Savannah River Site

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HLW Tank 18 Waste Removal Systems Engineering Evaluation

Final Report (U)

WSRC-RP-2001-00024
Revision 0

May 22, 2001

HLW Tank 18 Waste Removal Systems Engineering Evaluation Final Report

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REVISION SUMMARY

Rev. No.	Rev. Date	Affected Sections	Description of Revision
0	05/22/01	All	Initial Issue

Abstract

Savannah River Site has fifty-one high level waste tanks in various phases of operation and closure. These tanks were originally constructed to receive, store and treat the high level waste created in support of the missions assigned by the Department of Energy (DOE). The Federal Facilities Agreement (FFA) (Reference 1) requires the high level waste (HLW) to be removed from the tanks and stabilized into a final waste form as well as closure of the tanks following waste removal. The FFA closure date for Tank 18 is March 2004.

Waste removal was previously performed on Tank 18 in 1986-1987. A heel of about 37,000 gallons of sludge remained. Closure in 1997 of Tanks 17 and 20 resulted in an additional 8,000 gallons of sludge being added to Tank 18. Closure of Tank 19, currently in progress, is expected to result in an additional 33,000 gallons of sludge being added to Tank 18. The resultant 78,000 gallons of sludge must be removed from Tank 18 in time to support the March 2004 closure date.

The Waste Removal Line Item Project S-W183 contains baseline scope and technology to retrofit Tank 18 with waste removal equipment. The baseline scope was exactly the same as the scope used in 1986-1987 that resulted in the large sludge heel described above. Though the technology was inadequate in that regard, it did serve to provide a financial placeholder in the Line Item Project until a more robust scope evaluation could be completed.

A formal Systems Engineering Evaluation (SEE) for Tank 18 was completed between October 2000 and February 2001. The purpose of the evolution was to determine the methodology, equipment and transfer routes to successfully meet the project mission.

This document contains the results of the evaluation and a recommendation for the waste removal process, equipment and strategy to be employed on Tank 18.

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1.0 Executive Summary

Savannah River Site has fifty-one high level waste tanks in various phases of operation and closure. These tanks were originally constructed to receive, store and treat the high level waste (HLW) created in support of the missions assigned by the DOE. The FFA (Reference 1) requires the HLW to be removed from the tanks and stabilized into a final waste form as well as closure of the tanks following waste removal.

The methodology to remove and transfer the high level waste from Tank 18 to another HLW tank is the focus of this report. The purpose of waste removal and transfer is to accommodate the eventual closure of Tank 18. This work is in support of the Line Item Project S-W183.

Removal and transfer of waste from other HLW tanks has been accomplished, but not without difficulty. The methods initially baselined to remove and transfer Tank 18 waste are no longer considered cost-effective. The HLW Tank 18 Waste Removal Systems Engineering Evaluation Team (Team) was formed to conduct a systematic evaluation to identify, evaluate, and recommend cost-effective and safe technology and transfer methods for Tank 18 waste. The Team considered prior methods, other alternatives, and new technologies. A Systems Engineering Evaluation (SEE) approach was used to ensure that a comprehensive study was completed. Risk assessments of proposed ideas and strategies provided significant information upon which to facilitate Team decisions.

The overall strategy recommended by the Team is summarized below:

- ***Prepare the Bulk Waste in Tank 18 (Function F.1)***: The recommendation is to develop and deploy a modified Advanced Design Mixing Pump (ADMP) to suspend the waste in a slurry thus enabling the waste to be transferred to another tank. The modified ADMP would have the same pump characteristics as the current ADMP, but it would be modified to fit into a 2-foot diameter riser. The smaller size enables the modified ADMP to fit into all 33 remaining waste removal tanks, whereas, the existing ADMP can only be used in nine of the remaining tanks. There is risk associated with this recommendation due to the probable time required to develop a totally new "wet end" to the ADMP versus the amount of schedule left on Tank 18. The risk mitigation involves refurbishing the unmodified ADMP and having it ready to install in Tank 18 in the event that the modified ADMP development takes too long.

- ***Transfer Non-Heel Bulk Waste to another HLW Tank (Function F.2)***: The recommendation is to use a Bibo pump as the prime mover. This is a standard, industrial grade, sump pump similar to the pump in current use on Tank 19. The recommendation also includes the completion of a tie-in from Tank 18 to Tank 7 by connecting the existing lines from Tank 18 to the F-Area Diversion Box –1 (FDB-1) and Tank 1 to Tank 7. This will provide a direct underground route from Tank 18 to Tank 7 in support of sludge batch #3 and requires only minor excavations.

- ***Prepare the Heel from Tank 18 (Function F.3)***: The recommendation is to continue to use the modified ADMP (or ADMP) from Function F.1 until the final level of less than

1,000 gallons of sludge remains. There is a risk associated with this approach in that too much water or too much time will be required to de-inventory the sludge to this level. The mitigation alternative is to use either sluicers or a robotic suction device for the final heel removal, if necessary.

- ***Transfer Heel to another HLW Tank (Function F.4)***: The prime mover and transfer route used for Function F.2 will be re-used for Heel Removal and transfer to Tank 7.

The significant value aspects of the overall recommended strategy for Tank 18 include:

- This recommendation can be used on all Tank types.
- Tank 18 center riser will use only one (1) pump. Subsequent tanks would employ the use of two pumps; which is less than the number established in the baseline.
- A trend toward "portability" is initiated by this strategy because the recommendation will include these design considerations
- Placement of the waste directly in Tank 7 will enhance sludge batch #3. This has two benefits, first that the waste will not be required to be moved later into this tank (prior plan was to send from Tank 18 to Tank 26 and at a later date, from Tank 26 to Tank 7). Secondly, the production schedule for DWPF will be enhanced due to the larger amount of material in sludge batch #3.
- Approximately $15 – 20 million in Life Cycle Cost savings over the life of the contract

To provide ease in publishing this Report, several supplemental documents have been issued with supporting information, as part of the SEE:

1. Tank 18 Systems Engineering Evaluation – Lessons Learned from Other Tanks, HLW-CST-2001-0003, February 21, 2001.....Reference 8
2. Tank 18 Systems Engineering Evaluation – Individual Idea Scoresheets, HLW-CST-2001-0004, February 21, 2001.....Reference 9
3. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 1, HLW-CST-2001-0005, February 21, 2001.....Reference 10
4. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 2, HLW-CST-2001-0006, February 21, 2001..... ...Reference 11
5. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 3, HLW-CST-2001-0007, February 21, 2001.....Reference. 12
6. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 4, HLW-CST-2001-0008, February 21, 2001.....Reference 13

2.0 Purpose

The purpose of this report is to define the methodology and transfer system recommended by the Team to remove the high level waste in Tank 18 and transfer it to another HLW tank. A description of the process used for identifying, evaluating, and selecting the recommendations and the results obtained are presented to provide the bases of decisions made by the Team.

The members of the Team are listed below along with their parent organization:

Name	Representing
Neil Davis - Team Leader	WR Program Manager
Gary Abell	Systems Engineering
Nader Elraheb	WR Engineering
Ed Howard	WR Design Engineering
John McCullough	HLW Maintenance
Jim Menghi	Project Management
Susan Peterman	WSMS
Mike Tinsley	CSTO/WR Project Liaison

The Team acknowledges the support provided by additional participants in the SEE process, including Vince Ledonne, Tommy Caldwell, Bob Leishear, and Dave Stefanko. The Team also acknowledges the contribution of Warren Adkins for the development of computerized graphics, Bob Grimm and Cathy Smalls for producing the systems engineering decision analysis results using the Logical Decisions software, and Ruth Whitaker and Kimbly Boatwright for clerical support in producing the Final Report.

3.0 Background

The H- and F-Area Tank Farms at SRS were constructed during the 1950s and 1960s to receive, store and treat the various radioactive waste streams generated in support of weapons grade material production. There are a total of fifty-one HLW tanks: twenty-nine in H-Tank Farm and twenty-two in F-Tank Farm. Two of the F-Tank Farm tanks have been closed, i.e. Tanks 17 and 20.

Tank 18 is a 1.3 million-gallon capacity, single-wall, Type IV waste tank located in F-Tank Farm. Tank 18 construction was completed in 1958 and the tank was immediately placed in service as a receiver of Low Heat Waste (LHW). The Tank is an 85 foot diameter flat-bottomed cylindrical carbon steel tank with a domed roof. The walls are roughly 28.5 feet high with the center height about 50 feet. There are no cooling coils or internal structures inside the tank. The location of Tank 18, with respect to other F Area HLW Tanks is shown in Figure 3-1.

From July 1959 to August 1987, F-Canyon PUREX and non-canyon wastes were received in Tank 18. The sludge solids deposited from F-Canyon were a product of LHW streams. Tank 18 non-canyon receipts consisted of various forms of supernate, LHW and High Heat Waste, evaporator overheads, dissolved salts and sludge slurries received from Tanks 2, 7, 13, 17, 19, 20, 30, 33 and 34. Sludge removal operations in Tank 18 began in April 1986; the sludge level was estimated at 551,000 gallons. Approximately 94% of the sludge was removed from Tank 18 and transferred to Tanks 40, 41, and 42 using three (3) standard slurry pumps. The last sludge transfer from Tank 18 occurred in August 1987 with the material being transferred to Tank 51 through the existing FDB-1 route. The transfer line from Tank 18 to FDB-1 is not a pressure testable line; the jacket is open at FDB-1.

Based on photos taken on May 25, 1988, the estimated sludge volume in Tank 18 was approximately 37,000 gallons. In 1996, Tank 18 received transfers from Tanks 17 and 20 in preparation of closure of both of those tanks. Tank 17 started with 10,000 gallons of sludge and transferred 7,800 gallons to Tank 18. Tank 20 started with 1,000 gallons of sludge and transferred only supernate. After the Tank 17 and 20 transfers, the sludge volume in Tank 18 was approximately 44,000 gallons.

On October 2, 2000, transfer of the contents of Tank 19 to Tank 18 was started. The initial composition of the Tank 19 inventory is estimated as 13,000 gallons of spent zeolite, 7,000 gallons of metal oxides/hydroxides (standard sludge) and 13,000 gallons of insoluble salts. The goal of the Tank 19 transfer was to transfer the 33,000 gallons from Tank 19 to Tank 18. As of February 2001, approximately 15,000 gallons of sludge has been transferred to Tank 18. The sludge volume in Tank 18 at the end of the Tank 19 heel removal campaign is projected to be 78,000 gallons. The supernate volume in Tank 18 at the end of the Tank 19 heel removal and spray washing campaigns is projected to total between 900,000 and 1,300,000 gallons at a specific gravity of 1.01.

Pictorial views of Tank 18 are provided in Figures 3-2 and Figure 3-3.

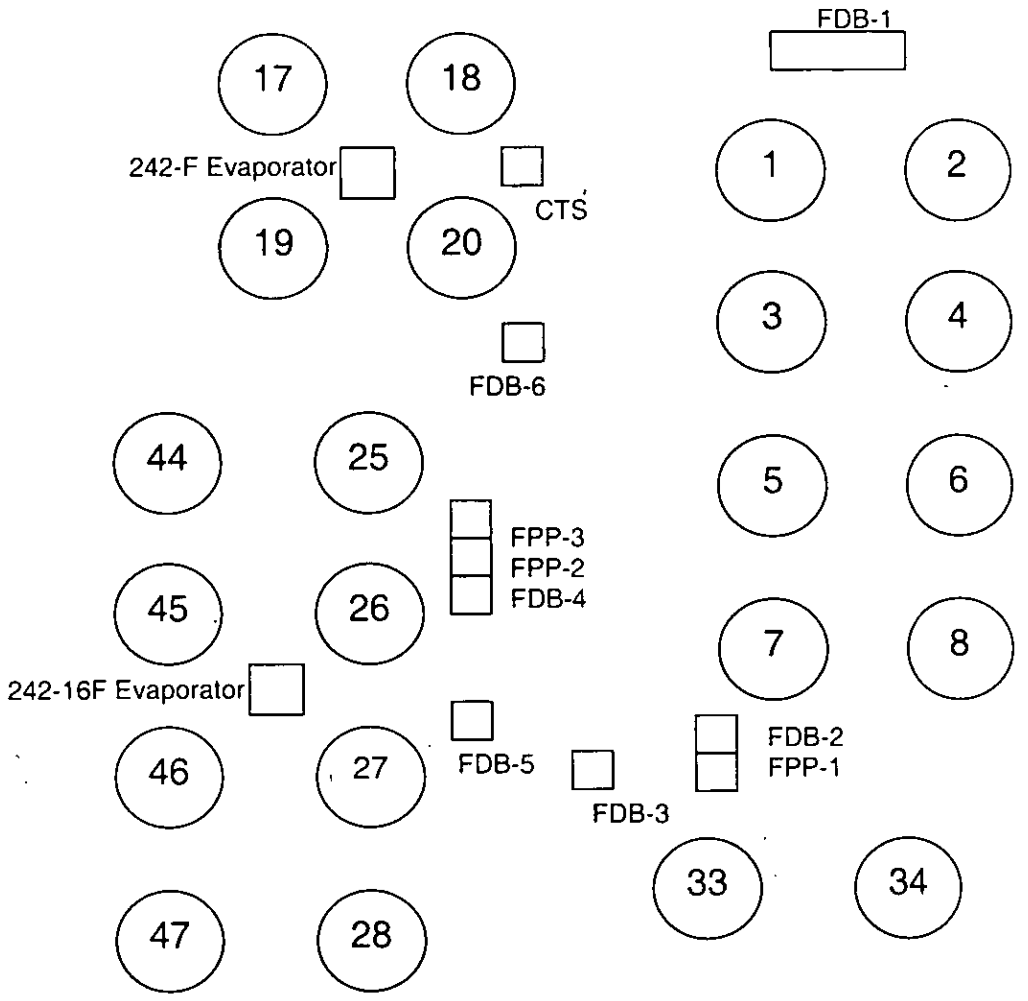

Figure 3-1. Relative Location of Tank 18 in F Area Tank Farm

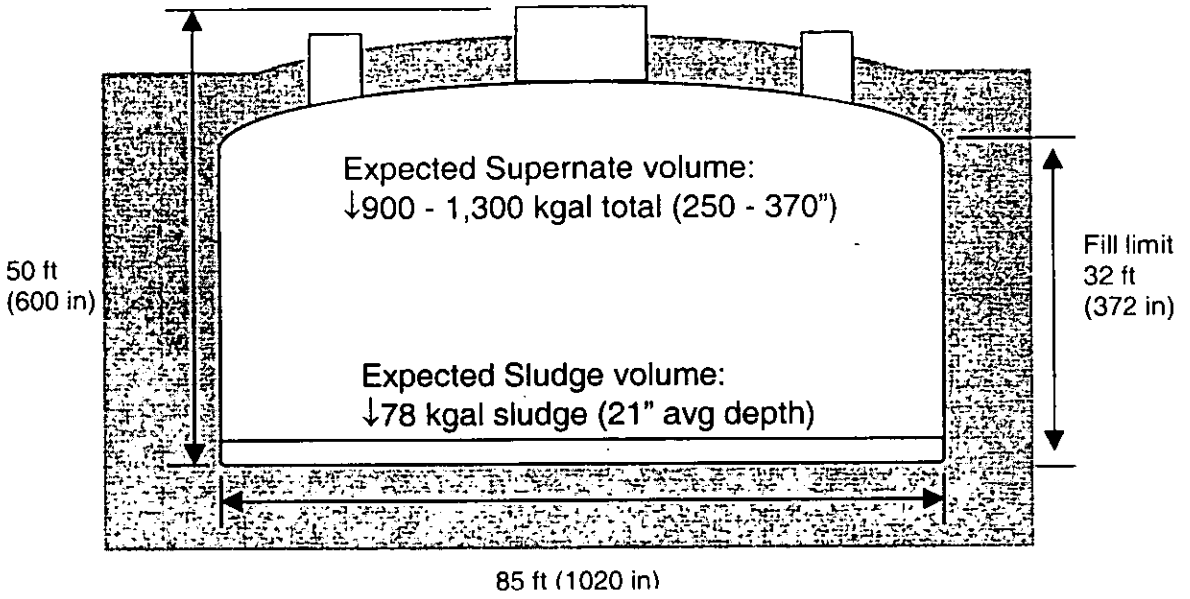

Figure 3-2. Contents in Tank 18

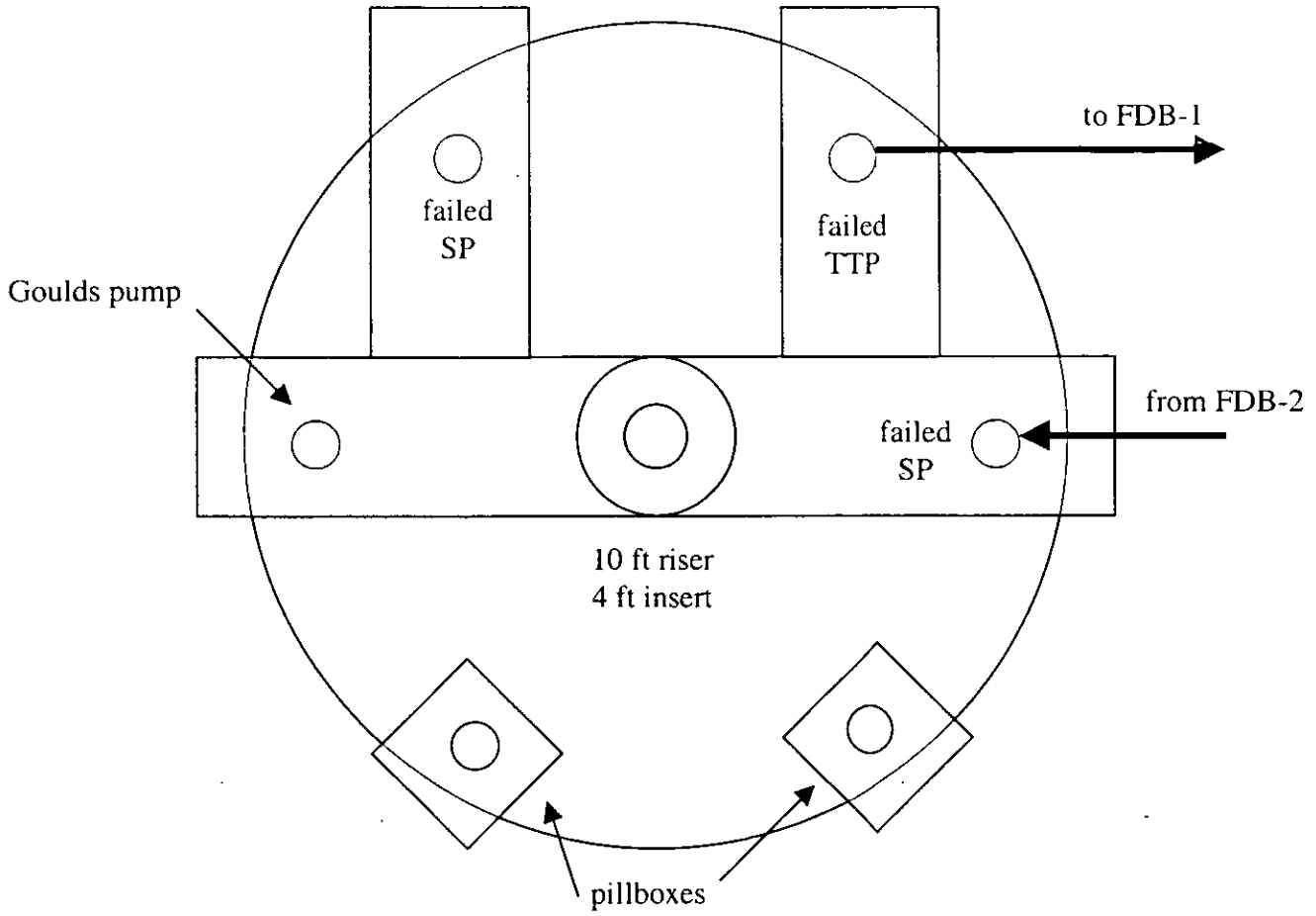

Figure 3-3. Tank 18 Configuration (Top View)

4.0 Recommended Overall Strategy

The Team's recommendations, implementation plans, estimated costs and schedules are detailed in this section (cost and schedule estimates are "rough order of magnitude"). The recommended overall strategy consists of several components and modifications, which were selected by the Team, based on the requirements for the various functions to be performed. The strategy's components and modifications are described, by function, in Sections 4.1 and 4.2. The plan for implementation of the overall strategy has been developed and is discussed in Section 4.4.2.

