Hexavalent Chromium in the 100 D Area

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FEB 06 2008
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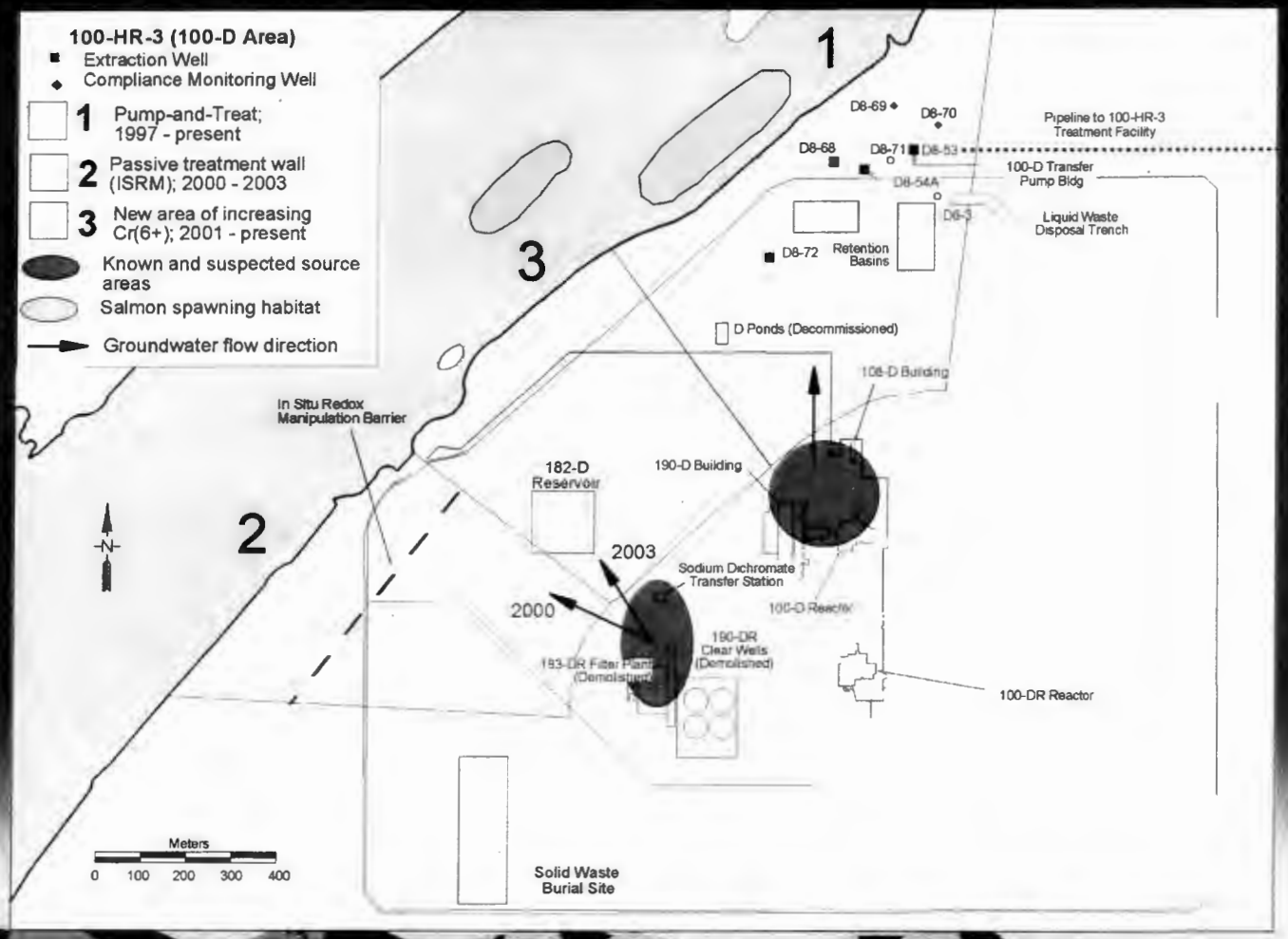
Issue/Summary

