ENVIRONMENTAL ASSESSMENT OF PAR POND SLUICE GATE TEST (U)

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Background

The Federal Energy Regulatory Commission mandates that spillway gates be opened to full height once every five years to ensure their safe operation in times of emergency. To meet this requirement, the SRS is proposing to conduct a test in which the sluice gate located near the base of the Par Pond dam is opened high enough to produce a nominal flow of 200,000 gpm and then re-closed. The gate will be opened slowly to allow time to observe the impacts of each flow increment, and the entire duration of the test is anticipated to take approximately six hours, although slight deviations from this schedule may occur. The test will be conducted sometime between 1 February 1995 and 15 March 1995. There are several concerns about the environmental impacts of this test. These fall into three categories:

- 1) concern that the high flows will resuspend sediments containing radioactive Cs-137 from the stream bed or floodplain of Lower Three Runs Creek (LTRC) and carry them downstream to the Savannah River,
- 2) concern that water chemistry in LTRC will be adversely affected by discharge from Par Pond resulting in deleterious effects on the biota of LTRC, and
- 3) concern that high flow velocities and scouring of the stream bed as a result of the tests will disturb the biota in LTRC.

Effects on the Redistribution of Cesium-137 in LTRC

Approximately 222 Ci of Cs-137 (cesium) was discharged to Par Pond and the LTRC from R-Reactor between 1954 and 1964 due to leaking fuel or target slugs in the spent fuel storage basins. After R-Reactor operations ceased in 1964, all cesium releases from that source were stopped (Hayes, 1991). Most of the cesium is presently contained in the sediments of both Par Pond and LTRC. Sediment concentrations range from 1 pCi/gm up to several hundred pCi/gm (Hayes, 1991, DOE 1992a).

Lower Three Runs Creek has experienced high flows many times. However, these extremes have typically been of a short duration. LTRC received the full flow discharge (up to 175,000 gpm) from R-Reactor prior to the existence of Par Pond. Following its impoundment, LTRC experienced a period of high flow between 1963-64. As late as the mid 1970s, effects of these high discharges were observable in the upper reaches of LTRC (Gladden, 1979). During the last decade, the flow in LTRC immediately below the dam has averaged 15,000 gpm, with maximum flows of approximately 40,000 gpm (WSRC, 1991). The average flow at Patterson Mill (approximately five miles downstream from the Par Pond dam) has been approximately 36,000 gpm (1974-1989), with a short-term high flow of approximately 330,000 gpm in 1980 (DOE 1992b, 1993).

During the drawdown of Par Pond in 1991, an estimated total of approximately 0.14 Ci of cesium was released through LTRC.

Assuming that all of the cesium was transported to the Savannah River, cesium concentrations in the river were a function of the drawdown rate, the river flow rate, the cesium concentration in Par Pond surface water (3.1 ± 0.8 pCi/L), and the cesium concentration in the river (0.012 pCi/L). For a maximum flow rate of 240,000 gpm in LTRC and a minimum flow rate of approximately 2,244,000 gpm in the river, the cesium concentration in the river was estimated to be approximately 0.35 pCi/L (Hayes, 1991).

This concentration would result in a dose rate of 0.0009 mrem per year, well below EPA's standard for community drinking water systems under the Safe Drinking Water Act (40 CFR 141) of 4 mrem per year to an individual drinking two liters per day. All possible offsite cesium and tritium doses from liquid and atmospheric releases as a result of the drawdown were estimated to be less than three hours of exposure to natural radiation (natural exposure rate = 0.036 mrem/hr) sources (Marter and Boni, 1991).

Based on the above observations, flows during the sluice gate test will approximate rates previously experienced in LTRC during the drawdown in 1991 and will not result in significant resuspension and transport of radionuclides downstream and offsite.

Effects on the Water Chemistry of LTRC

Water in the hypolimnion of Par Pond becomes anoxic during the summer due to thermal stratification and the decomposition of organic matter as is typical of mesotrophic reservoirs in the Southeast (Wetzel 1975). Under anoxic conditions, chemical equilibria favor the dissolution of metals into the water column where the concentrations of some constituents may reach levels that are deleterious to aquatic life. Water chemistry measurements from Par Pond during mid-September 1994 (Paller 1994) indicated that iron and manganese concentrations near the bottom of the reservoir exceeded levels that may cause chronic effects to aquatic life based on USEPA (USEPA 1992) criteria. In addition, dissolved oxygen levels were below the 5.0 mg/l considered necessary to support biologically balanced communities of aquatic organisms (USEPA 1992).

Thermally stratified lakes and reservoirs in the southeast typically become vertically mixed during cooler weather after the surface water temperature declines and the lake turns over. As a result of mixing, the water column becomes oxygenated and reduced metals oxidize and precipitate out of the water column (Wetzel 1975). Recent measurements indicate that Par Pond has turned over. Re-stratification is not expected until late spring or early summer 1995. Therefore, the currently proposed temporal window for the pump tests, February 1 - April 1, 1995, will occur during the period when Par Pond is mixed and oxygen and dissolved metal concentrations near the bottom of the lake (where the sluice gate is located) are not inimical to aquatic life. As a result, the

release of this water into LTRC will not result in toxic effects to LTRC biota.

Effects of Scouring on LTRC Biota

Because the flow in LTRC will increase to unusually high levels during the sluice gate test, physical impacts of high flows on the biota of LTRC are a concern. Several studies have shown that floods and unstable, fluctuating flow regimes can have negative effects on fish community structure, with impacts on small fishes being particularly prominent (Schlosser 1985, Matthews 1986, Bain et al. 1988). However, recovery generally occurs fairly rapidly after floods (Matthews 1986), presumably because storm flooding is a naturally occurring disturbance, and stream biota are adapted to withstand the effects of such disturbances.

In evaluating the probable impact of flow increases that result from the sluice gate test, it is necessary to consider the duration of the test, the extent to which the resulting flow increase exceeds natural flow perturbations, and the ability of the biota in southeastern coastal plane streams to endure brief periods of high flow. The test will be brief (approximately six hours); therefore, the period of high flow will approximate a natural spate in duration. While the magnitude of the flow will be high, 200,000 gpm compared with the currently maintained minimum flow of 4,500 gpm in LTRC, flows in excess of 200,000 gpm sometimes occur in local streams as a result of storm events. Paller et al. (1992) reported a flood flow in excess of 250,000 in Pen Branch, a stream with a base flow at that time of approximately 15,000 - 20,000 gpm. They also studied the effects of a three month period of fluctuating artificial flow increases with peaks of 200,000 gpm in this stream. Fish samples collected before and after the period of flow increase indicated relatively little change in species richness, species composition, condition, or size composition that could be attributed to the flow increases. They concluded that southeastern coastal plain fish assemblages are resilient to short-term increases in stream flow because they are adapted to the effects of natural spates. Therefore, while the sluice gate tests may affect the physical habitat in portions of Lower Three Runs to some extent, it is likely that the effects upon stream biota will be temporary and relatively minor.

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