The four basic functions, to be satisfied by a successful waste removal process were defined in the following Table by the Team:

Table 4.0-1 Description of Functions

Function F.1: *Prepare Bulk Waste in Tank 18*
Function F.2: *Transfer Non-Heel Bulk Waste to another HLW Tank (Prime Mover and Transfer Route)*
Function F.3: *Prepare Heel in Tank 18*
Function F.4: *Transfer Heel to another HLW Tank*

4.1 Waste Preparation Methodology

***Prepare Bulk Waste in Tank 18 (F.1)*:**
The recommendation is to develop and deploy a modified Advanced Design Mixing Pump (ADMP) to suspend the waste in a slurry, thus enabling the waste to be transferred to another tank. The modified ADMP would have the same pump characteristics as the existing ADMP, but it would be modified to fit into a 2-foot diameter riser. The smaller size enables the modified ADMP to fit into all 33 remaining waste removal tanks whereas the existing ADMP can only be used in nine (9) of the remaining tanks. The ADMP has been successfully demonstrated at TNX, for over 4,200 pump hours, with materials that are significantly more viscous than Tank 18 is expected to contain. Additionally, the ADMP has a greater Effective Cleaning Radius (ECR) than the current slurry pumps, thus reducing the number of pumps that must be installed in each tank to complete waste removal. There is schedule risk in this recommendation, due to the probable time required to develop a totally new "wet end" (where the material is brought into the pump) to the ADMP. The risk mitigation involves providing seed money to the pump vendor to prioritize the activity and refurbishing the existing ADMP to have it ready to install in Tank 18, in the event that the modified ADMP development cannot meet the schedule requirements.

***Prepare Heel in Tank 18 (F.3)*:**
The Team's recommendation is to continue to use the modified ADMP (or ADMP) from Function F.1 until the final level of less than 1,000 gallons of sludge remains. There is a risk that too much water or too much time will be required to de-inventory the sludge to this level. To address this potential scenario, the Team recommends that enhancements, such as sluicers or a robotic suction device for the final heel removal, be

available after further evaluation of these options. The sluicers or robotic suction device would be made ready for deployment prior to completion of bulk waste removal.

4.2 Waste Transfer Methodology

Transfer Non-Heel Bulk Waste to another HLW Tank (Function F.2):
This function was subsequently subdivided into tow sub-functions, i.e., ***Prime Mover*** and ***Transfer Route***. ***Prime Mover***: The recommendation is to use a Bibo pump as the prime mover. This is a standard, industrial grade, sump pump, similar to the pump currently in use on Tank 19. ***Transfer Route***: The recommendation is to complete a tie-in from Tank 18 to Tank 7 by connecting the existing lines from Tank 18 to F Area Diversion Box –1 (FDB-1) and Tank 1 to Tank 7. This will provide a direct underground route from Tank 18 to Tank 7 and requires only minor excavations. The various portions of this transfer route will be inspected prior to design activities, for risk mitigation action. After Tank 18 Waste Removal has been completed the Tank 1 to Tank 7 transfer line will be reinstated to its original configuration. Transferring the waste to Tank 7 now will eliminate the need for transfer to this tank at a later date. This will reduce the overall number of steps needed to prepare Sludge Batch #3.

Transfer Heel to another HLW Tank (Function F.4):
The prime mover and transfer route used for Function F.2 will be re-used for Heel Removal, i.e., Bibo pump.

4.3 System Integration Overview

The integration of the overall recommended strategy and the associated modifications and equipment fits well into the HLW systems, structures, components, and processes already in existence. The required modifications of existing systems, structures, and components are not first-of-a-kind other than modifying the ADMP. Preparation for implementation of the recommended strategy will require:

- Demolition and removal (D&R) of the Telescoping Transfer Pump (TTP) in the Tank 18 northeast riser.
- D&R of the Goulds pump in the Tank 18 west riser.
- Modification of the existing steel on Tank 18 to support the ADMP.
- Installation of a new variable frequency drive and turntable to support ADMP operation.
- Relocation of the existing equipment currently installed in the Tank 18 center riser. (H&V piping, Reel Tape, Dip Tubes, etc.)
- Modification of two existing transfer lines in order to establish a direct route from Tank 18 to Tank 7. Minor excavation will be required to complete the transfer line modifications and tie-in and would be completed in an area that has minor impact on normal Tank Farm activities.
- There are several changes that would be required to the Authorization Basis, however, changes/updates would be needed for any of the chosen options.
- Operational activities, such as procedures and training would involve mock-ups and demonstrations to ensure readiness to operate.

A major advantage recognized by the Team is that the proposed system will likely work in all Tank designs, i.e., type I, II, II, IIA, and IV, pending further engineering evaluations, e.g., structural analyses of cooling coils and the impingement of tank fluids during mixing.

4.4 Implementation

4.4.1 Implementation Schedule and Costs

The Team developed the costs (using parametric analysis) and schedules associated with the various activities associated with the recommendations. The parametric costs are provided below in Table 4.4.1-1:

Table 4.4.1-1 Parametric Costs of the Implementation Plan

Option	Tank 18 Total Estimated Cost (TEC)	Comments
Modified ADMP	5.2 million	High risk, high LCC savings
ADMP	4.7 million	Low project risk to Tank 18, same cost savings as Modified ADMP, only downside is that Modified ADMP would not be demonstrated until Tank 11 or Tank 26 (2-3 years)
Baseline	6.7 million	

4.4.2 Implementation Plan

An integrated logic driven approach for implementation of the recommended strategy was developed and is shown in Figure 4.4.2-1 on the following page.

Tank 18 Implementation Plan Logic Diagram

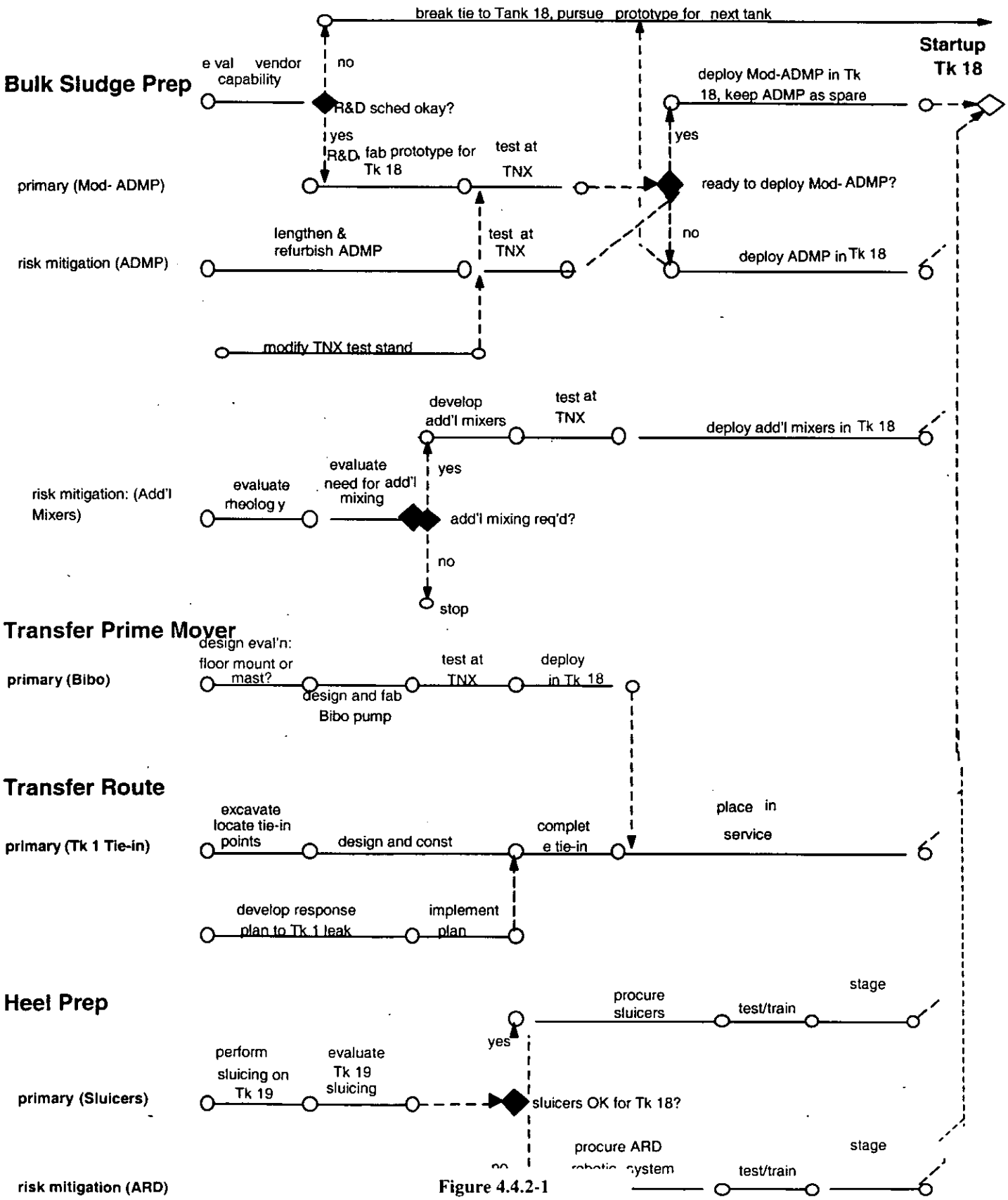

Figure 4.4.2-1

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5.0 Team Process

The systems engineering evaluation concept used to identify, evaluate and select recommended solutions entailed planning the Team's activities and following the plan. For each key activity to be completed by the Team, the inputs, outputs, support resources and controls were identified. The activities focused on first understanding the problem to be solved, its causes and impacts, describing what a successful solution had to accomplish, and then seeking viable solutions. The Team followed a process based on systems engineering principles in order to proceed in a logical sequence, facilitate creative thinking and minimize bias in developing solutions. The Team's process consisted of three key elements referred to as the *Activity Planning Model, Desktop Procedures,* and *Validation*, which are described below. The Team used consensus to make decisions throughout the process.

5.1 Activity Planning Model

The Activity Planning Model developed by the Team contains the following information:

- Activities (steps) needed to complete the Team's mission using a graded approach,
- Inputs, controls, resource requirements, and outputs associated with each step,
- The logical sequencing of steps,
- The scheduled dates of completion for each step.

Attachment 1 provides the Activity Planning Model developed and used by the Team.

5.2 Desktop Procedures

The Team developed specific instructions on how to conduct key steps within the Activity Planning Model. The instructions were captured in "Desktop Procedures" and controlled locally within the Team by Team Leader signature. The Desktops required the Team to think about how it would execute the various steps prior to starting them. This facilitated a common understanding and common expectations of the process.

Desktop procedures were written for the following steps in the Activity Plan and are included in Attachment 2 for reference:

DTP-001	Development, Approval And Control Of Desktop Procedures
DTP-002	Identification Of Concepts To Remove HLW From Tank 18
DTP-003	Application Of Screening Criteria
DTP-004	Risk Analysis
DTP-005	Application of Weighted Evaluation Criteria
DTP-006	Tank 18 Waste Removal Strategy Selection Process

5.3 Validation

The third key element of the process was the validation of Team activities at specific intervals. Validation consisted of stakeholder interim reviews of completed Team

outputs and proposed future activities. The purpose of each validation was to review Team activities with the stakeholders and obtain approval of the information developed before proceeding to the subsequent steps.

The three validation points in the schedule are shown on the Activity Planning Model (Attachment 1), as steps 8, 14 and 21, respectively. The first validation, conducted on November 3 resulted in concurrence with the activities, problem definition schedules, assumptions, key functions and requirements, interfaces, terms/definitions, screening and weighted selection criteria.

The second Validation, conducted on December 8, resulted in an emphasis on life cycle cost savings of the waste removal program.

A final Validation, conducted on February 2, 2001, was to receive concurrence from stakeholders on the Recommended Strategy developed by the Team prior to presentation to the Decision Makers.

A briefing was held with the HLW Board (Decision Makers) on February 7, 2001. Approval was received to implement the strategy as recommended by the Team.

6.0 Results

This Section documents the results obtained by the Team for the activities described on the Activity Planning Model (Attachment 1).

6.1 Team Formation and Orientation

The members of the Team are listed in Section 2 of this report. The Team orientation consisted of an introduction, overview of Team protocols, schedules, expectations of the Team leader and an overview of the systems engineering process.

6.2 Define Team Activities, Resources and Schedules

Activities, resources, and schedules are presented in the Activity Planning Model shown in Attachment 1. The model was developed by the Team prior to commencement of subsequent activities. This up-front planning facilitated a clear roadmap of actions and the associated inputs, outputs, controls and resources needed to complete the Team's mission.

6.3 Define Problem

The problem, its bases and potential impacts, defined by the Team are as follows:

Problem Statement: It is believed that the Tank 18 baseline waste removal method and system will not perform as required.

Basis:

- Three standard 150 hp slurry pumps mounted in the three available risers were used to remove sludge from Tank 18 in the mid 1980's. The pumps were irregularly spaced in the east, west and northwest risers. An estimated 42,000 gallons of sludge remained after a prolonged sludge removal campaign. The pumps were unable to develop the required ECR in this orientation. The suspended sludge settled in the quiescent zones in the tank. The Tank 19 heel removal demonstration will add an estimated 33,000 gallons of sludge to Tank 18 in FY01.
- The baseline calls for refurbishing three standard slurry pumps and installing them in the same risers. This baseline was chosen as a financial "placeholder" in full recognition that it is not a viable means to remove the remaining sludge.
- Cognizant engineers associated with the waste removal project assumed that a standard slurry pump with a single discharge could be used to increase the ECR. This pump was tested at TNX and demonstrated to have a 40 foot ECR using a kaolin clay/water mixture as the test medium. The required ECR is 42.5 feet to reach the most remote part of the tank.
- Alternate sludge mobilization technologies (Flygt mixers) were demonstrated in Tanks 17 and 20 with marginal success on small volumes of sludge. Improved versions of these mixers were deployed in Tank 19 during September, 2000; however, additional development is required to remove the estimated 75,000 gallons that will be in Tank 18.

Impacts:

- Tank 18 must be closed by March 2004. Failure to do so will result in a violation of the Federal Facilities Agreement. South Carolina Department of Health and Environmental Controls (SCDHEC) could levy fines and penalties.

6.4 Review Design Input

Based on a review of Project S-W183 design inputs (technical baseline), the Team focused on the key functions, requirements, and assumptions which proposed solutions for Tank 18 waste removal must address. These key inputs are discussed below in terms of functions (what the solution must do), requirements (how well the solution must perform the functions), and key assumptions the Team made in order to proceed forward.

6.4.1 Key Functions

The Team defined the high level functions that any proposed solution must satisfy in order to be considered a viable option. These are shown in Figure 6.4.2-1. The functions of "Isolating Tank 18" and "Closing Tank 18" were not within the scope of the Team's activities.

6.4.2 Key Requirements

The Team defined the high level requirements that any proposed solution must satisfy in order to be considered a viable option.

The requirements are subdivided into two types, i.e., performance requirements, and interface requirements. The high level requirements in these two categories are listed in Figure 6.4.2-1. The detailed requirements exist in the approved technical baseline documents which include the: wastewater operating permit (WWOP) (Reference 2), downstream waste acceptance criteria (WAC) (Reference 3), site standards, authorization bases (AB) (e.g., tank top loading, structural integrity database, corrosion control), general tank closure plan (e.g., performance assessments, residual amounts), functional performance requirements (FPR) document (Reference 4), and functional design criteria (FDC) document (Reference 5).