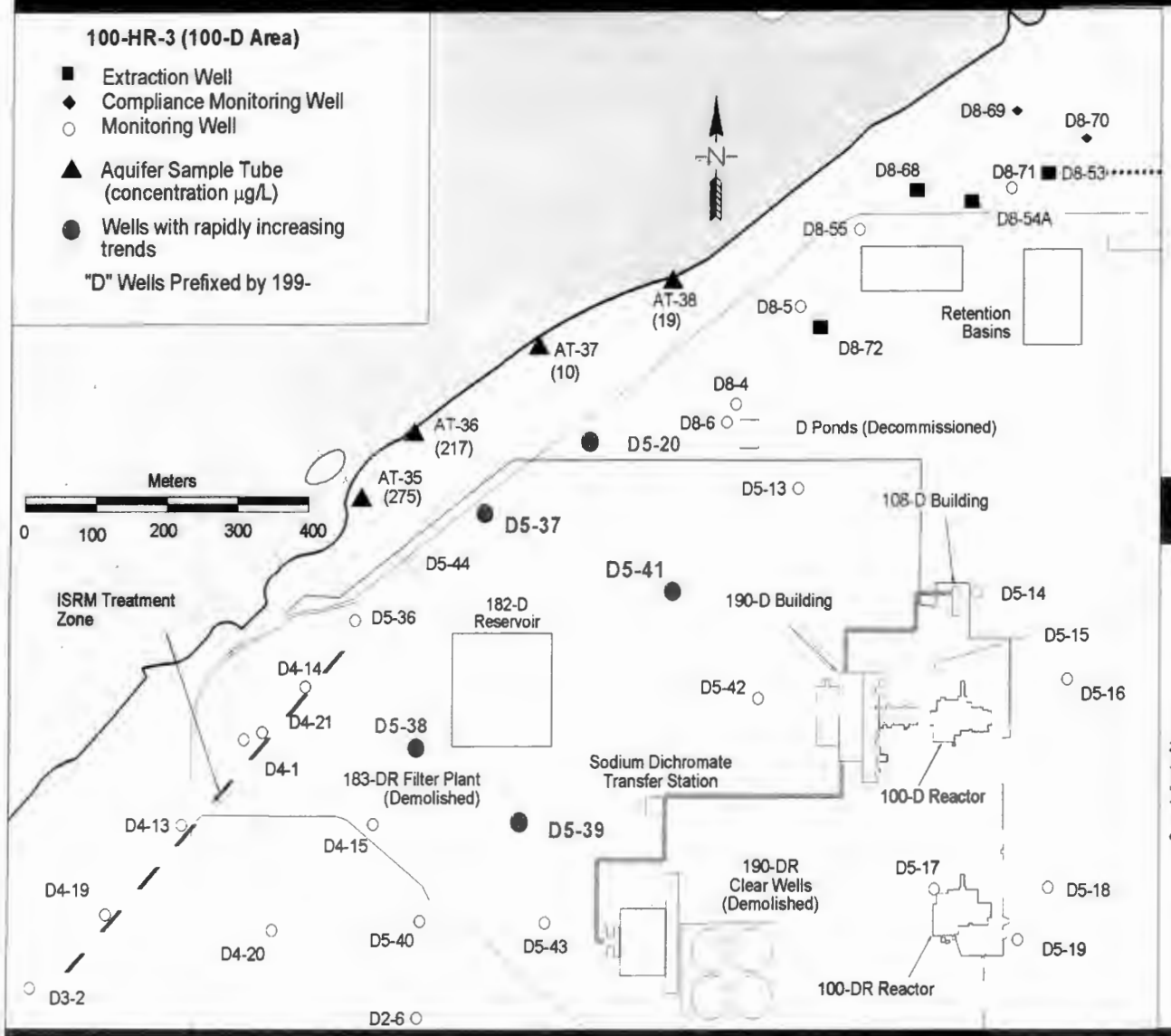
- $Cr(6^+)$ ~30 times State aquatic standard (10 µg/L) recently discovered at shoreline beyond existing treatment zones
- Higher landward concentrations are increasing sharply
- Salmon redds located nearby

