bats potentially roosting or foraging in the vicinity of the facility during operations would be very unlikely, and any disturbance would be expected to be negligible. On the basis of these considerations, DOE concludes that the proposed action is not likely to adversely affect the Indiana bat. No critical habitat exists for this species in the action area.

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