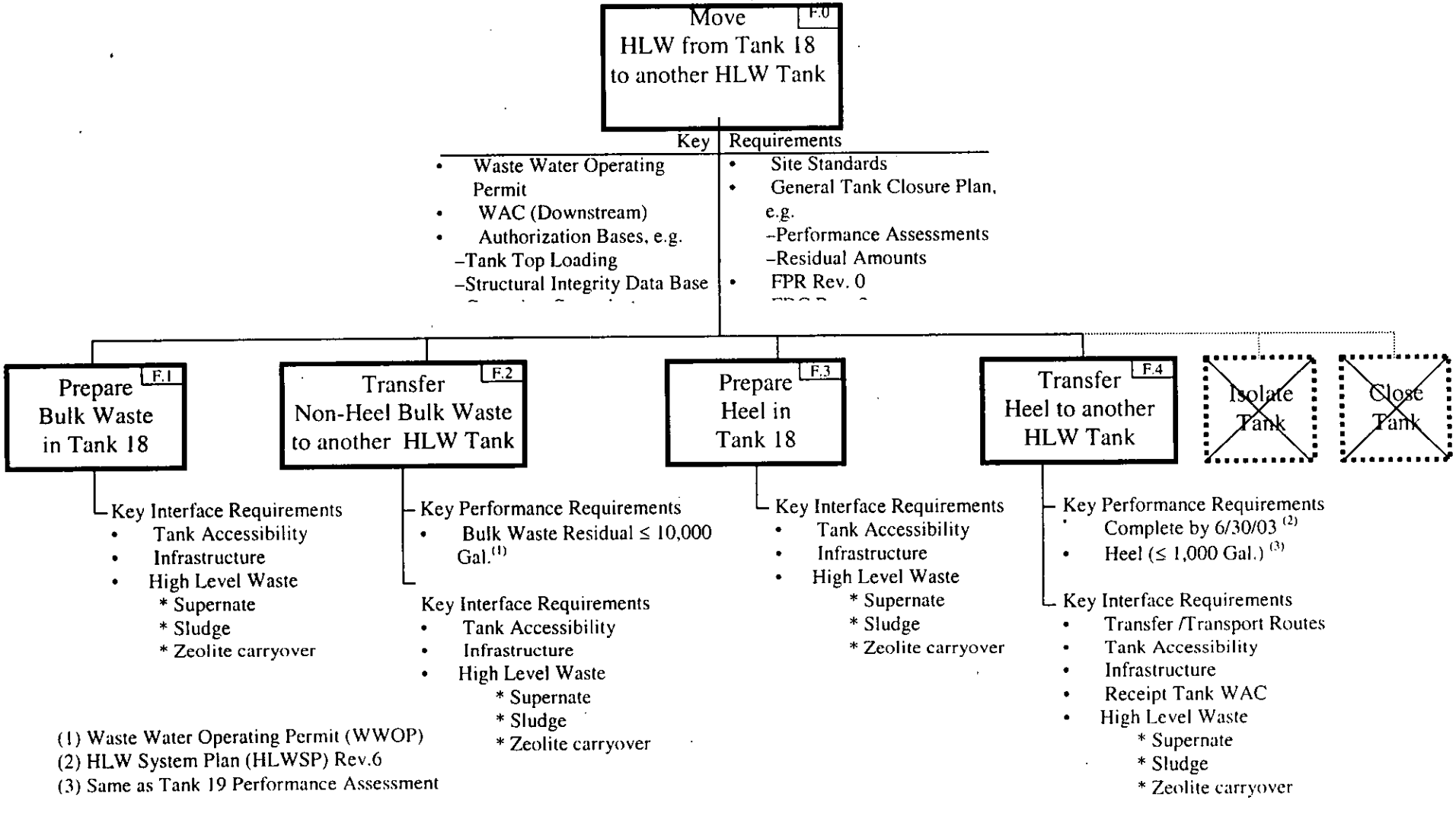


Figure 6.4.2-1 HLW Tank 18 Waste Removal Top Level Functions and Requirements

6.4.3 Key Assumptions

The key assumptions formulated by the Team are listed below with the basis (rationale) for making the assumption.

1. **Funding** - Tank 18 waste removal will receive the required funding (TEC, other project costs (OPC) and Operation Expenses) to complete waste removal activities per the schedule shown in HLW System Plan, Revision 11 (Reference 6). **Basis** - The FFA Plan and Schedule for closure of old-style tanks will carry sufficient priority at the site level to ensure adequate funding for this task.

2. **Project Baseline** - it is possible to revise the existing baseline to accommodate the recommended technology. **Basis** - the baseline technology is not expected to be successful, and the Waste Removal line item project scope includes development and demonstration of alternative technologies.

3. **FFA Tank Closure Date** - the March 30, 2004 closure date is non-negotiable. **Basis** - numerous interactions with SCDHEC indicate that re-negotiation is unlikely.

4. **Authorization Basis (AB)** – the AB will remain the same throughout the performance of this project. **Basis** – no significant or more restrictive changes to the AB are anticipated.

5. **Regulatory Requirements** - the Tank Closure Environmental Impact Statement (EIS) Record of Decision, the Natural Resources Defense Council (NRDC) lawsuit, and the Nuclear Regulatory Commission (NRC) Waste Incidental to Reprocessing rulings will allow closure of Tank 18 consistent with the precedent set by Tanks 17 and 20. **Basis** - resolution of each item is ongoing, all indications are that the rulings will be favorable.

6. **Tank 19 Schedule** - heel removal will be completed in Tank 19 so as not to interfere with Tank 18 waste removal. **Basis** - Tank 19 must be closed one year before Tank 18. Waste transfer from Tank 19 to Tank 18 are brief in duration (<1 day) and can easily be accommodated if they occur during Tank 18 construction.

7. **Tank 19 Sludge Composition** - the sludge removed from Tank 19 will be similar in physical characteristics (shear stress, particle size, etc.) to the sludge currently in Tank 18. **Basis** - the sludge in each tank came from the same source, the sludge in Tank 19 will have been slurried in FY00.

8. **Riser Availability** - all risers on Tank 18 are assumed to be available for equipment insertion including the two pillbox risers and risers containing failed slurry pumps. **Basis** - failed equipment has been removed on other tanks, pillboxes have been removed on other tanks or equipment inserted through the roof of the pillbox into the tank.

9. **New Risers** - new risers can be installed as needed. **Basis** - a new riser was installed on Tank 19.

10. **Tank Access** - existing piping penetrations into/out of Tank 18 can be used, new penetrations can be installed. **Basis** - existing penetrations have been reused on other tanks, new penetrations have been installed into diversion boxes which are similar in construction to waste tanks.

11. **Tanktop Truss** - the existing Corrective Action Report (CAR) (Reference 7) can be dispositioned to allow reuse for waste removal. **Basis** - similar trusses on Tanks 17, 19 and 20 were refurbished and used for heel removal.

12. **Tank 18 Projected Levels** - the projected volume of sludge/solids at the start of waste removal operations in Tank 18 is approximately 75,000 (75K) gallons (pre Tank 19 transfers into Tank 18). **Basis** - Present contents of Tank 18 consists of 42K gallons of sludge, and Tank 19 contents is 33K gallons of solids (including zeolite) to be transferred into Tank 18. Projected supernate level in Tank 18 is estimated to be 308K gallons presently in Tank 18 and 275K gallons from Tank 19. Additional liquid waste will be generated during the Tank 19 Heel Removal, which will is limited, by the Authorization Basis, to be transferred to Tank 18.

13. **Zeolite** - If the Tank 19 contents are transferred to Tank 18, the Zeolite will be in a form/consistency which is easily prepared and transferred from Tank 18 to another HLW Tank. **Basis** - a) In order to transfer the Zeolite from Tank 19 to Tank 18, it had to be in a transferable condition. b) The preparation used to mobilize the Zeolite in Tank 19 will result in a "non-reversible" state in Tank 18, i.e., the Zeolite will not re-coalesce. c) A Cesium Removal Column has never been installed in Tank 18. Zeolite in Tank 19 is very consolidated and was not slurried and transferred to Tank 18 during Tank 19 waste removal during 1980-86 based on sample analyses.

14. **Tank Isolation** - Nine months are required to complete Tank isolation, grouting, and closure of Type IV waste tanks. **Basis** - Experience with Tanks 17 & 20 which required about seven months for each.

15. **Program Impacts** - Potential impacts from other programs (e.g., canyons, 2H evaporator recovery, 3H evaporator operations) will not affect the Tank 18 waste removal project. **Basis** - Major known changes of other programs have not affected the Tank 18 project.

16. **Sludge Destination** - The sludge from Tank 18 will be sent to Tank 7. **Basis** - Tank 7 will become Sludge Batch #3. If the sludge in Tank 18 can be sent to Tank 7, then more canisters can be made from Sludge Batch #3 at virtually no additional cost to the customer. Also, High Level Waste System Plan (HLWSP) Revision 12, which is currently being developed, is based on sending the Tank 18 sludge to Tank 7.

17. **Schedule** - The schedule for Tank 7 sludge removal can be meshed with Tank 18 sludge removal in a way that supports the need date for Sludge Batch #3. **Basis** - The existing Tank 7 schedule shows sludge removal occurring from 9/02 to 2/03. The draft schedule for Tank 18 shows sludge removal occurring from 4/03 to 6/03 (about a 4 month mismatch). It may be possible to add the Tank 18 sludge to Extended Sludge Processing (ESP) after the Tank 7 sludge without delaying Sludge

Batch #3 due to the very dilute salt content in the Tank 18 sludge or it may be possible to accelerate the Tank 18 schedule to better match the Tank 7 schedule.

6.5 Define Screening and Selection Criteria

In order to objectively evaluate proposed options, the Team developed screening criteria and weighted selection criteria for evaluating both individual ideas and total strategies. The criteria and associated definitions used are described below.

6.5.1 Screening Criteria

Screening criterion are non-negotiable (go/no-go) aspects which solutions must meet to be considered for further evaluation. Some screening criteria applied to ideas, some to total strategies, and some to both. The *Screening Criteria* and associated bases used by the Team are listed below:

1. *The idea performs part or all of the function(s). A strategy must satisfy all the functions.* **Basis**: If the idea/strategy does not contribute to the solution then it is of no value.

2. *The idea/strategy supports the 6-30-03 completion of waste preparation and transfer of HLW from Tank 18 to another receipt tank.* **Basis**: Support FFA commitments per HLW System Plan, Revision. 11 (Reference 6).

3. *The TEC ≤ $7.8M (applicable to individual ideas only; strategies will consider life cycle cost benefits separately).* **Basis**: Represents a 20% increase from current TEC of $6.5M which allows latitude to consider more options. The $6.5M is the TEC/management reserve (MR)/Contingency for Tank 18 waste removal (waste preparation & transfer) and excludes spray washing, tank isolation & closure, and OPC.

4. *Implementation does not require qualification of a new Defense Waste Processing Facility (DWPF) glass waste form.* **Basis**: Re-qualification is not accepted based on long lead time to complete and uncertainty of success.

5. *The idea/strategy does not present any obvious and unreasonable hazards to the workers, public, or environment and does not violate non-negotiable regulatory requirements.* **Basis**: Injury or environmental damage is unacceptable.

6.5.2 Selection Criteria

In order for the Team to objectively select the best overall methodology (i.e., strategy) to remove (prepare/transfer) waste starting with Tank 18, required defining weighted attributes to facilitate distinguishing and grading the candidate ideas and strategies. The Team defined and weighted "selection" criteria (attributes) deemed important to success. Higher weighted criteria are considered more important than lower weighted criteria. An initial set of weighted criteria were used to evaluate and score individual ideas. A *different set* of weighted criteria were developed to evaluate strategies. (Note: As used

by the Team, strategies are various individual ideas grouped together to form an overall solution.) The applicable criteria are detailed in Section 6.9 for the ideas and Section 6.13 for strategies.

To provide clarity and consistency in scoring ideas, the Team used "utility functions". Utility Functions (UF) define gradations (point ranges) within the selection criteria to make it easier and more consistent in applying the selection criteria. These are also described in later sections of the report.

6.6 Brainstorming

The Team conducted two formal brainstorming sessions on October 12, 2000, to identify ideas for each of the four functions (prepare bulk waste in Tank 18, transfer non-heel bulk waste to another HLW tank, prepare heel in Tank 18, transfer heel to another HLW tank) to be addressed. Participants included the Team and invited guests with subject matter expertise in various aspects of waste preparation, removal, and transfers. The following is a composite list of the participants:

Facilitators	**Team Members**	**SMEs**
Ed Urbanawiz	Gary Abell	Glenn Beaumier
	Tommy Caldwell	Joe Cato
	Neil Davis	Paul D'Entremont
	Nader Elraheb	Eric Freed
	Max Howard	M. Harrell
	Robert Leishear	J. Herbert
	J. McCullough	Gary Johnson
	James Menghi	Mark Mahoney
	David Stefanko	Scott Saunders
		Paul Schearer
		Charles Sharpe
		Mike Tinsley
		Eloy Saldivar
		Robert Wilson

The identification of ideas was done in accordance with Desktop Procedure, DTP-002 (Attachment 2). Participants were provided a briefing package (Attachment 3) in advance of the brainstorming sessions in an effort to stimulate the generation of ideas.

A raw list of about 140 ideas resulted from the brainstorming session. Additional ideas were generated during the course of the Team's subsequent activities, including whether the Heel Preparation idea would be reused from bulk preparation or it would be stand alone. Tank 26 was originally designated to receive the waste from Tank 18, based on the HLW System Plan, Revision 11 (Reference 6). The change in receiver tanks resulted in additional transfer routes being identified and ideas were added, which resulted in evaluating the transfer routes. Some transfer routes were modified and others were eliminated because they could not be implemented for Tank 7 as the receiver tank. Those that still were applicable were coded with an "M" for modified.

Supplemental documents, such as Pro-formas, were issued that detail the ideas developed as part of this evaluation (References 10-13). The total number of ideas considered by the Team totaled 218. The number of ideas, per function, are shown in Table 6.6-1:

Table 6.6-1 Idea Summary

F.1 Prepare Bulk Waste in Tank 18	74 Ideas Total
F.2 Transfer Non-Heel Bulk Waste to another HLW Tank Prime Mover 23 Ideas Transfer Route 20 Ideas	43 Ideas Total
F.3 Prepare Heel in Tank 18	56 Ideas Total
F.4 Transfer Heel to another HLW Tank Prime Mover 34 Ideas Transfer Route 11 Ideas	45 Ideas Total

All ideas were submitted on a "Pro-Forma" form as shown in the Briefing Package (Attachment 3). The idea Pro-Formas were binned based on the particular function (bulk waste preparation, bulk waste removal, heel preparation, or heel removal). References 10 through 13 contain all of the Pro-Formas submitted for consideration.

6.7 Screening

The Team reviewed the ideas for commonality and combined similar ideas into one idea. The ideas were then screened by applying the screening criteria discussed in Section 6.5.1. The results of the screening process are presented in Tables I, II, and III of Attachment 4. Table I lists all ideas (prior to combining the similar ones) that *passed screening*; Table II lists those ideas which *failed the screening* along with the particular criterion it failed; and Table III lists the shortened list from Table I (i.e. acceptable ideas) after combining similar ideas. It should be noted that the screening process was revisited whenever new information about individual ideas or global strategies evolved.

Table 6.7-1 is a listing of the categories, by function, that the initial ideas were binned into during the brainstorming sessions.

Table 6.7-1 Categories of Generated Ideas

F.1 Prepare Bulk Waste in Tank 18: Long shaft and submersible slurry pumps, propellers, agitators, arms, scrapers, dredges, robots, chemical dissolution, erosion, sluicing, sparging, ultrasonics
F.2 Transfer Non-Heel Bulk Waste to another HLW Tank: Prime Movers: TTP, transfer pump, sump pump (floor/mast), jets, robots, arm, based, screw, lift, diaphragm, piston pumps Transfer Routes to Tank 7: truck, via FDB-1, bypass FDB-1, overland, via catch tank, via feed line to tank 7 or 26
F.3 Prepare Heel in Tank 18: The same categories shown in F.1 above ideas plus dewater/vacuum, grout in place, create sump, microbial, in-situ, absorb, chemical separation
F.4 Transfer Heel to another HLW Tank: Same categories as F.2 above

The screening process was done in accordance with Desktop Procedure, DTP-003 (Attachment 2).

6.8 Develop and Evaluate Viable Options

Table III in Attachment 4, includes a listing of the summarized ideas that were advanced for further consideration. Additional information developed for these ideas was added to the Pro-Forma sheets (References 10-13).

6.9 Apply Selection Criteria to Ideas

The weighted selection criteria applied to ideas are shown in Table 6.9-1. The individual scoresheets which document the raw scores, including discussion comments, were issued separately (Reference 9).

Table 6.9-1: Selection Criteria, Weights, and Definitions Used to Score Ideas

Criterion Title	Criterion Number	Assigned Weight	Criterion Definition
Effectiveness	1.0	0.22	The degree of confidence that the alternative will perform the function for which it was proposed.
Complexity	2.0	0.18	The degree of complexity of the alternative with regard to design, construction, testing, and operation.
Design	2.1	0.06	The degree of complexity of design with regard to Title II, Title III, and procurement of engineered equipment.
Construction/Start Up	2.2	0.06	The degree of complexity of construction with regard to fabrication, installation, excavations, equipment D&R, and testing.
Operation	2.3	0.06	The degree of complexity of operations with regard to ops resources, training, procedures, maintainability, and close coupled ops.
Technical Maturity	3.0	0.15	The degree to which the alternative has been developed and/or has been demonstrated in a radioactive waste removal application.
Authorization Basis Impact	4.0	0.15	The degree of Authorization Basis changes required to implement the alternative.
System Integration	5.0	0.12	The degree to which the alternative is compatible with existing regulatory programs (WWOP, WAC, etc.), processes, and infrastructure.
Regulatory Programs/Processes	5.1	0.06	The degree of compatibility with regard to existing regulatory programs and processes.
Infrastructure	5.2	0.06	The degree of compatibility with regard to existing infrastructure.
Reliability	6.0	0.13	The degree of confidence to which the equipment will perform the needed functions without failure.
Safety	7.0	0.05	The degree to which the alternative can be constructed and operated with regard to industrial safety and radiological controls.

The utility functions used for each criteria are shown in Table 6.9-2.

