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Draft Agenda
Environmental Workshop
Auditorium, Environmental and Molecular Sciences Laboratory
Battelle Campus, Richland

Wednesday, January 5, 2005
8:00 AM to ~4:00 PM

Time	Program	Presenter
8:00 AM	Sign in	
8:30	Introductions/Objectives	Ted Poston/Dana Ward
8:45	NRTC - Responsibilities	Don Steffeck
9:00	Site Ecological Risk Assessments FH and BHI Brief Overview	Roy Bauer or BHI designate
9:15	Groundwater Protection Program	John Fruchter
10:00	Break	
10:15	Public Safety Resource and Protection Program	Roger Dirkes
10:45	Surface Environmental Surveillance Program	Ted Poston (and staff)
11:15	Ecological Monitoring and Compliance	Janelle Downs (and staff)
12:00	Lunch	
1:15 PM	Near Field Monitoring Program	Ron Mitchell
1:45	Fisheries Related Research at Hanford	Dave Geist
2:30	Composite Analysis	Bob Bryce
3:00	Break	
3:15	Science and Technology	Mark Freshley and staff
~4:15	Wrap-up Discussion	Ted Poston/All

This is a start

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Fisheries Related Research at Hanford

David Geist
Pacific Northwest National Laboratory

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Introduction

- Hanford Reach supports the largest naturally producing Chinook salmon population in the PNW.
- Adult fall Chinook salmon escapement to the Reach has averaged ~35,000 for the past 43 years.
- Important population for monitoring anadromous fish populations in PNW, including treaties with Canada and Native American Tribes.

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Overview

- Life history of fall Chinook salmon
- Salmon spawning habitat studies (BPA)
- Salmon spawning surveys (DOE)
- Priest Rapids Dam re-licensing studies (Grant PUD)
- Other research

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Salmon Life Cycle is Diverse

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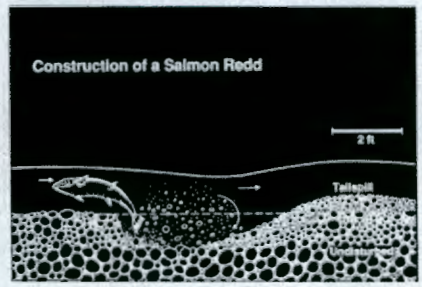
Spawning – Construction of a Redd (Nest)



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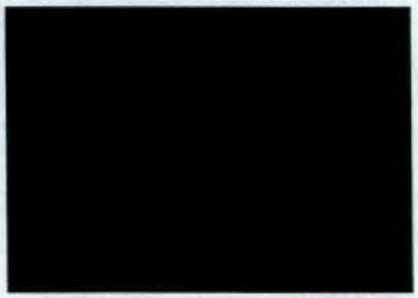
Spawning – Female Coho Salmon Digging



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Incubation and Hatching

Eggs in redd develop for a few months and then hatch - now they are called alevins

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Freshwater Rearing and Growth

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Smolts Move Downstream

The young fish swim from rivers (freshwater) into the estuary (mixed), then into the ocean (salt water)

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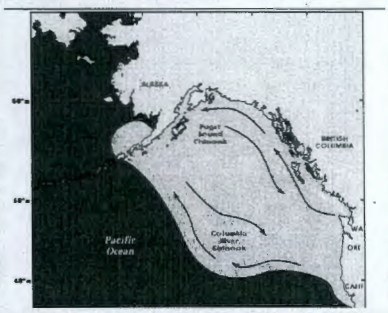
Ocean Migration



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Ocean Growth

Salmon eat lots of good food (like krill and herring)

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Migrate Back Upstream

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After Spawning

Adult Pacific salmon die after they spawn and their bodies provide food for the streams

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Fall Chinook Salmon Spawning Habitat Studies

- BPA-funded project starting in 1994
- Objectives of study are to:
  - Determine the fall Chinook salmon redd capacity of the Hanford Reach.
  - Determine the relationship between physical habitat at different spatial scales and fall Chinook salmon spawning locations.

