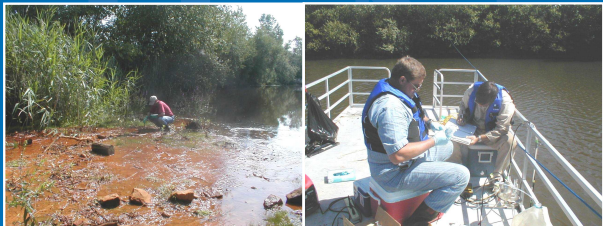


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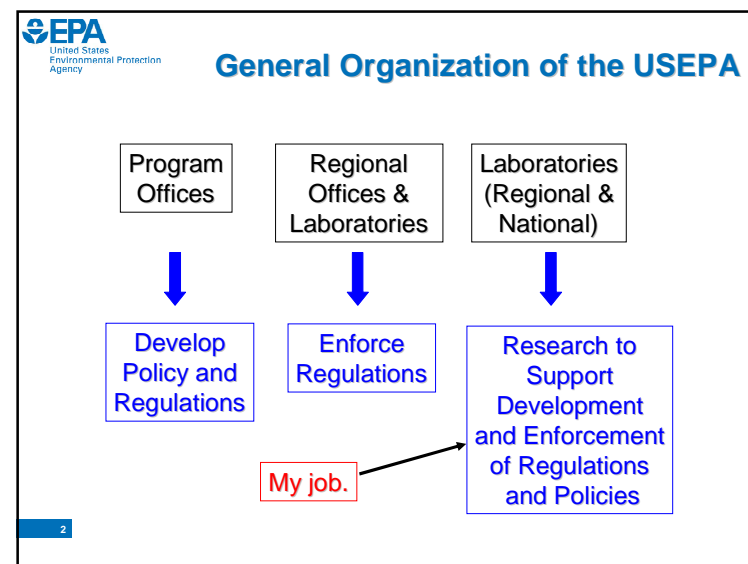
Environmental Research in Practice: Restoration and Protection of Water Resources

Robert G. Ford



Office of Research and Development, National Risk Management Research Laboratory
Land Remediation and Pollution Control Division, Cincinnati, OH

10 Apr 2009
EEES Seminar
Clemson, SC



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Road Map for Talk

- 1) Describe USEPA organization
- 2) My job with examples of technical support to Regions and Program Offices
- 3) Case Study 1 – in the field...
- 4) Case Study 2 – at the desk...
- 5) Wrap-up & questions

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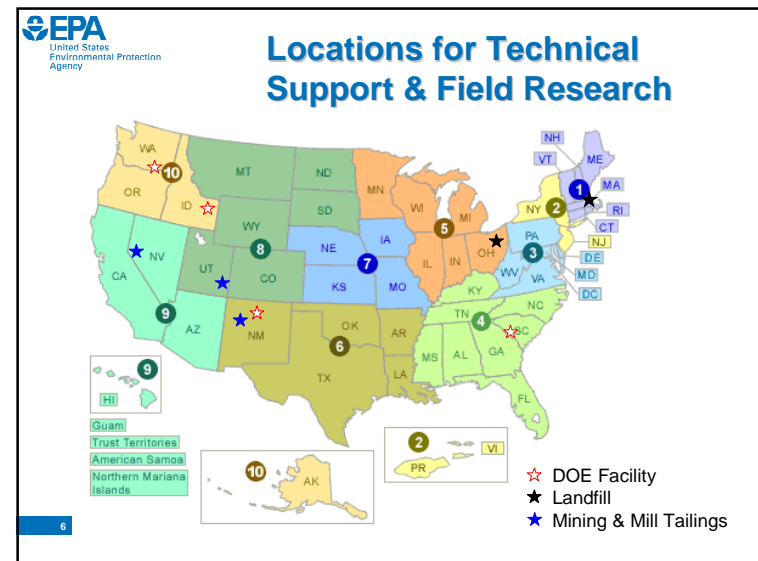
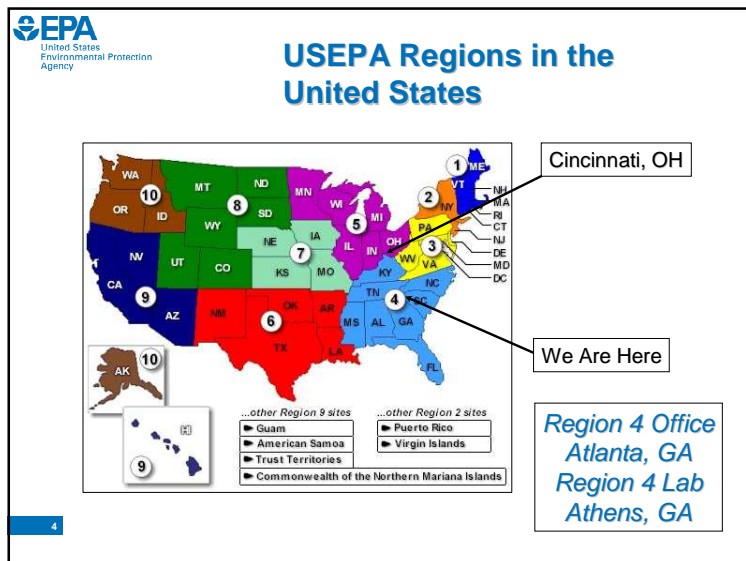
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What guides the Agency's work?