Table 6.9-2 Utility Functions

Criterion Title	Criterion Number	Utility Function	Value (in points)
Effectiveness	1.0	High level of confidence	100
		Moderate level of confidence	50
		Low level of confidence	0
Complexity	2.0		
Design	2.1	High level of complexity	100
Construction	2.2	Moderate level of complexity	50
Operation	2.3	Low level of complexity	0
Technical Maturity	3.0	Fully developed and proven in a radioactive waste removal application	100
		Fully developed and proven in a non-radioactive waste removal application	50
		Pilot plant/prototypical application demonstrated	30
		Theoretical/R&D	0
Authorization Basis Impact	4.0	Utilizes the existing AB with negligible changes by internal contractor (WSRC)	100
		May result in significant AB changes requiring DOE approval	50
		May result in significant AB changes requiring DOE approval and addresses a new accident scenario	25
		May result in a new AB	0
System Integration	5.0		
Reg. Prog/ Processes	5.1	High level of compatibility	100
		Moderate level of compatibility	50
Infrastructure	5.2	Low level of compatibility	0
Reliability	6.0	High level of confidence	100
		Moderate level of confidence	50
		Low level of confidence	0
Safety	7.0	Minimal safety/radcon risks to construct, operate, and maintain	100
		Moderate safety/radcon risks to construct, operate, and maintain	50
		Significant safety/radcon risks to construct, operate, and maintain	0

These selection criteria were applied to each idea in Table III (Attachment 4). For each idea, the Pro-Forma was reviewed and the merits of the idea were discussed with the Team to reach a consensus utility function score for each of the criteria. The application of the weighted criteria was a simple process of assigning points (0-100) from the list of utility functions, multiplying the criteria weight times the utility function value and summing up the score for each idea. The maximum score (most desirable) possible is 100. Attachment 5 is the weighted score for each of the ideas by function and provides an overall ranking. The individual scoresheets which documented the rationale for the utility function score applied was issued as a separate document (Reference 9). This resulted in numerical scoring which allows for a "ranking" of ideas within each functional area, i.e. bulk waste preparation, bulk waste transfer, heel preparation, and heel removal. The application of weighted selection criteria was done in accordance with Desktop Procedure, DTP-005 (Attachment 2).

Table 6.9-3 lists the top scoring ideas within each function. This method of ranking was used to identify the more promising ideas to pursue versus those of least benefit. The ranking did not preclude the use of any idea as a final recommendation. Due to the large number of ideas submitted and scored for F.1 (prepare bulk waste in Tank 18), the Team elected to take the highest scoring ideas in F.1 from the three categories, i.e., pumps, robotics, and arms. This provided the Team with several options to consider in subsequent strategy development. This was not done for the other functions (F.2, F.3, and F.4) because there was a limited number of top scoring ideas.

Table 6.9-3 Top Scoring Ideas After Applying Selection Criteria

Function	Idea	Category	Description	Score
F.1	A4	Pump	ADMP with Flygts	89.5
	A1	Pump	Quad Volute Slurry Pump (QVSP)	88.9
	A70	Pump	4 Slurry Pumps (SPs)	87.7
	A73	Pump	Slurry Pumps with TTP	84.7
	A72	Pump	ADMP with 2 Slurry Pumps	84.2
	A43	Robotics	ARD (SRS procure/deploy/operate)	83.6
	A74	Arm	Arm with Confined Sluicing End Effector (CSEE)	82.6
	A12	Pump	Submersible Pump	82.0
	A41	Pump	Modified ADMP	80.5
	A53	Pump	Modify Existing Slurry Pumps	79.5
	A46	Pump	101-SY Modified Slurry Pump	79.3
	A44	Robotics	Houdini Robot with CSEE	78.9
F.2	B38	Prime Mover	TTP	97
	B16	Prime Mover	Diode pump	93
	B8	Prime Mover	Bibo pump	91
	B43M	Transfer Route	Tank 1 Tie-in	91
	B4M	Transfer Route	Above-ground Transfer Line	86
F.3	C1	Robot	ARD robot	86
	C20	Arm	Arm	84
	C56R	Sluicer	Sluicer	78
	C21	Chemical	Chemical Cleaning (acid dissolution)	76
F.4	N/A	N/A	Same as F.2	N/A

This ranked order of ideas was reviewed by the Team. The following table identifies the ideas that were not considered further and the rationale for this decision in picking the top scoring ideas from the three categories in Function F.1.

Table 6.9-4 Function F.1 Scored Ideas Removed From Further Consideration

Idea	Description	Rationale
A73	Slurry Pumps with TTP	F.1 Idea is the same as A70 (combined with F.2 prime mover)
A72	ADMP with 2 Slurry Pumps	F.1 Idea is the similar to A4 (combined)
A12	Submersible Pump	Idea is similar to A70 (combined)
A53	Modify Existing Slurry Pumps	Ideas is similar to A70 (combined)
A46	101-SY Modified Slurry Pump	Idea is similar to A70 (combined)

6.10 Analyze Risks

A risk analysis was performed on the top scoring ideas within each function, i.e. Prepare Bulk Waste in Tank 18, Transfer Non-Heel Bulk Waste to another HLW Tank, Prepare Heel in Tank 18, and Transfer Heel to another HLW Tank, as identified in Table 6.9-3. A summary of the risks identified by idea is presented in Table 6.10-1. The risk assessment sheets, which detail each identified risk, the likelihood of occurrence, the consequence(s) of occurrence, risk level, and risk handling strategies for each candidate idea, are provided in Attachment 7. The risk analysis was performed in accordance with Desktop Procedure, DTP-004 (Attachment 2).

Table 6.10-1 Risk Analysis Summary

Idea	Idea Title	High and Moderate Risks Identified
A4	ADMP	Process hazard [gas filled column] (Moderate)
A41	Modified ADMP	The vendor may take too long to develop the pump.
A43	ARD	Pump requirements for transfer of material (High) Operations and maintenance experience (Moderate) Tether management (Moderate)
A44	Houdini/CSEE	Difficulty to perform function test (High) Operations and maintenance experience (Moderate) Tether management (Moderate)
A70	4 Slurry Pumps	Substantial D&R (Moderate)
A74	Arm w/CSEE	Reliability, Availability, Maintainability Issues (High) Complex design (Moderate)
B4M	Hose in Hose	Co-occupancy issue [routing of hose and Control Room] (Moderate) Substantial D&R (Moderate)
B16	Diode Pump	No high or moderate risks identified.
B43M	Tank1 Tie-In	Difficulty to perform functional test (Moderate)
C21	Chemical Cleaning	New application of technology (High) Multiple system interfaces (High) Project schedule uncertainties (High)
C56	Sluicer	Multiple interfaces required (Moderate)

Upon completion of the risk analysis, a cross-check was made by the Team to ensure consistency and uniformity of risk was assessed between the different ideas.

The impact on cost and schedule derived from the Risk Analysis were incorporated into the costs and schedules developed for the strategies. Additional discussion on how risk was used to eliminate strategies is provided in Section 6.12.

6.11 Develop Strategies

The resulting individual ideas, applied to each function, as shown in Table 6.9-3 and modified per Table 6.9-4 were used to establish strategies for waste removal for further consideration. The strategies were defined by using ideas from each of the function and combining them together. A total of 210 strategies were mathematically possible.

6.12 Strategy Screening Criteria

The Team recognized that not all of the 210 combinations were feasible, i.e., conflicting configurations. For example, you could not deploy the arm in F.3, when the ADMP was already deployed in the same riser. The incompatible strategies (96) were not considered for further evaluation.

The remaining strategies were screened against the screening criteria (Section 6.5.1) to determine if they passed. The strategy screening criteria included the following:

- The strategy must perform all of the functions
- The strategy must support the Federal Facilities Agreement date
- The strategy must not require a new glass form
- The strategy must not impose any unreasonable hazards.

The final number of viable strategies considered for further evaluation was 114. Attachment 6, Strategy Scoring includes as Table IV, the listing of all of the viable strategies.

Also, as a result of the risk analysis, 24 strategies did not possess adequate assurance that they would work or have alternative backup methodologies should the primary idea not work. The strategies eliminated from further consideration are identified in Table 6.12-1. Ninety (90) viable strategies remained for further evaluation.

Table 6.12-1 Strategies Eliminated Based on Risk

Strategy Description	Strategy Number	Rationale
ADMP	S1, SS5, S9, S13, S17, and S21	Risk associated with reducing sludge level <1 inch
QVSP	S25, S29, S33, S37, S41, and S45	Same
Modified ADMP	S49, S54, S59, S64, S69, and S74,	Same
4 Slurry Pumps	S79, S84, S89, S94, S99, and S104	Same

6.13 Apply Selection Criteria to Strategies

New weighted selection criteria and utility functions were defined and applied to the 90 strategies. Table 6.13-1 summarizes the selection criteria applied to the combined strategies. The utility functions used to facilitate consistent scoring are shown in Table 6.13-2. The listing of the individual strategies is included Attachment 6, Table IV.

Table 6.13-1: Selection Criteria, Weights and Definitions Used To Score Strategies

Criterion Title	Criterion Number	Assigned Weight	Criterion Definition
Cost	1.0	0.32	The degree of initial cost incurred and/or cost savings realized by utilizing the strategy.
Initial Cost to Deploy	1.1	0.12	The magnitude of cost to deploy the strategy on Tank 18. (Initial cost is equal to: TPC Cost – TFA Funding utilized)
Life Cycle Cost	1.2	0.20	The degree of Life Cycle Cost savings that will be realized within the HLW Waste Removal Program over the eight year period of FY01 – FY08 by utilizing the strategy.
Effectiveness	2.0	0.28	The degree of confidence that the strategy will perform all functions.
Complexity	3.0	0.25	The degree of complexity of the strategy with regard to design, construction, testing, and operation. Design: The degree of complexity of the strategy with regard to Title II, Title III, and procurement of engineered equipment. Construction: The degree of complexity of construction with regard to fabrication, installation, excavations, equipment D&R, and testing. Operation: The degree of complexity of operations with regard to operations resources, training, procedures, maintainability, and close coupled operations.
Authorization Basis Impact	4.0	0.15	The degree of Authorization Basis changes required to implement the alternative.

Table 6.13-2 Utility Functions

Criterion Title	Criterion Number	Utility Function	Value (Points)
Cost	1.0		
Initial Cost to Deploy	1.1	Low Cost to Deploy	100
		Moderate Cost to Deploy	50
		High Cost to Deploy	0
Life Cycle Cost Savings	1.2	High Degree of LCC Savings	100
		Moderate Degree of LCC Savings	50
		Low Degree of LCC Savings	0
Effectiveness	2.0	High level of confidence	100
		Moderate level of confidence	50
		Low level of confidence	0
Complexity	3.0	High level of complexity	100
		Moderate level of complexity	50
		Low level of complexity	0
Authorization Basis Impact	4.0	Utilizes the existing AB with negligible changes by internal contractor (WSRC)	100
		May result in significant AB changes requiring DOE approval	50
		May result in significant AB changes requiring DOE approval and addresses a new accident scenario	25
		May result in a new AB	0

This process involved evaluating the functions and ideas as individual items and then as an aggregate strategy. For example, would deploying the ARD robot after bulk waste removal was complete, require additional costs to retrofit the equipment or would there be a need to do additional design at the onset. If so, the costs would increase and the design would be more complex which would lower the overall score. By performing this review, a consistency check was completed both horizontally and vertically to ensure that the logic was appropriate.

The *Initial Cost to Deploy* costs were developed per idea per applicable function(s). The Initial Cost to Deploy criterion was evaluated after determining the actions needed to implement/deploy the idea, e.g., project work. This information was evaluated and the

total amount for deployment was given as a rough order of magnitude (ROM) estimate based on the Team's experience with similar activities at the site, including estimated procurement costs and credits for Tank Focus Area funds. Once the overall range for costs, within a function, was determined, an arithmetical average was used to determine the scores. The minimum cost idea to deploy received a 100 and the maximum cost idea to deploy received a 0. The results of the risk analysis, e.g., risk handling costs, were factored in as appropriate. The scores for this selection criteria per idea per function are shown in Attachment 6, Table IV.2.

The *LCC Savings* criteria was evaluated after determining whether the idea could be used on any of the four remaining tanks (11, 26, 4, and 15) in the performance period of eight years assumed as the life-cycle for the study versus the current baseline cost. Eight years was selected as the life-cycle since it envelopes the current contract period of six years and the operational period of two years. The extent to which the idea could be reused and was effective for these other tanks was used to determine the score. One idea clearly had extensive LCC savings and scored 100 points. The remaining ideas had extremely limited or no LCC savings potential had scored less than 10 points. The results of the risk analysis, e.g., risk handling costs, were factored into as appropriate. The scores for this selection criteria per idea per function are shown in Attachment 6, Table IV.2.

The selection criteria for the areas of *Effectiveness*, *Complexity* and *Authorization Basis Impact* utilized the scores previously determined for each idea for each function. These individual scores are presented in Attachment 6. Effectiveness Scores are in Table IV.3. Complexity Scores are in Table IV.4. Authorization Basis Impact Scores are in Table IV.5. The Team evaluated these scores for consistency between ideas and between the functions before proceeding.

In order to develop an aggregate strategy score for the five selection criteria, a mathematical expression was formulated, which applied an additional set of weights to the different functions. The mathematical expressions were developed based on each selection criteria and the importance of each function when compared to each other. The mathematical expressions used to determine the aggregate scores for each selection criteria are in Table 6.13-3.

Table 6.13-3 Aggregate Score Formulas

Selection Criteria Formula	F.1	F.2 Prime Mover	F.2 Transfer Route	F.3	F.4
1. Deployment Cost	75%	15%	10%	0%	0%
2. LCC Savings	60%	15%	10%	15%	0%
3. Effectiveness	40%	10%	0%	50%	0%
4. Complexity	40%	5%	15%	40%	0%
5. AB Impacts	10%	15%	40%	35%	0%

As an example, for the *Initial Cost To Deploy*, the Team felt that the cost of Function 1 was the most important and outweighed the other functions, in that Function 1 accounted for 75% of the cost to deploy for the strategy. The Function 1 score accounts for the costs of Function 3, as these costs were modified to include risk mitigation costs.

The costs of the prime mover were slightly more than the costs for the transfer route, and as a result the weighting factors were assigned as 15% and 10%. No costs were attributed to Function 4 as these are part of Function 2.

The Tables in Attachment 6 includes these formulas at the top and bottom of the spreadsheet for clarity. A summary of the aggregate scores for each of the selection criteria can be found in Table IV.6. The aggregate scores would be applied against the utility function for determination of the final total score. These results of this process are shown in descending order in Attachment 6, Table IV.1.

In order to detail the process the Team implemented to determine the aggregate scores, the following example is available:

*Example: **Strategy S60** (Modified ADMP, with Bibo pump as prime mover, using the Tank 1 Tie-In transfer route and deploying the ARD robot for heel preparation would get the following aggregate score:*

Deployment Cost:
Scores from ideas (Table IV.2, Attachment 6, Strategy S60)
F.1=78 F.2 (PM)=90 F.2(RT)=60 F.3=100 F.4=0
Applying Formula 1: (.75)(78)+(.15)(90)+(.1)(60)+(0)(100)+(0)(0)= 78

LCC Savings
Scores from ideas (Table IV.2, Attachment 6, Strategy S60)
F.1=100 F.2 (PM)=80 F.2(RT)=60 F.3=0 F.4=0
Applying Formula 3: (.6)(100)+(.15)(90)+(.1)(60)+(.15)(0)+(0)(0)= 72

Effectiveness:
Scores from ideas (Table IV.3, Attachment 6, Strategy S60)
F.1=89 F.2 (PM)=95 F.2(RT)=100 F.3=95 F.4=0
Applying Formula 3: (.4)(89)+(.1)(95)+(0)(100)+(.5)(95)+(0)(0)= 92.6

Complexity:
Scores from ideas (Table IV.4, Attachment 6, Strategy S60)
F.1=77 F.2 (PM)=86 F.2(RT)=86 F.3=98 F.4=0
Applying Formula 4: (.4)(77)+(.05)(86)+(.15)(86)+(.4)(98)+(0)(0)= 87.2

AB Impacts:
Scores from ideas (Table IV.5, Attachment 6, Strategy S60)
F.1=86 F.2 (PM)=100 F.2(RT)=89 F.3=81 F.4=0
Applying Formula 5: (.1)(86)+(.15)(100)+(.4)(89)+(.35)(81)+(0)(0)= 87.55

Therefore the scores and the selection criteria weights can be summarized as follows:
Strategy Scores (Table IV.1, Attachment 6, Strategy S60 and Weights from Table 6.13-1)
Cost to Deploy: 78(.12)=9.36
LCC Savings: 72(.2)=14.4
Effectiveness: 92.6(.28)=25.928

Complexity: 87.2(.25)=20.4
AB Impacts: 87.55(.15)=13.1325
Total Weighted Score=83.22

A Sensitivity Analysis was performed on the strategy scores to determine if the scoring of strategies was sensitive. This analysis was competed by varying the individual criteria weights of the selection criteria to see if small changes (±10%) caused major changes in the strategy rank ordering. It was determined that only minor changes in rank ordering were observed. The Team concluded that the ranking of ideas was fairly insensitive to small changes in criteria weighting. The results of the strategy sensitivity analysis are included in Attachment 8.

6.14 Select Option and Implementation Plan

Utilizing the information prepared, the strategies were ranked in descending order based on total score (shown in Table IV.1, Attachment 6). This information was evaluated by the Team as input to selecting a recommended option. Table 6.14-1 summarizes the results of the strategy scoring by function:

Table 6.14-1 Scored Results of Strategies by Function

Prepare Bulk Waste in Tank 18 (F.1)	Modified ADMP-based strategies (83) ARD for all functions (78) Houdini for all functions (75) ADMP-based strategies (73) Arm for all functions (73) QVSP-based strategies (70) Four Slurry Pump-based strategies (68)
Transfer Non-Heel Bulk Waste to another HLW Tank (F.2)	Prime Mover (F.2): The Bibo pump always scored higher than the TTP or Diode pump Transfer Route (F.2): Below-Ground Route - Tank 1 Tie-In always scored higher than the Above-Ground - Hose in Hose route
Prepare Heel in Tank 18 (F.3)	ARD always scored higher than Sluicers, Chemical Cleaning, and Arm
Transfer Heel to another HLW Tank (F.4)	No scores were generated separately for this function. Refer to F.1.

