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MERCURY BIO-ACCUMULATION BY HYDROPSYCHID CADDISFLIES IN UPPER THREE RUNS CREEK, SAVANNAH RIVER PLANT AIKEN, SOUTH CAROLINA

(Prior to Release of F/H Area ETF Effluent Discharge)

DISCLAIMER

Sample Dates: April 28, 1988
August 4, 1988
September 27, 1988

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I. Introduction

In anticipation of the fall 1988 start-up of effluent discharges into Upper three Runs Creek by the F/H Area Effluent Treatment Facility of the Savannah River Plant, Aiken, South Carolina, a two and one half year study was initiated in June 1987. The study is to assess the impact of the effluent on Upper Three Runs Creek. Upper Three Runs Creek is an intensively studied fourth order stream known for its high species richness. Designed to assess the potential impact of the F/H area effluent on the creek, the study includes qualitative and quantitative macroinvertebrate stream surveys at five sites, chronic toxicity testing of the effluent, water chemistry and bioaccumulation analysis.

This report discusses the results of bioaccumulation studies completed during 1988 prior to the release of F/H area effluent.

II. Methods

A. Sampling

In the original scope of work designed for this assessment the bioaccumulation study was to be conducted with the use of cages, within which a designated number of hydropsychid caddisflies were to have been kept. Submerged in Upper Three Runs Creek for a period of one month, the organisms were to be retrieved, weighed and tested for mercury (Hg) bioaccumulation. Preliminary testing during the fall of 1987 showed it to be impractical to conduct the study in this manner. It was not feasible to design a cage of small enough mesh size to prevent escape of the test organisms and invasion by new organisms yet large enough to maintain sufficiently strong flow of current and prevent siltation of the cages. Furthermore, the hydropsychids were behaviorally disinclined to construct feeding nets under such circumstances.

As a result, it was necessary to collect hydropschid caddisflies from the stream with the assumption that organism drift was minimal. The majority of test organisms were Hydropsyche elissoma, although a small percentage (approximately 20%) were Cheumatopsyche spp. Highest concentrations of hydropsychids were found on Valisneria (aquatic plants), with lesser numbers on submerged sticks and twigs. These habitats were patchy in the stretch of Upper Three Runs Creek under study, with large beds of Valisneria located only at two points (midway between sites 3 and 4; midway between sites 4 and 5). During sampling in April and September 1988, concentrations of hydropsychids in the stream were too small to provide data for each site individually.

After organisms were collected they were placed in stream water in zip-lock type plastic bags and chilled during transport. In the laboratory organisms were separated, counted and placed in labelled vials.

B. Mercury Analysis

Two methods were used to process the organisms collected. During the April and August studies, the test organisms were counted and dried at 103°C to obtain a dry weight. Subsequently, the dried remains were digested with an acid/permanganate solution. In September it was deemed more appropriate to analyze for Hg using wet weights, in which the organisms were blotted dry prior to weighing and digesting. Weights were measured using a Mettler electronic balance reading to 0.1 mg.

Once weighed, the organisms were preserved with HNO_3 and submitted to the metals section of the laboratory for analysis by the cold vapor technique for mercury (EPA 245.1).

III. Results

A. April 28, 1988 Collection. (all sites combined).

Dry Weight	# Caddisflies	Hg Detection Limit	Hg (mg/kg) Dry Weight
0.395 g	200	50 ug/kg	<0.050

B. August 4, 1988 Collection (by individual site.)

Site	Dry Weight	# Caddisflies	Hg Detection Limit	Hg (mg/kg) Dry Weigh
1	0.3054 g	87	0.160 mg/kg	<0.160
2	0.2673 g	83	0.190 mg/kg	<0.190
3	0.2074 g	78	0.240 mg/kg	<0.240
4	0.4113 g	126	0.120 mg/kg	0.210
5	0.3193 g	126	0.160 mg/kg	0.180

C. September 27, 1988 Collection (3 sites).

Site	Wet Weight	# Caddisflies	Hg Detection Limit	Hg (mg/kg) Wet Weigh
2-3	0.025 g	18	0.800 mg/kg	<0.800
3-4	0.268 g	111	0.075 mg/kg	<0.075
4-5	0.264 g	70	0.075 mg/kg	<0.075

IV. Summary

The mercury data do not indicate significant levels of bioaccumulation by the caddisflies. Because of the differing masses of organisms collected at each site the detection limits vary from 0.05 mg/kg to 0.24 mg/kg dry weight. The September detection limits were 0.075 and 0.80 mg/kg wet weight. Mercury was detected in organisms at two sites in August at levels just above the detection limits. Those values were below the detection limits reported for other sites. Except for site 2-3 of September the mercury levels are below 0.25 mg/kg, indicating the lack of measurable mercury accumulation. The analysis of water and sediment during the first 15 months of this study showed mercury levels in those media were below limits of detection.

V. References

EPA. 1979. "Methods for Chemical Analysis of Water and Wastes" (EPA 600 4/79-020)