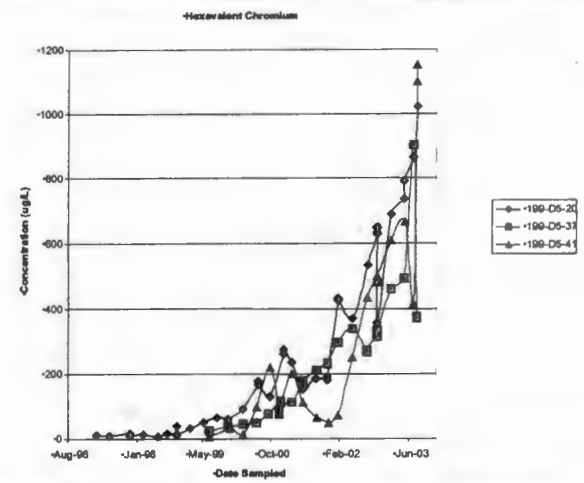
- Immediate corrective action requires considering reprioritization of funding

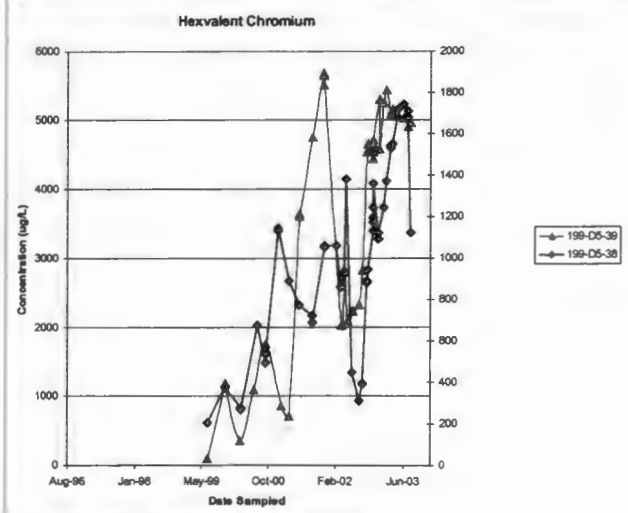
100 D Area Groundwater Contaminant & Treatment Zones



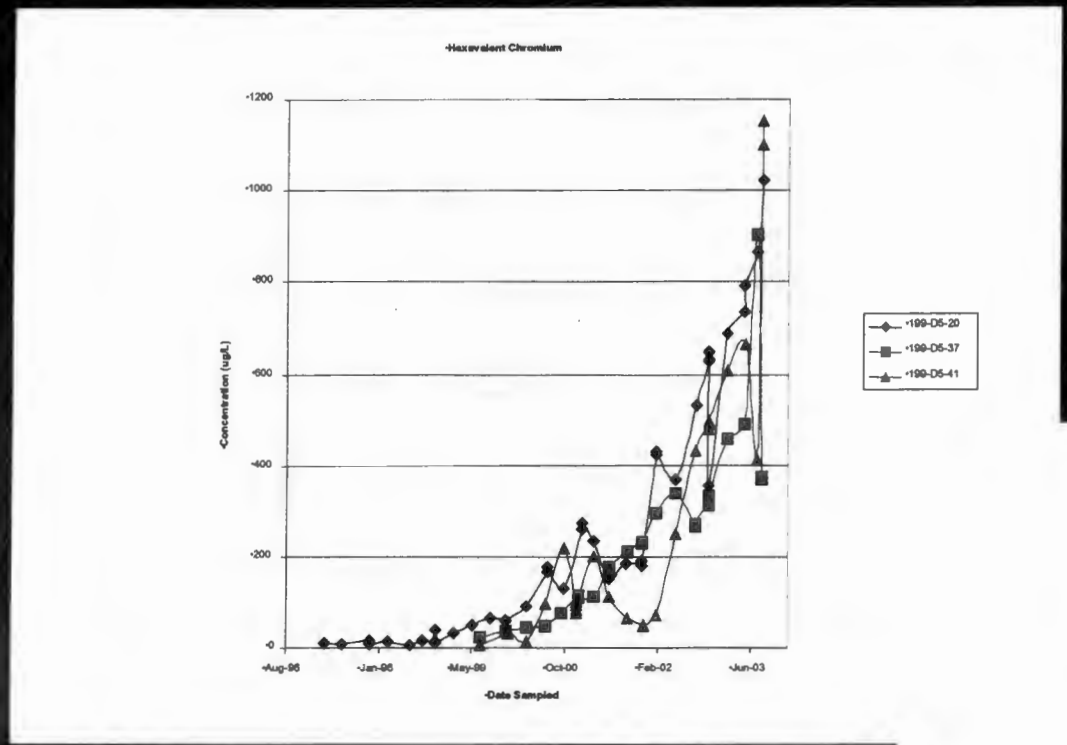
Sample Locations and Concentration History