After review of this information, the Team recommends the following overall strategy:

Prepare Bulk Waste in Tank 18 (Function F.1): *The recommendation is to develop and deploy a modified ADMP to suspend the waste in a slurry, prior to pumping to another tank.* The modified ADMP would have the same pump characteristics as the existing ADMP, but it would be modified to fit into a 2-foot riser. Only a limited number of tanks have the 4-foot riser required to deploy the current ADMP. Rationale: This strategy leverages the existing excellent ADMP experience, the smaller diameter means this pump can be used in any tank, and Tank Focus Area is likely to co-fund this activity as Hanford has expressed a similar need. Future Applications: The smaller size pump

can be used on all five tanks to be worked (18, 11, 26, 4, and 15) in the current contract period. This pump could be used in all 33 remaining waste removal tanks, pending cooling coil evaluation (1-3, 5-6, 9-10, 12-14, 21-25, 27-39, and 43-47). There is a potential use for the pump in the seven waste processing tanks (40-42, 48-51). Projected savings versus baseline in current contract period is >$15 million based on using 3 versus 4 pumps per tank, there is also a potential for reducing the need to only 2 pumps per tank. Risk: There is a risk that it may take longer than 18 months to develop,

test, and approve the prototype. This may be an insurmountable risk, based on initial discussions with the vendor. Risk Mitigation: Added $0.5 million to cost to allow for fast-tracking of the development effort to modify the design, refurbish the existing ADMP and use if the modified ADMP is not ready in time. Houdini and ARD were not picked (although they scored higher) to mitigate the bulk sludge preparation risk in lieu of ADMP because of concerns with operating robots in 21 inches of sludge and also because there would be no LCC savings from this option in the contract period.

Transfer Non-Heel Bulk Waste to another HLW Tank (Function F.2)
Prime Mover: *The recommendation is to use a Bibo pump as the prime mover.* Rationale: The pump is made by ITT Flygt. The pump is a standard, industrial grade, sump pump, similar to the pump currently in use on Tank 19. The Bibo pumps are inexpensive. Tank 19's use has transferred >2,000,000 gallons of sludge/slurry woth this pump design and has been in operation for over six months. Future Applications: Bibo pumps can be used in all remaining tanks. Risk: A minor risk but no significant risk was identified. Risk Mitigation: Complete a thorough test of pump and complete a design for the pump interface points to provide the ability to easily replace or add a new pump.

Transfer Route: *The recommendation is to complete a tie-in from Tank 18 to Tank 7 by connecting the existing lines from Tank 18 to FDB-1 and Tank 1 to Tank 7.* Rationale: This will provide a direct underground route from Tank 18 to Tank 7 and requires only minor excavations to complete the two tie-ins. This line bypasses FDB-1 and all associated AB issues. There would be no inadvertent transfer paths and require only minimal interfaces. The tie-in would take about 20 feet of new pipe with two tie-in points and caps and the excavation would only be about 4 foot deep. After Tank 18 Waste Removal has been completed the Tank 1 to Tank 7 transfer line will be reinstated to its original configuration. Future Applications: None, one-time cost savings. Risk: Tie-ins may be more expensive than planned, AB may be difficult when Tank 1 jet discharge route is capped. Risk Mitigation: Test line segment jackets early.

Prepare Heel in Tank 18 (Function F.3): *The recommendation is to continue to use the modified ADMP (or ADMP) from F.1 until the final level of less than 1,000 gallons of sludge remains.* Rationale: The pump can be used in the heel preparation phase if water management (decants) and schedule allow continued use of the ADMP for heel preparation. Future Applications: Tanks 21-24, however this is after the current contract period. Risk: May require too much water or too much time. Risk Mitigation: Procure and stage robotic suction device/system. The cost is between $100K to $300K for the entire system. There is already experience with this product at SRS. The robot will fit

through a 24 inch riser. The unit provides a fully developed mobile sluicing/suction similar to Houdini but without the extensive support structure and equipment.

***Transfer Heel to another HLW Tank (Function F.4)**: The equipment and transfer route determined for Function F.2 will be used for Heel Removal.*

The selection of the recommended technology and transfer methods was made by the Team based on several considerations, i.e.:

- Ranking of alternatives based on the application of the weighted selection criteria. This included sensitivity analysis.
- A system integration overview for the most promising alternatives. This required "visualizing" the implementation of each alternative to assess upstream and downstream impacts on the entire HLW system.
- Discussions with subject matter experts (SMEs), stakeholders, and decision makers.
- Consideration of the new six year contract period and the tanks to be emptied during that period.
- Team expertise and judgement.

To provide ease in publishing this Report, several supplemental documents have been issued with supporting information, as part of the SEE (see References 8-13).

7.0 Glossary

Advanced Design Mixing Pump – This is a prototype slurry pump that was jointly developed by Hanford and SRS based on the lessons learned from both sites. The pump is a 55 foot tall vertical shaft, dual discharge centrifugal pump with a 300 hp motor mounted above the tank top and a 39 inch diameter pump casing submerged in the waste. The pump capacity is 5,200 gal/min at the maximum operating speed of 1,150 rpm. The expected cleaning radius in SRS sludge is 50 feet. This pump has been tested at SRS for over 4,000 hours but has never been deployed in a radioactive environment.

Baseline Technology - the waste removal technology for Tank 18 identified in project documentation (e.g., Functional Performance Requirements (FPR), Functional Design Criteria (FDC)) which includes 3 standard slurry pumps and 1 telescoping transfer pump.

Bulk Waste Removal - is defined as removing the first 99% of the original volume of waste which typically means leaving no more than 10,000 gallons of waste in the tank at the completion of bulk waste removal. This operation is typically done with slurry pumps.

Decision Makers - the HLW Board consisting of the Level 1 and 2 Managers in the HLW Division and matrixed support managers.

Demonstrated (Proven) Technology - Technology that is commercially available and/or has been used in the nuclear industry.

Heel Removal - the purpose of heel removal is to remove as much of the remaining waste as required to enable the tank to pass a Performance Assessment indicating that the tank is ready to close. Preliminary calculations indicate that Tank 18 must have no more than 1,000 gallons of sludge remaining at the time of closure. Heel removal on Tanks 16, 17 and 20 employed several different techniques in addition to slurry pumps.

Idea - A concept, if implemented, which would satisfy some or all of the Tank 18 Waste Removal System functions and/or requirements.

Life Cycle – The life cycle of this activity includes all of the tanks currently scheduled for waste removal during the next eight years (starting in FY01) as reflected in the current WSRC Contract and the HLW System Plan, Rev. 11. The Tanks included are: Tank 18, Tank 11, Tank 26, Tank 15, and Tank 4.

Life Cycle Cost - The life cycle cost is the capital cost for the project to retrofit the five HLW tanks in the Life Cycle with waste removal equipment minus projected TFA funding for new technologies.

Life Cycle Cost Savings: The life cycle cost savings was used as the basis to evaluate from the strategies selected using the current Baseline Costs

Slurry Pump – This pump is a 45 foot tall vertical shaft, dual discharge centrifugal pump with a 150 hp motor mounted above the tank top and a 22 inch diameter pump casing submerged in the waste. The pump capacity is 1200 gal/min at the maximum operating

speed of 1800 rpm. The expected effective cleaning radius in SRS sludge is 25 feet. This type of slurry pump has been used to remove waste from several tanks at SRS and West Valley.

Stakeholders - Individuals or organizations potentially impacted by the recommended alternative.

Subject Matter Experts (SMEs)- SMEs are individuals recognized by the Team as experts in a particular field(s).

Validation – a scheduled meeting that provides the opportunity for stakeholder input and feedback at key points during the execution of the Systems Engineering Evaluation process.

Waste Removal (WR) - the removal of high level waste (e.g., sludge, salt, supernate, zeolite) from a waste tank. Waste removal may consist of "bulk waste removal" and "heel removal".

8.0 Acronyms

AB	Authorization Basis
ADMP	Advanced Design Mixing Pump
ARD	Advanced Research and Development Environmental, Inc.
CAR	Corrective Action Report
CSEE	Confined Sluicing End Effector
CST	Concentration, Storage, and Transfer
D&R	Demolition and Removal
DOE	Department of Energy
DTP	Desktop Procedure
DWPF	Defense Waste Processing Facility
E7	Conduct of Engineering & Technical Support Manual
ECR	Effective Cleaning Radius
EIS	Environmental Impact Statement
ESP	Extended Sludge Processing
F.1	Prepare Bulk Waste in Tank 18
F.2	Transfer Non-Heel Bulk Waste to another HLW Tank (Prime Mover and Transfer Route)
F.3	Prepare Heel in Tank 18
F.4	Transfer Heel to another HLW Tank
FDB	F Area Diversion Box
FDC	Functional Design Criteria
FFA	Federal Facility Agreement
FPR	Functional Performance Requirements
FTF	F Area Tank Farm
FY	Fiscal Year
H&V	Heating and Ventilation
HLW	High Level Waste
HLWSP	High Level Waste System Plan
HTF	H Area Tank Farm
IM	Implementation Manual
K	1,000
LCC	Life Cycle Cost
LHW	Low Heat Waste
MR	Management Reserve
NRC	Nuclear Regulatory Commission
NRDC	Natural Resources Defense Council
O&M	Operations and Maintenance
OPC	Other Project Costs
PBI	Performance Based Incentive
PEM	Project Engineering Manager
PUREX	Plutonium Uranium Extraction
QVSP	Quad Volute Slurry Pump
R&D	Research and Development
RAMI	Reliability, Accountability, Maintainability Issues
ROM	Rough Order of Magnitude

SCDHEC	South Carolina Department of Health and Environmental Controls
SE	Systems Engineering
SEE	Systems Engineering Evaluation
SME	Subject Matter Experts
SP	Slurry Pump
SRS	Savannah River Site
SRTC	Savannah River Technology Center
TEC	Total Estimated Cost
TFA	Tank Focus Area
TNX	SRTC Development Facility for 200 Areas
TP	Transfer Pump
TTP	Telescoping Transfer Pump
UF	Utility Function
VP	Vice President
WAC	Waste Acceptance Criteria
WR	Waste Removal
WSMS	Westinghouse Safety Management Solutions
WSRC	Westinghouse Savannah River Corporation
WWOP	Wastewater Operating Permit

9.0 References

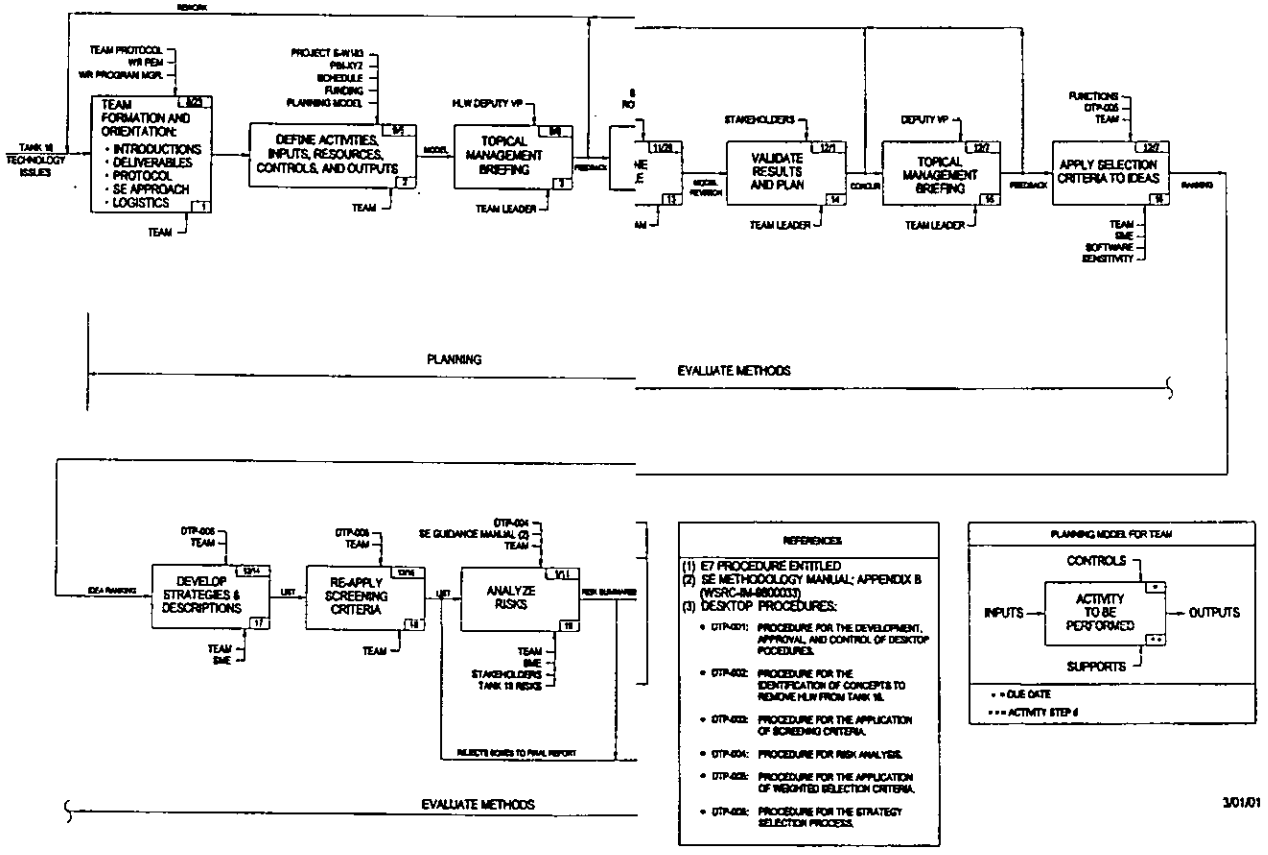
1. Federal Facilities Agreement for the Savannah River Site, Administrative Docket Number 89-05-FF, August 13, 1993.
2. Chapman, J. W., Permit to Operate #17, 424-IW, F/H Area High-Level Waste Tank Farm, South Carolina Department of Health and Environmental Control, March 3, 1993.
3. Waste Acceptance Criteria Program Requirements for Radioactive Waste, 1S WAC 1.02, August 28, 2000.
4. Functional Performance Requirements for Project S-W183 Waste Removal, G-FPR-G-00019, Rev. 0, May 19, 1999.
5. Functional Design Criteria S-2081 Waste Removal and Extended Sludge Processing, G-FDC-G-00029, Rev. 2, September 30, 1993 and amendments.
6. High Level Waste System Plan, HLW-2000-00019, Revision 11, April 2000.
7. Corrective Action Report on Structural Steel, 95-CAR-22-0001.
8. Tank 18 Systems Engineering Evaluation – Lessons Learned from Other Tanks, HLW-CST-2001-0003, February 21, 2001.
9. Tank 18 Systems Engineering Evaluation – Individual Idea Scoresheets, HLW-CST-2001-0004, February 21, 2001.
10. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 1, HLW-CST-2001-0005, February 21, 2001.
11. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 2, HLW-CST-2001-0006, February 21, 2001.
12. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 3, HLW-CST-2001-0007, February 21, 2001.
13. Tank 18 Systems Engineering Evaluation – Developed Ideas for Function 4, HLW-CST-2001-0008, February 21, 2001.

10.0 Attachments

ATTACHMENT 1

ACTIVITY PLANNING MODEL

HLW Tank 18 Waste Removal Technology Team Activity Planning Model


REMARK
TEAM PROTOCOL
WR PEM
WR PROGRAM MGR.
TANK 18 TECHNOLOGY ISSUES
TEAM FORMATION AND ORIENTATION:
• INTRODUCTIONS
• DELIVERABLES
• PROTOCOL
• SE APPROACH
• LOGISTICS
TEAM
PROJECT E-W MG
POLICY2
SCHEDULE
FUNDING
PLANNING MODEL
DEFINE ACTIVITIES, INPUTS, RESOURCES, CONTROLS, AND OUTPUTS
TEAM
MODEL
HLW DEPUTY VP
TOPICAL MANAGEMENT BRIEFING
TEAM LEADER
FEEDBACK
RD
NE
M
AM
MODEL REVISION
STAKEHOLDERS
VALIDATE RESULTS AND PLAN
TEAM LEADER
CONCUR
DEPUTY VP
TOPICAL MANAGEMENT BRIEFING
TEAM LEADER
FEEDBACK
FUNCTIONS
DTP-005
TEAM
APPLY SELECTION CRITERIA TO IDEAS
TEAM
SME
SOFTWARE
SENSITIVITY
PLANNING
EVALUATE METHODS
DTP-005
TEAM
IDEA RANKING
DEVELOP STRATEGIES & DESCRIPTIONS
TEAM
SME
LIST
DTP-005
TEAM
RE-APPLY SCREENING CRITERIA
TEAM
LIST
DTP-004
SE GUIDANCE MANUAL (2)
TEAM
ANALYZE RISKS
TEAM
SME
STAKEHOLDERS
TANK 18 RISKS
RISK SUMMARIES
REJECTS NOMES TO FINAL REPORT
EVALUATE METHODS
REFERENCES
(1) E7 PROCEDURE ENTITLED
(2) SE METHODOLOGY MANUAL; APPENDIX B (WSRC-IM-9800033)
(3) DESKTOP PROCEDURES:
• DTP-001: PROCEDURE FOR THE DEVELOPMENT, APPROVAL, AND CONTROL OF DESKTOP PROCEDURES.
• DTP-002: PROCEDURE FOR THE IDENTIFICATION OF CONCEPTS TO REMOVE HLW FROM TANK 18.
• DTP-003: PROCEDURE FOR THE APPLICATION OF SCREENING CRITERIA.
• DTP-004: PROCEDURE FOR RISK ANALYSIS.
• DTP-005: PROCEDURE FOR THE APPLICATION OF WEIGHTED SELECTION CRITERIA.
• DTP-006: PROCEDURE FOR THE STRATEGY SELECTION PROCESS.
PLANNING MODEL FOR TEAM
CONTROLS
INPUTS
ACTIVITY TO BE PERFORMED
OUTPUTS
SUPPORTS
* = DUE DATE
** = ACTIVITY STEP #
3/01/01

ATTACHMENT 2

DESKTOP PROCEDURES

DTP-001
Revision: 0

SAVANNAH RIVER SITE

HIGH LEVEL WASTE SALT DISPOSITION
TANK 18 WASTE REMOVAL TECHNOLOGY TEAM

DESKTOP PROCEDURE FOR THE DEVELOPMENT, APPROVAL AND CONTROL OF DESKTOP PROCEDURES

APPROVED:_____ DATE:_____
Neil Davis
Tank 18 Waste Removal Technology Team Leader

1.0 Purpose

The Savannah River Site (SRS) High Level Waste Tank 18 Waste Removal Technology Team ("Team") was formed to systematically evaluate alternatives and recommend a preferred method for preparing and transferring (removal) High Level Waste from Tank 18 to another HLW waste tank. This Desktop Procedure provides the necessary direction to develop and approve desktop procedures to be utilized by the Team and support personnel to conduct a systems engineering evaluation on Tank 18.

