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**ENTRAINMENT SAMPLING AT THE
SAVANNAH RIVER SITE (SRS)
SAVANNAH RIVER WATER INTAKES (1991) [U]**

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ENTRAINMENT SAMPLING AT THE SAVANNAH RIVER SITE (SRS) SAVANNAH RIVER WATER INTAKES (1991) [U]

1.0 INTRODUCTION

Cooling water for the Westinghouse Savannah River Company (WSRC) L-Reactor, K-Reactor, and makeup water for Par Pond is pumped from the Savannah River at the 1G, 3G, and 5G pumphouses. Ichthyoplankton (drifting fish larvae and eggs) from the river are entrained into the reactor cooling systems with the river water. They are passed through the reactor heat exchangers where temperatures may reach 70°C during full power operation. Ichthyoplankton mortality under such conditions is presumably 100%. The number of ichthyoplankton entrained into the cooling system depends on the density and distribution of ichthyoplankton in the river, discharge levels in the river, and the volume of water withdrawn by the pumps. Entrainment at the 1G pumphouse, which is just downstream from the confluence of Upper Three Runs Creek and the Savannah River, is also influenced by discharge rates and ichthyoplankton densities in Upper Three Runs Creek.

Entrainment at the SRS pumphouses was estimated in 1982, 1983, 1984, and 1985 (ECS 1983, Paller et al. 1984, 1985, and 1986). The species of greatest interest in these studies, based on their economic importance and likelihood of being entrained, were the American shad (Alosa sapidissima) and striped bass (Morone saxatilis). A third species of high importance was the shortnose sturgeon (Acipenser brevirostrum), which is on the endangered list. While not as likely to be entrained as American shad and striped bass, any losses among this species are undesirable because of its rarity.

2.0 PURPOSE

Apart from a small pilot study conducted in 1989, ichthyoplankton samples have not been collected from the vicinity of the SRS intake canals since 1985. The Department of Energy (DOE) has requested that the Environmental Sciences Section (ESS) or the Savannah River Laboratory (SRL) resume ichthyoplankton sampling for the purpose of assessing entrainment at the SRS Savannah River intakes. This request is due to the anticipated restart of several SRS reactors and the growing concern surrounding striped bass and American shad stocks in the Savannah River. The following scope of work presents a sampling plan that will collect information on the spatial (i.e., horizontal and vertical) and temporal distribution of fish eggs and larvae near the SRS intake canal mouths. This data will be combined with information on water movement patterns near the canal mouths (to be obtained in a future study) in order to determine the percentage of ichthyoplankton that are removed from the Savannah River by the SRS intakes. The following sampling plan incorporates improvements in experimental design that resulted from the findings of the 1989 pilot study.

3.0 SCOPE OF WORK

3.1 Data acquisition and field sampling

Sampling locations

Ichthyoplankton sampling will be conducted at two locations, RM 155.4 (approximately 5 - 25 m above the 3G intake canal) and RM 157.3 (approximately 5 - 25 m above the 1G intake canal) [Figure 1].

Sampling methods

Samples will be collected from a transect across the Savannah River at each of the two sampling locations. Sampling will consist of:

- physical (width, depth, current velocity) characterization
- ichthyoplankton sampling

Physical characterization will be conducted once at each sampling location prior to initiating ichthyoplankton sampling. Physical characterization data will be provided to Westinghouse Savannah River Company (WSRC) within 24 hours of collection. The WSRC contract manager will use this information to determine the sector areas used in the ichthyoplankton sampling program.

Physical characterization will consist of river depth, width, and current velocity measurement. A cable may be stretched across the river along the sampling transects and anchored on each bank to assist with this process. *If used, the cable will be conspicuously marked with flagging tape. Any additional safety precautions, such as deploying a safety boat in front of the cable, will be taken as required to prevent boaters from colliding with the cable.* Width measurements (nearest m) can be read directly from the cable (if calibrated) or from a measuring tape. Depth (nearest 0.1 m) and current velocity (nearest cm/s) will be measured at 10 m intervals across the river. Current velocity will be measured near the surface and at one-meter depth intervals. River stage height will be recorded along with the physical measurements.