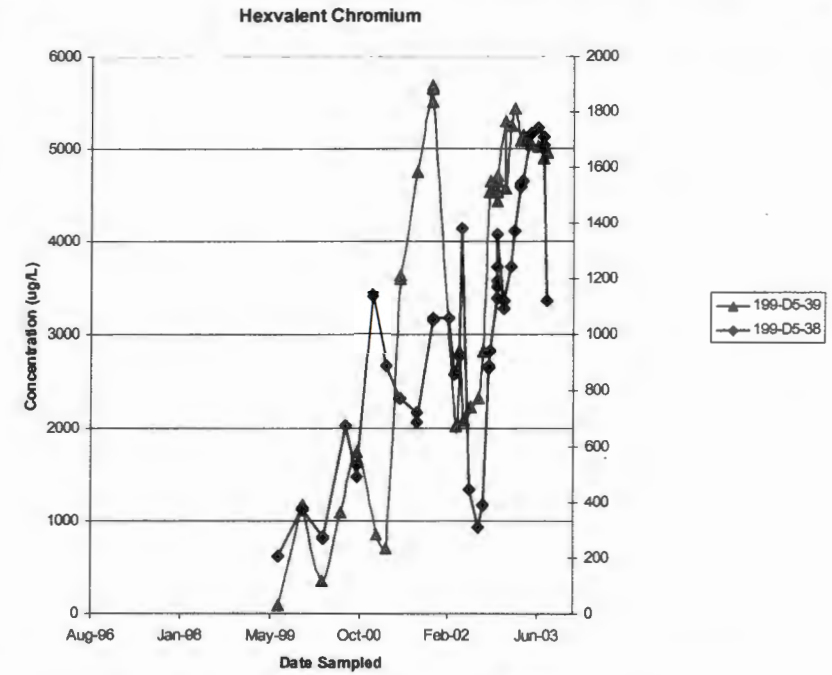






Concentration History





Regulator Notifications/Response

- Increasing chromium trends highlighted in the monthly Unit Managers Meeting over the past several months
- Ecology's unit manager was briefed (9/17/03) on status of strategy. Minutes included outline of topics covered:
  - Characterization (wells and aquifer tubes)
  - drivers and source identification
  - evaluation of treatment options
- Recent shoreline aquifer tube results will be reported following confirmation sampling

Known and Suspected Source Areas

- Known leakage/spills of sodium dichromate stock solution (50 wt %) at central transfer station northwest of DR reactor
- Known leakage from storage tanks north of D reactor near
- Disposal trench that received stock solution leakage/spills at 190-D building
- Spills and leaks may have migrated to greater depths than practical for removal by soil excavation

Known and Suspected Source Areas (cont)

- Soil contamination found at 183-DR Head House located southwest of dichromate transfer station

- Suspected leakage along several thousand feet of chemical piping between transfer station and both reactor areas

- Aging pressurized water lines cross and run parallel with chemical transfer lines in several places

Requirements from ROD and Legal Drivers

- General
  - "Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this ROD, may present and imminent and substantial endangerment to public health, welfare or the environment"
- Specific Objectives from ROD
  - Prevent discharge of Cr(6+) that exceeds WAC ambient water quality standard (now 10 ug/L)
  - Receptor point of concern is river substrate to 18 in (46 cm)
  - Priority given to areas with suitable salmon habitat

Requirements from ROD and Legal Drivers (cont)

- **Interim Remedial Action ROD, (1996)**
  - **Groundwater will be pumped from up to 10 wells and treated by ion exchange before reinjection *(4 wells currently included in extraction network)***
- **Amended ROD (1999)**
  - **Deploy In Situ Redox Manipulation (ISRM), a permeable groundwater treatment barrier that reduces the mobility and toxicity of chromium in groundwater *(to treat the hot spot in the southwestern area of 100D)***