2.0 Scope

This procedure provides direction for the development, approval and control of desktop procedures to be used by the Team and support personnel to complete Team activities.

3.0 Responsibilities

The Team Leader or his designee, shall be responsible for implementation of this procedure.

The Team is responsible for review and approval of desktop procedures. The Team approval of desktop procedures shall be documented by the signature of the Team Leader in the approval block of the procedures.

4.0 Process

The desktop procedure process is depicted in the flowchart shown in Figure 1.

Procedures shall be developed in accordance with the format guidelines of the "Desktop Procedure Template" (Attachment 1).

Revisions to desktop procedures shall be performed by the same process as the original procedure and the revision number shall be modified accordingly.

Procedures shall be numbered with the format of "DTP-xxx" where xxx is a sequential number e.g., DTP-001, DTP-002.

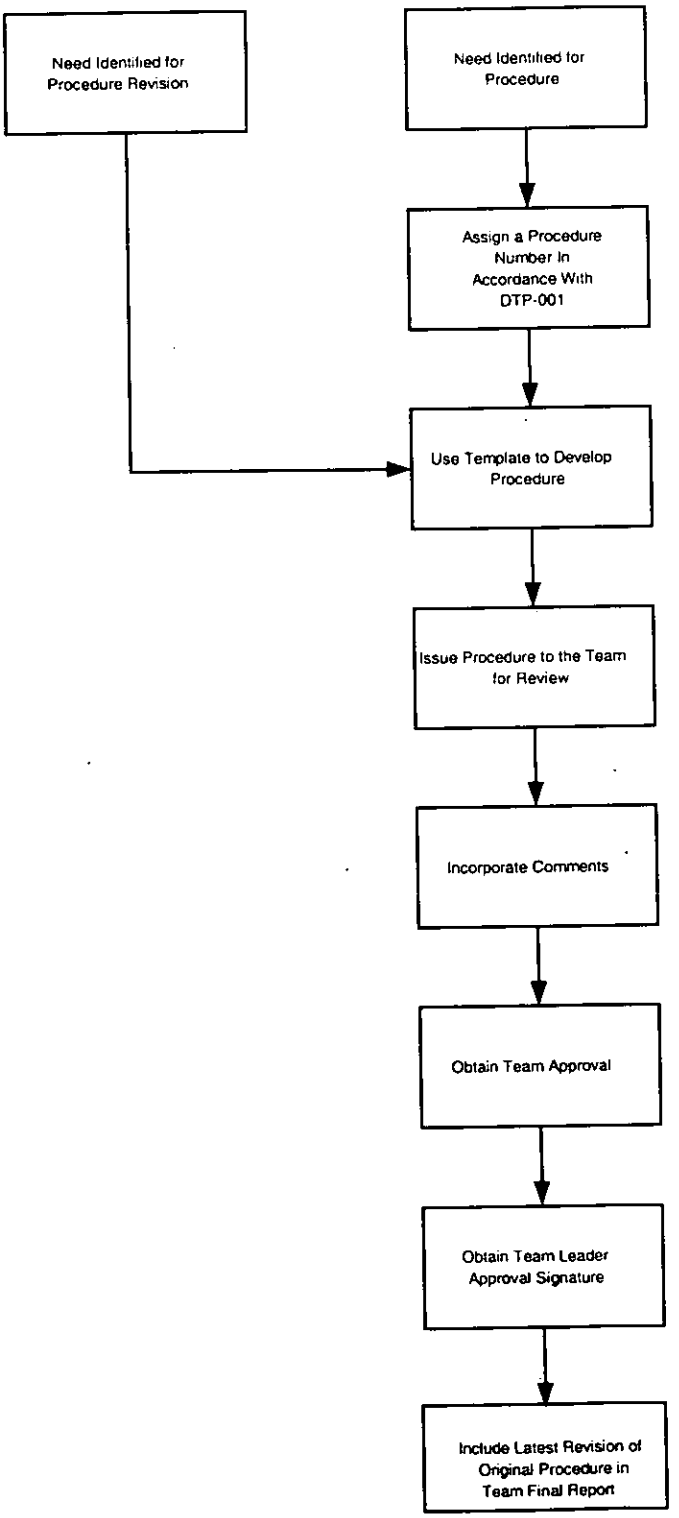
5.0 Records

Procedures produced as a result of this desktop procedure shall be included in the Team's Final Report.

6.0 References

None

Figure 1 - Desktop Procedure Development and Approval



Attachment 1 – Desktop Procedure Template

DTP-XXX
Revision: x

SAVANNAH RIVER SITE

HIGH LEVEL WASTE SALT DISPOSITION
TANK 18 WASTE REMOVAL TECHNOLOGY TEAM

DESKTOP PROCEDURE FOR
THE

[*TITLE*]

APPROVED:_____ DATE:_____
Neil Davis
Tank 18 Waste Removal Technology Team Leader

1.0 Purpose

This desktop procedure provides the methodology for performing [*Name process and briefly state why procedure is needed*].

2.0 Scope

This procedure shall be used by the Team, SMEs and/or stakeholders to [*Briefly state what will be performed under this procedure. If the procedure supersedes a previously issued position paper, a statement should be made -"This procedure supersedes position paper xxxxxx"*].

3.0 Definitions [*Optional*]

Team	The members of the HLW Tank 18 Waste Removal Technology Team.

[*Above is an example of the format of "definitions," the definitions included here would be dictated by the individual procedure*].

4.0 Responsibilities

The Team Leader shall be responsible for the implementation of this procedure and for initial approval and approval of changes to this procedure. [*add any additional responsibilities unique to the activities covered by this procedure*]

The Team and support personnel are responsible for performing the [*subject*] process as defined within this procedure. [*Add any additional responsibilities unique to the activities covered by this procedure*]

[*add any additional personnel/groups and their responsibilities unique to the activities covered by this procedure. Where responsibilities can be designated it should be stated here within the definition of the responsibility*].

5.0 Discussion [*Optional*]

[*This section should be used to* provide *clarification, history, philosophy as deemed necessary by the author to aid in the overall understanding of the process covered by the procedure - if process is simple and easily understood then no further explanation is necessary*].

6.0 Process

[*The overall process is depicted in the flowchart shown in Figure 1*]

[*The process methodology shall be defined in terms of "functional title" shall perform "function" – topics may be added to logically divide functions or responsibilities or stages of the process*]

6.1 [TOPIC 1]

[*Topic process methodology*]

[SUBTOPIC A]

[*Subtopic process methodology*]

[SUBTOPIC B]

[*Subtopic process methodology*]

[*If documents require processing by document control, refer to the document Control procedure*]

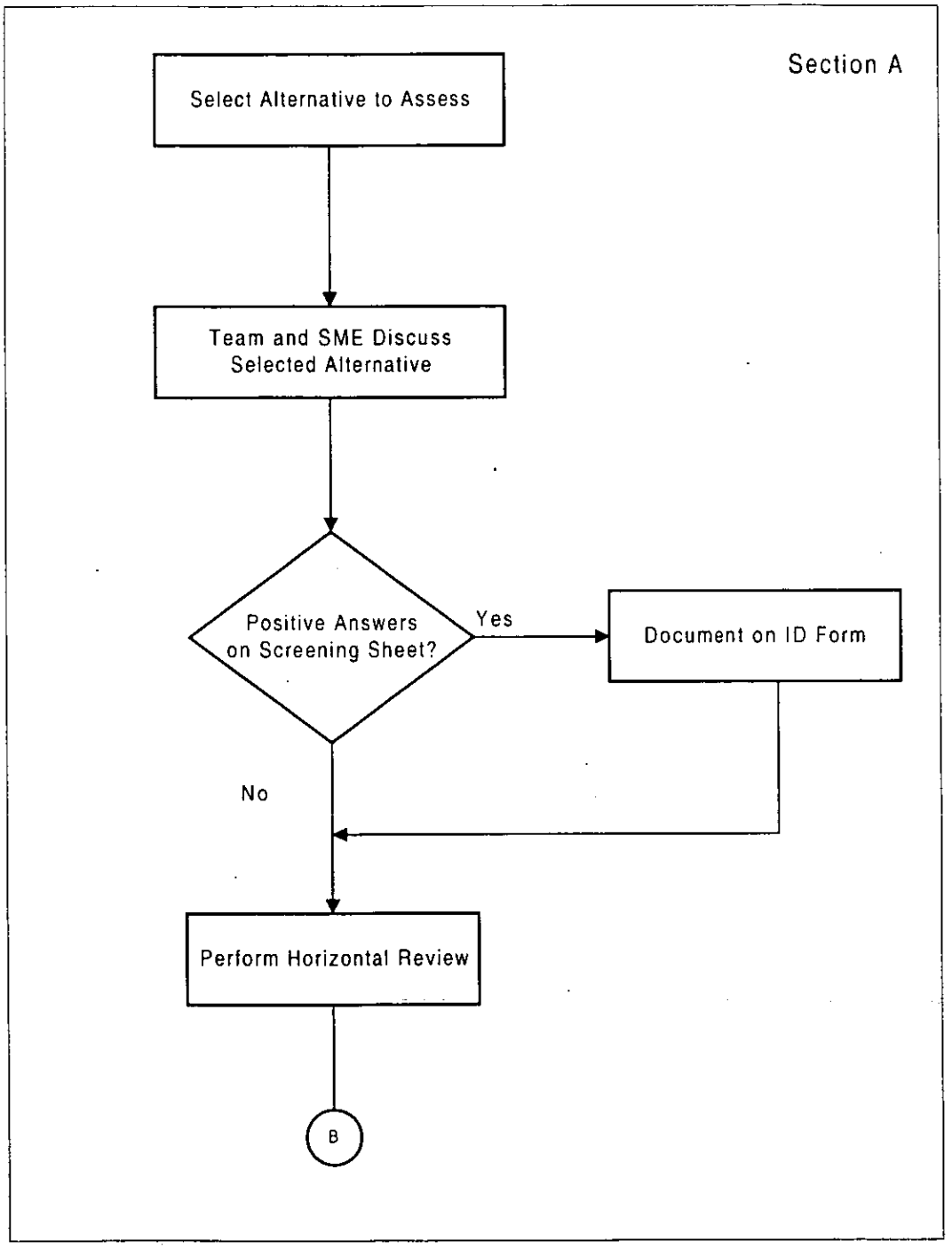
7.0 Records

Documents produced during the Team activities will be included in the Team's Final Report. [*name process*]

8.0 References

1. DTP-001, Desktop Procedure for the Development, Approval and Control of Desktop Procedures.

Figure 1: (EXAMPLE) Determination of Risk and Risk Handling Strategies



DTP-002
Revision 0

SAVANNAH RIVER SITE
HIGH LEVEL WASTE
TANK 18 WASTE REMOVAL TECHNOLOGY TEAM

DESKTOP PROCEDURE FOR

THE

IDENTIFICATION OF CONCEPTS TO REMOVE HLW FROM TANK 18

APPROVED:_____ DATE:_____
Neil Davis
HLW Tank 18 Waste Removal Technology Team Leader

1.0 Purpose

This desktop procedure provides the necessary guidance and requirements for the HLW Tank 18 Waste Removal Technology Team (Team) to perform the identification of ideas and concepts.

2.0 Scope

This procedure shall be used by the Team, SMEs and/or Stakeholders to facilitate the solicitation and documentation of ideas for use in the definition of a preferred strategy for removal of HLW from Tank 18.

3.0 Definitions

Baseline Technology:	The technology referenced in the project baseline for Tank 18 Waste Removal which consists of three slurry pumps and one telescoping transfer pump.
Demonstrated (Proven) Technology:	Technology which is commercially available and/or has been used in the nuclear industry.
Idea:	A concept, if implemented, which would satisfy some or all of the Tank 18 Waste Removal System functions and/or requirements.
Pro-Forma:	A Team form used to document a candidate idea for consideration.
Briefing Package:	An information package to facilitate brainstorming. It contains such things as the problem definition, critical mission need, top level functions and requirements, a model representing the generic solution(s) to developing a strategy, and a Pro-Forma form (Attachment 1) to document ideas.
Stakeholders:	Individuals or organizations potentially impacted by the recommended alternative(s).
Subject Matter Experts: *(SMEs)*	Individuals recognized by the Team as experts in a particular field(s).

4.0 Responsibilities

The Team is responsible for review and approval of this desktop procedure. The Team approval of this desktop procedure shall be documented by the signature of the Team Leader in the approval block of the procedure. Revisions will be annotated by sequential revision numbers and approval.

The Team Leader is responsible for the implementation of this procedure.

The Team, SMEs and/or Stakeholders are responsible for identification of ideas as defined within this procedure.

5.0 Discussion

The Team was formed to identify, evaluate, and select an integrated system (including technology) to remove and transfer HLW from Tank 18 to another HLW tank. The activities prescribed in this procedure use a systematic approach to facilitate the completion of the Team activities.

6.0 Process

The overall process of identifying ideas for subsequent evaluation, is depicted in Figure 1.

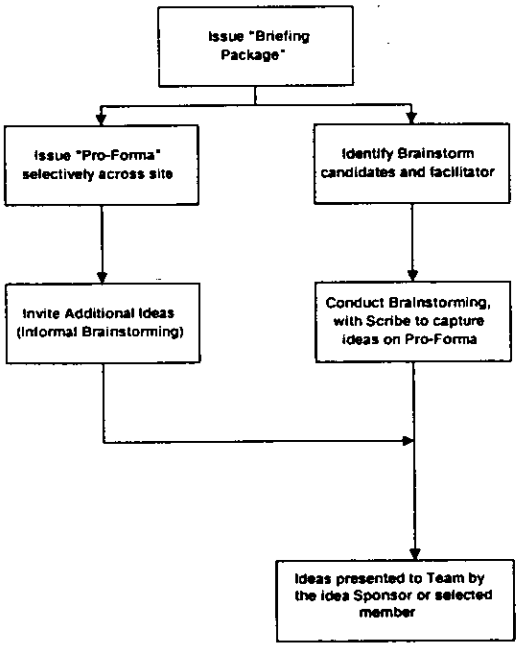


Figure 1. Process for Identification of Ideas

6.1 Identification of Ideas

The methods to solicit and identify relevant ideas and concepts for subsequent evaluation are as follows:

6.1.1 Formal brainstorming sessions shall be conducted. The Team shall identify SMEs and Stakeholders to supplement the Team expertise. A briefing package shall be distributed in advance of brainstorming activities in order to provide invitees with ample time to think about solutions. Ideas presented during the brainstorming shall be documented on a Pro-Forma form.

6.1.2 Input from other knowledgeable people not attending formal brainstorming sessions will also be solicited. Target groups or organizations will be defined by the Team. These individuals shall be different than those participating in the formal brainstorming activity. These individuals shall be provided a briefing package. Ideas submitted by individuals shall be documented on a Pro-Forma form.

6.2 Documenting Results

Ideas and concepts identified through the methods described above shall be documented on a Pro-Forma form before it can be considered as a potential strategy or component thereof.

7.0 Records

Documented results produced as a result of implementing this desktop procedure will be included in the Team's Final Report.

8.0 References

1. DTP-001, HLW Tank 18 Waste Removal Technology Team Desktop Procedure for the Development and Control of Desktop Procedures.

Attachment 1
HLW Tank 18 Waste Removal System
Pro-Forma Form

Idea #:_____ **Sponsor:**_____ **Date:**_____

Originator:_____ **Phone#**_____

Title: _____

_____

Description: _____

_____

_____

_____

_____

_____

_____

Technical Maturity: _____

_____

_____

_____

Safety Issues: _____

_____

_____

_____

Advantages: _____

_____

_____

_____

Disadvantages: _____

_____

_____

_____

Attachment 1 (cont'd)

Explanatory Notes for "Idea Pro-Forma"

Idea – To be inserted by the Team, or designee.

Sponsor - the originator, a suitable "champion" or a Team member.

Date - Date submitted.

Originator - name and phone number needed for follow-up purposes.

Title - should capture the key unit operations of the proposed idea.

Description - should be a single paragraph technical description of the steps involved in the proposed idea, clearly identifying where use is made of existing HLW processes/facilities or other process/facilities at the SRS.

Technical Maturity - a key criterion for screening ideas. Define the current development status of the process, (e.g., theoretical idea, chemistry proven in lab, fully commercialized for non-nuclear applications, full nuclear operation).

Safety Issues - a key criterion for screening ideas. What significant safety issues would have to be tackled on the proposed idea (e.g., hazardous chemicals, risk of explosion, high temp, pressure, etc.)?

Advantages and Disadvantages - apart from safety and technical maturity, what are the other principal advantages and disadvantages of the proposed idea, e.g., simplicity, cost, operability, use of existing facilities, etc., as compared to the baseline technology.

Process Diagram (Optional) - If you can, sketch the principal steps of the process, showing interaction with existing facilities, on the back of the sheet.

Completed Forms - Returned to Jim Menghi, either by E-mail or hard copy to 241-109F, or FAX 2-3780. Otherwise, return to another member of the Team: Gary Abell, Tommy Caldwell, Neil Davis, Nader Elraheb, Ed (Max) Howard, Bob Leishear, John McCullough, or Dave Stefanko.

