Table 4-51. Maximum ground-level concentrations of nonradiological air constituents at the Savannah River Site boundary under the Shut Down and Deactivate Alternative.

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Nonradiological constituent	Modeled maximum air concentration[a] ($\mu g/m^3$)	Maximum allowable concentration[b] ($\mu g/m^3$)
Antimony	8.6×10^{-6}	2.5
Arsenic	2.2×10^{-5}	1.0
Beryllium	2.9×10^{-6}	0.01
Cadmium	1.3×10^{-6}	0.25
Lead	1.8×10^{-5}	1.5 (calendar quarter average)
Manganese	2.6×10^{-6}	25
Mercury	1.2×10^{-6}	0.25
PM_{10}[c]	16	50 (annual average) 150 (24-hour average)

a. DOE assumed 30 disturbances per month (i.e., once per day) of the lakebed so that the calculated air concentration is an upper bound of the concentration over any time period (e.g., week, month, year).
b. Source: SCDHEC (1976).
c. PM_{10} is particulate matter with a diameter of 10 microns (0.00001 m) or less.

TC

Table 4-52 lists the maximum concentration in air of the radiological constituents at the boundary of the SRS. A column also is included in the table that shows the radiation dose resulting from annual exposure to this concentration of material. This radiation dose was calculated for all potential exposure pathways (e.g., ingestion of vegetation, direct exposure to radiation) that are the result of material being suspended and transported to the site boundary. These doses are much less than the 10 millirem per year requirement in 40 CFR 61.

A benefit to the environment would be the reduction of fugitive evaporative tritium emissions from the L-Lake surface water. The maximum calculated reduction in airborne tritium concentration would be 0.073 picocurie per cubic meter.

The combined effects of the shutdown and deactivation of the River Water System would have minimal impact on the ambient air quality at SRS.

4.3.4.3.3 Shut Down and Maintain

The combined effects of this alternative would be the same as those described in Section 4.3.4.3.2. Increases in concentrations of PM_{10}, air toxics, and radionuclides would be within both State and Federal regulatory guidelines.

4.3.5 ECOLOGY

The *Environmental Assessment for the Natural Fluctuation of Water Level in Par Pond and Reduced Water Flow in Steel Creek below L-Lake at the Savannah River Site* (DOE 1995a) describes the impacts of the 1991-1995 drawdown of Par Pond and the expected impacts of allowing the surface water level of Par Pond to fluctuate naturally from a full pool of approximately 200 feet (61 meters) to 195 feet (59.4 meters). The alternatives considered in this EIS would allow Par Pond to fluctuate naturally. They differ only to the extent that DOE would maintain the operability of the River Water System. The actions considered in this EIS, in relation to Par Pond, have undergone a thorough NEPA review.

Table 4-52. Maximum ground-level concentrations of radiological air constituents at the SRS boundary under the Shut Down and Deactivate Alternative.

Radiological constituent	Modeled maximum air concentration[a] (pCi/m^3)	Dose from all pathways (mrem/yr)
cesium-137	1.6×10^{-4}	6.5×10^{-3}
cobalt-60	6.1×10^{-7}	1.0×10^{-5}
plutonium-239	3.7×10^{-8}	3.5×10^{-5}
promethium-146	7.9×10^{-9}	9.5×10^{-9}
uranium-233	9.6×10^{-7}	9.3×10^{-5}
thorium-229	4.5×10^{-9}	4.7×10^{-6}
radium-225	4.5×10^{-9}	1.8×10^{-7}
actinium-225	4.5×10^{-9}	3.0×10^{-8}

a. *DOE assumed 30 disturbances per month (i.e., once per day) of the lakebed so that the calculated air concentration is an upper bound of the concentration over any time period (e.g., week, month, year).*

TC

4.3.5.1 Affected Environment

4.3.5.1.1 Terrestrial Ecology

Gibbons and Semlitsch (1991) provide information on the distribution and abundance of SRS amphibians and reptiles, including those occurring in the Par Pond area. Wike et al. (1994) *contains useful information on the birds of the* SRS, with special emphasis on waterfowl and threatened and endangered species (the red-cockaded woodpecker, bald eagle, and wood stork). Section 4.3.5.3 of this EIS describes these threatened and endangered species and their relative abundance and distribution on the SRS. Cothran et al. (1991) contains information on SRS mammals, including those of the Par Pond system. Gibbons et al. (1986) presents useful information on the distribution and abundance of semiaquatic mammals (e.g., the muskrat and beaver) in the Par Pond area.

A number of researchers (Brisbin, Geiger, and Smith 1973; Kennamer, McCreedy, and Brisbin 1993; Colwell, Kennamer, and Brisbin 1995; Peters, *Brisbin, and Kennamer 1995)* have investigated patterns of radiocesium contamination in Par Pond and Pond B and evaluated the uptake and retention of cesium-137 in birds [wood ducks (*Aix sponsa*), coots (*Fulica americana*), mourning doves (*Zenaida macroura*), and domestic chickens (*Gallus gallus*)] foraging and nesting in the Par Pond area. These studies concluded that while the birds' bodies often contained elevated levels of cesium-137, these levels are "...below those expected to affect hatchability or any other aspect of the breeding biology of these birds" (Kennamer, McCreedy, and Brisbin 1993) and "...do not indicate any present health hazard to the general public who may use them for food" (Brisbin, Geiger, and Smith 1973). Moreover, these species (all of which, except the chicken, are migratory) rapidly lose accumulated radiocesium when they move to uncontaminated areas due to their small body sizes and high basal metabolic rates. Total elimination time of a given body burden of cesium-137 *may be as little as* 12 *to* 15 *days in the* mourning dove and 30 days in the larger wood duck (Kennamer et al. 1997).

L7-04 L7-05

Burger et al. (1996) examined concentrations of metals (mercury, lead, cadmium, selenium, manganese, and chromium) in tissues of mourning doves that foraged on herbaceous vegetation growing in the Par Pond lakebed in

L7-04 L7-05

1992 and 1993. Doves from Par Pond had significantly higher levels of selenium and manganese in muscle tissue than doves from control sites outside SRS. For all metals, however, L7-04 concentrations in doves from Par Pond and L7-05 control sites were generally within the lower range of those reported in the literature, suggesting that those metals do not pose a health problem to the doves or to animals (including humans) who might consume them.

Aerial surveys of the Par Pond system conducted from 1981 to 1985 revealed that 20 waterfowl species spent some portion of the fall-winter period in the Par Pond system (Wike et al. 1994). Over the 4-year period, waterfowl use of the Par Pond system increased, while midwinter numbers declined in South Carolina and the Atlantic flyway. Lesser scaup (*Aytha affinis*) were most numerous, followed by ring-necked ducks (*A. Collaris*), ruddy ducks (*Oxyura jamaicensis*), and buffleheads (*Bucephala albeola*). Three of the four species showed a preference for areas unaffected by reactor operations, while ruddy ducks were frequently observed in areas receiving heated effluent from P-Reactor. Recent surveys conducted by Savannah River Ecology Laboratory scientists suggest that waterfowl use of Par Pond has remained high.

