# EM-20 Groundwater Workshop Summary
# Department of Energy - Richland Operations Office
# Richland, Washington
# March 27, 2007

**Workshop objective**

To develop a prioritized list of groundwater remediation "needs" where science and technology projects may lead to significant improvements in meeting the objective to address contaminant migrations and protect the Columbia River.

**Opening Remarks**

- Mark Gilbertson, Deputy Assistant Secretary for Technology, Department of Energy-Headquarters (DOE-HQ), welcomed workshop participants. He explained that Hanford groundwater remediation work is a DOE-HQ priority in the direct funding plan being prepared over the next month for Congressional consideration. DOE-HQ is committed to moving forward with Hanford groundwater remediation work, but needs to understand the consensus priorities. DOE-HQ is partnering with the DOE-Office of Science to direct some basic research to continually revise groundwater remediation technical assumptions. The workshop input and feedback will be incorporated into technical research on groundwater remediation projects.

- Cheryl Whalen, Washington State Department of Ecology (Ecology), said Hanford soil and groundwater cannot be cleaned up to meet regulations without innovative technology demonstration and deployment. The Hanford Site Groundwater Remediation Strategy was developed by the Site Technology Coordination Group (STCG) in the 1990s and is built into every groundwater interim record of decision (ROD) to accelerate groundwater cleanup. The regulatory agencies and stakeholders have continually emphasized this strategy to DOE and its contractors.

  To date, DOE has been unable to fulfill a number of previously identified needs to meet common Tri-Party Agreement (TPA) soil and groundwater goals and agreements. Since the end of the STCG in 1997, little progress has been made on developing and implementing groundwater remediation technologies.

  The 2005 Congressional appropriation to address groundwater contamination to protect the Columbia River was an encouraging and important first step in addressing immediate soil and groundwater cleanup needs. Significant issues and work remains to be done. DOE still needs to address vadose zone issues in the River Corridor and Central Plateau; long-lived radionuclides in the deep vadose zone; the need for cost-effective technologies to treat the high volume of contaminated groundwater extracted in the River Corridor and Central Plateau; and a number of unknowns regarding contaminant transport and interaction with the environment.

Ecology expects DOE to work toward cleaning up Hanford soil and groundwater to meet TPA milestones. Ecology looks forward to collaborating with DOE to address soil and groundwater remediation priorities. Ecology believes the following needs are groundwater cleanup priorities:

- Achieve ambient water quality levels for chromium (Cr-VI) in the Columbia River
- Meet drinking water standards for strontium (Sr-90)
- Attain highest beneficial use for groundwater in the 300 Area currently contaminated with uranium
- Contain Central Plateau contaminant plumes
- Shrink the footprint of all plumes as much as possible and as soon as possible

- Dennis Faulk, US Environmental Protection Agency (EPA), said groundwater remediation funding is essential to Hanford cleanup. The 2005 Congressional appropriation enabled DOE to begin catching up on groundwater remediation needs. Hanford has significant technology needs to address soil and groundwater contamination problems. DOE's proposed priorities align closely with regulatory agency priorities.

**Technical Background**

- Blaine Rowley, DOE-HQ, reviewed the process by which remediation technologies were investigated and selected, as part of a $10 million Congressional appropriation in 2005, to protect the Columbia River from contamination. A workshop held in January 2006 narrowed the initial 23 submitted technology proposals down to 10 proposals for further consideration using the following evaluation criteria:
  - Relevancy (met the Congressional mandate to protect the Columbia River)
  - Risk reduction
  - Baseline improvements
  - Implementability
  - Acceptability

  In the spring of 2006, an independent expert review panel considered the 10 proposals and recommended six with minor modifications, recommended one with significant revisions, and rejected three. In May 2006, five projects were approved for funding and work was initiated. There was no Congressional appropriation for 2007, but input from the workshop will help identify and prioritize Hanford groundwater and vadose zone needs.

