TECHNOLOGY NEEDS/OPPORTUNITIES STATEMENT

IMPROVED, COST-EFFECTIVE METHODS FOR SUB-SURFACE ACCESS TO SUPPORT CHARACTERIZATION AND REMEDIATION

Identification No.: RL-SS25
Date: September 2001

Program: Environmental Restoration
OPS Office/Site: Richland Operations Office/Hanford Site
Operable Unit(s): Broad need potentially applicable to multiple operable units.
PBS No.: RL-SS04 (RL-VZ01), RL-RC01 (RL-ER01), RL-RC02 (RL-ER03), RL-CP01 (RL-ER02), RL-RC01 and RL-CP01 (RL-ER08)
Waste Stream: Disposition Map Designation: ER-03 [technical risk score 3], ER-04 [technical risk score 3], ER-10 [technical risk score 5], ER-18 [technical risk score 5], ER-14 [technical risk score 5]
TSD Title: N/A
Waste Management Unit (if applicable): N/A
Facility: N/A

***Priority Rating*:**

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" priority:

_X_ 1. Critical to the success of the ACPC
____ 2. Provides substantial benefit to ACPC projects (e.g., moderate to high lifecycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays)
____ 3. Provides opportunities for significant, but lower cost savings or risk reduction, and may reduce uncertainty in ACPC project success

The four major core projects of the Groundwater/Vadose Zone Integration Project (200 Area Remediation, Immobilized Low-Activity Waste Performance Assessment, Tank Farm Closure, and Tank Farm Vadose Zone) list this need as a high priority.

Need Title: Improved, Cost-Effective Methods for Sub-Surface Access to Support Characterization and Remediation.

Need/Opportunity Category: Technology Need

Need Description: The Hanford site contains large volumes of contaminated vadose zone and aquifer soils. In some areas, these soils are located at depths of 500 ft while access to other soils is restricted by the presence of surface or near surface objects such as buildings or underground tanks. The Hanford geology also is quite varied and ranges from unconsolidated silty sands to gravels and cobbles. Cost effective technologies that allow access to this wide variety of

sediments for both characterization and remediation are required. Improvements in both vertical and horizontal access techniques are desired.

Schedule Requirements:

Earliest Date Required: 8/1/99

Latest Date Required: 9/30/15

Characterization and remediation activities are ongoing.

***Problem Description*:** The Hanford geology that must be accessed by these technologies is divided into three primary components; the Hanford Formation (upper sediment unit), the Plio-Pleistocene Unit (interlayer in the 200 West Area), and the Ringold Formation (lower sediment unit). The Hanford Formation is comprised of unconsolidated sands, gravels, and fine-grained slackwater deposits from cataclysmic floods of the Pleistocene period. The relative proportion of sand, gravel, and fine-grain deposits is dependent on the location within the Hanford site. The Plio-Pleistocene Unit (1-m to 5-m thick) consists of a caliche cemented layer, well-cemented calcium carbonate enriched sediment and a loess composed of fine grained sand and silt. The Ringold Formation is comprised of unconsolidated and semi-consolidated fluvial and lacustrine sediments ranging from gravels with interbedded silt and sand lenses to muddy sandy gravels with interbedded sand and muddy sand lenses. The 100 Area subsurface is primarily comprised of Hanford Formation. The 200 East Area is primarily comprised of Hanford and Ringold Formation. The 200 West Area is a mixture of the three components.

Access technologies are used for both characterization and remediation at several different areas throughout the Hanford Site. A few specific examples are discussed to illustrate the different needs.

Groundwater operable unit 200-ZP-1 is located in the northern half of the 200 West Area. Carbon tetrachloride in this operable unit extends in groundwater over a 4.5 square mile area. Depth to the water table is 270 feet. The ultimate remediation goal for the CCl_4 plume is to eliminate a sufficient amount of contamination so that the plume concentration will not exceed 5 ppb at the 200 Area plateau boundary. An interim ROD has been issued requiring an interim remedial measure (IRM) to treat the 2000-3000 ppb portion of the carbon tetrachloride plume northwest of Z Plant (excluding the T Plant plume). Contaminated groundwater within the operable unit is being pumped from the aquifer, then treated with an air-stripping unit followed by vapor phase granular activated carbon polishing. Initial modeling indicates that pump and treat will need to be expanded and operated for 33 to 56 years to meet stated objectives. Other remediation activities are being considered but costs to access this deep and large contaminant plume limit practical options.

The 100-H, 100-D and 100-K Areas contain three chromium plumes. The areal extent of the north plume is about 2,000' x 4,000' and the south plume is about 2,000' x 2,000'. Both plumes have an average thickness of about 15 feet with concentrations ranging from 60 to 2000 ppb. Depth to the water table is 85 feet. Pump & Treat and In Situ Redox Manipulation (ISRM)

barrier technology which both rely on conventional vertical well technology are being used to control the migration of portions of these plumes. However, less expensive access technologies, and potentially horizontal well technologies, would reduce the cost of characterizing the location of the plumes and installing/monitoring the effectiveness of these solutions.