The drawdown of Par Pond decimated many beds of mussels and clams that were stranded when the reservoir waters receded (DOE 1995a). Although many freshwater mollusks can survive for several months by burrowing in mud or moist soils (Pennak 1978), they cannot survive longer periods out of water, from which they derive food and oxygen. The loss of mussels and clams resulted in reduced use of Par Pond by waterfowl in the winter of 1991-1992 (DOE 1995a). Several duck species that traditionally winter on Par Pond (e.g., ring-necked ducks and bufflehead) feed on plant material and mollusks in areas where emergent vegetation is growing, particularly when preferred plant foods (such as wild celery, smartweed, widgeon grass, waterlily, buttonbush, and pondweed) are not abundant (Sprunt and Chamberlain 1970; Hoppe, Smith, and Wester 1986). Other species, such as lesser scaup and ruddy ducks, feed on small invertebrates (snails, clams, and mussels) in deeper Par Pond waters (Hoppe, Smith, and Wester 1986; Bergan and Smith 1989).

The drawdown appeared to have little lasting effect on adult alligators, but the loss of cover appeared to have reduced alligator nesting success and juvenile survival. The drawdown had no noticeable effect on bald eagle use of Par Pond. As in years past, Par Pond was used extensively by foraging and roosting bald eagles. The rapid drawdown of Par Pond in 1991 stranded fish in shallow pools, making them easy prey for wading birds, including the endangered wood stork. As a result, there was a marked increase in the number of wood storks foraging around the margins of Par Pond (DOE 1995a). Surveys of Par Pond in 1992, 1993, 1994, and 1995 indicated that wood stork use of Par Pond had returned to normal, with storks observed occasionally foraging in the area.

4.3.5.1.2 Aquatic Ecology

The aquatic ecology of Par Pond was studied intensively from January 1984 through June 1985 as part of a Clean Water Act Section 316(a) thermal effects demonstration. It supported a diverse phytoplankton community; green algae had the most taxonomic representation, followed by the diatoms and blue-green algae (Chimney, Cody, and Starkel 1985). In terms of density, diatoms were the most abundant algal group. In terms of primary productivity, chlorophyll-*a* concentrations, and algal community composition, Par Pond was similar to other lakes in the southeastern United States.

Protozoans and rotifers were the numerical dominants of the zooplankton community, with protozoans more abundant in the winter and spring, and rotifers in the summer (Chimney, Cody, and Starkel 1985). Larger-bodied cladocerans and copepods were most abundant in the summer, indicating a lack of strong pressure from fish predation. As with the phytoplankton, the zooplankton community in Par Pond was similar to other southeastern systems.

Par Pond received additional zooplankton study as part of the last 3 years (1990 through 1992) of the Clean Water Act Section 316(a) thermal effects demonstration for L-Lake (Gladden et al. 1989; Bowen 1993a). It is difficult to infer changes in the Par Pond community between 1985 and 1990 from the presentation of data in Bowen (1993a), but protozoan densities varied widely from 1990 to 1992; they were often similar and sometimes higher than the protozoan densities in L-Lake.

Fish populations were temporarily affected by the Par Pond drawdown, which reduced spawning and nursery habitat for many species and increased predation on small forage species [e.g., brook silverside (*Labidesthes sicculus*), golden shiner (*Notemigonus crysoleucas*), and *Notropis* species] and young-of-the-year sunfish that use littoral zone macrophyte beds for escape cover.

4.3.5.1.3 Wetlands Ecology

The creation of Par Pond in 1958 flooded several thousand acres (several square kilometers) of upland habitat and riparian wetlands. Stable water levels in Par Pond during the first 33 years of its existence (1958 to 1991) allowed wetland vegetation communities to develop along the shore. However, extensive beds of macrophytes along the shoreline did not develop until the mid-1970s (Wike et al. 1994). These beds essentially stabilized by the early 1980s. A study of wetland vegetation at Par Pond in the mid-1980s characterized the wetlands of Par Pond as comprised of three classes: aquatic bed L11-19
(floating-leaves species), emergent (herbs, mosses, and ferns), and scrub-shrub (shrubs and trees). Most of the wetland communities around the lake represented moderately late-successional stages (i.e., mature vegetation communities) with low species diversity. Most areas were dominated by only a few species of perennial plants, with few annual species. Aquatic bed regions were dominated by lotus (*Nelumbo lutea*), waterlily (*Nymphaea odorata*), and watershield (*Brasenia schreberi*); emergent wetlands were dominated by cattail (*Typha* spp.) and maidencane (*Panicum hemitomon*); and the scrub-shrub areas were dominated by willows (*Salix* spp.), sweet gale (*Myrica* spp.), and maples (*Acer* spp.) (Grace 1985).

In March 1991 DOE discovered a depression on the downstream slope of the Par Pond dam (Cold Dam). While determining whether repairs were needed, DOE lowered the lake level approximately 19 feet (5.8 meters) for safety reasons. As a result, both the emergent and nonemergent littoral wetland vegetation were exposed to drying conditions, and extensive macrophyte losses occurred. Surveys conducted in August 1992 indicated that some reinvasion was occurring on the newly exposed shoreline. For the most part, grasses, sedges, and rushes were the dominant forms, and some old-field species had also taken root (Wike et al. 1994).

Par Pond was restored to full pool in spring 1995, and has remained at full pool since refill, fluctuating only slightly. Periodic surveys of the shoreline aquatic communities have been conducted since the reservoir was refilled. Shoreline aquatic vegetation is undergoing rapid redevelopment. Maidencane, the current dominant emergent species, has become less abundant in deeper water since the water level rose. Several other species that dominated wetland areas of Par Pond before the drawdown are increasing in abundance, including lotus, waterlily, watershield, and spike rush (*Eleocharis equisetoides*). Cattails are also scattered throughout most of Par Pond, and long beds are forming in the Middle Arm. Lotus expanded in 1996 into areas formerly dominated by cattails. In addition, woody species, including loblolly pine (*Pinus taeda*), willow, and red maple, that colonized the reservoir's edge during the drawdown, are declining in abundance since the refill, although there is a band of willow and red maple around the margins of the lake (Mackey and Riley 1996).

4.3.5.2 Environmental Impacts

4.3.5.2.1 No Action

Terrestrial Ecology

The Par Pond environmental assessment (DOE 1995a) predicted that a "substantial and productive" aquatic macrophyte community would become established when Par Pond was allowed to fluctuate naturally; however, this new macrophyte community probably would be less extensive and less diverse, similar to macrophyte communities in other southeastern flood-control and hydroelectric power reservoirs with seasonal water level fluctuations. Instability in the littoral zone would result in reduced macroinvertebrate productivity, which in turn would reduce the value of the littoral zone as a foraging area for reptiles, waterfowl, shorebirds, and mammals.

The environmental assessment also predicted that the number of waterfowl using Par Pond would increase (in relation to the 1991-1995 drawdown period) if DOE allowed the lake to fluctuate naturally, but would be smaller than the numbers of birds that used the reservoir when the water was at full pool (199 to 200 feet above mean sea level). This predicted reduction in waterfowl use of Par Pond was based on the facts that (1) the reservoir would be smaller, providing proportionally less preferred shallow-water habitat; (2) the total acreage of aquatic macrophytes that provide waterfowl with food and cover would be smaller; and (3) the production of benthic organisms, including aquatic insect larvae and mollusks that are important foods for diving ducks, would be reduced by the instability of the littoral zone.

The environmental assessment suggested that fluctuating water levels would not be disruptive to normal movement and behavior of adult alligators, but the loss of shoreline stability and cover could affect reproductive success and juvenile survival. These impacts probably would lessen over the next several years as shoreline macrophyte communities become reestablished.