- Mike Thompson, DOE-Richland Operations Office (DOE-RL), described current and potential future Hanford groundwater impacts to the Columbia River. Stakeholder values for groundwater remediation work include:
  - Protect the Columbia River
  - Deal realistically and forcefully with groundwater contamination
  - Get on with cleanup
  - Do no harm during cleanup

- Use the most practicable, timely, and available technology, while leaving room for future innovation

Mike reviewed the status of groundwater contamination at Hanford and the current projects underway. The current approach to groundwater remediation at Hanford has been to:

- Find and remediate contamination sources
- Eliminate conditions that mobilize vadose zone contaminants
- Implement and optimize remediation systems to protect the river, as required by interim records of decision (RODs)
- Complete the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial investigation/feasibility study (RI/FS) process leading to integrated source/groundwater RODs

- Scott Petersen, Fluor Hanford and John Fruchter, Pacific Northwest National Laboratory (PNNL), presented updates on the progress of the nine funded groundwater remediation projects:
  - Uranium stabilization through polyphosphate injection in the 300 Area
  - Strontium ($Sr^{90}$) absorption through phytoremediation in the 100-N Area
  - Sequestration of $Sr^{90}$ Subsurface Contamination by Surface Infiltration of an Apatite Solution
  - Natural attenuation of carbon tetrachloride $CCl_4$ in the 100-Q West Area
  - Biostability treatment test to supplement function of the In-Situ Redox Manipulation (ISRM) barrier
  - Vadose zone chromium (Cr) characterization
  - ISRM barrier mending through injection of micron-sized iron to reduce Cr(VI) to Cr(III), which is much less toxic and less mobile
  - Electrocoagulation to remove chromium
  - Refine the chromium source location in the 100-D Area

**Discussion of Groundwater Remediation Prioritized Needs**

After lunch, workshop participants engaged in small group discussions to provide input on DOE-RL's proposed priorities list. Groups were asked specifically to confirm the proposed priorities, identify proposed priorities that should not be included on the list, and propose other priorities that should be included. Results of the small group discussions will help develop a consensus priorities list and inform which projects are ultimately selected for direct funding.

Results are summarized below according to DOE-RL's proposed list of prioritized science and technology needs for groundwater remediation. Each proposed priority need is listed, followed by workshop input.

Priority A (needs affecting contaminants currently entering the Columbia River):

*1(a). 100 Area vadose zone chromium remediation (100-H, 100-D, 100-K) and*

*1(b). 300 Area vadose zone uranium remediation*

- There is strong support for chromium and uranium remediation projects; however, there is a need to explore projects that could have an immediate impact on transport and remediation.
- Consider delaying addressing these needs until uncertainty is reduced.
- Include characterization in any discussion of remediation.

*2. 300 Area deep TCE characterization/remediation*

- Consider broadening this to a high level need called "characterization of solvent contamination."
- This need should be covered in the baseline.

*3. 100-N phytoremediation Sr-90 (transfer into food chain, hot-zone test, compatibility with Apatite barrier)*

- Phytoremediation for Sr-90 should not be included on the Priority A list, since it is a "polishing step" and could be considered a baseline cleanup activity.
- Consider listing this as a B or C priority, or removing this need from the list of prioritized needs altogether.

*4. Understanding hydraulics & chemistry of groundwater/Columbia River interaction for Cr, Sr-90 & U*

- Should be included in a broader high-priority need for site-wide conceptual models.

*5. 100-N petroleum remediation*

- Need more information on this threat to the Columbia River and current remediation, and how to treat radionuclides mixed with organic contaminants.
- This need should be covered in the baseline.
- In addition to identifying methods for removing this contamination, consideration must be given to developing methods for treating the material (e.g., what type of treatment will be used to avoid creating mixed waste? Organic contaminants and radionuclides need to be stripped sequentially.).

<u>Priority B</u> (needs affecting 200 Area contaminants that could reach the Columbia River)

*1. Deep vadose zone Tc-99 remediation in the 200 Area*

- Consider elevating this need to the Priority A list.
- Need to keep Tc-99 out of the groundwater and Columbia River.

*2. Gable Gap & geohydrology between 200 Area & Columbia River*

- Should be rolled up into a need called “Better tools for vadose zone characterization”.

*3. 200 Area uranium remediation (vadose zone & groundwater)*

*4. Tank farm mobile contaminant release conceptual model*

*5. Residual tank waste characterization/remediation*

*6. Surface barrier design/testing*

- Surface barrier design and testing should be lowered to a Priority C need, and should address lateral as well as vertical contaminant transport.
- There is concern about surface barriers precluding other remediation projects.

