Site Need Statement

General Reference Information	
1 *	***Need Title:*** Tank Leak Mitigation Systems
2 *	***Need Code:*** RL-WT027
3 *	***Need Summary:*** The use of liquid based retrieval methods for SST waste removal involves the addition of liquid to tanks to dislodge, mobilize, retrieve, and transfer the waste and therefore increases the potential for waste leakage to the environment. Leak mitigation applies to all SST retrievals. Leak mitigation efforts and tools, that can be shown to provide cost-benefit and significant risk reduction over baseline methods, must be incorporated into retrieval system design and operating procedures in accordance with the provisions of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). Existing mitigation techniques (i.e., the current baseline approach) must continue to be evaluated against potential/candidate mitigating technologies to ensure that the most cost-effective, risk reducing approach is applied. Periodic identification and evaluation of potential leak mitigation tools for possible application during SST retrieval operations is required on a continuing basis. The volume of liquids available for leakage from Hanford's SSTs is being minimized by saltwell pumping operations that are removing drainable and pumpable liquids. Although leak mitigation is being approached proactively through retrieval system designs that use little, if any, liquids to dislodge, mobilize, retrieve, and transfer the waste, a need exists for demonstrating in-tank and ex-tank leak mitigation methods to provide options for deployment should a leak occur to minimize potential impacts on human health and the environment. This leak mitigation need statement is also support by other, more specific, need statements that address the development and demonstration of "getter materials" to reduce contaminant mobility (WT046S) and "reactive barriers to contaminant migration" (WT061).
4 *	***Origination Date:*** FY 2000
5 *	***Need Type:*** Technology Need
6	***Operation Office:*** Office of River Protection (ORP)
7	***Geographic Site Name:*** Hanford Site
8 *	***Project:*** Retrieval PBS No: RL-TW04
9 *	***National Priority:*** __X_ 1. High - Critical to the success of the EM program, and a solution is required to achieve the current planned cost and schedule. ____2. Medium - Provides substantial benefit to EM program projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays). ____3. Low - Provides opportunities for significant, but lower cost savings or risk reduction, may reduce the uncertainty in EM program project success.
10	***Operations Office Priority:***
Problem Description Information	
11	***Operations Office Program Description:*** The Retrieval & Disposal Program is responsible for coordinating and integrating Program/Project Planning and Execution; Environment, Safety, Health, and Quality Assurance; Facility Operations; Engineering; Maintenance; Interim Stabilization; and Technology Development, Demonstrations, and Deployments necessary for the safe and cost effective retrieval and disposal of SST and DST wastes, associated underground storage tanks, and ancillary piping and equipment. Safe storage of wastes includes day-to-day operations of the SST's and saltwell pumping operations to remove pumpable liquids from the SST's for transfer to double-shell tanks (DST's) to achieve interim stabilization and minimize the potential for SST leakage. Retrieval projects will be conducted to remove wastes from SST's for placement in DST's in support of waste feed delivery to the Waste Treatment Plant and eventual waste immobilization. An integral part of SST waste retrieval operations is leak detection, monitoring, and mitigation. Safe storage, retrieval, and closure activities associated with SST wastes are