In the 100-N Area, strontium-90 (half-life 29.3 years) is present in groundwater at activities up to 6000 pCi/L. Depth to the water table is 70-80 feet at the source. Plume thickness ranges from 13 to 40 feet. This problem is currently being assessed through the Innovative Treatment Remediation Demonstration (ITRD) process. This process reduces communication and regulatory barriers and develops an operational test and evaluation program that leads to implementation of the best technology. This assessment is ongoing and will continue into FY99, however, several potential solutions that are being considered in this process would benefit from less expensive access technologies.

The Hanford site is currently investigating methods (e.g. cone penetrometers) to cost effectively access soils near and below underground storage tanks and soil waste sites. These investigations have been productive for near surface soils but are limited in deployment depth in many types of Hanford soil. Recent borehole spectral gamma data in the 200 Area indicate that cesium-137 has migrated deeper than previously expected at both the SX and BX tank farms. Groundwater data for several tank farm waste management areas also suggest that pathways through the vadose zone exist and could impact groundwater quality. These observations suggest that fundamental assumptions about contaminant mobility that support single shell tank cleanup options and schedules may be incorrect. However, drag down of contamination or preferential paths generated by vertical wells may also be the cause of some of this contamination. Access technologies that do not drill through overlying contaminated soils and can reach the required depths to groundwater in the 200 Area could help confirm the existence of these contaminants at depth and determine appropriate actions. More cost effective access than the current baseline borehole techniques would provide a significant cost impact in the 200 Area because of the large number of waste sites that need to be characterized over the next ten years.

Benefit to the Project Baseline of Filling Need: Improved access technology may significantly decrease the current costs associated with the baseline drilling technologies.

***Functional Performance Requirements*:** Access technologies should be as cost effective as, or better than, conventional vertical well drilling access technologies (e.g. <$300 per ft in non-radiation zones, <$2000/ft in radiation zones). The technology should allow access to soils at depths up to 500 ft and allow for access to long (1000-5000 ft) horizontal sections of contaminated soils. The technology should be able to accurately access specific portions of contaminated soils and therefore needs good directional and location control. The technology must be appropriate for the variety sediments at Hanford. The technology should minimize the generation of secondary wastes and support both characterization and remediation activities. Use of drilling mud is generally not possible or very limited at Hanford and is not applicable to characterization boreholes.

***Work Breakdown Structure (WBS) No.* :** 1.4.03.1.1 (RL-RC01)
1.4.03.1.2 (RL-RC02)
1.4.03.3.1 (RL-CP01)
1.4.03.4.4 (RL-SS04)

TIP No.: N/A

Relevant PBS Milestone: PBS-MC-026, PBS-MC-027, PBS-MC-028, M-15-00, M-16-00

***Justification For Need*:**

Technical: There are two main technical justifications for this need. The first is that the large size of several Hanford plumes and the depth of some contamination, especially in the 200 Area, limits practical remediation options unless the expense of accessing the contaminated areas can be reduced. The second justification relates to characterization. Significant decisions about the treatment of the vadose zone in the 200 Area must be based on a sufficient amount of characterization data that is not effected by the sampling method.

Regulatory: Capability to collect this information would also be useful to support selection and monitoring of effective remedial alternatives.

Environmental Safety and Health: Improved access technologies could help reduce secondary waste generated during drilling operations and reduce the potential for worker exposure.

Potential Life-Cycle Cost Savings of Need (in $000s) and Cost Savings Explanation: The estimated life-cycle cost savings associated with filling this need is $50M. This estimate is based on an assumed savings of 25% of the projected assessment cost for the 200 Area of $80M plus additional savings for remediation technology deployments.

Cultural/Stakeholder Concerns: Long horizontal wells could reduce the amount of surface damage to culturally sensitive areas by limiting the number of surface penetrations required to treat a given site.

Other: None.

Current Baseline Technology: Air rotary, sonic, and cable tool drilling are the primary access technology used at the Hanford Site.

Cost: Approximate drilling costs are $300 per foot in areas with low levels of contamination. Cost per foot can be as high as $2000 per foot in more contaminated areas like the tank farms.

Waste: Drill cuttings and PPE from drilling operations.

How Long It Will Take: The baseline drilling techniques can drill at a rate of up to about 300 ft per week.

End-User: Richland Environmental Restoration Project, River Protection Project Tank Farm Closure Program, River Protection Project Immobilized Waste Program

Site Technical Point-of-Contact: Scott W. Petersen, BHI, (509) 372-9126; John April, BHI, (509) 372-9632; Curt Wittreich, (509) 372-9586; Ashur R. Michael, BHI, (509) 372-9074; Jared D. Isaacs, BHI, (509) 372-9162; Tony Knepp, CHG, (509) 372-9514; Michael J. Truex, PNNL, (509) 376-5461

Contractor Facility/Project Manager: V. R. (Vern) Dronen (100 and 300 Areas), BHI, (509) 372-9075; Michael J. Graham (200 Area), BHI (509) 372-9179

DOE End-User/Representative Point-of-Contact: Arlene C. Tortoso DOE, (509) 373-9631; Bryan L. Foley, DOE, (509) 376-7087; Robert G. Mcleod, DOE, (509) 372-0096; Glenn I. Goldberg, DOE, (509) 376-9552; Robert M. Yasek, DOE, (509) 372-1270; Owen Robertson, DOE, (509) 373-6295