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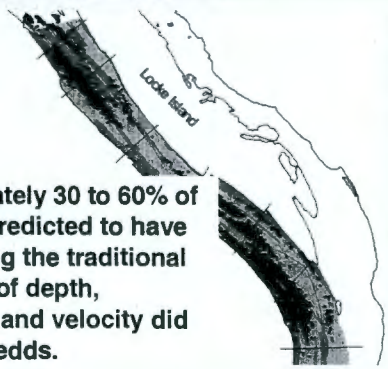

Approximately 30 to 60% of the sites predicted to have redds using the traditional attributes of depth, substrate, and velocity did not have redds.

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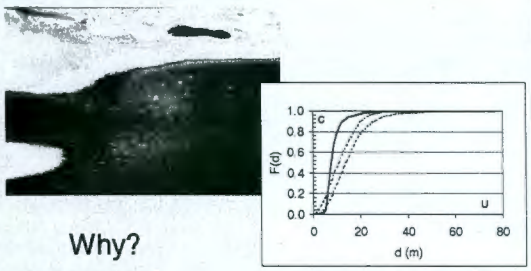
Redds Are Clustered



Why?

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Geomorphic Features and Salmon Spawning Habitat

- Micro-habitat limits where salmon spawn
- Form and function of micro-habitat affected by geomorphic features at larger scales
- Geomorphic bed-forms result in interstitial flow pathways within the river bed and its banks

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Hyporheic Zone and Salmon Spawning

- HZ contains a mix of groundwater (originating below land areas) and river water (originating as downwelling)
- Salmonids spawn near upwelling and downwelling areas
- Provides stable and optimal egg incubation environment

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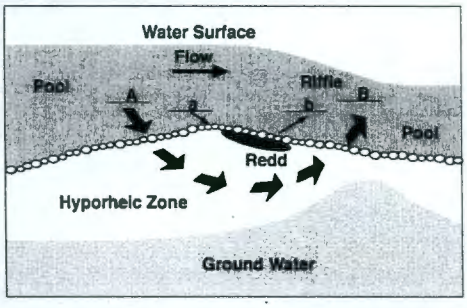
Hyporheic Flow in Cross-Section



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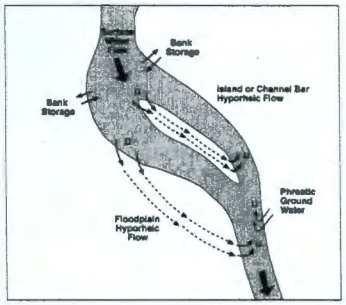
Hyporheic Flow in Plan Form



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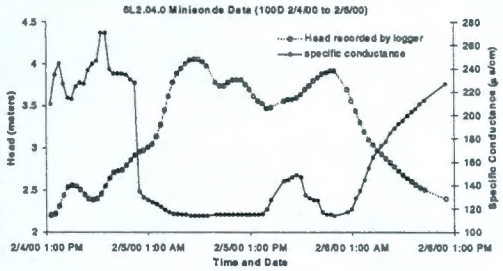
Hyporheic Zone is a Dynamic Environment



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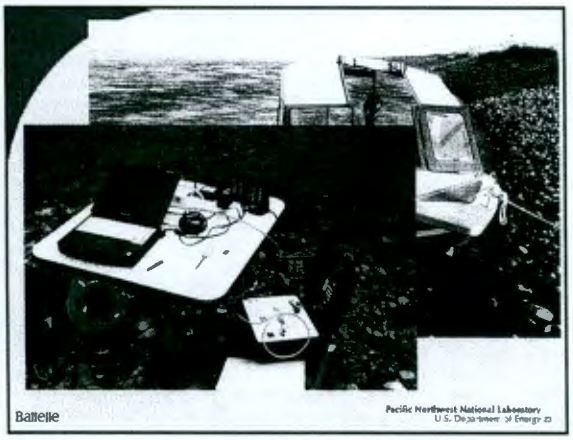

