BIOLOGICAL OPINION
FOR THE PROPOSED OPERATION OF THE
WATTS BAR NUCLEAR PLANT
RHEA COUNTY, TENNESSEE

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MARCH 1995

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A. INTRODUCTION

This presents the biological opinion of the U.S. Fish and Wildlife Service (Service) regarding impacts to Federally-listed endangered and threatened species from operation of the Watts Bar Nuclear Plant in Rhea County, Tennessee. It responds to a letter from Mr. William T. Russell, Director of the Office of Nuclear Reactor Regulation, dated October 28, 1994, and received on November 1, 1994, officially requesting initiation of formal consultation. This biological opinion only fulfills the requirements of Section 7 of the Endangered Species Act (Act) of 1973, as amended, and does not address issues relevant to other Federal environmental statutes. Upon completion of a biological assessment prepared jointly with the Tennessee Valley Authority (TVA), the Nuclear Regulatory Commission (NRC) and TVA have determined that the proposed action is not likely to adversely affect the following Federally listed species:

Gray bat - Myotis grisescens (E)
Bald eagle - Haliaeetus leucocephalus (E)
Snail darter - Percina tanasi (T)
Dromedary pearly mussel - Dromus dromas (E)
Pink mucket pearly mussel - Lampsilis abrupta (=L. orbiculata)(E)
Rough pigtoe (mussel) - Pleurobema plenum (E)
Fanshell (mussel) - Cyprogenia stegaria (E)

However, NRC believes that its regulatory interests would be best served by initiating formal consultation.

A copy of this consultation is on file and available for review during normal business hours at the Service's Cookeville Field Office, 446 Neal Street, Cookeville, Tennessee 38501; telephone 615/528-6481; FAX 615/528-7075.

B. PROJECT DESCRIPTION

The Watts Bar Nuclear Plant (WBN) is located on the west bank of Chickamauga Reservoir near Tennessee River Mile 528, approximately two river miles below Watts Bar Dam and one mile downriver from the Watts Bar Fossil Plant. The facility consists of two nuclear-generating units designed to produce over 2,500 megawatts of electricity. Construction of all of the major exterior facilities

and associated transmission lines was completed in the 1970's. Unit 1 is essentially complete and Unit 2 is approximately 65 percent complete. The proposed action involves the operation of Units 1 and 2. The Tennessee Valley Authority proposes to initiate operation in the Spring of 1995 and is currently re-evaluating completion of Unit 2.

The Watts Bar Nuclear plant will be operated in a closed cycle cooling mode, using one natural draft cooling tower for each nuclear unit. An intake channel constructed in the adjacent channel of the Tennessee River will provide makeup water and water for all other needs at the facility. Blowdown from both units will be discharged through a diffuser system in the river channel at Mile 527.9 or will be stored in a holding pond for later release into the diffuser. Water will be stored when releases from Watts Bar Dam are less than 3,500 cubic feet per second (cfs). Maximum discharge through the diffusers will be 173 cfs.

A variety of chemicals will be used for various purposes at WBN, the end products of which will be disposed of or discharged into the Tennessee River. Substances that will be used or produced during operation of WBN include: alum, sulfuric acid, sodium hydroxide, chloride, sulfate, carbonates, boric acid, ammonia, hydrazine, copper, nickel, pyrophosphate, coppertrol, an organic co-polymer dispersant, clamtrol (molluscicide), zinc sulfate, and bromo-chloro-hydantoin.

Another part of the WBN project involved construction of five off-site transmission lines. Two of the lines are less than 5.5 miles in length, two are approximately 40 miles long, and the remaining line is almost 90 miles long.

C. CONSULTATION HISTORY

Construction of the Watts Bar Nuclear Plant was initiated prior to passage of the Endangered Species Act, and all major facilities were completed in the 1970's. However, operation of the facility requires a license by the Nuclear Regulatory Commission, thus requiring compliance with Section 7 provisions. A final environmental statement for the project was issued in 1978, along with a determination that the proposed operation of the facility would not adversely affect endangered species.

The Tennessee Valley Authority transmitted a draft biological assessment to the Service on August 25, 1994. The draft assessment concluded that the project would not affect any endangered species. The Service reviewed the draft assessment and requested, by letter

of September 6, 1994, that TVA address questions regarding discharge of heated water, radioactive materials, and hazardous materials into the Tennessee River.

A final biological assessment, jointly prepared by TVA and NRC, concluded that operation of WBN was not likely to adversely affect individuals or populations of any of the seven endangered and threatened species known to occur in the project area. The joint biological assessment was submitted, consultation initiated, and Service concurrence requested by TVA on October 5, 1994. The Service concurred with the "not likely to adversely effect" finding by letter of November 21, 1994. A subsequent letter by the Service submitted on November 22, withdrew concurrence and stated that Section 7 consultation could not be concluded at that time, because of the pending formal consultation with NRC.
The Nuclear Regulatory Commission, although agreeing with the determination made by TVA in the assessment jointly prepared by both agencies, concluded that its regulatory interests would best be served by initiating formal consultation. An official request for formal consultation was submitted to the Service, along with a copy of the joint NRC/TVA biological assessment, on October 28, 1994. Consultation under Section 7 of the Endangered Species Act for operation of the Watts Bar Nuclear Plant will officially be concluded with issuance of this biological opinion.

The Nuclear Regulatory Commission submitted a supplemental letter to the Service on January 25, 1995. The letter informed the Service that an additional candidate species (the pyramid pigtoe mussel) might occur in the vicinity of the proposed project. Although this species was not considered in the biological assessment, NRC and TVA concluded that the conclusions reached in the assessment applied to this additional species as well as three other candidate species included in the assessment. Consequently, the presence of this species did not alter the "no effect" finding made by TVA and NRC.

