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From: Brad_Frazier@r1.fws.gov
Sent: Tuesday, January 02, 2001 4:35 PM
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Cc: Aaron_DeLonay@usgs.gov; Aida_Farag@usgs.gov; Laverne_Cleveland@usgs.gov; Edward_Little@usgs.gov; Dan_Audet@r1.fws.gov
Subject: Concise summary of Avoidance Studies report

Hello Hanford Natural Resource Trustees:

Jay McConnaughey requested a brief summary of the USGS Draft Report "Laboratory evaluation of the behavioral avoidance-preference response of chinook salmon (Oncorhynchus tshawytscha) to chromium in the Hanford Reach of the Columbia River, Washington, USA."

I asked Aaron DeLonay, the principal investigator of this report, for help in this matter. Aaron provided six concise bullets that summarize the report. I thought this was an excellent summary that everyone could benefit from, so I am including it below.

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Enjoy,
Brad

Here's the summary:

Laboratory tests were conducted to measure the response of salmon presented with a choice between a control condition and a test condition consisting of chromium-contaminated water. Water quality simulating the conditions occurring in the Columbia River were used to control variables such as hardness and pH that are known to affect the speciation, complexation, biological availability and toxicity of metals, such as chromium.

Two experiments were conducted. Experiment I presented salmon with a choice between experimental water (80 mg/L hardness) with chromium (test condition) and without chromium (control condition). Experiment II presented salmon with simulated groundwater (200 mg/L) with chromium (test condition) and experimental water (80 mg/L hardness) without chromium (control condition).

Data from Experiment I indicated that chinook salmon were able to detect and avoid relatively low concentrations of chromium. Salmon parr avoided concentrations of chromium equal to and greater than 54 ug/L. The highest concentration not producing a statistically significant avoidance response when compared to the response of fish under control conditions was 27 ug/L. These data are consistent with avoidance thresholds reported in the literature for other species.

Significant avoidance of chromium occurs within the range of concentrations expected to occur in the Hanford Reach of the Columbia River. Although chromium is diluted rapidly as contaminated groundwater migrates into the river channel, concentrations of hexavalent chromium in the groundwater upwellings of the Hanford 100 Areas have been documented to range from non-detectable to 632 mg/L in porewater from substrate at the bottom of the Columbia River (Hope and Peterson 1996).

The results of Experiment II indicated that the salmon parr did not show a significant preference for simulated Hanford groundwater over experimental Hanford water. In addition salmon failed to avoid chromium when chromium was added to simulated groundwater. The presentation of chromium in a

tests with other species and other metals (Hartwell et al. 1987, Woodward et al. 1995).

From our experiments it is difficult to discern the cause of the altered response observed in Experiment II. Various factors may have contributed to this difference in behavioral responses between the experiments including, acclimation history of the test organisms, competing motivational variables, and the alteration of the perception of chromium by salmon due to the water quality changes accompanying simulated groundwater. Further studies would be required to elucidate the causative mechanisms.