	also supported by Special Projects and Vadose Zone Projects to characterize groundwater flow and contaminant transport phenomena, geohydrological conditions, and the nature and extent of contaminant plumes.
12	***Need/Problem Description:*** Mitigating systems that improve on the capabilities of the current baseline approach are needed. The objective is to prevent, curb, or eliminate the possibility or extent of liquid waste leakage from underground storage tanks into the surrounding soils. If cost-benefit, risk-reduction, and alternatives evaluations of new in-tank and ex-tank mitigating technologies determine that deployment, implementation, and operation is feasible, then further evaluation should be pursued. Such evaluations may include bench- and field-scale demonstrations and testing. Example concepts that could be evaluated include retrieval methods and operating strategies that minimize the potential for leakage, leak point and potential leak point location, seek-and-seal devices and methods, administrative approaches that maximize the use and coordination of currently available tools and methods including such things as sheet pile barriers, close-coupled grout injection barriers, dry-air containment barriers, auxiliary pumping schemes, reactive zones/barriers, "stop-leak" formulations, borehole mining strategies, and other approaches. **Consequences of Not Filling Need:** A position based upon current baseline mitigation tools and capabilities will be negotiated with Ecology through ongoing efforts to prepare Functions and Requirements (F&R) documents. However, continued effort to seek new, or enhanced old methods and tools is a major Hanford Stakeholder value that will be associated with approval to proceed. Although efforts are being made to minimize the potential for leakage during retrieval operations through retrieval system designs and operating strategies, if a leak does occur, then failure to provide leak mitigation technologies could result in wider spread of contaminants and increased costs to remediate and close the tank farm. Failure to provide effective leak mitigation technologies could increase the risk posed to human health and the environment. Furthermore, if a leak does occur, it is possible that regulators could call for the shutdown of retrieval operations with subsequent impacts on the cost and schedule of retrieval operations. ** **Program Baseline Summary (PBS) No.:** TW04 ** **Work Breakdown Structure (WBS) No.:** 5.02.01.01.02.02 ** **TIP No.:** NA
13	***Functional Performance Requirements:*** The final leak mitigation approach and functional requirements will be negotiated with EOE-ORP and Ecology. Candidate mitigation systems will be evaluated by such criteria as overall cost-benefit and risk-reduction potential, ease of use and deployment, overall effectiveness, and capability to verify effectiveness. Leak mitigation systems should address the following types of issues: • Maximizing in-tank and/or ex-tank opportunities to reduce or stop leakage prior to, during, or following waste retrieval. • Use of hardware systems that are deployable in or around the target tank to required locations that will facilitate use as designed. • Availability and/or deployability in order to operate during the time frame of need (e.g., at the time and location of a detected leak, or within the time frame of a waste retrieval campaign) • Cost-benefit and risk-reduction when compared to the baseline approach and no-action scenario. • The mitigation tool/system must include a capability for installation verification and periodic performance verification while installed and/or in service. • The mitigation tool/system must utilize materials that are compatible with the waste (i.e., won't degrade), appropriate to the planned period of use, capable of surviving deployment. • Should not produce tank or tank waste conditions that preclude further attempts at waste retrieval or tank/tank farm closure, or that create additional, more complex retrieval problems or conditions. • In-tank methods must be capable of deploying the leak mitigating provision below the waste level and in such a manner so as to not impact the waste composition adversely when compared to waste feed delivery specifications to the Waste Treatment Plant. • Leak mitigation techniques that sequester or otherwise reduce the mobility of contaminants of concern must remain effective over the period of time determined by the Retrieval Performance Evaluation (RPE) Methodology or other appropriate risk-based models. • Ex-tank leak mitigation techniques must be deployable in Hanford Site geology in such a manner that a laterally and vertically continuous zone of treatment is achieved.

	Outsourcing Potential: Demonstration of candidate leak mitigation tools and methods will show where other DOE sites, national laboratories, universities, and private industry has the capabilities to perform now and where additional technology would be helpful. Leak mitigation methods have been developed and deployed in support of the petroleum industry and other industries wherein subsurface hydrogeologic controls are needed. In-tank leak mitigation methods employing non-flowing thixotropic materials have been investigated.
**	**Schedule Requirements:** This need supports Tri-Party Agreement milestones for development and deployment of waste tank leak detection, monitoring, and mitigation (LDMM) techniques and for completing leak detection, monitoring, and mitigation (LDMM) system design by May 2003. Tri-Party Agreement M-45 series milestones require incorporation of LDMM techniques that will be used during retrieval of SST wastes, and demonstration and evaluation of those tools that prove to be viable. Leak mitigation systems can provide value throughout the duration of waste retrieval. Furthermore, if designed properly, leak mitigation systems can play a prominent role during site closure and post closure operations.
14	***Definition of Solution:*** The successful solution will be easily and rapidly deployed either in- or out-of-tank in the event that a leak is detected. The solution will either contain the leakage or mitigate the leakage by reducing the mobility of contaminants of concern (e.g., carbon-14, selenium-79, technetium-99, iodine-129, uranium-238). The successful solution will not adversely impact subsequent efforts directed at tank waste retrieval and will not compromise the composition of waste feed to the Waste Treatment Plant. The successful solution must sequester or otherwise immobilize contaminants of concern over a time period to be determined by the RPE Methodology or other risk-based approach.
15 *	***Targeted Focus Area:*** Tanks Focus Area (TFA)
16	***Potential Benefits:***
17 *	***Potential Cost Savings:*** $200,000,000 to $500,000,000
18 *	***Potential Cost Savings Narrative:*** Mitigation of leakage is directly related to the potential extent of action required for tank and tank farm remediation and closure, and the implementation of potential closure options. Mitigation and reduction of leakage can, therefore, be directly related to the cost of soil remediation should that become necessary. A significant cost avoidance is expected if DOE can avoid this type of higher contingency factor. Successful leak mitigation techniques will allow consideration of a greater range of waste retrieval options and methods and minimize the need for retrieval system shutdown with impacts to cost and schedule.
**	***Technical Basis:*** Provisions for leakage mitigation are critical to initiating actions to remove waste from leaking tanks. Tri-Party Agreement M-45 Series Milestones require measures for leak detection, monitoring, and mitigation to be included in the design of all SST retrieval systems. At present, if a leak is detected during waste retrieval operations the only option is to increase the waste pumping rate (e.g., through auxiliary pumping) to minimize the potential impact of the leak. Capabilities to implement in-tank stop leak methods and/or subsurface barriers and reactive zone to tank leaks should be investigated as part of a comprehensive approach to successful leak mitigation during retrieval operations. Bench-scale testing of reactive zones has demonstrated "proof of concept" for immobilizing contaminants such as technetium, uranium, and actinides.
19	***Cultural/Stakeholder Basis:*** Leak detection, monitoring, and mitigation (LDMM) during waste retrieval are major issues of concern with Ecology and Hanford Stakeholders. This concern is reflected in Tri-Party Agreement milestones, review of the RPP EIS, and in other public documentation. Recent Tri-Party Agreement negotiations has resulted in the integration of LDMM provisions with retrieval system designs.
20	***Environment, Safety, and Health Basis:*** Leakage must not be allowed to occur to an extent that will preclude the use of available tools and methods for remediating the contaminated soil or result in unacceptable environmental risks as determined by the RPE Methodology or other risk-based approach. A viable approach to leak mitigation during waste retrieval operations will contribute to the capability to ensure that leakage is managed within retrieval release criteria and target leak detection rates as determined by the risk-based RPE Methodology, and to maintain overall safe operations during waste retrieval. Demonstrated capabilities for leak mitigation during tank waste retrieval operations will help to ensure

