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Testimony
Before the Committee on Resources
Subcommittee on Water and Power
United States House of Representatives

Reviving Hydro-Electric Power on the Savannah River:
A Clean and Renewable Resource for Generations

September 27th, 2004

Improvements to Hydropower on the Savannah River
U.S Army Corps of Engineers
Savannah District

Mr. Chairman and distinguished members of the Subcommittee:

I am honored to be testifying before you on “Reviving Hydroelectric Power on the Savannah River.” I am COL Mark Held, District Commander of the Savannah District and I am representing LTG Carl Strock, Chief of Engineers. In particular, my testimony will provide background information on the Savannah River Hydroelectric power facilities.

The Savannah District currently has three major Hydropower facilities, Hartwell Dam and Lake, the Richard B. Russell Dam and Lake, and the J. Strom Thurmond (formerly known as Clark Hill) Dam and Lake. These three projects, constructed over a period of time from 1948 through the mid 1980’s, provide for Hydropower, Recreation, Water Supply, Flood Control, Navigation and Environmental benefits to the entire 400-mile Savannah River basin.

Each of the three projects has a unique history and is operated, maintained and used for various purposes. However, I would like to point out that all three projects share a seasonal environmental concern that has been addressed differently at the three projects. During the late summer and early fall, discharges from the lake through the powerplant have been oxygen deficient. The dissolved oxygen levels in the tailwaters of all three lakes during late summer through early fall are usually below that needed for fish reproduction, but are sufficient for fish survival.

Hartwell Dam and Lake

Construction began in 1955 and was completed in 1962 for the 17,790 foot dam and hydropower plant. Built with the provision for five generating units, four were initially installed along with the dam, with the fifth unit completed in 1986. The total capacity for all five units as of 1990 was 344 MW, the four older units at 66 MW each, with the fifth unit capable of producing 80 MW.

The Savannah District has retro-fitted all five hydropower turbines with “hub baffles” that increase the dissolved oxygen in the tail water by at least 2 parts per million (ppm). However, this modification comes at a cost of a 2% to 3% loss in turbine efficiency when the ambient air is allowed through the turbine, usually from the late summer through early fall of each year. The Corps has also installed a hydropower control software package called “Waterview”, which monitors the environmental conditions of the powerplant releases in order to optimize the use of the water for power production and environmental stewardship.

In 1992, the U.S. Army Corps of Engineers launched the Major Rehabilitation program, allowing for the new investment of significant construction funds towards re-establishing the reliability of our aging power plants. In 1994, the Savannah District received approval for a new Major Rehabilitation project at Hartwell, calling for the rewinding of the four older generators, the replacement of the transformers, the refurbishment and/or replacement of key electrical/mechanical equipment, the refurbishment of the switchyard and the four older turbines, and the construction of a new oil/water separator for environmental purposes. Total estimated cost of this work is $33,000,000, and is scheduled for completion in the spring of 2005.

When completed, the total capacity for all five units will increase from 344 MW to 422 MW, a 23% increase in overall plant capacity. In addition, the upgrading of the peripheral equipment will assure a much higher reliability, capacity and promises to substantially reduce the average cost of operation and maintenance. The inclusion of a new oil/water separator, will assure that, in the case of a failure of one of the new oil-filled transformers, oil will not enter the downstream tail water, preventing damage to the ecosystem.

When the Hartwell Rehab project was first proposed in 1993, regaining lost reliability was the primary concern. Frequent failures in the generator units had caused unscheduled shutdowns and reduced power outputs and increased operation and maintenance costs. Current policy then was first to establish whether the increase in reliability and decrease in operation and maintenance costs could economically justify a rehabilitation. If so, further increases in outputs (power and capacity) could be added. At that time, features to provide solely for environmental improvements were not allowed to be a part of the Rehabilitation program. Since the turbines had not shown a reliability problem, the only turbine work was for minor welding and other cavitation repair.

There is an opportunity to further rehabilitate the powerplant by the replacement of the turbines with the new dissolved oxygen improving turbines, such as the type being installed at the J. Strom Thurmond powerplant. Based on the actual costs for the seven units at J. Strom Thurmond, we anticipate that the replacement of the 5 turbines would cost approximately $25 million. Any economic justification for such a project would include in the analysis the benefits of not incurring the seasonal loss in turbine efficiency during the late summer and early fall of each year.

The main benefit of turbine replacement would be for the increase in turbine efficiency, allowing for a greater percentage of power to be derived from the falling water. This increased efficiency would be on the order of 5% during normal operation, and would increase to a 10% increase in efficiency when compared to when hub baffles are used. Through improvements in turbine technology, there would likely be additional horsepower available that would be converted to electrical energy. In addition, these new turbines would have the capability to provide dissolved oxygen improvements to the waters downstream of the powerplant, an issue that is most acute during the late summer and early fall of each year.

Richard B. Russell Dam and Lake

Construction began in 1974 and was completed in 1986 for the construction of the 1,800 foot concrete dam and hydropower plant. The total capacity for all eight units, as of the year 2000, with the addition of pumped storage was 600 MW, each with a rated capacity of 75 MW. As mitigation for the impacts of the Richard B. Russell impoundment, an underwater Oxygen Injection System has been installed upstream of the dam. This system is designed to provide a minimum of 5 parts per million of dissolved oxygen in the tailrace of the Russell powerplant from summer through early fall of each year.