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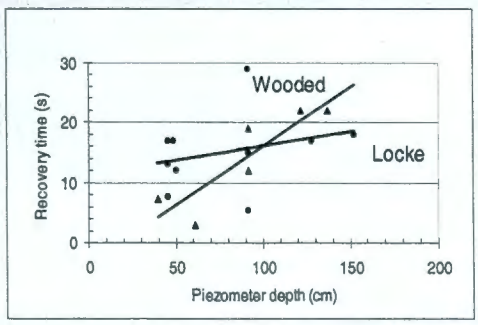
Sediment Permeability



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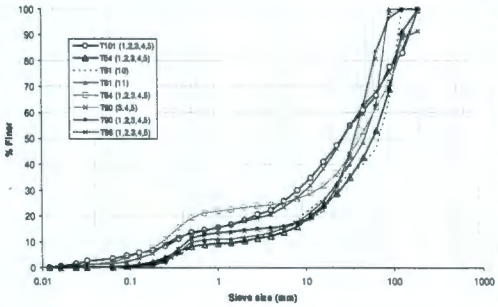
Riverbed Grainsize Distribution



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Questions We Hope To Answer

- Does the Hanford Reach represent what historic mainstem spawning habitat looked like prior to inundation?
- Can the Reach be used as a template to develop salmon recovery plans and strategies for other locations?
- What are the geomorphic features of alluvial rivers that link through different spatial scales to form spawning habitat for fall Chinook salmon?

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Hanford Redd Surveys

- Funded by Department of Energy as a long-term population monitoring effort (1948 to present)
- Aerial surveys conducted three to five times per year.
- Redd counts provided to management agencies and others.
- One of the longest running monitoring projects of salmon spawning.

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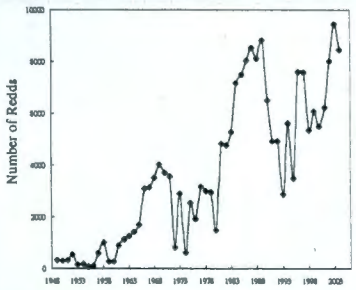
Hanford Reach Fall Chinook Salmon Spawning



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Priest Rapids Re-Licensing Studies

- Battelle funded by Grant County Public Utility District 2000 to 2002
- Support of Grant's re-license application for the Priest Rapids Project (PRD and WAN).
- Fall Chinook salmon investigations on juvenile and adult stages within the Project area.
  - Juvenile – distribution, abundance, habitat suitability, growth, survival, and stranding.
  - Adult – spawning escapement, habitat use, fallback, and behavior.
- Hanford Reach was primarily stranding of juveniles.

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1D Hanford Reach Stranding Model

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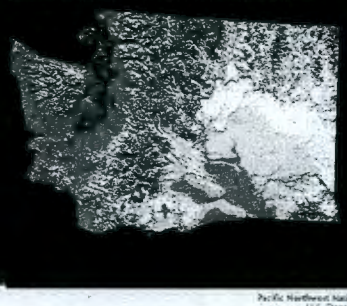
Stranding Studies
in the
Hanford Reach of the Columbia River



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Other Research

- Monitoring activities associated with USFWS Hanford Reach Monument
  - User surveys (fishing, boating, etc)
  - Summary document of White Bluffs sloughing
- USGS juvenile fall Chinook salmon habitat use.
- USGS/USFWS/CRITFC bathymetric surveys.
- Fallback studies at Priest Rapids Dam.
- WDFW surveys and carcass recovery.