Fluctuating water levels would have little or no effect on bald eagles, although the environmental assessment noted that a slight increase in radiocesium and mercury intake could occur as a result of higher levels of contaminants in Par Pond ecological receptors (e.g., small mammals and fish) that are prey for eagles. There is no evidence that allowing Par Pond to fluctuate naturally would create conditions attractive to wood storks, because water level changes would be gradual, allowing most fish to move downslope with receding waters. As a result, wood storks would not be exposed to higher than normal concentrations of contaminants in water, sediments, and fish. Section 4.3.5.3 contains a comprehensive assessment of potential impacts to threatened and endangered species of shutting down the River Water System.

Aquatic Ecology

The environmental assessment (DOE 1995a) noted that Par Pond had received continuous infusions of nutrients for more than 30 years and predicted that a reduction in nutrient inputs would result in the development of aquatic communities (i.e., plankton and fish) that more closely resemble those of typical southeastern reservoirs that do not receive substantial nutrient inputs. The environmental assessment pointed out that a reduction in one nutrient, potassium, could lead to increased levels of cesium-137 in aquatic organisms. In the absence of potassium, aquatic organisms readily take up cesium, which cells accept as potassium because of its chemical similarity.

The environmental assessment predicted that fish populations would be reduced by fluctuating water levels and reduced nutrient inputs when pumping of river water was discontinued. Fluctuating water levels could hinder the reproduction of species (e.g., yellow perch and chain pickerel) that spawn in shallow, weedy areas, and would be particularly harmful if reservoir levels dropped precipitously during sensitive periods (e.g., soon after eggs are deposited in beds in shallow water).

Wetland Ecology

The No-Action Alternative would allow the water level in Par Pond to fluctuate naturally from a full pool of approximately 200 feet (61 meters) to 195 feet (59.4 meters) above mean sea level. This could expose as much as 340 acres (1.4 square kilometers) of sediment (DOE 1995a). However, the level is likely to remain at approximately 196 feet (59.7 meters) about 65 percent of the time, which would expose only about 115 acres (0.5 square kilometers) of sediment. Thus, some changes are likely to occur in contrast to the relatively stable and biologically productive nature of the ecosystem and littoral wetland areas that existed during the initial 33 years of Par Pond's existence. Specifically, a reduction of and instability in the littoral zone and related communities are likely to occur. The 1991 drawdown removed approximately 50 percent of the reservoir's surface area, much of which was shallow wetlands that provided habitat and foraging resources for a variety of fish and wildlife. Because impacts on the littoral-zone plant communities from natural fluctuation are not likely to be as extensive as those during the drawdown, the communities over time would resemble those in most seasonally fluctuating impoundments in the Southeast.

A recent study estimated areas of aquatic vegetation, essentially wetland vegetation, that would develop at various water levels for Par Pond; an estimated 800 acres (3.2 square kilometers) of aquatic macrophytes would be present at 199.2 feet (59.8 meters) and about 600 acres (2.4 square kilometers) at 195 feet (59.4 meters) (Narumalani 1993). Both the acreage and species composition of the aquatic macrophyte community would be affected, but impacts would be smaller, and a substantial and productive macrophyte community would develop at lower ranges of fluctuation. The species composition would differ from the one that developed during the stable water level regime. Reservoir water levels are often manipulated to control aquatic plant communities, and the results vary depending on the timing and length of drawdown and the geographic area (Cooke et al. 1986). These fluctuations can both decrease and increase the abundance of certain species; for example, cattail and bulrush (*Scirpus cyperinus*) can benefit from lower water levels because they require bare mudflats as a seedbed (Lantz et al. 1964).

Many wetland vegetation species can survive and even thrive with heavily fluctuating water levels; as a result, relative tolerance to the water-level fluctuations that could occur would determine future community dominance patterns at Par Pond (Mackey and Riley 1996). Maidencane in Carolina Bays on the SRS survived water levels as high as 4 feet (1.2 meters) via stem elongation, and occupied as much as 30 percent of plots of this species in depths to 5.6 feet (1.7 meters) (Kirkman and Sharitz 1993). The rate of refilling in Par Pond did not exceed the rates of maidencane stem growth and elongation around the newly exposed shoreline (Mackey and Riley 1996). For these reasons, maidencane could become a dominant species in Par Pond, although wave action in deeper water could inhibit continued growth and survival of this macrophyte in more steeply sloped areas. Cattail beds would also expand and, as mentioned above, spike rush is appearing in beds in areas almost identical to those observed in predrawdown studies. Lotus, also dominant before the drawdown, is likely to continue to remain dominant in intermediate and deeper waters up to depths of 6.5 to 10 feet (2 to 3 meters). It could also replace maidencane in deeper water areas (Mackey and Riley 1996).

Grace (1985) observed that the lack of appreciable water-level fluctuation in Par Pond may have created stagnant sediments in some of the back regions of Par Pond coves, causing them to be almost devoid of vegetation. Fluctuations in the water level would aerate these sediments and could expedite degradation of waste products. For example, oxygenating these stagnant areas could reduce the effect of certain substances, such as ammonia and hydrogen sulfide, that are naturally present in these kinds of backwater areas and can be highly toxic to aquatic organisms (Rand and Petrocelli 1985).

Rapid recovery of aquatic macrophytes has occurred at Par Pond, especially in predrawdown wetland areas, following almost 4 years of a 19-foot (5.8-meter) drawdown that resulted in the destruction of macrophyte beds and exposure of seed banks. Given the relatively low predicted extremes of water-level fluctuation expected, impacts to wetland vegetation could occur but would be limited to a maximum reduction of 200 acres (0.8 square kilometer) and related changes in relative abundance of wetland plant species around the lake margins.

4.3.5.2.2 Shut Down and Deactivate

DOE expects impacts from this alternative to be similar to those from the No-Action Alternative.

4.3.5.2.3 Shut Down and Maintain

DOE expects impacts from this alternative to be similar to those from the No-Action Alternative.

4.3.5.3 <u>Threatened and Endangered Species</u>

Savannah River Site Proposed, Threatened, Endangered, and Sensitive Plants and Animals (SRFS 1994) describes Federally listed threatened, endangered, and candidate plant and animal species that occur or might occur on the SRS. At present, the SRS monitors and protects these species and has active management programs for the wood stork, red-cockaded woodpecker, and smooth coneflower. Table 4-53 presents Federally listed species.

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4.3.5.3.1 Affected Environment

Smooth coneflower (*Echinacea laevigata*)

The smooth purple coneflower occurs in the southeastern United States in open frequently disturbed (burned or mowed) areas such as highway roadsides and transmission line rights-of-way that receive ample sunlight (FWS 1995). Two smooth coneflower populations have been identified on the SRS: (1) off Burma Road approximately 2 miles (3 kilometers) southwest of F-Area, and (2) on a 115-kilovolt transmission line that intersects Road 9 approximately 1 mile (1.6 kilometers) east of L-Lake. Neither population is in an area that activities associated with the Proposed Action would affect. Therefore, this EIS will not discuss this species further.

Table 4-53. Threatened and endangered plant and animal species of the Savannah River Site.

Common name (scientific name)	Status
Animals	
Bald eagle (*Haliaeetus leucocephalus*)	T[a]
Wood stork (*Mycteria americana*)	E[b]
Red-cockaded woodpecker (*Picoides borealis*)	E
American alligator (*Alligator mississippiensis*)	T/SA[c]
Shortnose sturgeon (*Acipenser brevirostrum*)	E
Plants	
Smooth coneflower (*Echinacea laevigata*)	E

a. T = Federally threatened species.
b. E = Federally endangered species.
c. T/SA = Threatened due to Similarity of Appearance to the endangered American crocodile.