The activities of the Agency are bound by Federal laws:

- Clean Water Act (CWA)
- Toxic Substances Control Act (TSCA)
- Resource Conservation and Recovery Act (RCRA)
- Comprehensive Environmental Response and Cleanup Act (CERCLA)
- Others...

3

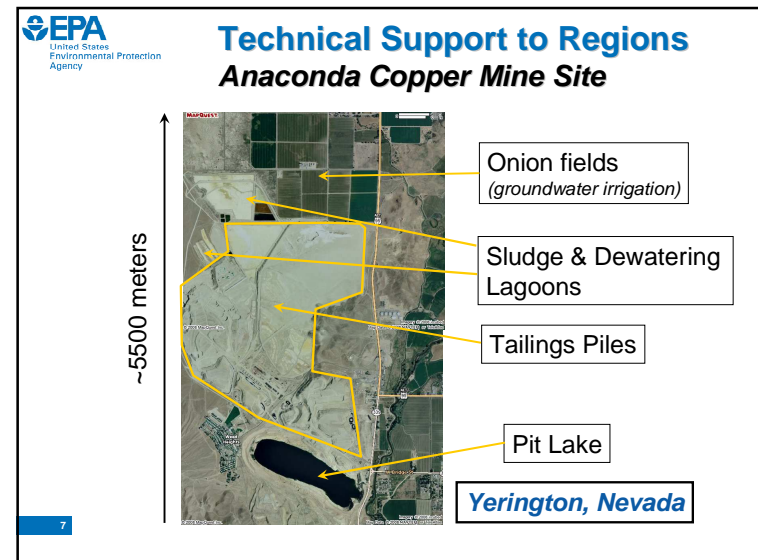


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What does my job entail?

- 1) Conduct **applied** and **basic** research:
 - Laboratory systems mimicking environmental settings
 - Development of methods for environmental sample characterization
 - Field research at contaminated sites – characterization & remediation
- 2) Provide technical assistance to Regional Offices at specific contaminated sites:
 - Technical review of site documents
 - Participate in technical meetings & negotiations
 - On-site technology demonstrations/evaluations
- 3) Provide technical assistance to Program Offices:
 - Review technical documents (guidance, methods)
 - Prepare technical reports summarizing state-of-the-science

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Technical Support to Program Offices

Monitored Natural Attenuation as a remediation
technology for groundwater restoration:

Monitored Natural Attenuation of Inorganic Contaminants in Ground Water
Volume 1
Technical Basis for Assessment

Evolution of Inorganic Contaminant Plume

Monitored Natural Attenuation of Inorganic Contaminants in Ground Water
Volume 2
Assessment for Non-Radionuclides
Including Arsenic, Cadmium, Chromium,
Copper, Lead, Nickel, Nitrate,
Perchlorate, and Selenium