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Surface Environmental Surveillance Project

Hanford Natural Resource Trustee Council Briefing

January 5, 2005

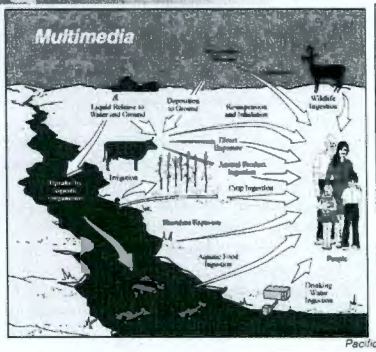
Ted M. Poston, Greg W. Patton
and Ernie J. Antonio
Project Website: http://sesp.pnl.gov/

Discussion Topics

- Basic program
- Special Studies
  - Shoreline vegetation report 1990-92
  - 100-N Shoreline Study with DOH 1997
  - 300 Area Shoreline Study with DOH 2001
  - 100-N Clam Dosimetry 2003
  - Columbia River Sediment Sampling
- Wrap up

Scope

- Multimedia environmental monitoring program (Offsite and onsite)
  - Radiological and chemical contaminants
  - External radiation
- Issue Annual Site Environmental Report
- Support ecological risk and cleanup (CERCLA) assessments and decisions
- Preoperational monitoring (e.g., WTP)
- Communicate offsite impacts to the public
- Support DOE Site Assessments and land release initiatives
- Provide technical support to Closure Division –
  - media relations
  - activists
- Support to headquarters on biota dose assessment and guidance for 450.1 and EMS



- Air
- Water
- Soil
- Vegetation
- Farm Products
- Wildlife
- Fish
- External Radiation
- *Integrated Biological Monitoring*

MEI <0.05 mrem

Project Objectives

- Coordinate onsite and offsite environmental sampling
- **Determine compliance with applicable standards, orders and regulations**
- Establish background levels and trends of environmental contaminants
- Determine effectiveness of effluent treatment/control
- Provide public assurance
- Detect and quantify unplanned releases
- Identify new or unplanned environmental quality issues

Users and collaborators

- **CERCLA Support (DQO, SAPs, design, risk assessment) – integration with EMC Project**
  - **B/C Pilot Study**
  - **Horseshoe Landfill Surveillance**
  - **River Corridor Risk Assessment**
  - **100-N scoping for 5 year review**
  - **Technical assistance to Central Plateau DQO**
  - **Technical support to Groundwater Performance Assessment Project (aquifer tube sampling)**

Relevant media sampling

- Sediment transport and river dynamics
  - Contaminant surveillance Priest Rapids, the Reach, to McNary, Snake River inputs
  - Sediment Transport – Mike Fayer - Hydrology
- Aquatic species sampling
  - Clams, crayfish, whitefish, bass, sucker, carp, sculpin, milfoil
- Radiological surveys of soil, sediment, plants
  - Surveillance and Near-field programs
  - Onsite-offsite, points of deposition, trend reports
- Terrestrial wildlife sampling
  - Surveillance and Near-field programs
  - Deer, rabbits, pheasant (quail), geese (ducks), mice

Radiological Sample Results in HEIS

Media	1971-1989	1990-1999	2000-2004
Air	78476	34901	20550
Foodstuffs	21099	11829	2414
Vegetation	6920	2999	1190
Wildlife Aquatic	2475	5277	1173
Wildlife Terrestrial	7576	4525	1170
Soil/Sediment	10226	7185	5568
Water	57390	36553	19366
Drinking Water	2236	3762	382
Total	**186398**	**107031**	**51813**

Types of Wildlife Sampled 1960s-1970s

- Waterfowl – Canada Goose, goldeneye, teal, mallard, rudy duck, merganser
- Upland Game Birds – pheasants, chucker, quail
- Invertebrates – Oysters (Willapa Bay)
- Carp, whitefish, perch, crappie, catfish, bass, sturgeon, trout, steelhead, sucker, king salmon, bluegill

Radionuclides associated with single pass reactor designs – maximum dose rate of 0.6 rad/day in mid-1960s