Red-cockaded woodpecker (*Picoides borealis*)

The red-cockaded woodpecker occurs in the open pine woodlands of the Coastal Plain, where it lives in small groups of two to nine birds called "clans" (Hooper, Robinson, and Jackson 1980; FWS 1985). Each clan consists of a mated pair, their current year's offspring, and "helpers," male offspring from previous years (FWS 1985). This species is unique in that it requires mature pine trees (greater than 60 years old), often with red heart (fungus) disease, in which to nest. Nest cavities often require years to complete and once constructed are often maintained for the life of the tree through successive generations of birds. The clan roosts and nests in a group of cavity trees called a colony, that can include as many as a dozen trees and often occupy a roughly circular area 1,500 to 2,500 feet (460 to 760 meters) in diameter (Hooper, Robinson, and Jackson 1980). The territory of the birds ranges from 98 to more than 247 acres (0.4 to 1 square kilometer), depending on habitat quality, and the total area used by a clan can be as large as 988 acres (4 square kilometers) (Hooper, Robinson, and Jackson 1980). The larvae of wood-boring insects, grubs, and beetles form the bulk of this woodpecker's food.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is a permanent breeding resident of South Carolina, arriving in the fall (October to November), nesting in midwinter (December to January), and migrating north to New England and Canada in midsummer after young have fledged (Sprunt and Chamberlain 1970). Numbers of eagles in South Carolina have risen steadily since the 1970s as a result of the national ban on certain organochlorine pesticides (e.g., DDT), the protection afforded the species by the Endangered Species Act, and the construction of several large reservoirs in the Coastal Plain and Piedmont of South Carolina (Mayer, Hoppe, and Kennamer 1985, 1986; Bryan et al. 1996).

Eagles fledged near the coast now are able to disperse inland to areas they previously did not inhabit such as the reservoirs built in the 1970s on the Savannah River and Broad River drainages. In 1978 only 15 nesting pairs of bald eagles were observed in South Carolina. By 1996 there were more than 100 nesting pairs in the State (Hart et al. 1996). The rate of increase in breeding territories (nesting pairs) appears to be greater in reservoir habitat in South Carolina than in nonreservoir (riverine and estuarine) habitats (Bryan et al. 1996).

Bald eagles in the southeastern United States generally nest at the boundary of a wooded area and an open area in a tall pine or cypress tree that affords a wide view of the surrounding countryside (Kale 1978). Nest trees are often the tallest in a particular forest stand, and are within 2 miles (3 kilometers) of water (Stalmaster 1987; FWS 1989).

Bald eagles in South Carolina eat fish almost exclusively but will feed on wounded waterfowl, wading birds, small mammals, and carrion, such as dead fish and road kills (Sprunt and Chamberlain 1970; Hart et al. 1996; LeMaster 1996). Bald eagles on the SRS have been observed feeding on largemouth bass, coots, buffleheads (small diving ducks), gray squirrels, and other small mammals (Hart et al. 1996).

Bald eagles were first reported on the SRS in 1959 when three were observed on Par Pond (Wike et al. 1994). Par Pond continued to be the center of eagle activity on the SRS until 1985, when DOE built L-Lake. In October 1985 L-Lake was completed and within 1 month an eagle was reported over that lake (Mayer, Hoppe, and Kennamer 1986). L-Lake now provides important foraging habitat for eagles that nest on Pen Branch, approximately 1 mile (1.6 kilometers) west of L-Lake (LeMaster 1996).

Bald eagle use of L-Lake has increased since 1987 (when the Savannah River Ecology Laboratory began surveys), with the highest number of sightings occurring in the fall and winter of 1992-1993 (Bryan et al. 1996). Eagle use of Par Pond over the same period has remained at a constant but fairly low level. In the winters of 1991-1992 and 1992-1993, when Par Pond was drawn down for repairs, bald eagles were frequently observed foraging in the area (Bryan et al. 1996). After the reservoir was refilled, bald eagles were seen less frequently in the Par Pond area.

There are three eagle nests on the Savannah River Site. The Eagle Bay nest, discovered in 1986, is in a live bald cypress tree in a beaver pond approximately 0.9 mile (1.5 kilometers) southwest of the Par Pond dam. The Pen Branch nest, discovered in 1990, is in a loblolly pine tree approximately 1 mile (1.6 kilometers) west of L-Lake. The recently discovered G Road nest is approximately 0.25 mile (0.4 kilometer) east of Par Pond (LeMaster 1996).

Eagles have nested intermittently at the Eagle Bay location since 1986, with wind storms twice destroying nests and once, in 1989, killing an eagle nestling (Hart et al. 1996). Chicks hatched at the Pen Branch nest every year from 1990 to 1996. To date, no young have been observed at the G Road nest.

Wood Stork (*Mycteria americana*)

Wood storks, large wading birds with wing spans of up to 5.5 feet (1.7 meters) occur throughout Florida, Georgia, and coastal South Carolina. They feed through a highly specialized process called tactolocation that involves wading (sometimes shuffling to intentionally disturb prey) in shallow pools with their bills opened slightly and submerged as far as the external nares. When a stork touches fish or other prey (e.g., snakes, crayfish) with its bill, it snaps its bill shut, capturing the prey. This feeding technique allows wood storks to forage in muddy or turbid water where birds that hunt visually cannot feed. To feed efficiently, storks forage in ponds where prey concentrate. This is especially important during the breeding season, because food requirements are greatest when adults are nesting or caring for young (Sprunt and Chamberlain 1970; Kale 1978).

Wood storks are colonial nesters. They build large nests in trees, usually over standing water. Nest heights range from a few meters above water in mangrove swamps to the tops of the tallest cypress trees. They breed during the dry season when evaporation in shallow ponds concentrates aquatic prey (Kale 1978; Ehrlich, Dobkin, and Wheye 1988). From northern Florida to South Carolina, wood storks breed from March to August.

The population of wood storks in the United States decreased from an estimated 20,000 pairs in 1930 to just under 5,000 pairs in 1980 (Coulter 1989). Habitat degradation and the loss of foraging habitat, which led to the population decline, ultimately resulted in the species being listed as Endangered under the Endangered Species Act in 1984 (Coulter, McCort, and Bryan 1987; Stokes and Stokes 1996). Restoration efforts have been moderately successful. The U.S. population has increased from 5,000 breeding pairs in 1980 to 8,000 breeding pairs in 1996 (Bryan 1996).

The most northern and inland wood stork colony, the Birdsville Colony, is in a 2.1-square-mile (5.7-square-kilometer) cypress swamp near Millen in Georgia. This wood stork colony is the breeding area of most storks observed foraging on the SRS. The SRS is approximately 28 miles (45 kilometers) from the Birdsville colony, a distance well within the 37- to 43-mile (60- to 70-kilometer) radius that wood storks can travel during daily feeding flights (Du Pont 1987d).

Wood storks forage in shallow, open water areas where prey concentrations are high enough to ensure successful feeding. Ideal feeding conditions usually occur in sheltered bodies of water where depths range from 2 to 6 inches (5 to 15 centimeters), and where the water column is relatively free of aquatic vegetation (Coulter and Bryan 1993). Before 1986, most wood stork foraging activity on the SRS was concentrated in the Savannah River swamps and associated stream deltas (Beaver Dam Creek, Fourmile Branch, Pen Branch, and Steel Creek) (Du Pont 1987d).