D. BACKGROUND INFORMATION

The Tennessee River and Cumberland River historically supported one of the most diverse and abundant aquatic faunas in the world. Since neither of these drainages were subjected to glaciation, they have developed unique habitats and aquatic communities over millions of years and are thought to be centers of speciation for some faunal groups, particularly freshwater mussels and fish. These two river systems support populations of species with relatively wide distributions throughout their respective drainages as well as species endemic to particular streams within each river system.

The aquatic habitat in the project area is a large river/reservoir habitat, consisting of the Tennessee River and its larger tributary streams, as well as artificially impounded reservoirs (Chickamauga Lake and Watts Bar Lake). All of the Federally listed aquatic species addressed in this biological opinion--as well as the bald eagle and gray bat--are known to inhabit, or are closely associated with, this habitat type. The Tennessee River consisted historically (i.e., before impoundment) of free-flowing habitat not unlike that in its large creek and small river tributaries. Currently, most of the free-flowing habitats in the Tennessee and Cumberland River drainages have been replaced by more lentic conditions as a result of construction of impoundments. Riffle and pool habitats over sand, gravel, boulder, and bedrock substrates that supported diverse aquatic communities now consist of permanent pool (lake) habitat with a completely different faunal composition. For the most part, the pre-impoundment fauna now exists in remnant populations immediately below the dams or in the free-flowing reaches at the extreme headwaters of the reservoirs.

FRESHWATER MUSSELS (NAIADES)

- o Pink mucket pearly mussel, rough pigtoe, fanshell, dromedary pearly mussel

Large streams, as well as large and small rivers in and around the project area, have evolved the most diverse freshwater mussel (naiad) fauna in the world. Over 100 species historically existed in these productive waters. Presently, over sixty species still exist as scattered, isolated, remnant populations in the remaining river reaches that still provide suitable habitat for these animals. A number of species are endemic to particular streams or watersheds.

Freshwater mussels are filter feeders; algae, detritus, and plankton suspended in the water column are brought in during normal siphoning activity and filtered from the water through the gills. Some researchers have reported that these animals accumulate certain pollutants (e.g., pesticides, heavy metals)(Imlay, 1982; Manly and George, 1977; Salanki and Varanka, 1976). Consequently, freshwater mussels may be good biological indicators of water quality (Imlay, 1982; Foster and Bates, 1978; Adams et al., 1981). However, some malacologists believe that contaminant levels do not accumulate, but rather fluctuate, in freshwater mussel tissues; and because some mussel species persist in moderately polluted streams, mussels may not provide good indications of changes in water quality (John Jenkinson, TVA, personal communication).

Freshwater mussels become sexually mature at three or four years of age and exhibit a unique reproductive strategy. Males release sperm into the water column that are taken in by females during

normal siphoning activities. Eggs are fertilized and held in modified gill pouches (marsupia) where they develop into the larval form (glochidia). Fully developed glochidia are released into the water and drift with stream currents. Although glochidia may survive for up to three or four days and may drift for relatively long distances (Howard and Anson, 1922; Widlak, 1982), glochidia not attaching to suitable fish hosts within six hours of release from the female may not survive (John Jenkinson, TVA, personal communication). Glochidia of some mussel species are able to metamorphose on several species of fish while high degrees of host specificity have been observed for others; glochidia of these host-specific species will successfully metamorphose on only certain groups or single species of fish. Those glochidia successfully attaching to the fins or gills of an appropriate host encyst and, after a certain period (depending on water temperature and other factors), metamorphose, drop from the fish and settle to the stream bottom as free-living juvenile mussels.

Two reproductive modes have been identified for North American freshwater mussels; fertilization of eggs, release of glochidia, and metamorphosis on fish hosts occur during a short period in spring and early summer in short-term (tachytictic) breeders. The eggs of long- term (bradytictic) breeders are fertilized during the summer, but glochidia are retained in the marsupia and released during the next breeding season. In streams supporting several species of bradytictic breeders, glochidia may be present in the water column year-round except for the period of gametogenesis due to seasonal differences in release of glochidia. Depending on the size of the female mussel, up to several hundreds of thousands of glochidia may be released by a single female mussel annually.

High mortality is thought to occur at two stages in the life cycle of freshwater mussels. Glochidia failing to attach to suitable fish hosts settle to the stream bottom and eventually perish or serve as prey for fish or invertebrate predators. Those attaching to unsuitable hosts are sloughed off and perish. Also, because of their size, metamorphosed juvenile mussels probably drift for certain distances, depending on stream currents; those that settle onto unsuitable substrate likely do not survive. Nonetheless, because mussels are long-lived (50 years or more)(Moyer, 1984) and have a high reproductive capacity, low annual recruitment is probably sufficient to maintain healthy populations.

Three of the four Federally endangered mussel species addressed in this biological opinion, the pink mucket pearly mussel (Lampsilis abrupta [=L. orbiculata]), fanshell (Cyprogenia stegaria), and rough pigtoe (Pleurobema plenum), are known to have been widely distributed in large river habitats in the Ohio, Tennessee, and Cumberland River drainages (U.S. Fish and Wildlife Service, 1983a,

1984, 1985, 1991). These species inhabit areas with moderate to swift current velocities with clean-swept sand and gravel substrates.

Reproducing populations of the fanshell are presently known to occur only in the Clinch River (Tennessee and Virginia), Green River (Kentucky), and Licking River (Kentucky). Smaller remnant populations are known to exist in the Tennessee, Cumberland, Barren, Kanawha, Tippecanoe, East Fork White, Wabash, Walhonding, and Muskingum Rivers, and Tygarts Creek, in Tennessee, Ohio, Indiana, West Virginia, and Kentucky (U.S. Fish and Wildlife Service, 1991).