<http://www.epa.gov/ada/publications.html>

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Approach to Groundwater Restoration

1 Reduce
contaminant flux in
subsurface...

Source
Removal/
Isolation

In-Situ
Treatment
(PRB)

2 Use of MNA to
remediate dilute
portion of plume...

MNA

Contaminant
Concentration
(above MCL or ARAR)

High
Low

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Generalized Site Scenario for Groundwater Contamination

Contaminant
Concentration
(above MCL or ARAR)

High
Low

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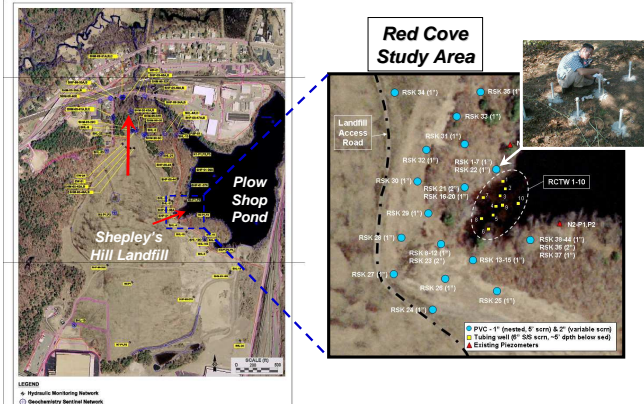
GW-SW Interactions Case Study 1

Fort Devens Superfund Site (BRAC)
Devens, MA
Arsenic

Superfund Site Information - MA7210025154
<http://www.epa.gov/region1/superfund/sites/devens/296835.pdf>

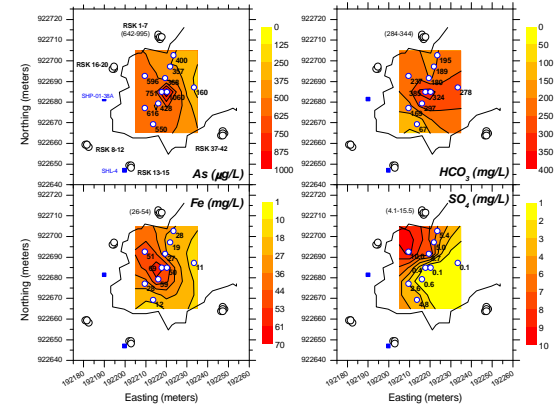
Example Field Research

Shepley's Hill Landfill – Former Fort Devens



Shallow GW Under Red Cove

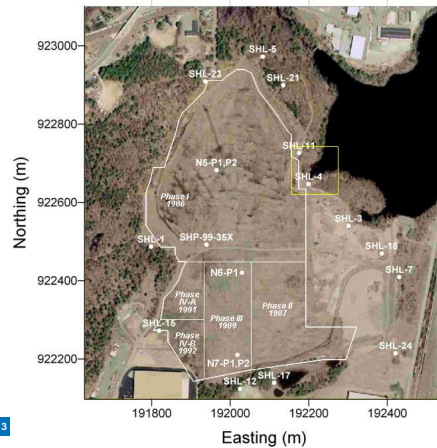
Signature for As, Fe, HCO₃ & SO₄



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Shepley's Hill Landfill

Disposal History

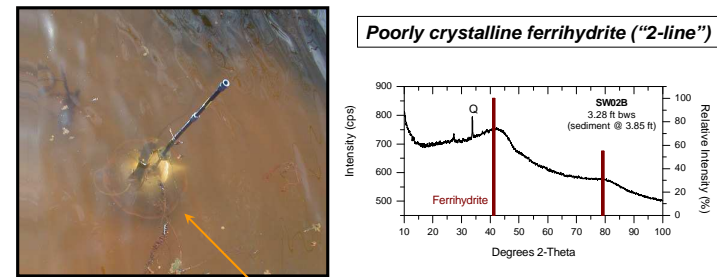


- Landfill operation started about 1917 and ceased 1992
- Unlined, no leachate collection, portion of waste below water table
- Arsenic sources: natural (bedrock, till, overburden), solid waste?
- Capped to control surface infiltration