At the time of the L-Reactor restart, DOE agreed to create new wood stork foraging areas near the SRS, mitigating an anticipated loss of foraging habitat in the Steel Creek delta. Kathwood Lake, consisting of four ponds [35 acres (0.14 square kilometer)], was built at the National Audubon Society's Silver Bluff Plantation Sanctuary in the spring of 1986, filled with water to a depth of 6-12 inches (15 to 30 centimeters), and stocked with bluegill, brown bullhead, and sterile grass carp (Coulter, McCort, and Bryan 1987). Bluegill and brown bullhead were selected because they were the preferred prey of wood storks in the wild; sterile grass carp were stocked to control aquatic vegetation. Kathwood Lake is approximately 19 miles (30 kilometers) northwest of the Steel Creek delta and 28 miles (45 kilometers) northeast of the Birdsville Colony.

By 1986 significant numbers of foraging wood storks were using Kathwood Lake. The maximum number of wood storks observed per day increased from 97 in 1986 to 250 in 1990 (Coulter 1993). The ponds have been highly successful in fulfilling their intended purpose.

Wood stork use of Par Pond and L-Lake has been intermittent and at fairly low levels in most years. After the Par Pond drawdown in the summer of 1991, the reservoir was monitored weekly for wood stork use. Wood storks used portions of the reservoir, particularly the North Arm, as foraging areas fairly consistently from late July through mid-October 1991. As many as 84 storks were observed in a single survey. No storks have been observed foraging in the Par Pond area since 1992 (LeMaster 1996).

Craig's Pond and Sarracenia Bay, two Carolina bays east of the North Arm of Par Pond were used by foraging wood storks in 1993 and 1996. Eagle Bay, just south of the Par Pond Dam, was also used by foraging storks in 1993 (LeMaster 1996).

The only documented wood stork use of L-Lake from 1987 to 1993 was a single stork observed foraging in lower L-Lake on September 24, 1987. The Savannah River Ecology Laboratory has conducted weekly aerial surveys of L-Lake during the nesting season since 1993. No storks have been observed during these surveys (LeMaster 1996).

Storks have been observed foraging and roosting in several wetlands near L-Lake. Peat Bay and an adjacent wetland next to the railroad tracks (both south of L-Lake and SC Highway 125) have been used by storks each year since 1993, with as many as 100 storks observed in a single survey. SRS personnel documented stork use of two additional nearby wetlands, Steel Creek Bay and an unnamed seasonal wetland near Robbins Station, as foraging habitat in 1995 (LeMaster 1996).

Wood stork use of the Savannah River swamp decreased steadily over the 1983-1990 period (Coulter 1993). This was attributed to high water levels in areas (such as Fourmile Branch) influenced by reactor operations and the dense growth of aquatic vegetation in other areas (such as Steel Creek) that no longer received large volumes of cooling water from reactor operations.

Over the last several years, wood storks have occasionally been observed foraging in the deltas of Fourmile Branch and Pen Branch. Most stork sightings in this area have occurred in the open cypress-gum river swamp that lies between these two deltas (LeMaster 1996).

American alligator (*Alligator mississippiensis*)

The American alligator, hunted almost to extinction by the middle of the 20th century, is now a common resident of the big river swamps, bayous, lakes, and marshes of Florida, the Gulf Coast, and the south Atlantic Coastal Plain (Conant and Collins 1991). The Fish and

Wildlife Service reclassified the alligator, previously listed as threatened in South Carolina, as "Threatened (due to Similarity of Appearance)" in June 1987 (52 FR 21059-21064). It was reclassified because populations in the southeast were flourishing as a result of successful state-run restoration programs and the species was no longer at risk. However, the Service maintained that some level of Federal protection was necessary to ensure against excessive taking of alligators and to protect the much-rarer (endangered) American crocodile (*Crocodylus acutus*); one concern was that enforcement personnel would not be able to distinguish between the processed hides of the two species.

In sanctuaries, refuges, and other areas where they are protected, alligators can grow to 16 feet (4.9 meters) long and weigh as much as 600 pounds (273 kilograms) (Mount 1975; Van Meter 1987; Conant and Collins 1991). The largest alligator ever captured on the SRS was 12.5 feet (3.8 meters) long (Gibbons and Semlitsch 1991). In captivity, alligators can live as long as 50 years; in the wild 30 to 35 years is probably the maximum lifespan (Van Meter 1987). Both sexes reach maturity at a length of about 6 feet (1.8 meters), when they are 8 to 12 years old, depending on the quality of the habitat.

Alligators occur in a variety of SRS habitats including river swamps, small streams, abandoned farm ponds, Carolina bays, and two large impoundments, Par Pond and L-Lake (Du Pont 1987d). Their abundance on the SRS is the direct result of more than 40 years of protection afforded the population by the secure SRS boundary (Gibbons and Semlitsch 1991). Par Pond contains the largest concentration of alligators on the SRS, more than 200 animals (LeMaster 1996). Alligators were plentiful in downstream portions of Steel Creek when it received heated effluent and are now commonly observed in and around L-Lake (Du Pont 1987d; LeMaster 1996). No population estimates are available for L-Lake.

Beaver Dam Creek, which receives heated effluent from the D-Area coal-fired power plant, supports a moderately large, self-sustaining population of alligators that consists of small numbers of adults and larger numbers of juveniles and subadults (Murphy 1981; Wike et al. 1994). Fourmile Branch contains small numbers of alligators in its lower reaches and delta, most of which are probably immigrants (juveniles and subadults) from nearby Beaver Dam Creek. High stream flows and temperatures from K-Reactor operations made most of Pen Branch unsuitable for alligators until 1988, but there are indications that alligators are recolonizing the lower reaches of the stream (Wike et al. 1994).

Steel Creek apparently supported a large alligator population in the early 1950s before the operation of the SRS reactors (Murphy 1981), but contained few alligators in its upper reaches during the years it received thermal effluent. Alligator numbers are still low in the Steel Creek drainage, with most animals found in the delta or in the vicinity of beaver ponds adjacent to the stream. Lower Three Runs has historically supported a reproducing population of alligators, most of which are concentrated in an area below the Par Pond dam where they are protected from human encroachment (Murphy 1981; Wike et al. 1994).

Before 1958 when Par Pond was built, alligators were uncommon on the SRS and were concentrated in the Lower Three Runs drainage (Murphy 1981). The SRS alligator population grew rapidly after Par Pond was filled, and by 1974 an estimated 109 alligators were in the reservoir, 60 of which were adults.

The number of alligators inhabiting Par Pond more than doubled from 1974 to 1988, from 109 to 266 animals (Brandt 1991). The size and age structure of the population in 1988 [a high proportion of young animals less than 6 feet (1.8 meters) long] indicated an expanding population. Brandt (1991) characterized the population as "quite healthy" and suggested that the number of alligators would increase until the carrying capacity (estimated to be around 500 individuals) was reached (Brandt 1991).

After Par Pond was drawn down (July-September 1991) Savannah River Ecology Laboratory scientists conducted studies to assess the effect of the drawdown on Par Pond alligators. Brisbin et al. (1992) reported that female alligators continued to guard nests even after the water had receded and all nests were more than 300 feet (100 meters) from the new shoreline. Brisbin et al. (1992) theorized that few hatchlings survived, noting that wading bird use of the area was heavy and that the young alligators were exposed to these and other predators (largemouth bass and other alligators) because of the lack of cover. There was also strong evidence for violent territorial encounters between adults that had left Par Pond and moved to other areas in search of better conditions (Brisbin et al. 1992).