Current Activities: Field

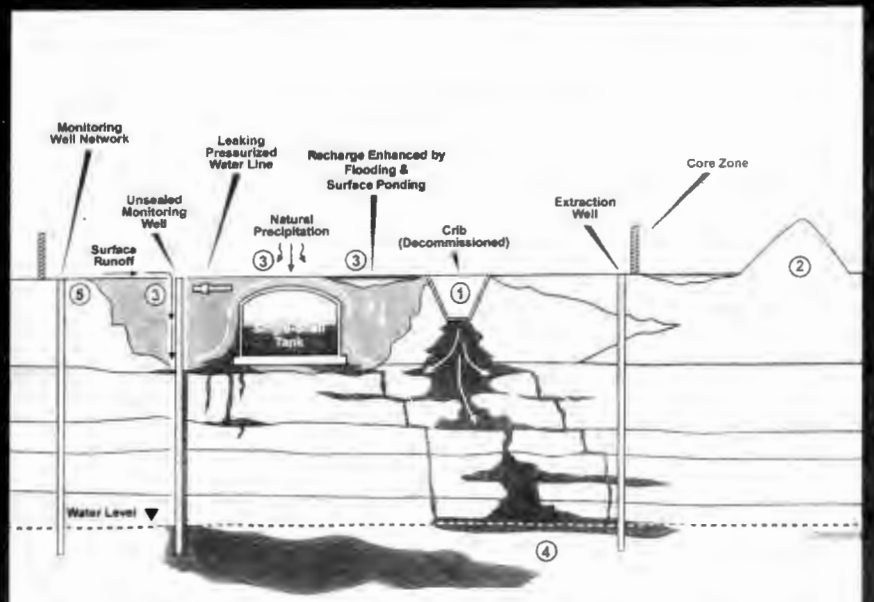
1. Install 3 new dual purpose wells in key locations

2. Install more aquifer tubes to define shoreline extent of expanding plume

Current Activities: Planning

Develop strategy and conduct engineering evaluation

- **Accelerate reduction of artificial recharge in 100 D Area**
- **Possible Remedial Action**
  - **Expand pump and treat**
  - **Change plume direction**
  - **Extend treatment wall**



Program Elements

Communication

- Prevent Degredation
- Remediate Groundwater
- Monitor Groundwater

Groundwater Protection Functional Areas:

1 – Remediate high-risk waste sites.
2 – Shrink the contaminated areas.
3 – Reduce natural and artificial recharge.
4 – Implement final groundwater remedies.
5 – Integrate groundwater monitoring needs.

Water and Source Control

- Suspected water line leaks are a problem:
  - Cannot depressurize old system for repairs
  - Fire system needed to meet nuclear facility requirements
- Helium leak detection of old chemical lines to isolate largest suspected leak spots
- In-place stabilization (H_2S) for deeply distributed sources identified
- Excavate contaminated soil as discovered

Expansion of Pump and Treat

- Covered by existing ROD
- Use existing and new wells in central contaminant zone
- Inject into two new wells to redirect "hot spot" back toward ISRM
- Existing resin method will not work at such high chromium concentrations
- Engineering evaluation of alternatives to resin underway
- Estimated cost ~$2M for stand alone new treatment plant, piping and electrical runs

Extension of Passive Barrier

- **Hydrologic Considerations**

- **Length depends on downstream extent of plume**

- **Could be as much as 600m and may need to block "long-shore drift" in stream bank storage zone**

- **Place near shoreline to intercept leading edge of plume**

Barrier Technology

- **ISRM (aqueous dithionite injection/in situ iron reduction method)**
  - ✓Already has regulatory approval
  - ✓Existing barrier has exhibited some break through
  - ✓Requires periodic (costly) reinjection
  - ✓Chemicals may seep into riverbed if installed near shoreline

Barrier Technology (cont)

- **Hydrofrac/zerovalent iron technology**
  - ✓Iron filings slurry emplaced in hydraulically induced vertical fracture wall
  - ✓No maintenance – one time installation
  - ✓Some concern about biofouling
  - ✓Endorsed by EPA research lab (Ada, Oklahoma) for Hanford

Barrier Cost/Emplacement Considerations

- Both methods ~$8M for initial installation of a 600m treatment wall
- Could be staged in 200m/year increments (depending on extent of plume and/or final remedy
- Longer lead time needed to get regulatory approval of hydrofrac/zerovalent iron method