The rough pigtoe presently occurs in the Tennessee, Cumberland, Clinch, Green, and Barren Rivers in Tennessee, Kentucky, Alabama, and Virginia (U.S. Fish and Wildlife Service, 1984). The pink mucket pearly mussel has the widest distribution of the four endangered large river mussel species addressed in this biological opinion. It is presently known to occur downstream from each Tennessee River impoundment, in the Kanawha River and Ohio River (West Virginia), and in two rivers in Missouri. Its historic distribution included the Tennessee River (Tennessee and Kentucky), Flint River and Limestone Creek (Alabama), Duck River, Holston River, French Broad River (Tennessee), Clinch River (Tennessee and Virginia), Cumberland River (Tennessee and Kentucky), Obey River (Tennessee), Ohio River, Allegheny River and Monongahela River (Pennsylvania), Elk River and Kanawha River (West Virginia), Scioto River and Muskingum River (Ohio), White River (Indiana), Wabash River (Indiana and Illinois), Mississippi River, Illinois River (Illinois), Ouachita River and Old River (Arkansas), Black River, Sac River, and St. Francis River (Missouri) (U.S. Fish and Wildlife Service, 1985). Although both species are relatively widespread, the reproductive status of many of the known populations of the rough pigtoe and pink mucket is not known.

The pink mucket pearly mussel may be more tolerant of a wider variety of habitat types than the other large river mussels. It has been found in the headwaters of several reservoirs in lentic conditions considered unsuitable for the other riverine mussel species. Although it is widespread, the pink mucket is rare where it occurs. (U.S. Fish and Wildlife Service, 1985)

The dromedary pearly mussel (Dromus dromas) is a Cumberlandian species--i.e., it is endemic to streams on the Cumberland Plateau. This species is presently known to occur in the Cumberland, Powell, and Clinch Rivers in Tennessee, Kentucky, and Virginia (U.S. Fish and Wildlife Service, 1983a). A single live specimen collected downstream from Watts Bar Dam is the only recent record for D. dromas in the project area, but the species is still known to be reproducing in the Clinch River in Tennessee (Steve Ahlstedt, USGS,

personal communication). Like the other three species, the dromedary pearly mussel inhabits areas with moderate to swift current over mixed sand/gravel/cobble substrate.

The rough pigtoe mussel is a short-term breeder; the dromedary and pink mucket are long-term breeders. The fanshell is also a long-term breeder (Ortmann, 1919). To date, no fish hosts for the four mussel species addressed in this biological opinion have been identified or confirmed. However, the sauger has been reported to be the host for glochidia of a mussel species (Higgin's eye pearly mussel) closely related to the pink mucket (U.S. Fish and Wildlife Service, 1985). Since the sauger also occurs in streams supporting populations of the pink mucket pearly mussel, it may serve as a glochidial host for that species as well.

- o FISH
  - o Snail darter

The snail darter, Percina tanasi, is a threatened species that is restricted to the upper Tennessee River drainage. The species may once have occurred in suitable habitats in the Tennessee River and its major tributaries from north-central Alabama to northeastern Tennessee. Presently, the species is known to occur in the mainstem of the Tennessee River (Watts Bar Lake, Chickamauga Lake, Nickajack Lake, Guntersville Lake), Sewee Creek, Sequatchie River, Hiwassee River, Paint Rock River and South Chickamauga Creek in Tennessee, Alabama, and Georgia (U.S. Fish and Wildlife Service, 1983b). The Hiwassee River population is the result of a successful transplant effort undertaken by TVA in 1975 and 1976. Snail darters were also transplanted into the Nolichucky River (NRM 18.0), Holston River (HRM 14.4), and Elk River (ERM 41.0). During routine fish surveys in 1988 and 1989, TVA biologists found snail darters in the lower Holston River (HRM 5.0) and the lower French Broad River in Knox County, Tennessee, indicating that the transplanted population in the Holston River may have reproduced and expanded. However, neither the Nolichucky River or Elk River transplants have resulted in successfully reproducing populations.

Percina tanasi spawns in shoal areas. Males arrive on spawning shoals from November through mid-January. Females arrive shortly after that and lay their eggs in gravel or on rocks through the middle of March. However, female snail darters in spawning condition have been observed in the Little Tennessee River as late as April and mid-May (Hickman and Fitz, 1978). The newly hatched fry may drift downstream to nursery areas in slackwater or pool habitats and remain there for six to seven months, at which time they (juveniles) move back into shoal habitats (Hickman and Fitz, 1978; Etnier and Starnes, 1993). Food habits of larval and post-larval snail darters are unknown, but zooplankton may comprise the

bulk of the diet (Etnier and Starnes, 1993); adults feed primarily on aquatic snails, as well as other aquatic macroinvertebrates (Hickman and Fitz, 1978; Etnier and Starnes, 1993).