Data from six alligator nests studied in the summer of 1994 during the Par Pond drawdown indicated that clutch sizes were reduced by 10.9 percent compared to pre-drawdown periods (Brisbin et al. in press). Body condition of hatchlings (based on length-weight relationships) was also lower. Nest predation appeared to have been reduced during drawdown, however, suggesting that negative reproductive impacts of the drawdown were to some extent compensated for by increased survival. When L7-01 the reservoir was refilled in late-summer of 1994, flooding caused the destruction of one of six nests studied and caused an overall loss of 30.6 percent of eggs produced (Brisbin et al. in press). There was no evidence that females responded to rising water by making additions or alterations to their nests. Impacts to nests from rising water levels appeared to be a function of location and topography.

Savannah River Ecology Laboratory scientists recently completed a study that compared body burdens of mercury in alligators from Par Pond L7-02 with alligators from the Florida Everglades (Yanochko et al. in press). Concentrations of mercury in kidney, muscle, and dermal scutes were lower in Par Pond alligators than Everglades alligators. There were no differences in mercury levels in tissues of animals collected before and after the Par Pond drawdown. The average concentration of mercury (4.1 milli- L7-02 gram per kilogram) in muscle tissue of Par Pond alligators was higher than advisory levels established by the State of Florida (0.5 milligram per kilogram) or the U.S. Food and Drug Administration (1.0 milligram per kilogram) as safe for human consumption.

In January 1996, a large male alligator measuring more than 3.9 meters (13 feet) long was found dead in Par Pond (Brisbin 1997). Decomposition of the carcass made it impossible to determine the cause of death, but samples of muscle, kidney, and liver tissue were analyzed for mercury residues. Mercury content of these tissues, expressed on a wet weight basis, averaged 3.5 milligram per kilogram for muscle, 33.6 milligram per kilogram for kidney, and 158.9 milligram per kilogram for liver (Brisbin 1997). The reason for these unusually high TC levels of mercury is unknown, but long-lived species such as the alligator tend to accumulate more mercury than other groups, such as amphibians and fish, that have much shorter life spans. Mercury concentrations in tissues of individual animals within a population may vary dramatically with differences in age, body size, diet, metabolic rate, sex, state of sexual maturity, condition, habitat preference, and time of year. The alligator found in Par Pond was at least 22 years old, and may have been considerably older.

Shortnose sturgeon (*Acipenser brevirostrum*)

The shortnose sturgeon is an anadromous fish that spawns in large Atlantic coastal rivers from New Brunswick, Canada, to north Florida (Scott and Crossman 1973). A species of commercial importance around the turn of the century, the shortnose sturgeon is now listed by the National Marine Fisheries Service as an endangered species. The decline of the species has been attributed to the impoundment of rivers, water pollution, and overfishing; recruitment rates appear to be too low to replenish depleted populations (Heidt and Gilbert 1978).

Shortnose sturgeon grow slowly, reach sexual maturity relatively late in life, and live as long as 30 years (Scott and Crossman 1973). Fish from southern populations can grow faster and mature earlier than those from northern populations (Heidt and Gilbert 1978). Spawning occurs in, or adjacent to, deep areas of rivers with significant currents [1 to 4 feet (0.3 to 1.2 meters) per second] during spring when water temperatures warm to 48 to 59°F (9 to 15°C) (Crance 1986; Rulifson, Huish, and Thoeson 1982). Adults apparently return to natal streams to spawn at 2- to 5-year intervals (Rulifson, Huish, and Thoeson 1982). Eggs are heavier than water and adhesive after fertilization, sinking quickly and adhering to sticks, stones, gravel, and rubble on the stream bottom (Crance 1986). The interaction of water temperature, current velocity, and substrate type apparently determines suitability of spawning habitat as well as hatching success. Very few larvae and juveniles have been collected, so little is known of their distribution and movement (Rulifson, Huish, and Thoeson 1982).

Before 1982 shortnose sturgeon were not known to occur in the middle reaches of the Savannah River. However, 12 shortnose sturgeon larvae were collected near SRS in a 4-year (1982 through 1985) DOE study of ichthyoplankton abundance and entrainment in reactor cooling water systems (DOE 1987b). When shortnose sturgeon were first collected in 1982 and 1983, DOE notified the National Marine Fisheries Service as required under Section 7 of the Endangered Species Act of 1973 (Muska and Mathews 1983). A subsequent biological assessment evaluated the potential impact of SRS operations on shortnose sturgeon. The assessment concluded that "existing and proposed operations (specifically L-Reactor) of the Savannah River Plant will not affect the continued existence of the shortnose sturgeon in the Savannah River" (Muska and Mathews 1983). This conclusion was based on the facts that (1) shortnose sturgeon spawned upriver and downriver of the SRS; (2) passage up and downstream was not blocked by thermal effluents; (3) shortnose sturgeon did not spawn or forage in SRS streams and swamps that received thermal discharges; (4) entrainment was unlikely because shortnose sturgeon eggs are demersal, adhesive, and negatively buoyant; and (5) impingement of healthy juvenile and adult shortnose sturgeon on cooling water system screening devices is highly unlikely given their strong swimming ability. The National Marine Fisheries Service concurred with the DOE determination that SRS operations did not threaten the Savannah River population of shortnose sturgeon (Du Pont 1985).

A South Carolina Wildlife and Marine Resources Division (now South Carolina Department of National Resources) study of seasonal movement and spawning habitat preferences of Savannah River shortnose sturgeon found two probable spawning sites, one upstream of SRS at river mile 177-179 (river kilometer 285-288) and the other downstream of the Site at river mile 115-121 (river kilometer 185-195) (Hall, Smith, and Lamprecht 1991). The *Comprehensive Cooling Water Study* (Du Pont 1985) suggested that shortnose sturgeon spawned as far upstream as the first migratory obstruction, the New Savannah Bluff Lock and Dam. The South Caroline Wildlife and Marine Resources Division study appears to support this theory.

4.3.5.3.2 Environmental Impacts

Red-cockaded woodpecker

<u>No Action</u>

Although there are two inactive red-cockaded woodpecker colonies within a mile (1.6 kilometers) of L-Lake (Colony 61 to the west, in the vicinity of Substation Number 3 and Colony 62 to the east, near the intersection of Roads B-4 and B-5), there are no active colonies within several miles of the reservoir. Therefore, none of the activities associated with the No-Action Alternative at L-Lake would affect this woodpecker. Receding water levels would not have an effect on birds foraging, roosting, and nesting in open pine woods miles away from the reservoir.

Although there are several inactive red-cockaded woodpecker colonies and foraging areas within 660 feet (200 meters) of the North Arm of Par Pond (Colonies 64, 65, and 70), there are no active colonies within several miles of the reservoir. None of the activities associated with the No-Action Alternative at Par Pond would affect red-cockaded woodpeckers. Fluctuating Par Pond water levels should have no effect on birds foraging, roosting, and nesting in open pine woods miles away from the reservoir.