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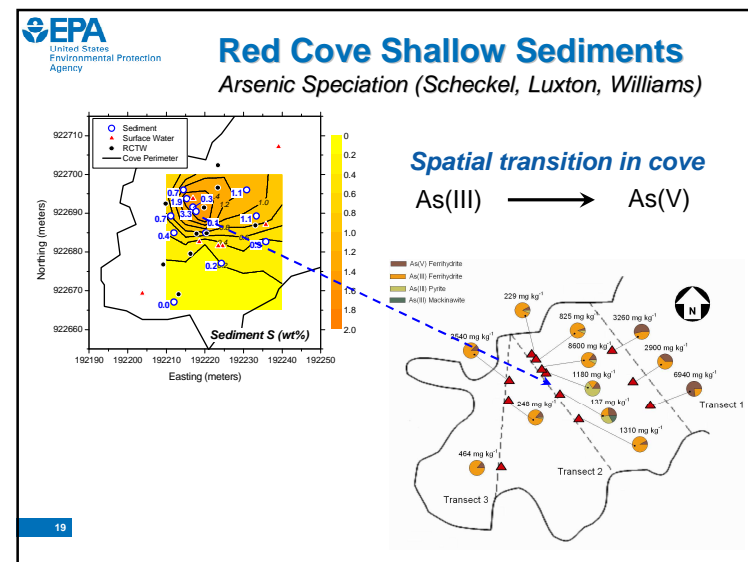
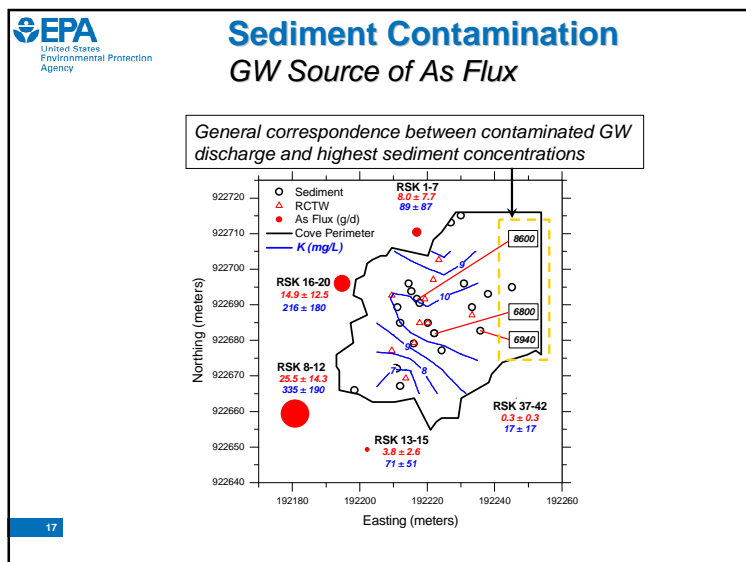
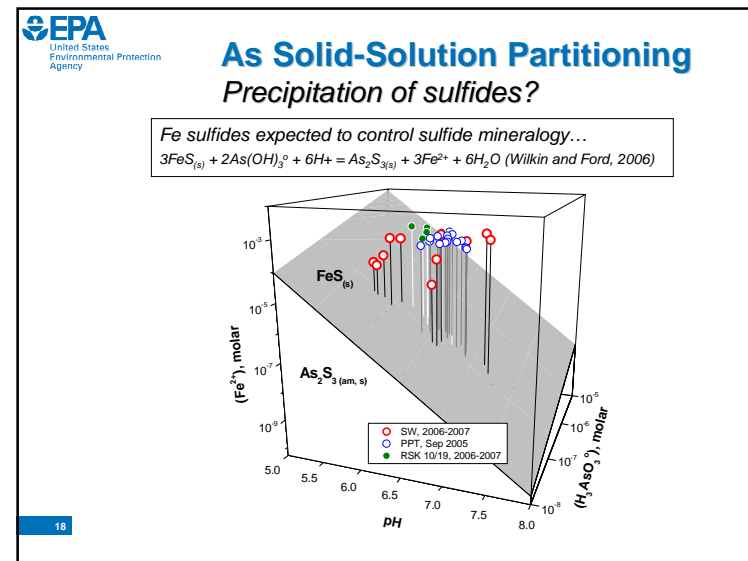
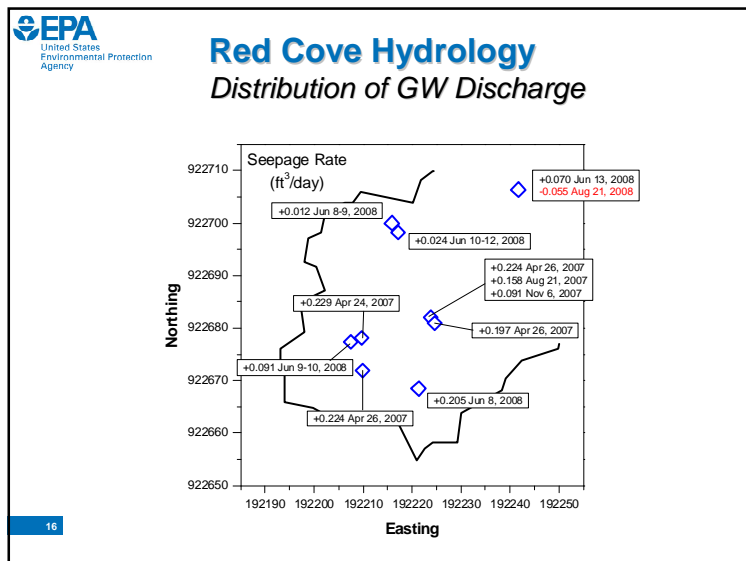
Red Cove Surface Water