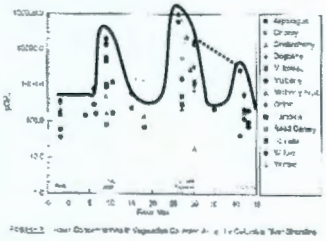
River corridor work

Emergency response

1990-92 Shoreline Vegetation Survey

- Sampled shoreline plants from Vernita Bridge to 300 Area
- Analyzed for full suite of radionuclides
- No metals or organic analyses in plants
- Following slides are scans from original document
  Antonio, Poston and Rickard 1993 – PNL-8797

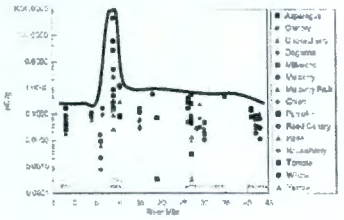
Tritium in shoreline plants 1990-92



Elevated at 100-N, Hanford Townsite and 300 Area

Daily dose rate of maximum plant (97,000 pCi/g dry wt.) was 0.00002 rad/day

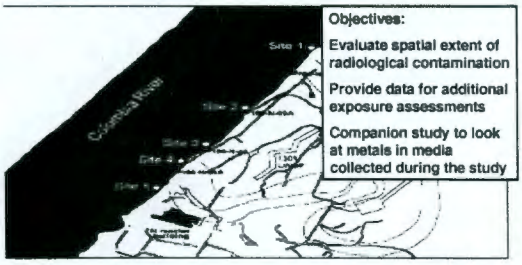
Strontium-90 in shoreline plants 1990-92



Elevated at 100-N Area

Daily dose rate of maximum plant (440 pCi/g dry wt.) was 0.018 rad/day (includes Sr-90 and Y-90 at equilibrium)

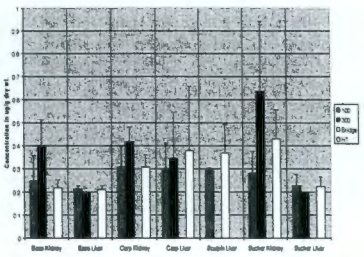
1997 100-N Study – PNNL & DOH



Objectives:

- **Evaluate spatial extent of radiological contamination**
- **Provide data for additional exposure assessments**
- **Companion study to look at metals in media collected during the study**

Chromium (mean +/- 1 SD) in fish tissue - 1997

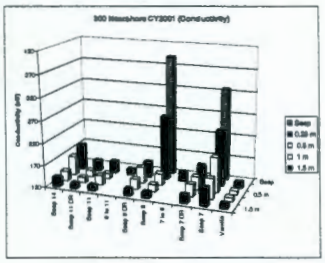


Other metals: Antimony, arsenic, beryllium, cadmium, copper, mercury, lead, silver, nickel, selenium, thallium, and zinc

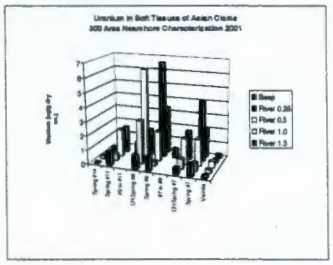
Reported in 1997 Site Environmental Report, PNL-11795

300 Area Shoreline Study 2001

Conductivity – near-shore water



Uranium- clam soft tissue



100-N Clam Shell Dosimetry

GM survey - 200 to 600 cpm; Background was <50 cpm

One 100-N composite sample had 383 pCi/g Sr-90 (1500 x Background)

TLD results 0.26 mrem/h (dry) and 0.22 mrem/h (wet)

1.2 mrad/h on contact with skin (Varskin model)