There are two inactive red-cockaded woodpecker colonies (Colonies 7 and 71) just west of Steel Creek and several active red-cockaded woodpecker colonies and foraging areas on bluffs and dry ridges to the west of Lower Three Runs in the area of the triangle formed by Round Tree Road, Patterson Mill Road, and Road A-18. None of the activities associated with the No-Action Alternative would affect red-cockaded woodpeckers foraging, roosting, or nesting in the vicinity of SRS streams.

Shut Down and Deactivate

Under this alternative, L-Lake would recede and DOE would not pump river water to Par Pond even if its level were to unexpectedly fall below 195 feet (59.4 meters). Neither circumstance would affect red-cockaded woodpeckers. Stream flows associated with this alternative would have no effect on birds that forage, roost, and nest exclusively in mature pine stands well outside of the floodplain.

Shut Down and Maintain

This alternative would have no impact on red-cockaded woodpeckers.

Bald Eagle

No Action

Under the No-Action Alternative, DOE would continue to maintain L-Lake at its current level of approximately 190 feet (58 meters). This action would not affect bald eagles nesting on Pen Branch or foraging in the L-Lake area.

Under the No-Action Alternative, Par Pond would fluctuate naturally from about 195 feet (59.4 meters) to 200 feet (61 meters). Shoreline instability could reduce the amount of wetland vegetation around the margins of the reservoir and limit the production of macroinvertebrates. Reduction in aquatic macrophyte coverage or density would reduce the amount of cover for forage fish, while reduced production of invertebrates could affect food resources of fish and certain mammals. If fish production or growth were affected, the prey base of the bald eagles could suffer (LeMaster 1996). Based on observations of bald eagles during the 1991 to 1995 Par Pond drawdown (DOE 1995a; Hart et al. 1996), when DOE lowered the reservoir as much as 19 feet (5.8 meters), impacts to eagles from the relatively small fluctuation that would occur under the No-Action Alternative would be minimal to nonexistent.

Shut Down and Deactivate

Under this alternative, DOE researched the effect on eagles from exposure to contaminated water, sediment, and prey items (mostly fish). TE

Hart et al. (1996) evaluated potential effects to bald eagles foraging in and around Par Pond and L-Lake from exposure to radiological (chiefly cesium-137) and nonradiological (mercury) contaminants. The analysis indicated that the radiation dose to Par Pond eagles from food and drinking water was approximately 0.0026 rad per day, well below the dose range of 0.1 to 1.0 rad per day that is considered protective of wildlife (IAEA 1992; Eisler 1994; Appendix B).

The average mercury concentration in Par Pond bass was 0.94 milligram per kilogram [parts per million (ppm)] over the 1988 to 1994 period (Table 4-54), below dietary levels that have caused acute effects (mortality) in some birds (Hart et al. 1996). The average mercury concentration in L-Lake bass over a shorter time period were slightly higher, 1.17 parts per million (Table 4-54). Mercury concentrations of this magnitude in fish would not have an acute effect on eagles feeding on them (Hart et al. 1996) but could cause subtle, sub-lethal effects (LeMaster 1996). Eisler (1987) recommended total mercury concentrations in food items of "sensitive" avian species not exceed 0.10 parts per million and suggested that a concentration as low as 0.05 parts per million could adversely affect reproduction. The historic reproductive success of eagles nesting at the Eagle Bay nest suggests that if sublethal effects are occurring, they are not affecting reproduction in a measurable way (Hart et al. 1996). Appendix B presents a more detailed evaluation of potential risks to bald eagles from exposure to cesium-137 and mercury in surface waters, sediments, and fish of Par Pond and L-Lake.

Lower water levels and reduced littoral vegetation in reservoirs could make prey more available to wading birds and other avian predators (e.g., eagles and ospreys) by forcing small fish out of protective vegetative cover (Bildstein et al. 1994). Lower reservoir levels could benefit eagles by reducing the amount of energy they expend foraging, but could be detrimental to eagles if prey were so easily captured that birds "gorged" and consistently ingested larger quantities of contaminated fish than normal. Bald eagles are known to gorge when food supplies are unusually abundant (e.g., on spawned-out salmon in the Pacific Northwest). However, they generally stop feeding when their crops and stomach(s) are full (Stalmaster 1987) and might fast for several days afterwards. Consequently, there is no reason to believe that eagles would eat unusually large quantities of contaminated fish. They probably would eat until satiated and then rest, conserving energy normally spent foraging. Implementing this alternative could result in the complete emptying of L-Lake in as few as 10 years (Jones and Lamarre 1994). L-Lake could be reduced to

Table 4-54. Mercury concentrations ppm in largemouth bass (parts per million).

Location	Years	Minimum	Mean	Maximum	N
Clarks Hill Lake[a]	1988-91	<0.10	0.37	1.51	8
Savannah River above SRS[a]	1988-93	0.16	0.44[b]	1.23	21
Savannah River at SRS[a]	1988-92	<0.10	0.75	1.61	31
Par Pond[a]	1988-94	0.11	0.94	3.2	52
Par Pond[c]	1991-93	0.05	NA[d]	1.9	300
Par Pond[e]	1995	NA	0.67	3.18	38
Lower Three Runs[a]	1988-93	0.25	1.15	2.2	35
L-Lake[a]	1992-94	0.43	1.17	2.87	15
L-Lake[f]	1995	NA	0.43	1.07	49
Savannah River below SRS[a]	1989-94	<0.01	0.60[g]	1.40	42

a. From SRS Annual Environmental Reports ("flesh" was analyzed).
b. Based on n=18 because some means not listed.
c. From Jagoe, Grasman, and Youngblood (1994); muscle was analyzed.
d. NA = Not available.
e. From Paller and Wike (1996a); whole fish were analyzed.
f. From Paller (1996); whole fish were analyzed.
g. Based on n=41.

a small ponded area at the head of the L-Lake dam. This would effectively eliminate the most important foraging habitat for the Pen Branch nest pair (LeMaster 1996). If L-Lake emptied, the closest large bodies of water providing suitable foraging habitat would be Par Pond and the Savannah River, both about 6 miles (10 kilometers) away (Hart et al. 1996). These locations are approximately 1.2 miles (2 kilometers) beyond the normal foraging range of bald eagles (Hart et al. 1996). Although eagles nesting on Pen Branch could adapt to the change by foraging in other areas or by feeding more heavily on birds, small mammals, and carrion, they probably would not continue to nest near L-Lake (LeMaster 1996).

Shut Down and Maintain

This alternative would produce the same kinds of impacts described for the Shut Down and Deactivate Alternative.

Wood Stork

No Action

Under the No-Action Alternative, wood stork use of L-Lake and Par Pond would continue to be infrequent because neither reservoir provides much suitable foraging habitat. Wood stork use of SRS streams and associated delta areas would not be likely to change. Impacts to wood storks under this alternative would be unlikely.

Shut Down and Deactivate

Under the Shut Down and Deactivate Alternative, L-Lake could drop as much as 70 feet (21 meters) in 10 years, and Par Pond could conceivably drop to a level of 195 feet (59.4 meters). Stork use of L-Lake under this alternative would depend on the rate at which the reservoir receded and on the topography of the reservoir bottom. A gradual drop in water level would reduce the likelihood of stork use of L-Lake. Natural or manmade depressions on the reservoir bottom could entrap fish as the water level recedes. Fish stranded in these pools could attract storks, particularly in late summer. Storks are generally observed in the region from May through September, with most SRS sightings in July and August (LeMaster 1996). TC

Wood stork use of Par Pond would probably occur only during a very severe summer drought or succession of dry years, when water levels could drop to a level where fish were forced from the shelter of the macrophyte belt along the shore of the reservoir. Mercury levels in stork prey in Par Pond are at a level of concern at present and could increase in a fluctuating environment. However, the Par Pond water level has not fluctuated more than a foot since DOE refilled the reservoir in March 1995. Overall, the water level last year has remained fairly constant even though a commitment to supply 10 cubic feet (0.28 cubic meter) per second to Lower Three Runs has been met and the average rainfall in the area was below normal (LeMaster 1996).