	adequate protection of human health and the environment should a leak occur.
21	***Regulatory Drivers:*** This task will contribute to the information base that is used during negotiation with Ecology and Hanford Stakeholders regarding a regulatory position for final retrieval and closure of Hanford SSTs. Leak mitigation is a major Hanford Stakeholder value and is expressed as a concern by Ecology through the Tri-Party Agreement M-45 series milestones. Regulations applicable to owners and operators of underground storage tanks require implementation of leak mitigation measures.
22 *	***Milestones:*** T04-01-341, T04-02-341, T04-03-100, T04-03-341, T04-04-110, T04-04-120, M-45 Tri-Party Agreement milestones.
23 *	***Material Streams:*** Sludge, Saltcake, Liquid (RL-HLW-20)
24	***TSD System:*** N/A
25	***Major Contaminants:*** Pu-238, 239, 240, 241; Am-241; U-238; C-14; Ni-59/63; Nb-94; Tc-99; I-129; Cm-242; Sr-90; Cs-137; Sn-126; Se-79; chromium; nitrate; nitrite; complexants (EDTA/HEDTA)
26	***Contaminated Media:*** Tank wastes and vadose zone soils.
27	***Volume/Size of Contaminated Media:*** Nominal capacities of SSTs range from 55,000 to 1,000,000 gallons.
28 *	***Earliest Date Required:*** 9/30/01
29 *	***Latest Date Required:*** 9/30/03
Baseline Technology Information	
30	***Baseline Technology/Process:*** Current baseline mitigation approach includes the following measures: • Use of smart waste retrieval methods and operating procedures to minimize aggravation of tank weak points. • Retrieving waste with appropriate diligence to determine, at the earliest possible time, if leakage is occurring. • Removal of drainable and pumpable liquids from tanks via interim stabilization saltwell pumping operations . • Minimization of operational/system down-time during which leaks can proceed by providing availability of [backup] equipment and staff. • Designing retrieval systems and equipment for dependability and minimum maintenance using little, if any, liquids to dislodge, mobilize, retrieve, and transfer wastes into the DST system. **Technology Insertion Point(s):** N/A
31	***Life-Cycle Cost Using Baseline:***
32	***Uncertainty on Baseline Life-Cycle Cost:***
33	***Completion Date Using Baseline:***
Points of Contact (POC)	
34	***Contractor End User POCs:*** J.W. (Jerry) Cammann, CHG, 509-372-2757, F/509-373-6101, Jerry_W_Cammann@rl.gov
35	***DOE End User POCs:*** E.J. (Joe) Cruz, DOE-PRD, 509-372-2606, F/509-373-1313, E_J_Cruz@rl.gov
36 **	***Other Contacts:*** K.A. (Ken) Gasper, CHG, 509-373-1948, F/509-376-1788, Kenneth_A_Ken_Gasper@rl.gov

*Element of a Site Need Statement appearing in IPABS-IS
**Element of a Site Need Statement required by CHG