Richard B. Russell is the largest Corps-owned plant east of the Mississippi River, consisting of eight units, four of which are pumped storage units. Pumped storage facilitates the reuse of the water to meet peak demands by pumping back during off peak periods, such as at night. The pumped storage component provides 300 MW of the total capacity.

Pump back operation is currently restricted to two pump units from June through September for environmental reasons during the peak summer season, while there is the greatest electrical demand. This pumping restriction will be lifted once a new oxygen injection system is built in J. Strom Thurmond Lake downstream of the Russell dam near Modoc, South Carolina. This oxygen injection system is a mitigation feature to offset the potential thermal impacts to the tail-water fishery downstream of the Richard B. Russell dam. Four unit pumping in the summertime increases tail-water temperatures to around 27 degrees centigrade which is above the comfort range for striped bass. The cost of the oxygen injection system is $5.5 million and will take three years to complete once it is initially funded.

In addition to providing increased hydropower capacity and energy, pumped storage is most effective as a water management tool that conserves water for reuse for hydropower, municipal and industrial water supply, recreation, and the environment. During times of drought significant water conservation can be realized through the use of pumped storage. The pumping capacity of each of the four units is 7,200 cubic feet per second (cfs); the four pumped storage units pumping for six hours per night will move over 14,000 acre / feet from Thurmond lake back into Russell lake for reuse. This total volume equates to 4.6 billion gallons per night.

J. Strom Thurmond Dam and Lake

Construction began in 1948 and was completed in 1954 for the 5,680 foot concrete and earth dam and hydropower plant. The total capacity for all seven units, as of 1990 was 280 MW, with all seven units with a rated capacity of 40 MW each.

The J. Strom Thurmond powerplant was the second powerplant to be proposed for Major Rehabilitation. In 1995, the Savannah District received approval for a new Major Rehabilitation project at J. Strom Thurmond, calling for the rewinding of the seven generators, the replacement of the transformers, the refurbishment and/or replacement of key electrical/mechanical equipment, and the replacement of the seven hydro turbines. Total estimated cost of this work is $70,000,000, and is scheduled for completion in the summer of 2005.

By the time that the J. Strom Thurmond project was proposed, policy allowed for power and capacity enhancements to be a more significant justification for a rehabilitation project. In addition, the District was allowed to propose environmental enhancements as long as the overall project was still economically justified. The currently approved J. Strom Thurmond Major Rehabilitation project increases the capacity of the seven hydropower units from 40 MW to 52 MW each, an increase of 30% over the pre-rehab project conditions. In addition, the upgrading of the peripheral equipment will assure a much higher reliability, capacity and promises to substantially reduce the average cost of operation and maintenance.

Another major feature of the Major Rehab project is the installation of the new Auto-Venting Turbines (AVT) at Thurmond, taking advantage of the scheduled replacement for the rehabilitation. This newly patented technology, jointly developed by Tennessee Valley Authority and Voith-Seimens, allows for the natural aspiration of air into the flowing water through small vents located in the trailing edges of the turbines. So far, with five units installed, testing indicates that the new AVT's are increasing the dissolved oxygen in the tail water from 2 ppm to 4 ppm, depending on ambient conditions, with a much reduced impact on turbine efficiency. The new AVT's will be operated during the summer and fall of each year. This technology promises to greatly improve the water quality and possibly the fishery habitat in the tail water of Thurmond towards the City of Augusta. However, there is a strong likelihood that the AVT technology will not be able to improve water quality enough to water quality goals of 5 ppm in all conditions.

It is not likely that there could be further significant increases to the hydropower capacity at J. Strom Thurmond in the foreseeable future. By using state-of-the-art materials and technology, the maximum hydropower efficiencies and capacity will be obtained with the Major Rehabilitation project. However, if it appears that, even with the AVT technology incorporated into the powerplant, the water quality downstream of the dam could be improved further, additional features could be added to increase the dissolved oxygen in the tailwater. Features, such as oxygen injection directly into the turbines, could be employed during critical periods in order to help establish a healthy environment year round in the waters downstream of the J. Strom Thurmond dam.

Savannah River Basin Comprehensive Water Resources Study

As a part of the Congressionally Authorized Feasibility Study, hydropower production is a major part of this study that is being conducted in two phases to assess and evaluate current and future needs and demands on the Savannah River Basin. We are currently in Phase 1 utilizing the Hydraulic Engineering Center Reservoir Simulation (HEC REES SIM) model to run different scenarios of operation involving our three plants with the goal being to develop recommendations that may improve general operations, drought management, water supply and water quality, and allocations. Model runs are being made to evaluate increased number of drought trigger elevations, increased conservation and flood storage pools, decreases to the amount of the winter draw down levels, and periodic downstream higher flow changes for ecological benefits to floodplains below the J. Strom Thurmond Dam extending to the fresh water estuaries above the Savannah Harbor.

The Corps is working cooperatively with the Nature Conservancy, the U.S. Fish and Wildlife Service, the City of Augusta, the Southeastern Power Administration (SEPA), and the Departments of Natural Resources for both South Carolina and Georgia to coordinate spring hydropower operations with the passage of anadromous fish in the lower Savannah River to accommodate the movements of these fish to spawning areas upstream of the New Savannah Bluff Lock and Dam, located downstream of the City of Augusta.

Mr. Chairman, thank you for providing the Corps of Engineers the opportunity to present testimony to you this morning. We appreciate your interest in these important issues that are of mutual concern.