Fish in both reservoir systems contain detectable levels of mercury. DOE assumed that approximately half of this mercury came from Savannah River water and half from natural sources (i.e., soils inundated when reservoirs were filled). Potential stork prey [fish less than 5 inches (13 centimeters) in length] collected from these reservoirs typically contain levels of mercury greater than 0.05 part per million (LeMaster 1996). Eisler (1987) recommended that total mercury concentrations in food items of "sensitive" avian species not exceed 0.10 part per million and suggested that a concentration as low as 0.05 part per million could adversely affect reproduction. In a study of wading birds in southern Florida species whose prey consisted of larger fish contained four times higher levels of mercury in the liver than those that consumed smaller fish or crustaceans, and suggested that declining numbers of nesting wading birds in southern Florida were due, in part, to mercury contamination of their food supply (LeMaster 1996). Although wood storks were not included in that study, they fall in the same

TE TC TC

trophic category – wading birds that consume larger fish (LeMaster 1996).

Mercury in reservoir sediments, whether from river inputs or atmospheric deposition, would typically be an inorganic form. However, mercury accumulated by aquatic organisms, and therefore potentially consumed by storks, is primarily a more toxic form, methyl mercury. The process controlling the transformation from inorganic species to methyl mercury is therefore key to the accumulation of mercury by aquatic organisms. Previous studies have suggested that methylation is enhanced in flooded soils (LeMaster 1996). Thus, fluctuating water levels in Par Pond could lead to increasing bioavailability of methyl mercury to aquatic organisms inhabiting those two systems (LeMaster 1996).

TC Appendix B presents a more detailed evaluation of potential risks to wood storks from exposure to mercury in surface waters, sediments, and fish of Par Pond and L-Lake.

Shut Down and Maintain

Impacts from this alternative would be similar to those described for the Shut Down and Deactivate Alternative.

American Alligator

No Action

Under this alternative, there would be no impacts to L-Lake alligators because water levels would not fluctuate appreciably. Under normal circumstances, Par Pond would fluctuate between 195 feet (59.4 meters) and 200 feet (61 meters). Water level changes of this magnitude should have no direct impact on alligators. Fluctuating water levels in Par Pond could affect the prey base for Par Pond alligators as described above (reduced production of forage fish; reduced growth of fish higher in the food chain). However, prey (food) is not a limiting factor for the Par Pond alligator population (LeMaster 1996).

Shut Down and Deactivate

Under this alternative, L-Lake could empty in 10 to 50 years, displacing alligators in the reservoir. If the drawdown is rapid (70 feet in 10 years as predicted by the most extreme of the four scenarios modeled) L-Lake alligators could be forced to move to other wetland habitats on the SRS. This could lead to (1) total reproductive failure in some years, caused by nest destruction, egg loss, or intense predation on hatchlings; (2) an increased incidence of violent intraspecific encounters, as L-Lake alligators were forced into established territories of adults in other areas, and (3) an increased likelihood of fatal encounters with humans and automobiles.

Based on recent Par Pond studies (Brisbin et al. in press), however, female alligators would probably not abandon established nests in response to the drawdown, and would continue to nest around L-Lake until food resources become limited or crowding forces subdominant animals to disperse to other SRS wetlands. Male alligators would be more likely to leave the L-Lake area because they have much larger home ranges than females and tend to move more within their home ranges (Van Meter 1987). Immature alligators, which actively roam over a larger area than adults (Van Meter 1987) and are not attached to breeding territories, would also be expected to disperse to other areas when competition for food or space becomes more intense. The lagoons near SC Highway 125 and the Steel Creek delta may provide suitable habitat for some of these displaced alligators (LeMaster 1996). Impacts to individual alligators in SRS streams would be minimal because most of these animals are associated with beaver ponds or other bodies of water that offer basic habitat requirements (relatively deep water, food, and cover).

Shut Down and Maintain

Impacts from this alternative would be similar to those described for the Shut Down and Deactivate Alternative.

Shortnose sturgeon

No Action

Shortnose sturgeon have never been collected or observed in any of the tributaries of the Savannah River that drain the SRS. The reduction in pumping to Fourmile Branch and Pen Branch/Indian Grave Branch under the No-Action Alternative should have no discernible impact on the Savannah River and its fish populations, including the shortnose sturgeon.

Small numbers of shortnose sturgeon larvae (12 larvae over a 4-year period) were entrained at the SRS river water intakes from 1982 through 1985, when pumping rates approached 400,000 gallons per minute (25.2 cubic meters per second) (DOE 1987b). Under the No-Action Alternative, DOE would withdraw 5,000 gallons per minute (0.32 cubic meter per second) from the Savannah River to maintain the water level of L-Lake and supply smaller amounts of water to the reactor areas for equipment cooling and fire protection. Some shortnose sturgeon larvae could be entrained, but the numbers would be a small fraction of those entrained in the 1960s, 1970s, and 1980s when pumping rates were as much as 80 times higher.

DOE would withdraw approximately 5,000 gallons per minute (0.32 cubic meter per second) of river water to maintain the level of L-Lake, which is less than 0.2 percent of the average Savannah River discharge 2.9 million gallons per minute (183 cubic meters per second) reported for the severe drought years of 1985 through 1988 (DOE 1990). The February-to-April spawning period historically has been a time of high river discharge. The actual percentage of river water withdrawn would undoubtedly be lower during this period. Given (1) the small volume of water withdrawal planned, (2) the preferred deep-water spawning habitat of shortnose sturgeon, and (3) the demersal nature of shortnose sturgeon eggs and larvae, the likelihood of a significant number of shortnose sturgeon eggs and larvae being entrained by the 5,000-gallon-per-minute pump seems remote. | TE

Shut Down and Deactivate

Under this alternative, DOE would not pump Savannah River water to maintain the level of L-Lake and Par Pond if its level fell below 195 feet (59.4 meters). As a result, no shortnose sturgeon eggs or larvae could be entrained.

Shut Down and Maintain

Under this alternative, there would be no routine pumping of river water to maintain L-Lake or Par Pond water levels. No shortnose sturgeon eggs or larvae could be entrained unless river water pumps were restarted.

4.3.6 LAND USE

4.3.6.1 Affected Environment

Section 4.1.6.1 describes the land and surroundings on the SRS. It also summarizes Future Use Project Team recommendations for the future use of the land and facilities on the Site and the current status of the SRS as a National Environmental Research Park. DOE has not identified any future mission or other uses, other than research and monitoring, for Par Pond (Hill 1996).

DOE monitors Par Pond regularly for chemical, metal, physical, and biological properties, water level, and radioactive effluents; the monitoring frequency varies with the location and sample type. Approximately 10 scientists and technicians per week conduct monitoring or research on the lake (Marcy 1996). Par Pond is restricted from other uses.

4.3.6.2 Land Use Impacts

4.3.6.2.1 No Action

Under the No-Action Alternative, DOE would not change the current uses of Par Pond; the lake status would be the same as that described