*7. $CCl_4$ volatilization losses*

- Need to understand $CCl_4$ inventory.
- Consider elevating this need to the Priority A list.

*8. Data visualization*

- Develop a data management tool to assist in risk evaluation for decision-making.
- Consider elevating this need to the Priority A list, since risk evaluation is a primary driver of cleanup projects.
- Develop detailed stratigraphic and hydrologic conceptualization for cleanup models, including:
  - Measuring water levels in wells
  - Obtaining adequate survey points in wells
  - Understanding groundwater and Columbia River interactions
  - Understanding multi-contaminant plume behavior

<u>Priority C</u> (needs that can be deferred until FY 2008)

*1. S&T activities to support full-scale implementation of FY 2006/2007 projects*

- Combine with priority 1(a)

*2. 100 Area chromium remediation between 100-D & 100-H (Columbia River "Horn")*

- Consider elevating this need to the Priority A list.

*3. Continued funding of abiotic $CCl_4$ degradation*

- Consider elevating this need to the Priority A list.

*4. Characterization/remediation of 200 Area pipelines*

- Integrate with the high-level waste program in the chromium remediation program in the 200 Area.

*5. Inexpensive drilling/sampling technologies for extremely radiological "hot" samples*

- Remove from the list of prioritized needs since not enough information exists on this topic.

**Additional Input on Groundwater Remediation Needs Issues**

- The proposed priority needs list lacks balance between short-term needs (e.g., impacts to the Columbia River) and long-term needs (e.g., deep vadose zone characterization). Concern was expressed about losing sight of the long-term contamination needs in favor of addressing short-term needs.
- The proposed priority needs list also lacks balance between specific and generic remediation needs.
- There are no silver bullet remedies; remediation needs should be identified and addressed using a systems approach.
- There is strong support for strategically integrating remediation needs. Currently, remediation efforts seem to be focused on problem or spot areas, and more cross-project integration is necessary. Consider revising some needs statements to reflect integration.
- Develop better site conceptual models and 3-D model of contamination plumes.
- Geophysics is being considered but not implemented. There are a lot of geophysical tools that could be explored for different remediation needs.
- Clarify how the proposed prioritized groundwater remediation needs fit into the overall Hanford cleanup strategy (e.g., How would 18-month remediation projects affect characterization activities, baseline activities, and 5- or 10-year cleanup plans?).
- Document and lay out the decision logic used to identify groundwater and vadose zone remediation needs, including goals and objectives.
- Clarify the distinction between A and B priorities. Seems like needs are equally important, but just on different timeframes.
- Perform adequate characterization before implementing remediation.
- Focus on “work packages” rather than specific projects to adequately fund enough work to solve a particular problem.
- Hydraulically manipulate the 200 West Area water table to restrict movement of Tc-99 and $CCl_4$.
- Ensure that selected technologies solve specific needs or problems.

- Identify and clarify needs that represent new work and those that should be addressed as part of the baseline.
- Consider the time required to implement remediation projects.
- Remediation to convert Cr(VI) to Cr(III) still leaves chromium in the vadose zone. This does not meet remove, treat, and dispose guidelines for contaminant cleanup. There is a need to ensure proposed soil remediation projects are allowable from a regulatory standpoint.
- Avoid allowing available technologies to drive remediation solutions. DOE should be aggressive about actively seeking solutions to contamination issues, and not passively selecting from proposals they receive.
- Consider investing in studies of uncontaminated areas as well as contaminated areas to fully characterize the vadose zone.

**Wrap-up**

Mike Thompson said input from the workshop will be integrated into a revised list of priority needs and discussed further with the Hanford Advisory Board, DOE-HQ, and the regulatory agencies.

Mark Gilbertson said the results of workshop discussion on prioritizing remediation needs are beneficial for informing DOE-HQ's collaboration with the Office of Science, Department of Defense, and others to direct science and technology research. DOE-HQ is committed to investing in remediation of Hanford groundwater contamination and understanding the prioritized needs will help DOE-HQ leverage funding for Hanford groundwater remediation activities.

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