BIRDS

o Bald eagle

The bald eagle, Haliaeetus leucocephalus, is a large North American raptor, attaining body lengths of approximately three feet, with wingspans of almost seven feet. Adults are easily identified by the distinctive white plumage on the head and tail. Juvenile birds may be mistaken for adult golden eagles, but can be identified by the white feathers on the wing linings and the absence of feathers on the legs. Two subspecies of bald eagles are presently recognized, the northern (H. l. alascanus) and southern (H. l. leucocephalus). However, the distinction between the two may not be tenable because there is apparently a continuous gradient in size and weight of birds geographically from north to south. Nevertheless, for recovery and Section 7 consultation purposes, the Service recognizes five distinct sub-populations, and this biological opinion will determine if the proposed project will jeopardize the continued existence of the Southeastern sub-population of bald eagles, the range of which includes the states of Kentucky, Tennessee, Arkansas, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Louisiana, Texas (east of the 100th meridian), and West Virginia (west of the 80th meridian). (U.S. Fish and Wildlife Service, 1989)

Bald eagles historically nested throughout the southeastern United States. The species was considered to be a common resident in Florida, Georgia, North Carolina, South Carolina, and Texas, but Kentucky and Tennessee did not historically have abundant eagle populations. Until recently, the last nesting activity in either state was reported from the 1950's (Kentucky) and early 1960's (Tennessee). For about thirty years, there had been no confirmed nesting activity in Kentucky or Tennessee, but substantial populations of eagles continued to winter along the Ohio River and Reelfoot Lake. In 1986, an eagle nest was discovered on the Ballard County Wildlife Management Area in western Kentucky. Despite failure of the nest in 1986, four additional nests have been constructed and several eaglets have been fledged. In addition, several nests have been reported recently along the Mississippi and Ohio Rivers west of Ballard County and one was recently found at an inland reservoir in eastern Kentucky (Laurel River Lake). The nest at Laurel River Lake failed in 1991 (the nest tree blew down during a storm) and, although no new nests have been discovered, a pair of adult bald eagles was observed at Laurel River Lake in 1992 and 1993. No nests are known to occur in the vicinity of the Watts Bar Nuclear Plant, but a nesting attempt was

made by a pair of eagles in 1994, approximately 4 miles south-southwest of WBN. The nearest known successful bald eagle nest exists on Tellico Lake, and other nests are known to exist at Cordell Hull Lake and at a number of locations in western Tennessee. Bald eagles also likely winter along the Tennessee River below Watts Bar Dam and around the reservoir.

Although the bulk of the bald eagle's diet consists of fish, the species is opportunistic and will feed on a variety of prey depending on its availability. Remains of catfish, turtles, coot, mullet, gallinule, and small mammals have been observed in nests and apparently supplement the eagle's diet (U.S. Fish and Wildlife Service, 1989).

Bald eagles begin to arrive at wintering areas in late October (depending on the severity of the weather in the northern portions of the range) and generally remain through March. Food availability may be the most important factor in maintaining wintering populations, but suitable perching and roosting sites also determine the degree of use (Steenhof, 1978). Preferred diurnal perch trees are near shore or within unobstructed view of the water and have stout, horizontal branches and adequate open area to facilitate hunting. Communal roost trees are usually protected from wind and may be bordered by open area, but are not necessarily near open water.

Depending on the area, nesting activity in the Southeastern states may begin as early as September or as late as December. At those times, mated pairs begin constructing nests or repairing existing nests. The female completes much of the nest construction with some help from the male. At times, however, bald eagles have been known to take over the nests of other large birds (e.g., ospreys). Eggs are laid between late October and December, and are incubated for approximately 35 days. Clutch size is generally two, but sometimes three eggs are hatched. Fledging takes ten to twelve weeks, and parental care may extend for an additional four to six weeks. Bald eagles require roughly four to five years before reaching breeding age, and mature adults generally return to the areas from which they were fledged to establish breeding territories. Eagles may use the same nest year after year, or the breeding pair may construct several additional nests within its territory and alternate use from one year to the next. Nesting territories encompass an area of up to one mile around the nest (however, territories are not necessarily circular around the nest) and are actively defended during the nesting season (U.S. Fish and Wildlife Service, 1989). In Tennessee, nesting activity may not begin until October. However, numerous observations indicate that egg laying takes place from late January through April, peaking in mid-February.

There appears to be significant variability among individual bald eagles in their sensitivity to disturbance. Some birds occur in areas having relatively high levels of disturbance. These birds are generally more tolerant of human activity than birds raised in isolated localities with low levels of activity and/or use. Disturbance of a nesting pair may result in abandonment of a territory, or if the nest site is not abandoned, the birds may respond to disturbance by reducing annual production. Some pairs are known to nest close to areas that undergo heavy human use, exhibiting tolerance to a certain degree of disturbance. Other active nests are located in relatively isolated, inaccessible areas. It is probable that the birds using these isolated areas are extremely sensitive to even minor disturbance.

MAMMALS

- Gray bat

The gray bat was listed as an endangered species on April 28, 1976. It is the largest species in the genus Myotis in the eastern United States, weighing 7 to 16 grams and having forearm lengths of 40 to 46 millimeters. The gray bat is easily distinguished from all other bats throughout its range by its unicolored dorsal fur. (U.S. Fish and Wildlife Service, 1982)

The species has a limited geographic range in karst areas of the southeastern United States. Populations occur primarily in Alabama, Kentucky, Missouri, Tennessee, and northern Arkansas; but smaller populations are known from northwestern Florida, western Georgia, southeastern Kansas, southern Illinois and Indiana, northeastern Oklahoma, northeastern Mississippi, and western Virginia. Distribution within the species' range has always been patchy, but increasing population isolation and fragmentation has been reported. (U.S. Fish and Wildlife Service, 1982)

Historically, individual hibernating gray bat populations numbered from 100,000 to 1,500,000 or more; summer colonies (in Alabama and Tennessee) averaged from 10,000 to 50,000 individuals, but some contained up to 250,000 bats. However, drastic declines in hibernating and maternity colony sizes as well as cave abandonment have been reported recently. The overall species decline, based on hibernating populations, is at least 50 percent during the past 50 years (U.S. Fish and Wildlife Service, 1982). Annual gray bat surveys in Alabama, Tennessee, Missouri, and Kentucky indicate that an average decline of 46 percent was occurring every 6 years during the 1960's and 1970's (the range was from 32 to 57 percent). If gray bat populations continue to decline at an average rate of 46 percent every 6 years, the species' population would be approximately 100,000 individuals by the year 2000. A population

of that size scattered over six states may not be large enough to sustain itself, and the species would likely face extinction (Tuttle, 1975; U.S. Fish and Wildlife Service, 1982).