Based on the physical characterization data, the WSRC contract manager will divide the river horizontally and vertically into 4 - 6 sectors at each transect. This information will be presented to the subcontractor prior to the commencement of ichthyoplankton sampling. Ichthyoplankton samples will be collected from each sector every two hours making a total of 12 samples from each sector on each sampling date. A randomization plan will be employed to ensure that each sector sample is taken at a randomly chosen depth and distance from the bank within each sector. The randomization plan specified above will be developed by WSRC personnel based on the physical characterization data provided by the subcontractor. This plan will specify the distance from the bank and depth at which each sample will be collected. A marked transect line or cable may be used to facilitate sampling. *Safety considerations associated with the use of a cable are described above.* Ichthyoplankton sampling at each transect on each sampling date will continue for a total of approximately 24 hours.

Ichthyoplankton will be collected with a 0.505 mm mesh plankton net measuring 0.5 m in diameter at the net mouth. Paired side-by-side nets in a "bongo" configuration will *not* be used in this study. A digital flow meter will be suspended in the mouth of the net to record the volume of water filtered for each sample. The net will be fitted with a one-liter plastic bottle at the cod end to hold organisms filtered from the water. The bottle will be appropriately labeled so that it can be associated with a field data sheet or notebook indicating the transect, sector, depth, time of day and date that the sample was collected. The notebook should also show the flowmeter readings associated with each sample, the names of the personnel that took the sample, general weather conditions, river stage, and any other pertinent information.

The single net sampling device will be used to collect ichthyoplankton in 50 m³ samples. Samples will be collected by suspending the net in the current at specified locations and depths until the proper amount of water is filtered. The depth of the net in the water column will be calculated from the length of the cord attached to the net and the angle of the cord (as measured with an inclinometer). Filtration must occur only at the specified depth of interest and not while raising and lowering the net. After sampling is completed, the net will be retrieved and washed so that the filtrate is flushed into the collecting bottle. Sufficient concentrated buffered (pH 7) formalin will be added to the bottle to bring the formalin concentration to approximately 5%. The bottle will be sealed and stored for return to the laboratory.

River stage height will be recorded at the end of each 24 hour sampling period. Temperature, dissolved oxygen, pH, and conductivity will be measured in the middle of each sector at the end of each 24 hr sample period.

Sample sorting and identification

In the laboratory, ichthyoplankton samples will be drained through a 0.5 mm or smaller mesh sieve and rinsed with tapwater. All fish eggs and larvae will be segregated from associated debris using an eyedropper or other appropriate instrument. The eggs and larvae of striped bass, American shad, and sturgeon will be identified, classified by life stage, enumerated, and stored in 100% ethanol. Separate counts will be maintained for each life stage. Larvae and the eggs of other species will be collected and stored but not identified.

3.2 Schedule of work

Ichthyoplankton sampling will begin the first week in March 1991 and continue through June 1991. Sampling will be conducted weekly. The interval between sampling at each location should not be less than five days. Each sample at each location will consist of a 24 hour series as described above.

Physical characterization will be conducted prior to ichthyoplankton sampling.

3.3 Data storage by Subcontractor

Field supervisors will have field notebooks to record all aspects of the daily sampling activities including information needed to recalculate the depth at which each sample was taken (i.e. length and angle of rope in the water) and distance of each sample from the bank. These notebooks will also record those results that are collected immediately (e.g. pH and current velocity). For ichthyoplankton identifications requiring laboratory analysis, there will be laboratory notebooks that will record all raw data from biological enumerations. Additional laboratory notebooks shall also contain records of instrument calibration or malfunction histories. Completed results will be stored as printed tables and on floppy disks (5 1/4" 360 K) for an

IBM/DOS microcomputer. The data will be stored in the form of Lotus 123 or Microsoft Excel files. Formats for data records will be supplied by WSRC. All computer data storage disks will be kept in duplicate until delivery to WSRC. One set of these duplicate disks and duplicate written copies of all other material shall be kept by the subcontractor for a period no less than 12 months from their date of delivery.

3.4 Data reporting by Subcontractor

The subcontractor shall submit a final written report to WSRC. The final report will describe field sampling techniques and present the results of the analyses described below. Data records on floppy disks will follow formats supplied by WSRC. All of the collected data will be given by the subcontractor to WSRC in the stored forms described above (see Scope-of-work, 3.3, data storage by subcontractor). This includes all field notebooks, finished printed data tables, reports, appendices, and the data stored on magnetic (floppy) disks.