DTP-003
Revision 1

SAVANNAH RIVER SITE

HIGH LEVEL WASTE
TANK 18 WASTE REMOVAL TECHNOLOGY TEAM

DESKTOP PROCEDURE FOR

THE

APPLICATION OF SCREENING CRITERIA

APPROVED:_____ DATE:_____
Neil Davis
HLW Tank 18 Waste Removal Technology Team Leader

1.0 Purpose

This desktop procedure provides the necessary guidance and requirements for the HLW Tank 18 Waste Removal Technology Team (Team) to perform the screening of ideas resulting in an "Initial List" for subsequent evaluation.

2.0 Scope

This procedure shall be used by the Team, SMEs and/or Stakeholders to apply screening criteria to candidate ideas developed by or submitted to, the Team.

3.0 Definitions

Baseline Technology: The technology referenced in the project baseline for Tank 18 Waste Removal which consists of three slurry pumps and one telescoping transfer pump.

Demonstrated (Proven) Technology: Technology which is commercially available and/or has been used in the nuclear industry.

Idea: A concept, if implemented, which would satisfy some or all of the Tank 18 Waste Removal System functions and/or requirements.

Pro-Forma: A Team form used to document a candidate idea for consideration.

Screening Criteria: Functions and/or requirements that must be met (non-negotiable) for a candidate idea to be considered viable for subsequent evaluation.

Stakeholders: Individuals or organizations potentially impacted by the recommended alternative(s).

Subject Matter Experts: *(SMEs)* SMEs are individuals recognized by the Team as experts in a particular field(s).

4.0 Responsibilities

The Team is responsible for review and approval of this desktop procedure. The Team approval of this desktop procedure shall be documented by the signature of the Team Leader in

the approval block of the procedure. Revisions will be annotated by sequential revision numbers and approval.

The Team Leader is responsible for the implementation of this procedure.

The Team, SMEs and/or Stakeholders are responsible for performing the application of screening criteria as defined within this procedure.

5.0 Discussion

The Team was formed to identify, evaluate, and select an integrated system (including technology) to remove and transfer HLW from Tank 18 to another HLW tank. The activities prescribed in this procedure use the Systems Engineering Process described in the Systems Engineering Guidance Manual[1], and will facilitate the completion of the Team activities.

6.0 Process

The overall process of screening ideas to develop an initial list is depicted in Figure 1.

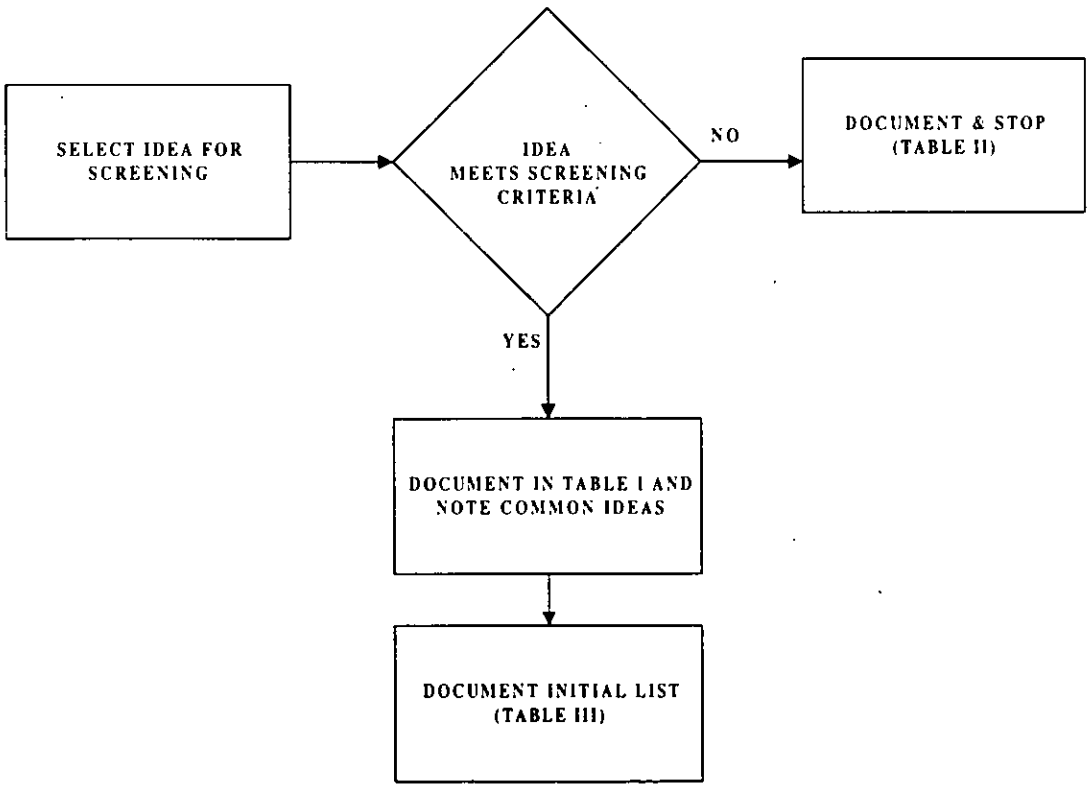


Figure 1. Idea Screening Process

6.1 Screening Criteria

The specific screening criteria to be applied and their bases are listed below:

1. The idea performs part or all of the function(s).

   Basis: If the idea does not contribute to the solution then it is of no value.

2. The idea supports the 6-30-03 completion of waste preparation and transfer of HLW from Tank 18 to another receipt tank.

   Basis: Supports the FFA commitments reflected in the HLW System Plan Rev. 11.

3. The TEC ≤ $7.8M

   Basis: Represents a 20% increase from current TEC of $6.5M which allows latitude to consider more options. The $6.5M is the TEC/MR/Contingency for Tank 18 waste removal (waste preparation and transfer) and excludes spray washing, tank isolation and closure, and OPC.

4. Implementation does not require qualification of a new DWPF glass waste form.

   Basis: Requalification is *not* acceptable based on long lead time to complete and uncertainty of success.

5. The idea complies with regulatory requirements (OSHA, EPA/DHEC, SRS Safety and Radcon Programs).

   Basis: Noncompliance is unacceptable.

6.2 Application of Screening Criteria

For consistency during the screening process, the criterion listed above shall be applied as shown in Figure 2. Each idea submitted to the Team shall be compared to the criteria as shown in Figure 2.

6.3 Participants

The Team expertise shall be supplemented by the use of SMEs and/or stakeholders, as appropriate to facilitate accurate screening of submitted ideas.

6.4 Documenting Results

6.4.1 Accepted Ideas

Those ideas which satisfy the screening criteria, or for which insufficient information exists to accurately assess the criteria, shall be documented in Table I. Common or similar ideas shall be noted in Table I comments.

6.4.2 Rejected Ideas

If the application of any criterion results in an "unacceptable" response, then that idea is rejected, and no further screening is required. Ideas screened out at this level shall have the screening criterion and causative failure documented (Table II) and dropped from further consideration.

6.4.3 Initial List Ideas

Table III will contain the unique ideas consolidated from Table I and will constitute the initial list of ideas. Ideas from Table I covered by an initial list idea shall be noted in the comments of Table III, where appropriate.

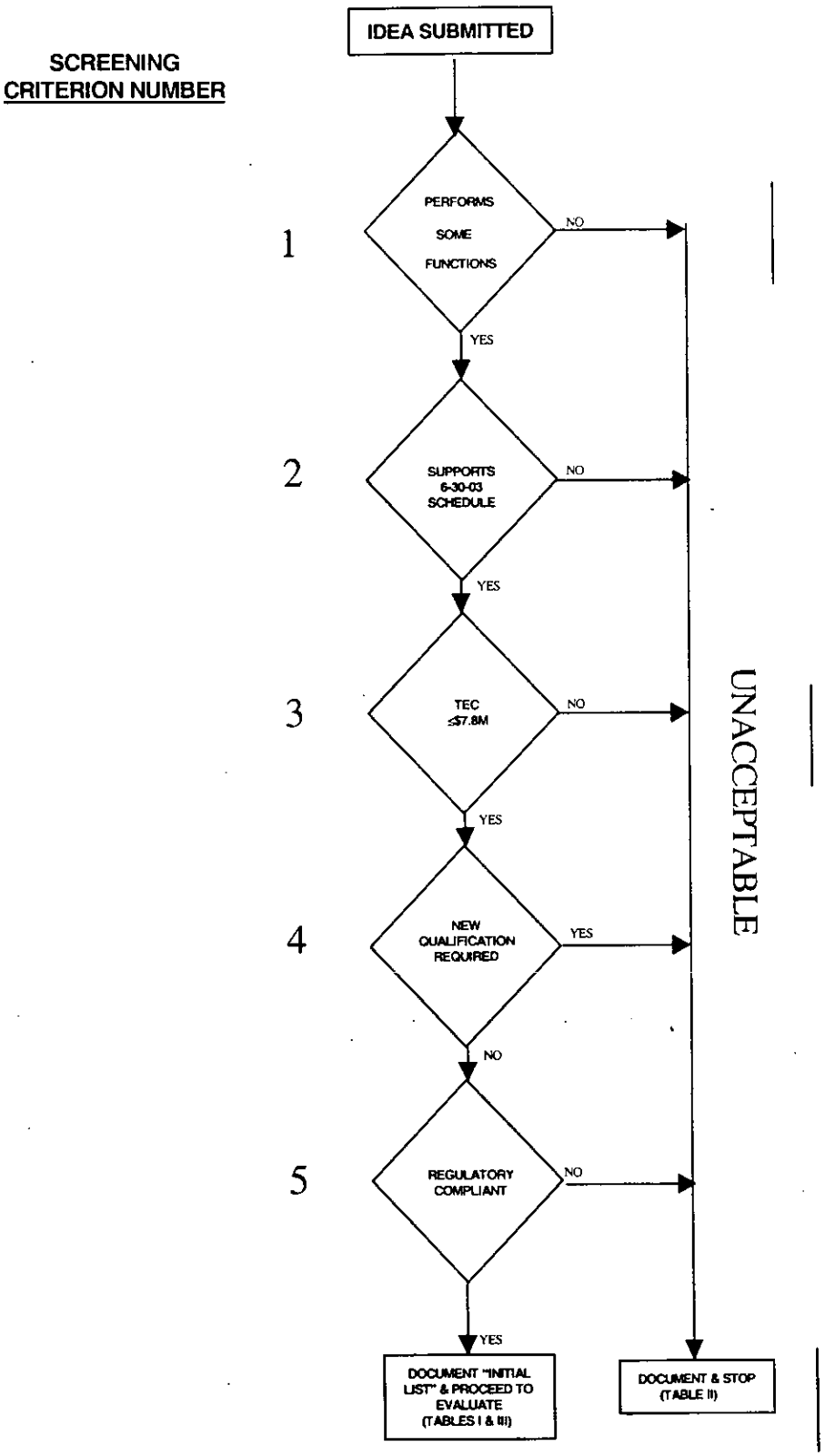


Figure 2. Application of Selection Criteria

7.0 Records

Documented results produced as a result of this desktop procedure will be included in the Team's Final Report.

8.0 References

1. WSRC-IM-98-0033: Systems Engineering Methodology Guidance Manual - Appendix A, Rev. 0.

2. DTP-001, HLW Tank 18 Waste Removal Technology Team Desktop Procedure for the Development and Control of Desktop Procedures.

TABLE I: ACCEPTABLE TANK 18 WASTE REMOVAL IDEAS
(Passed Screening Criteria)

IDEA NO.	IDEA TITLE	IDEA SUMMARY	COMMENT

TABLE II: UNACCEPTABLE TANK 18 WASTE REMOVAL IDEAS
(Failed Screening Criteria)

IDEA NO.	IDEA TITLE	SCREENING CRITERION FAILED	COMMENTS

TABLE III: INITIAL LIST IDEAS FOR TANK 18 WASTE REMOVAL
(Redundant Ideas Accepted & Combined)

IDEA NO.	IDEA TITLE	IDEA SUMMARY	COMMENTS

DTP-004
Revision 0

SAVANNAH RIVER SITE

HIGH LEVEL WASTE
TANK 18 WASTE REMOVAL TECHNOLOGY TEAM

DESKTOP PROCEDURE FOR

RISK ANALYSIS

APPROVED:_____ DATE:_____
Neil Davis
HLW Tank 18 Waste Removal Technology Team Leader

1.0 Purpose

This desktop procedure provides the methodology for the HLW Tank 18 Waste Removal Technology Team (Team) to perform risk analyses on the screened ideas.

2.0 Scope

This procedure shall be used by the Team. The application of the risk analysis process to the ideas will involve the identification and evaluation of risks. The evaluation will include determining a risk level (i.e. high, moderate, low), Risk Handling Strategies (RHS), and residual risk levels. The risk analysis process concludes with preliminary cost and schedule estimates to implement the necessary and sufficient RHS.

3.0 Definitions

Baseline Technology: The technology referenced in the project baseline for Tank 18 Waste Removal which consists of three slurry pumps and one telescoping transfer pump.

Consequence of Occurrence: The impact(s) realized as a result of a risk occurring.

Demonstrated (Proven) Technology: Technology which is commercially available and/or has been used in the nuclear industry.

Idea: A concept, if implemented, which would satisfy some or all of the Tank 18 Waste Removal System functions and/or requirements.

Probability of Occurrence: The likelihood that a risk will be realized.

Residual Risk Level: The significance of the risk remaining after credit is taken for proposed risk handling strategies.

Risk: An issue that may cause an uncertainty.

Risk Acceptance: A handling strategy that accepts the risk "as is". This type of strategy does not attempt to reduce the risk level. Low and some moderate level risks are examples of the types of risks that are normally subject to being accepted.

Risk Handling Strategy: An approach which, if implemented, would eliminate or at least reduce the consequence of a risk occurring. Handling strategies can be grouped into the following five categories:

- **Risk Prevention**
- **Risk Mitigation**
- **Risk Reduction**
- **Risk Transference**
- **Risk Acceptance**

Risk Level: The significance of the identified risk based on probability and consequence considerations. The risk level prior to or subsequent to consideration of risk handling strategies are designated as RL and RL_h, respectively.

Risk Mitigation: A handling strategy that mitigates the consequence of a risk. This type of strategy essentially drives the consequences of a risk to zero, eliminating the risk.

Risk Prevention: A handling strategy that prevents the risk from occurring (avoidance). This type of strategy essentially drives the probability of the risk occurring to zero, eliminating the risk.

Risk Reduction: A handling strategy that reduces risk, but does NOT eliminate it. This type of strategy reduces the probability and/or the consequences of a risk, but eliminates neither. The risk remains, but at a reduced level.

Risk Transference: A handling strategy that transfers the risk to a new owner (e.g., different project). The new owner must accept the risk before it can be transferred.

Stakeholders: Individuals or organizations potentially impacted by the recommended strategy(s).

Subject Matter Experts: Individuals recognized by the Team as experts in a particular field(s).

4.0 Responsibilities

The Team is responsible for review and approval of this desktop procedure. The Team approval of this desktop procedure shall be documented by the signature of the Team Leader in the approval block of the procedure.

The Team Leader is responsible for the implementation of this procedure.

The Team, SMEs and/or Stakeholders are responsible for performing the analysis of risk as defined within this procedure.

5.0 Discussion

The Team was formed to identify, evaluate, and select an integrated system (including technology) to remove and transfer HLW from Tank 18 to another HLW Tank. The activities prescribed in this procedure use the Systems Engineering Process described in the Systems Engineering Guidance Manual [1], and will facilitate the completion of the Team activities.

The ideas are evaluated for risks to assist in down-selecting to the final recommendation. Uncertainty and associated contingency analyses will be performed in more detail after the final recommendation. The risk analysis will primarily focus on the ability of the ideas to satisfy the project baselines and issues relative to the four functions (*bulk waste preparation, bulk waste transfer, heel preparation, and heel transfer)* that must be performed.

6.0 Process

The overall process of performing the risk analysis is depicted in Figure 1.

6.1 Risk Screening Criteria

To provide consistency in assessing risk, the risk screening criteria identified in Attachment 1 shall be applied to each idea or composite strategy.

6.3 Risk Identification

Identified risks shall be documented on Attachment 2 whenever a "yes" results from the previous step. Explanatory notes or bases should be provided for clarification.

6.4 Identify Probability of Occurrence

The qualitative probability (i.e., Very Likely, Likely, Unlikely, Very Unlikely), from Table I of the risk initially occurring, *without taking credit for risk handling*, shall be declared in Attachment 2.

6.5 Identify Consequences of Risk

The initial consequences which may result, *without taking credit for risk handling*, from the identified risk shall be stated in Attachment 2 and quantified as to "Crisis, Critical, Significant, Marginal, or Negligible" based on the definitions in Table II.

6.6 Horizontal Check for Consistency

The following steps shall be applied sequentially such that the consistency check is complete.

6.6.1 Double Counting

The Risk Screening Area Checklist (Attachment 1) was created to assure that no risks are overlooked. As a result, the same risk may be stated more than once for an idea. The following guideline shall be followed to eliminate double-counting of the same or very similar risks:

Guideline: If a Risk Assessment Identification Form simply identifies an additional manifestation of a risk previously identified for the alternative, the risk identified should be consolidated with the other manifestations. The consolidation should preserve pertinent probability and consequence information from each draft Identification Form. The risk screening area in which the risk is preserved should be consistent with the area in which this type of risk is documented for other alternatives.

6.6.2 Risk Statement Consistency Guideline

Over the period in which the risk assessment will be performed, the potential exists for variations in the wording of the risk statements. Differences in wording may imply differences in the risk, so it is important to assure that risks are stated consistently across the alternatives assessed.

Guideline: A risk which applies to more than one alternative should be worded in the same manner for each occurrence unless there is a distinguishing aspect of its application to an alternative that is to be noted in the risk statement.

6.5.3 Inclusiveness Guideline

As the risks are identified over a period of time for the various alternatives, new risks applicable to alternatives previously assessed may be discovered. An attempt should be made to assure that these new risks are identified for each alternative to which the risk is applicable.