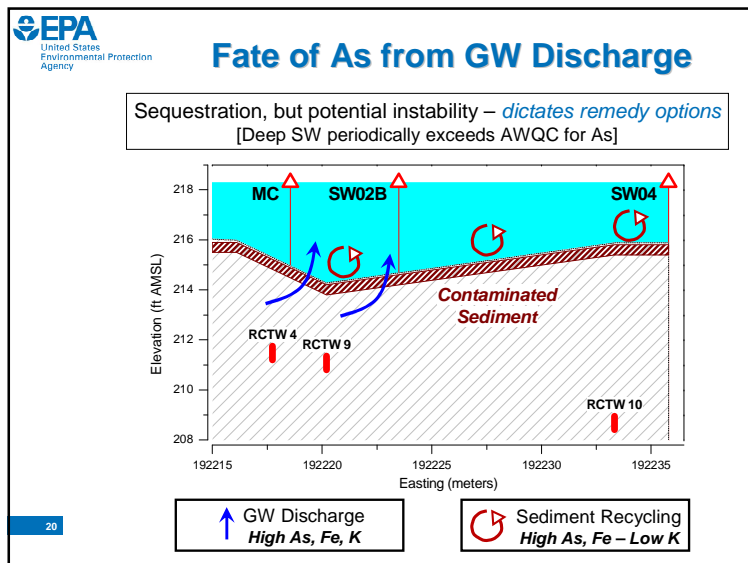
Suspended Solids Mineralogy



Bi-directional Advective Flux Meter
<http://www.epa.gov/nrmrl/pubs/600r06122/600r06122.htm>

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GW-SW Interactions Case Study 2

Hanford 300 Area (USDOE)
Richland, WA
Uranium

Superfund Site Information - WA2890090077
<http://ifchanford.pnl.gov/publications/>
<http://ifchanford.pnl.gov/documents/>