The gray bat is among the most habitat-restricted mammals in the United States. With rare exception, the species roosts in caves throughout the year and, because of highly specific habitat requirements, less than 5 percent of available caves provide suitable environmental conditions. Gray bat colonies migrate seasonally from 17 to 525 kilometers between warm (14-25 degrees C) and cold (6-11 degrees C) caves. (U.S. Fish and Wildlife Service, 1982)

Myotis grisescens feeds almost exclusively over water. Caves used by maternity colonies are usually located within 1 kilometer of, and rarely more than 4 kilometers from, rivers or reservoirs over which the bats feed. A variety of aquatic insects (adult stage) are consumed, but the gray bat appears to prefer adult mayflies, stoneflies, and caddisflies (LaVal et al., 1977).

Relatively undisturbed forest canopy also appears to be an important component of gray bat habitat. Young often feed and take shelter in the forest surrounding the cave opening and gray bats of all ages fly in the canopy between the cave and foraging areas. Forest cover also provides a measure of protection against predators. Consequently, gray bat feeding areas are generally not found along sections of river or reservoir shoreline where adjacent forest canopy has been removed (LaVal et al., 1977).

Gray bats breed upon arrival at hibernacula. Females store sperm through the winter and become pregnant soon after emergence in late March to early April. Summer colonies occupy traditional home ranges that often contain several roosting caves near rivers or reservoirs. Members of the colony are extremely loyal to their home range, but may disperse to different caves within that range. Females congregate in maternity colonies, usually the warmest cave in the home range, and give birth (each female bears a single young) in late May to early June. Growth rates and survival of young are dependent upon the size of the colony and the distance of the cave from foraging areas (Tuttle, 1975; Tuttle, 1976). Most young begin to fly within 20 to 35 days of birth and are apparently not taught how or where to hunt.

Human disturbance has been identified as a major factor in the decline of the gray bat, particularly at two times of the year. Disturbance of bats at the hibernaculum from mid-August through April awakens the bats, resulting in excessive expenditure of energy reserves stored by individual bats. Repeated disturbance may cause the bats to emerge from hibernation before prey becomes available, resulting in high mortality. Intrusion into caves used

by maternity colonies between late May and mid-July may result in the death of hundreds or thousands of flightless young. (U.S. Fish and Wildlife Service, 1982)

Other causes of decline in gray bat populations include improper use of pesticides that may cause direct mortality to the bats or secondary poisoning from feeding on contaminated insects. Natural calamities (such as flooding of caves and collapse or fill-in of entrances), commercialization, and improper gating of gray bat hibernacula and summer caves also are contributory factors in the recent decrease in population numbers. Even if the bats escape initial destruction or alteration of the cave, survival of displaced populations is questionable due to the species' strong site attachment and highly specific habitat requirements. In addition, pollution and siltation of foraging areas, as well as deforestation along waterways and between caves and foraging areas, reduce foraging area and overall habitat quality. (U.S. Fish and Wildlife Service, 1982)

In the past 15 years, efforts to protect and recover the gray bat have shown some success. Populations in high priority hibernacula and maternity caves have stabilized or undergone moderate increases as a result of protection measures such as acquisition, signing, fencing, and gating. Gray bat numbers are now thought to be stable (at lower than historic levels) in Alabama and Arkansas, but declines are still reported throughout some portions of the species' range (Robert Currie, FWS, personal communication).

E. PROJECT IMPACTS

Direct/Indirect Effects

Impacts to listed species resulting from operation of the Watts Bar Nuclear Plant are likely to occur primarily as a result of heated water discharge from the plant or from inadvertent or accidental spills of radioactive or hazardous materials into the river. These materials could cause direct mortality to individuals, or could adversely affect normal behavior or reproduction. Over time, low-level contamination could result in adverse chronic effects.

Heated water will be discharged through a diffuser constructed in the river. This will facilitate mixing and dilution with the river water and should not result in any significant reduction in dissolved oxygen level or in temperature shock. Discharge of non-radioactive materials will not exceed levels contained in the existing State-issued National Pollution Discharge Elimination System (NPDES) permit. Release of radioactive materials will be in accordance with provisions of 10 CFR, Part 20, for release to unrestricted areas.

Chemicals and other substances to be used at WBN include alum, sulfuric acid, sodium hydroxide, chloride, boric acid, metallic salts, carbonates, ammonia, hydrazine, copper, nickel, pyrophosphate, zinc sulfate, coppertrol, clamtrol, bromo-chloro-hydantoin, and an organic co-polymer dispersant. Waste products from use of alum in the makeup water filter plant will not be discharged into the Tennessee River, but will be disposed of in a landfill. Copper and nickel will not be added to the system at WBN, however, corrosion will result in these metals entering the river at certain concentrations. Waste products from the remaining chemicals will be discharged into the river. Some, such as zinc and ammonia, are known to be detrimental to aquatic organisms and could have significant adverse effects on fish and mussels, including endangered species, in the action area. Improper use of substances such as clamtrol, a molluscicide, could result in high mortality of non-target molluscs in the river. However, in order to minimize the effects of discharged chemical end products, WBN will operate in accordance with a State-issued NPDES permit. Standards established in that permit are designed to prevent water quality degradation that would result from unregulated discharge of pollutants into the river. Various extensive testing and monitoring efforts will be implemented by WBN to ensure that the plant remains in compliance with the NPDES permit.