Data analysis will include the following:

- 1) A table showing the number of American shad, striped bass, and shortnose sturgeon collected from each transect over all sampling dates. Each life stage should be listed separately.
- 2) Tables showing densities (number/1000 m³) for each species (all life stages combined) in each sector at each transect during each two hour interval on each sampling date.
- 3) Tables showing the mean monthly density, standard deviation, and sample size for each species (all life stages combined) in each sector at each transect during each two hour interval.
- 4) Tables showing the mean density, standard deviation, and sample size for each species (all life stages combined) in each sector at each transect during each two hour interval over all sample dates.
- 5) Tables showing the mean, standard deviation, range and sample size for each physical/chemical variable in each sector at each transect during each two hour interval over all sample dates.

3.5 Data confidentiality

All of the data collected or obtained by the subcontractor will remain the sole property of WSRC. No data shall be authorized for distribution, in any manner, until *all data* are cleared through the express written consent of WSRC and the U. S. Department of Energy.

4.0 SUPPLIER QUALITY ASSURANCE PROGRAM

4.1 Quality assurance program

The subcontractor is required to document and maintain an established Quality Assurance (QA) program. The subcontractor will provide detailed documentation of its QA program when submitting its bid. The subcontractor's QA requirements will be applicable to any sub-tier subcontractors used to supplement these specifications. QA protocols will be documented in the final report submitted to WSRC.

4.2 Deliverable Items

The deliverable items for this contract include a final written report describing field and laboratory techniques and including all specified tables (see Section 3.4), all field notebooks, magnetic (floppy) disks containing data records, and all preserved fish eggs and larvae collected during the study.

4.3 Schedule of deliverables

The subcontractor will submit all deliverables to WSRC within 60 days of the completion of field work.

4.4 Change control procedures

Any changes to this scope of work will be documented in writing and agreed to prior to implementation by WSRC.

4.5 Acceptance methods

Upon receipt of the deliverables from the subcontractor, WSRC shall review their content; make reasonable corrections for compliance with regards to contract content and presentation formatting; and, if necessary, return them to the subcontractor for revision. The subcontractor will then revise this first draft and resubmit it to WSRC for verification of corrections within 14 days.

Acceptance of the final deliverables shall be based solely on the judgement of the WSRC technical representatives. Ten per cent (10%) of the order value of the contract shall be withheld pending acceptance of final deliverables.

4.6 Handling of nonconforming items

The subcontractor shall immediately notify WSRC by telephone of any deviations in sampling procedure or data recording that prevents full compliance with the Scope of Work. Verbal notification will be followed by a written nonconformance report to be submitted within seven (7) days following the nonconformance incident. Nonconforming items shall include lost data or samples, departures from prescribed methodologies, inadequate instrumental calibration or breakdowns, errors in computer codes, and any other instances where QC/QA criteria are not achieved.

4.7 Documentation of exceptions to the bid

The offerer shall document any exceptions to this Request for Proposal (RFP) in their response. Exceptions to the RFP must be documented in writing and a proposal for resolution presented.

5.0 SAFETY AND SECURITY

All work associated with this project must be carried out in a safe manner. The subcontractor must demonstrate that its safety procedures are equivalent to WSRC safety procedures for all work at SRS. Safety procedures shall be in compliance with the Savannah River Site Safety Manual, Item 4.04.

Each subcontractor employee who will be working onsite must receive a plant orientation prior to conducting work on the SRS site. This orientation covers safety, security, occupational health, and environmental issues.

All subcontractor employees working at the SRS must wear an identification badge and a TLD (thermoluminescent dosimeter) badge at all times. Both badges shall be provided by WSRC.

The subcontractor shall give WSRC a Material Safety Data Sheet (MSDS) for each chemical brought on the SRS for work required by these specifications. The MSDSs shall be posted at the work site along with other permits required and provided by WSRC.

WSRC has the authority to stop work if safety related requirements are not followed. Continued willful abuse of the safety policies shall result in termination of the contract.

All equipment used in this project must be surveyed by WSRS Health Protection personnel prior to removal from SRS.

6.0 BIDDING REQUIREMENTS

The subcontractor shall submit a detailed price bid in accordance with the specifications indicated in the Scope-of-Work.

7.0 DEFINITIONS

The following definitions apply to this project description.

SRL ESS - The Savannah River Laboratory (SRL) Environmental Sciences Section (ESS) is the sole representative of WSRC at the Savannah River Site (SRS) and is the principal contact for the subcontractor during all phases of the work given in this project description.

Subcontractor - The subcontractor is the company or the company's representative that is awarded the contract for the sampling and analysis proposed in this project.

END

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