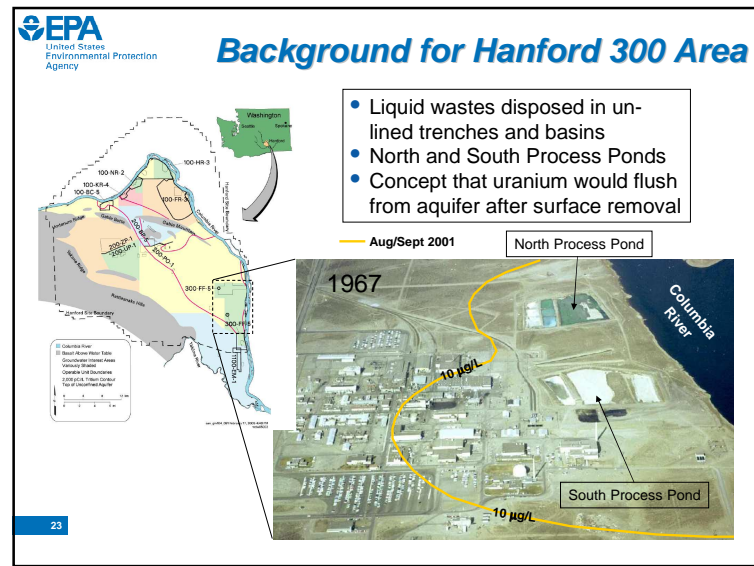
22

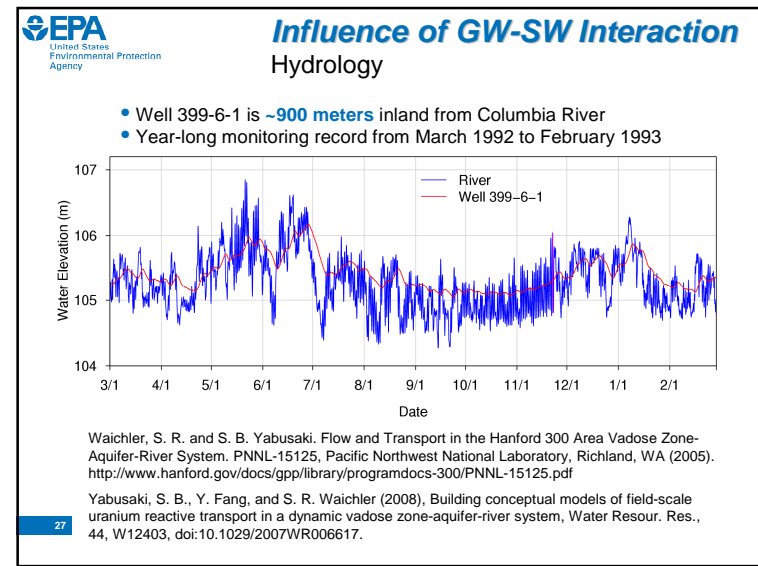
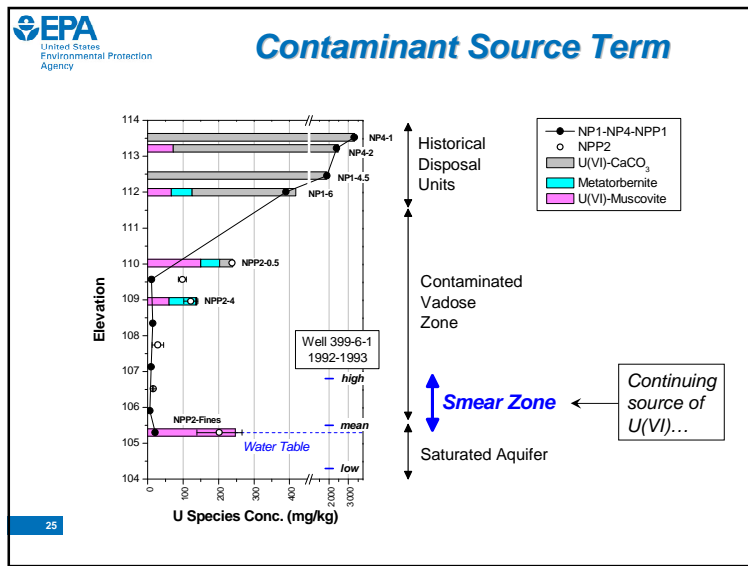
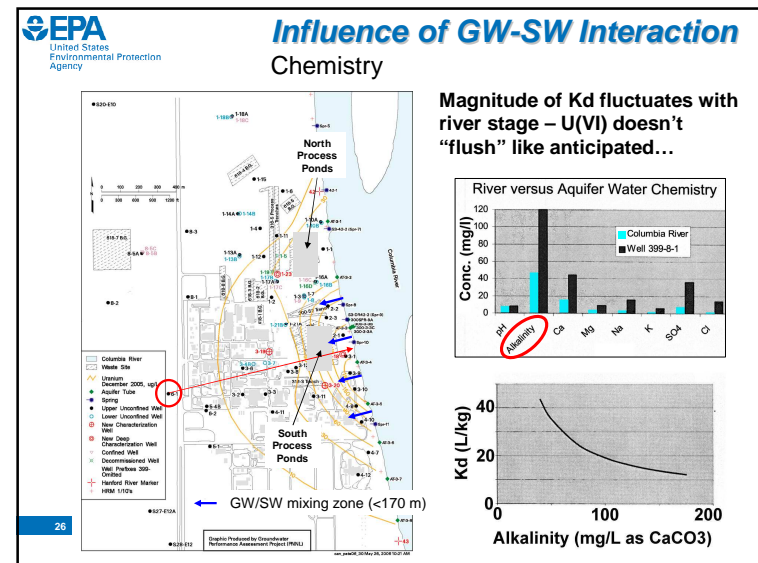
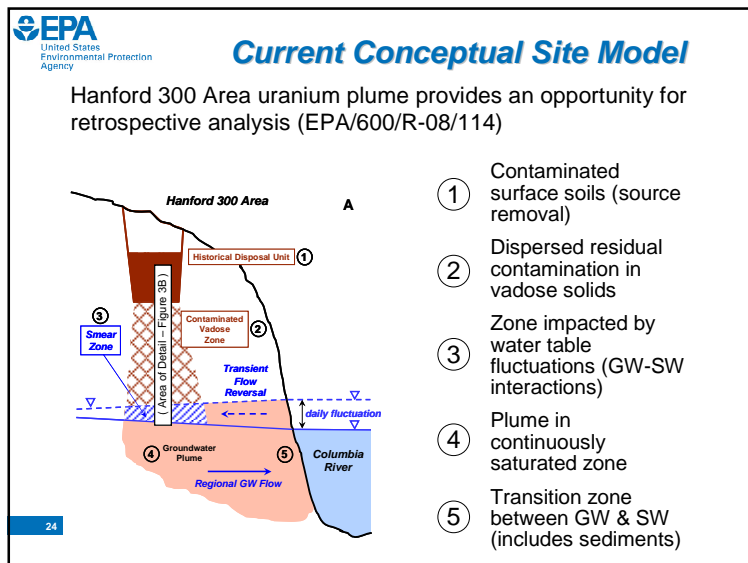
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What's the solution?

- Shut off the "arsenic spigot" discharging to cove
 - GW extraction or hydraulic re-direction
 - Permeable reactive barrier
 - Manipulate saturated aquifer to more oxidizing
- Deal with in-place contaminated sediments – removal or some form of capping
 - Driven by risk to ecosystem and/or human health

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What's the solution?

- Control release of uranium from residual sources in vadose (smear zone) and portion of saturated aquifer
 - Injection of phosphate to precipitate U(VI) [pilot field study w/ polyphosphate]
 - Aquifer is oxidizing, so reduction to U(IV) not likely sustainable
 - Manipulating subsurface chemistry is challenging – hydraulic delivery and reaction dynamics!

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The End!

Questions?

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New Research Initiatives (my limited perspective...)

- 1) Introduction of new synthetic constituents into the hydrosphere and biosphere, e.g., nanomaterials
- 2) Modifications to management of energy production
 - Biofuels (analogy is MTBE)
 - Carbon Sequestration (subsurface injection)
 - Nuclear (mining, reprocessing, waste)
- 3) Management of water resources – supply and quality
 - Moving away from “point source” mentality to “watershed” mentality (remediation)
 - Water distribution infrastructure
 - Treatment residuals management (ties back in to “watershed”)

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