Impacts to listed species may also result from activities associated with maintenance of the five transmission line rights-of-way. Use of herbicides to maintain these areas could result in direct mortality to non-target terrestrial species or stress-related mortality resulting from chronic effects.

Cumulative Effects

Cumulative effects are those effects of future State and private activities on endangered and threatened species or critical habitat that are reasonably certain to occur within the action area of the Federal action subject to consultation. Future Federal actions will be subject to the consultation requirements established in Section 7 and, therefore, are not considered cumulative in the proposed action.

At the present time, there are no known State or private activities proposed that are reasonably certain to occur in the vicinity of the Watts Bar Nuclear Plant as a result of the plant operation. Therefore, cumulative effects, as defined by the Act, are not anticipated to occur. However, businesses or industries, particularly of the support-type (i.e., those that provide services to plant employees) may be attracted to the area in the future.

F. BIOLOGICAL OPINION

The Nuclear Regulatory Commission is proposing to issue a license to the Tennessee Valley Authority to operate the Watts Bar Nuclear Plant. Determinations of "not likely to adversely affect" were made by TVA and NRC for the gray bat, bald eagle, snail darter, rough pigtoe, pink mucket pearly mussel, fanshell, and dromedary pearly mussel. Although agreeing with the findings made by TVA, NRC chose to initiate formal consultation for issuance of the license.

o BALD EAGLE

The jeopardy standard for the bald eagle is based on consideration of impacts to one of five identified sub-populations. In order to determine jeopardy for bald eagles in Tennessee, the Service must conclude that a proposed action will threaten the continued existence of the species over the entire southeastern United States. The Service is presently evaluating current nesting data to determine if the bald eagle should be downlisted from endangered to threatened status. However, of the five sub-populations, all but the Southeastern population have achieved the recovery objectives described in the respective species' recovery plans. The recovery goals for the Southeastern sub-population are based on establishment and success of a designated number of nesting pairs in each state. To date, not all of the Southeastern states have reached the designated number of nesting eagles. The recovery objective for Tennessee, which has been achieved, is fifteen nesting pairs. In 1993, there were 18 occupied nests, fifteen of which successfully fledged young. Consequently, actions that result in abandonment or failure of the nests in Tennessee would adversely affect the recovery of the species in the State and the Southeastern sub-population, but would not necessarily threaten the survival and recovery of the species throughout the Southeast.

After review of the status of the bald eagle, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that operation of the Watts Bar Nuclear Plant, as proposed, is not likely to jeopardize the continued existence of the bald eagle. No critical habitat has been designated for this species; therefore, none will be affected. However, there is a potential for impacts to bald eagles in the vicinity of the Watts Bar Nuclear Plant as a result of operation and associated activities. This area apparently provides suitable wintering habitat and potential nesting habitat and, although the bald eagle may be considered "recovered" in the State, this habitat may become more important to the bald eagle in Tennessee as the species expands its range. Loss

of the habitat along the Tennessee River below Watts Bar Dam through project-related disturbance could impede full recovery of the Southeastern sub-population.

o FISH

Only the Sewee Creek snail darter population occurs within the project impact area, which constitutes one of several reproducing snail darter populations known to exist throughout the species' range. Because the species is sensitive to changes in its habitat, pollution of the river in the form of heated water discharge, release of radioactive materials, or accidental spills of radioactive or hazardous materials resulting from operation of the facility could have adverse impacts on the species or its habitat. However, after reviewing the status of the snail darter, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that operation of the Watts Bar Nuclear Plant, as proposed, is not likely to jeopardize the continued existence of the snail darter. Critical habitat for this species was designated in the Little Tennessee River at the time the species was listed; however, the designation of critical habitat was withdrawn when the snail darter was downgraded to threatened status in 1984. Therefore, this action will not result in destruction or adverse modification of critical habitat.

o MUSSELS

Freshwater mussel populations have been affected by a variety of activities. Impoundment of the Tennessee River, and other rivers, has altered miles of free-flowing riverine habitat. Agriculture, mining, road construction, development, and forestry operations have all contributed to siltation of streams and rivers and degradation of water quality. Point and non-point pollution from agricultural, industrial, and urban sources have directly resulted in population declines, and have indirectly affected mussels by eliminating essential fish hosts. Recent die-offs of undetermined cause throughout the Southeast have also contributed to significant declines in mussel populations.

Introduction of exotic species is undoubtedly another cause of decline in native mussel populations in the United States. In the 1930's, the Asian clam (Corbicula fluminea) was introduced into North American waters in the Pacific Northwest and the species spread throughout the United States by the mid-1970's. The zebra mussel (Dreissena polymorpha) was probably introduced into the Great Lakes from Europe sometime in the mid-1980's. It has recently been found in the Mississippi, Ohio, Cumberland, and

Tennessee Rivers and has the potential to spread throughout the Southeast. Both of these species have tremendous reproductive capacities, reaching densities of tens of thousands of individuals per square meter. At high densities, both species have the ability to filter tremendous quantities of water and plankton, thus reducing the availability of food for native species. Corbicula fluminea has been attributed as a cause of decline in native mussel populations in some streams due to its competitive advantages. Dreissena polymorpha has been present in North American waters for approximately 10 years, and it has been known to adversely affect or eliminate many species of native mussels in the Great Lakes and the rivers of the Northeast and Midwest. The remaining populations of native, large-river mussels in the Southeast are thus in danger of extirpation as the zebra mussel continues to spread.