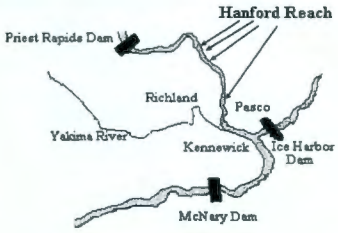
~0.018 rad/d to soft tissues

Surface Environmental Surveillance Project: Overview of Sediment Sampling

SESP Routine Sediment Sampling

- Annual sampling following spring floods
- Upper sediment using Ponar dredge
- Samples analyzed for:
  - Radionuclides (Gamma, Sr-90, U, Pu)
  - Metals
  - Bioavailable metals (SEM/AVS)
  - TOC
  - Sediment grain size (occasionally)
  - Co-sampling with WaDOH

Routine Sediment Sampling Locations

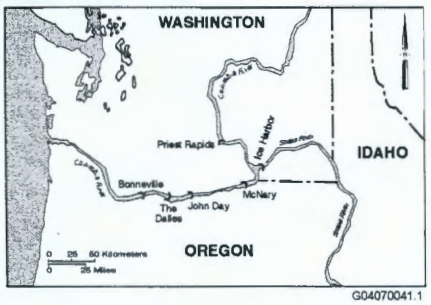


Upriver/Down River Comparisons

- No differences in radionuclide concentrations between upriver and downriver locations [i.e. no indication of Hanford Site inputs]
- K-40, Sr-90, Cs-137, uranium, and plutonium are consistently detected in most river sediment
- Detectable amounts of metals were found for all locations
- Maximum and median concentrations for most metals were higher at Priest Rapids Dam compared to Hanford Reach or McNary Dam [e.g. Cd, Cr, Cu, Ni, Pb, Zn]

Additional Sediment Sampling Efforts

- 2003 Lower Columbia River Sediment Study – Multi Agency [WaDOH, WaDOE, ODOE, and PNNL]
- 2003 Characterization of Systems – Sediment samples collected from irrigation returns, and the Yakima, Snake, and Walla Walla Rivers [radionuclides, metals, grain size, SEM/AVS, TOC]
- 2001. *Simultaneously-Extracted Metals/Acid-Volatile-Sulfide and Total Metals in Surface Sediment from the Hanford Reach of the Columbia River and the Lower Snake River*, Patton, G. W. and E. A. Crecelius. PNNL-13417


WASHINGTON
IDAHO
OREGON
Priest Rapids
Ice Harbor
Bonneville
The Dalles
John Day
McNary
0 25 50 Kilometers
0 25 Miles

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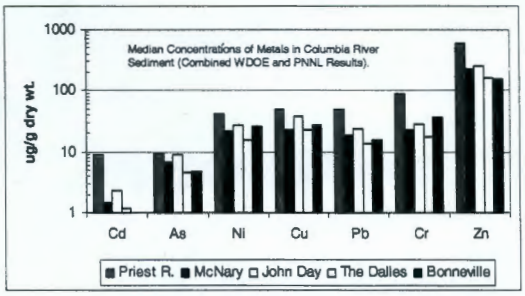
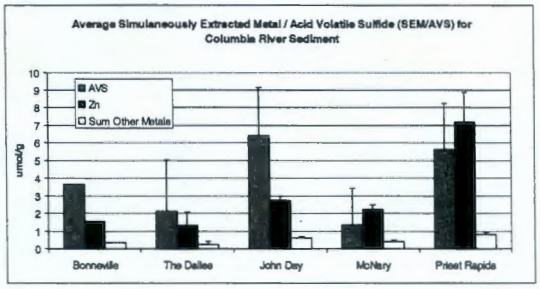

Median Concentrations of Metals in Columbia River Sediment (Combined WDOE and PNNL Results).
ug/g dry wt.
1000
100
10
1
Cd
As
Ni
Cu
Pb
Cr
Zn
Priest R.
McNary
John Day
The Dalles
Bonneville


Average Simulaneously Extracted Metal / Acid Volatile Sulfide (SEM/AVS) for Columbia River Sediment
umol/g
AVS
Zn
Sum Other Metals
Bonneville
The Dalles
John Day
McNary
Priest Rapids