After reviewing the current status of the dromedary pearly mussel, fanshell, pink mucket pearly mussel, and rough pigtoe, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that, because the populations of the four endangered mussel species in this reach of the Tennessee River are small and none are presently known to be reproducing, operation of the Watts Bar Nuclear Plant, as proposed, is not likely to jeopardize the continued existence of the dromedary pearly mussel (Dromus dromas), rough pigtoe (Pleurobema plenum), fanshell (Cyprogenia stegaria), or pink mucket pearly mussel (Lampsilis orbiculata). No critical habitat has been designated for these species; therefore, none will be affected.

o MAMMALS

At present, there are two known caves within five miles of the Watts Bar Nuclear Plant that are occupied by gray bats during the summer. The reach of the Tennessee River adjacent to the Plant may therefore provide foraging habitat for the species. After reviewing the current status of the gray bat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that, although operation of the facility and associated activities may impact the Tennessee River, operation of the Watts Bar Nuclear Plant, as proposed, is not likely to jeopardize the continued existence of the gray bat. No critical habitat has been designated for this species; therefore, none will be affected.

G. INCIDENTAL TAKE

NOTICE: While the incidental take statement provided in this consultation satisfies the requirements of the Endangered Species Act, as amended, it does not constitute an exemption from the prohibitions of take of listed migratory birds under the more restrictive provisions of the Migratory Bird Treaty Act.

Section 9 of the Endangered Species Act, as amended, prohibits any taking (=harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in such activities) of listed species without a special exemption. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered taking within the bounds of the Act, provided that such taking is in compliance with the incidental take statement.

This section of the biological opinion addresses incidental take of the dromedary pearly mussel, rough pigtoe, fanshell, pink mucket pearly mussel, snail darter, gray bat, and bald eagle resulting from project activities, and presents the Service's estimates of the anticipated amount or extent of take. In meeting the provisions of Section 7(b)(4) of the Endangered Species Act, we have reviewed the biological information and other available information relative to this action.

Given the ranges and present statuses of some of the species (e.g., dromedary pearly mussel, fanshell) involved in this consultation, it is possible that incidental take could reach levels that would be in violation of Section 7(a)(2). Although there is a substantial amount of quantitative data regarding the fish and mussel resources below Watts Bar Dam, it would be difficult to locate a dead mussel or snail darter given the size of the Tennessee River, or to attribute the death to operation of WBN. In addition, there is a general lack of data regarding use of the river and adjacent terrestrial habitat by bald eagles and gray bats. Therefore, it is not possible to estimate the number of individuals that might be taken or the amount of habitat that might be affected as a result of plant operation. Therefore, the NRC should contact the Service's Cookeville Field Office if incidental take of one individual of any of the species listed in this section attributable to operation of, or associated activities at, the Watts Bar Nuclear Plant occurs to determine if reinitiation of consultation is needed. Operation of the plant may continue during these discussions. **The incidental take of bald eagles is not authorized by the Bald and Golden Eagle Protection Act. Therefore, such take is not authorized by this incidental take statement.**

Reasonable and Prudent Measures

As a reasonable and prudent measure to minimize incidental take of the endangered and threatened species addressed in this biological opinion, with the exception of the bald eagle, the NRC should:

1. Ensure that adequate procedures are in place to prevent degradation of water quality in the Tennessee River from operation of the Watts Bar Nuclear Plant.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the following terms and conditions, which implement the reasonable and prudent measure described above, must be complied with:

1. The NRC should ensure that adequate plans are in place, which contain measures that will be implemented in the event of a spill or other accident involving radioactive, hazardous, or toxic materials, prior to operation of the Watts Bar Nuclear Plant. The plans should contain measures that employ the latest technology in containment and/or clean-up of hazardous materials. The plans should provide for rapid reporting of and response to spills and accidents. The plans should be reviewed and updated as needed to ensure that the latest techniques and methodologies are incorporated.

2. Any license and subsequent renewal will contain a clause giving NRC the option to revoke the license if TVA does not maintain and comply with a valid NPDES permit. If the temperature and/or contaminant limits contained in the State-issued permit are exceeded, this office will be contacted to determine if reinitiation of consultation is necessary. Plant operation may continue during these discussions. Water quality monitoring will be an integral and ongoing part of the operation of WBN to ensure early detection of problems. Reports of water quality monitoring will be submitted to NRC and the Service's Cookeville Office at least annually. Since at least four endangered mussel species are likely to occur in the Tennessee River in the project area, toxicity testing using freshwater mussels would provide TVA and the Service an early warning mechanism regarding adverse changes in water quality resulting from discharges from the Watts Bar Nuclear Plant. Mussels are presently being held and propagated at TVA's Browns Ferry Nuclear Plant for toxicity testing purposes at that facility. Portions

of that stock could be used at the Watts Bar facility. Toxicity testing with juvenile mussels would be particularly valuable since that life stage is likely more sensitive to changes in water quality than adult mussels or some of the standard bioassay organisms. However, since Ceriodaphnia has been shown to be more sensitive, it will also be used as a test organism. An appropriate testing schedule will be developed. Results of these tests will be submitted to this office and the NRC.

Upon locating a dead, injured, or sick specimen of an endangered or threatened species, initial notification must be made to this office and the appropriate Fish and Wildlife Service Law Enforcement Agent in Nashville, Tennessee (Mike Elkins; 615/736-5532). Care should be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

If, during the course of the action, incidental take occurs as a result of plant operation, NRC should contact the Cookeville Office to determine if reinitiation of consultation is needed. If it is determined that further consultation is needed and that the impact of additional taking will cause an irreversible and adverse impact on the species, as per Section 402.14(i) (50 CFR), plant operations must be stopped in the interim period between the initiation and completion of the new consultation. The Nuclear Regulatory Commission or Tennessee Valley Authority should provide an explanation of the causes of the taking.

H. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act states that "All other Federal agencies shall, in consultation with and with the assistance of the Secretary [of Interior], carry out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act." We believe that this provision of the Act places an obligation on all Federal agencies to implement positive programs to benefit listed species. A number of recent court cases appear to support that belief. Agencies have some discretion in **choosing** conservation programs, but Section 7(a)(1) places a mandate on agencies to implement some type of programs. And although candidate species are not legally protected by the Endangered Species Act, provisions of Section 4(B)(3) of the

Act (1988 amendments) direct the Service to monitor the status of those species and to conduct "pre-listing recovery actions." In keeping with the intent of Sections 7(a)(1) and 4(B)(3), the Service recommends that the Nuclear Regulatory Commission and/or Tennessee Valley Authority implement the following measures, or other measures of their choosing, to promote the conservation of the listed species involved in this consultation, and the candidate species included in the biological assessment:

1. NRC and TVA should initiate an active program to conduct, or become cooperators (e.g., provide research funds) in research to develop techniques for cryopreservation of freshwater mussels. Because of the magnitude of threats to this faunal group, successful cryopreservation of adult mussels, juveniles, glochidia, or gametes may be the only means of preserving mussels, particularly large-river species, for future reintroduction. A recent Service-funded study investigated the feasibility of cryopreservation, but did not successfully achieve development of techniques for long-term preservation.

2. NRC and TVA should initiate an active program to conduct research, or become cooperators (e.g., provide research funds) in other ongoing research, regarding artificial propagation of freshwater mussels. TVA has been directly involved in such research in the past and still has the facilities and expertise to resume such an effort. Successful propagation of mussels would be of great benefit in that it would provide stocks of mussels that could be used for augmenting existing mussel populations, reestablishing populations in areas that have recovered from past degradations, or for cryopreservation. Given the rarity of some of the listed mussel species and the high potential for loss of the native large-river mussel fauna resulting from invasion of the exotic zebra mussel, maintenance of stocks of these species may be the only means of preserving and recovering this unique fauna.

3. NRC and TVA should provide funds for the construction, operation, and maintenance of a facility to hold and rear freshwater mussels. The facility could consist of raceways with a flow-through system using river water, or it could be a series of shallow ponds. This facility would serve as a refuge for native large-river mussels, including endangered species. Mussels brought to this facility should be used to conduct research for propagation, rearing, cryopreservation, and to provide a stock of mussels for reintroduction into rivers in the future. The facility could ultimately be used as a hatchery and refuge for large-river mussels throughout

the Tennessee and Cumberland River drainages. A prime consideration in construction and operation of the facility would be to ensure that it remains free of zebra mussels. This would be accomplished by incorporation of adequate filtration of river water, quarantine of mussels brought in, and other means.

4. NRC and TVA should conduct, or become cooperators (e.g., provide research funds) in ongoing studies regarding, long-term research to determine the best means of transplanting freshwater mussels. Past efforts in this area have met with variable success with regard to survival of transplanted mussels. In addition, there is a virtual lack of information regarding growth and reproduction of transplanted mussels.

5. NRC and TVA should conduct, or become cooperators (e.g., provide research funds) in ongoing research regarding, life history studies on Tennessee River mussel species, including endangered species. Of the over 100 species that historically existed in the Tennessee River drainage, only 40-50 species remain. Detailed life history information is available for less than 15 percent of those species. Basic life history information is critical to successful recovery of endangered species and management of all remaining mussel species. Studies should examine, among other things, various aspects of the life cycle, including growth, reproduction, fish hosts, and habitat requirements (physical, chemical, etc.). These studies should also attempt to determine the sensitivity and/or susceptibility of various species to disturbance of their habitat. Some species (e.g., species in the genus Epioblasma) appear to be declining throughout their ranges while others inhabiting the same rivers and streams remain stable (John Jenkinson, TVA, personal communication). This may indicate that certain species are sensitive to even minor disturbances to the habitat or changes in water quality. Results of these studies should be published in appropriate scientific journals and disseminated to appropriate agency and university personnel.

6. NRC and TVA should develop an educational program (e.g., audio/visual presentation, pamphlets, brochures, teaching aids, etc.) that could be distributed or made available to area schools and organizations. The program should describe the fauna and flora found in the eastern portion of the Tennessee River Valley, the changes in the flora and fauna from historic times to the present, endangered

and threatened plants and animals, unique habitats and the wildlife and plants that utilize those habitats, and the importance of protecting this unique flora and fauna.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or benefit listed species or their habitats, the Service requests notification of the implementation of the above-listed conservation recommendations or any other conservation measures implemented by your agency in conjunction with the proposed project.

I. CONCLUSION

This concludes formal consultation between the Service and NRC for the operation of the Watts Bar Nuclear Plant. Consultation should be reinitiated if: (1) incidental take of listed species resulting from plant operation occurs and it is determined (through discussions with the Service) that additional take would have irreversible adverse effects on the species, (2) new information reveals that the proposed project may affect listed species in a manner or to an extent not previously considered, (3) the proposed project is subsequently modified to include activities which were not considered during this consultation, or (4) new species are listed or critical habitat designated that might be affected by the proposed project.

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February 16, 1995

NOTE TO: Doris J. Hoover
Document Liaison Officer

FROM: Linda Luther
Licensing Assistant
License Renewal Project
Directorate, ADAR, NRR

SUBJECT: DOCUMENT FOR THE PDR - WATTS BAR

I am attaching a letter from Douglas B. Winford to William T. Russell dated March 8, 1995, on the Watts Bar Nuclear Power Plant biological assessment prepared jointly by NRC and TVA. Please ensure that this letter is sent to the Public Document Room under Docket Nos. 50-390 and 50-391.

Attachment: As stated

cc: Scott Newberry
Frank Akstulewicz
Scott Flanders