Guideline: After risks are identified for each alternative, the alternatives will be assessed for applicability of all risks. If a risk is found to be applicable to an alternative for which an identification form does not exist, an identification form will be generated for that alternative.

6.5.4 Completeness Guideline

The horizontal review will be performed following the completion of the primary portion of the risk assessment. Any subsequent additional knowledge obtained will offer the potential for a changed view of risk probability and consequence. Any such changed views will be examined in the horizontal review.

Guideline: Additional information or reappraisals of the probability and/or consequence of identified risks should be included in the values assigned to the risk. Any risks not identified in the risk assessment, but coming to light prior to or during the horizontal review should be documented on the Risk Screening Area checklist and with an identification form for the applicable alternative.

6.5.5 Uniformity Guideline

Due to the time period over which the risk assessment will be performed, the Team recognizes the potential that the assigned risk probability and consequence levels (i.e., High, Medium, Low) from alternatives assessed early in the process to those assessed toward the end of the process will vary. In order to form a sound basis for the risk handling and adjustment process; the Risk Levels (RL) must be similarly assigned from alternative to alternative for similar probability and consequence. [Note that identical risk statements may appropriately have different probability and consequence levels for different alternatives if the probability and/or consequence of the risk are different for each alternative.]

Guideline: Probabilities and consequences must be assigned on the same scale for the different alternatives. Assigned probability or consequences which are not comparable to the values used for similar risk probabilities and consequences will be adjusted according to the values provided in Tables I and II

6.7 Determination of Risk Level

The Risk Level (RL or RL_h), (i.e., High, Moderate or Low) will be determined by applying the assigned probability and consequence factors to Table III. The risk level shall be recorded on Attachment 2.

To define the levels of risk in Table III, the Team considered the guidelines provided in references 1, 2, 3 and applied them as deemed appropriate to this stage of risk analysis.

6.8 Identify Risk Handling Strategies

For risks with a Risk Level of "High", Risk Handling Strategies (RHS), shall be developed and recorded on Attachment 2. This approach ensures that handling of risks, with at least a "significant" consequence and "likely" probability of occurrence, is addressed. Risk Handling Strategies shall consider; prevention, mitigation, reduction, transference, or acceptance of the stated risks as methods of lowering the risk level.

6.9 Determine Schedule for Risk Handling Strategies

The estimated duration for completion of the proposed RHS shall be recorded on Attachment 2. The Team, SMEs, and/or stakeholders will use "best judgement" to develop the estimated durations. If the RHS does not result in lowering the RL_h to at least a "moderate" level, then an "N/A" will be recorded for duration.

6.10 Determine Cost of Risk Handling Strategies

The estimated cost associated with the RHS shall be recorded on Attachment 2. The Team, SMEs, and/or stakeholders will use "best judgement" to develop the estimated costs. The costs will be rough order of magnitude in nature. If the RHS does not result in lowering the RL_h to at least a "moderate" level, then an "N/A" will be recorded for cost.

6.11 Determine Impact of Risk Handling Strategy

Risk Handling Strategies are intended to either eliminate or, at a minimum, reduce the risk level. Therefore, the Team will reevaluate the original probability and consequence levels assigned by considering (i.e., take credit for) the proposed risk handling strategies defined for a particular risk. An update (adjustment) to the consequence and/or probability and the resulting risk level

will be made and stated in Section F of Attachment 2. The rationale for lowering the consequence or probability levels will be provided in the "Basis".

The re-evaluated or "new" probabilities, consequences and resulting residual risk levels (from Tables I, II, and III, respectively) will be annotated as P_h, C_h, and RL_h. The subscript "h" indicates that the impact of the RHL has been "handled". If no adjustments are made, then the P_h, C_h, and RL_h values will be the same as the original values.

6.12 Disposition of Ideas/Strategies Based on Risk

The Team shall review the residual risk RL_h levels for the risks identified. Each idea/strategy containing "High" RL_h levels will be dropped from further consideration. A high RL_h indicates that feasible risk handling strategies could not be formulated to reduce the risk level to a moderate or low level.

The ideas or strategies with "Low" or "Moderate" RL_h levels will be considered for further evaluation.

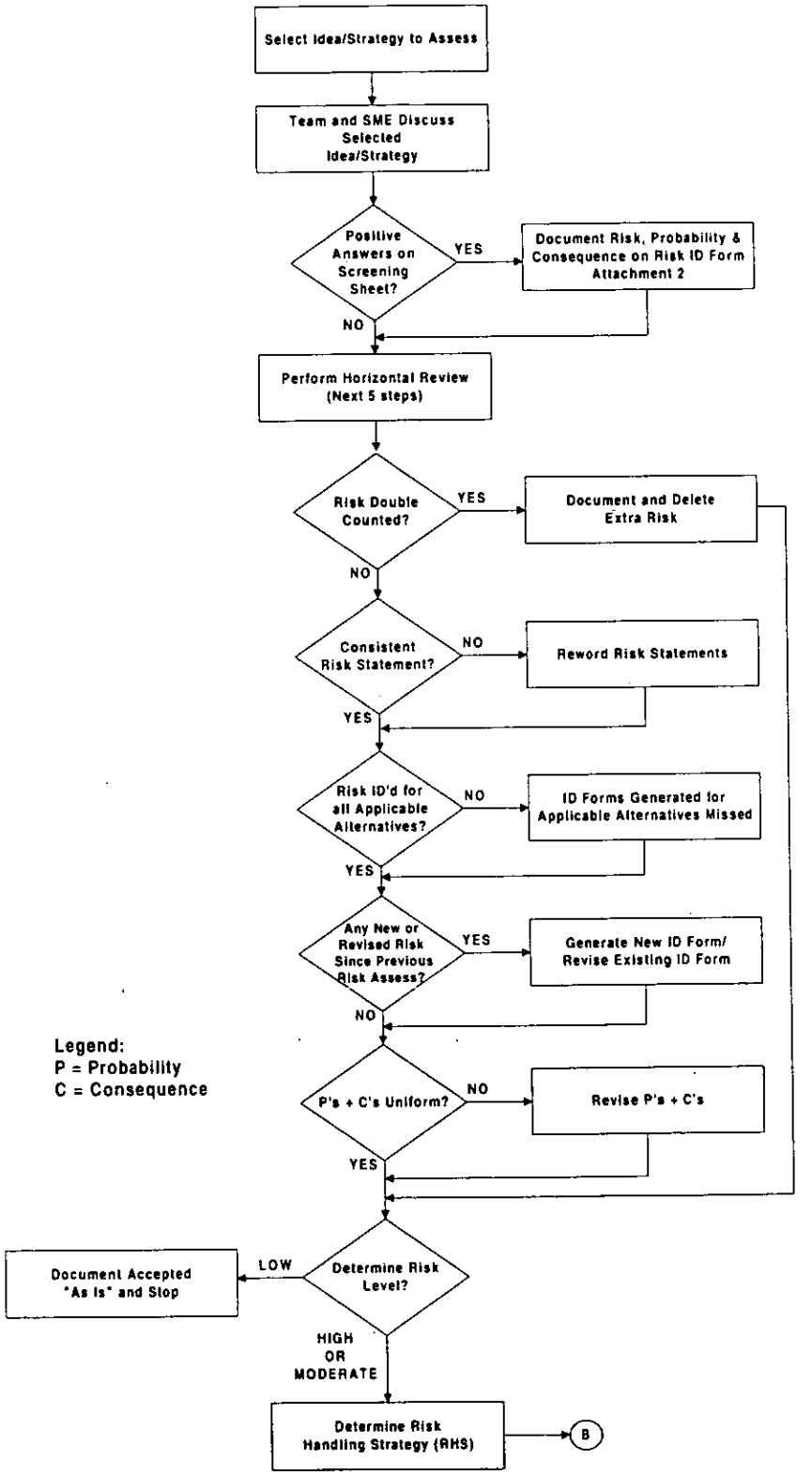


Figure 1. Determination of Risk and Risk Handling Strategies

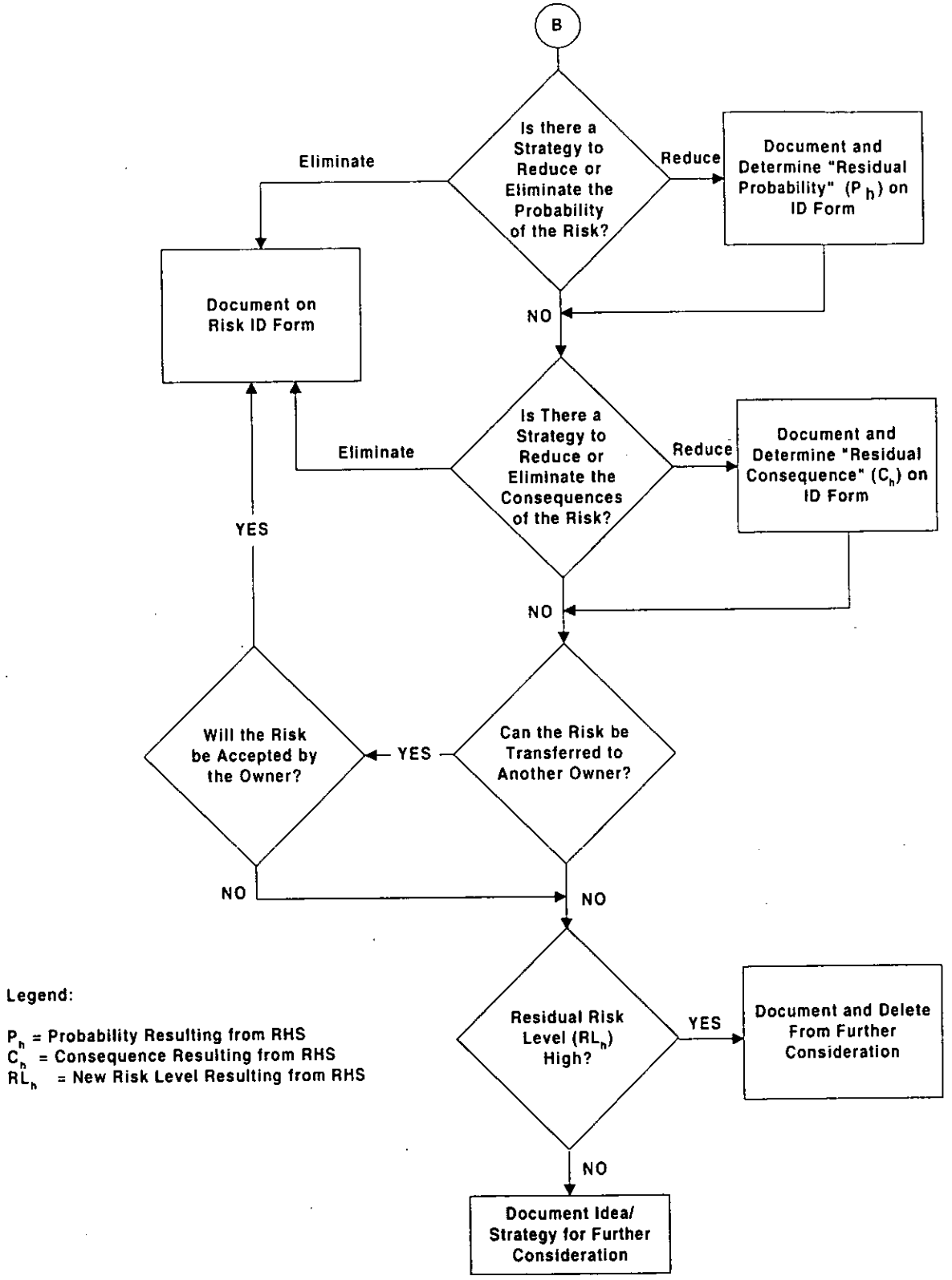


Figure 1. Determination of Risk and Risk Handling Strategies (cont.)

7.0 Records

Documented results produced as a result of implementing this desktop procedure will be included in the Team's Final report.

8.0 References

1. WSRC-IM-98-0033, "Systems Engineering Methodology Guidance Manual, Appendix B".
2. WSRC E7 Manual, "Conduct of Engineering and Technical Support".
3. WSRC E11 Manual, "Conduct of Project Management and Control".
4. DTP-001, Tank 18 Waste Removal Technology Team Desktop Procedure for the Development and Control of Desktop Procedures".

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # _____ Function _____

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?			
2. Unknown or unclear technology?			
3. New application of existing technology?			
4. Modernized/advanced technology in existing application?			
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?			
2. Multiple technical agencies an issue?			
3. Interfaces with operating SSCs during construction/installation present issues?			
4. Interfaces with operating SSCs including testing present issues?			
5. Involves co-occupancy issues?			
6. H&V/Negative pressure loss issues?			
7. Multiple Project/Facility interfaces cause issues?			
C. SAFETY			
1. Criticality potential?			
2. Significant exposure/contamination potential?			
3. Any significant impact or challenge to the Facility's Authorization Basis?			
4. Hazardous material issues?			
5. Process hazard potential?			
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?			
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?			
2. Additional releases?			
3. Undefined disposal methods?			
4. Requires substantial equipment D&R?			
5. Emergency transfers needed?			
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?			
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?			
2. Undefined, incomplete or unclear design criteria?			
3. Complex design features (e.g., controls, seismic, compatibility)?			
4. Difficult to perform functional test?			
5. Issues with the content, number or clarity of assumptions?			
6. Precludes portability of infrastructure?			
7. RAMI issues?			

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # _____ Function _____

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?			
2. Specialty resource requirements create concerns?			
3. Are existing utility locations a concern (above/below ground)?			
4. Are geological conditions a concern?			
5. Is weather a concern?			
6. Are critical lifts a concern?			
7. Is there insufficient experience with the O&M of the proposed system?			
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?			
2. Fast track critical needs issues?			
H. PROCUREMENT			
1. Long lead items that may affect critical path?			
2. Potential unavailable qualified vendors or contractors?			
3. Is the procurement strategy inadequate?			
4. Is it a first-use subcontractor/vendor that presents issues?			
5. Do vendor support issues exist?			
I. OTHER			
1. Contract issues?			
2. Direct hire/subcontract issues?			
3. Systems startup concerns?			

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number:_____ Date:_____ Idea/Strategy Number:_____

Idea/Strategy Title:_____

A. Statement of Risk *(What are we concerned about?)*

_____

_____

Basis for the risk: _____

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence:_____

_____

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*:_____

_____

D. Risk Level (RL): ◯ High ◯ Moderate ◯ Low

E. Risk Handling Strategy (RHS):

_____

_____

_____

Estimated Cost: _____ Estimated Schedule: _____

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): Basis:_____

◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

_____

New Consequence (C_h): Basis_____

◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

_____

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

Table I – Risk Probability Thresholds

Probability of Occurrence		Criteria
Qualitative	**Quantitative**	
Very Unlikely	≤ 0.1	Will not likely occur anytime in the life cycle of SRS facilities; or the estimated recurrence interval exceeds 10,000 years*; or the probability of occurrence is less than or equal to 10%.
Unlikely	> 0.1 but ≤ 0.4	Will not likely occur in the life cycle of the project or its facilities; or estimated recurrence interval exceeds 1000 years*; or the probability of occurrence is greater than 10% but less than or equal to 40%.
Likely	> 0.4 but < 0.8	Will likely occur sometime during the life cycle of the project or its facilities; or estimated recurrence interval is between 10 - 1000 years*; or the probability of occurrence is greater than 40% but less than 80%.
Very Likely	≥ 0.8	Will likely occur sometime during the life cycle of the project; or estimated recurrence interval is less than 10 years*; or the probability of occurrence is greater than or equal to 80%.

*Time intervals to be customized per needs specific to the modification being assessed.

Table II – Risk Consequence Thresholds

Consequence of Occurrence		Criteria
Qualitative	**Quantitative**	
Negligible	≤ 0.1	• Minimal or no consequences; unimportant. • Some potential transfer of money, but budget estimates not exceeded. • Negligible impact on program; slight potential for schedule change; compensated by available schedule float.
Marginal	0.2 to 0.4	• Small reduction in modification/project technical performance. • Moderate threat to facility mission, environment, or people; may require minor facility redesign or repair, minor environmental remediation, or first aid/minor medical intervention. • Cost estimates marginally exceed budget.* • Minor slip in schedule with some potential adjustment to milestones required.*
Significant	0.5 to 0.7	• Significant degradation in modification/project technical performance. • Significant threat to facility mission, environment, or people; requires some facility redesign or repair, significant environmental remediation, or causes injury requiring medical treatment. • Cost estimates significantly exceed budget.* • Significant slip in schedule with resulting milestones changes that may affect facility mission.*
Critical	0.8 to 0.9	• Technical goals of modification/project cannot be achieved. • Serious threat to facility mission, environment, or people; possibly completing only portions of the mission or requiring major facility redesign or rebuilding, extensive environmental remediation, or intensive medical care for life-threatening injury. • Cost estimates seriously exceed budget.* • Excessive schedule slip unacceptably affecting overall mission of facility/site/DOE objectives, etc..*
Crisis	> 0.9	• Modification/project cannot be completed. • Cost estimates unacceptably exceed budget.* • Catastrophic threat to facility mission, environment, or people; possibly causing loss of mission, long term environmental abandonment, and death.*

*Actual dollar values and schedule delays to be determined, per the needs/limitations of the modification being assessed.

Table III – Risk Level (RL) Determination Matrix

Probability of Risk Materializing	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	High	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very Unlikely	Low	Low	Low	Low	High

Severity of Consequence

DTP-005
Revision 0

SAVANNAH RIVER SITE

HIGH LEVEL WASTE
TANK 18 WASTE REMOVAL TECHNOLOGY TEAM

DESKTOP PROCEDURE

FOR THE

APPLICATION OF WEIGHTED EVALUATION CRITERIA

APPROVED:_____ DATE:_____
Neal Davis
Tank 18 Waste Removal Technology Team Leader

1.0 Purpose

This desktop procedure provides the methodology for the HLW Tank 18 Waste Removal Technology Team (Team) to apply weighted evaluation criteria to the waste removal (preparation/transfer) ideas which passed the screening procedure [1].

2.0 Scope

This procedure shall be used by the Team to rank the ideas based on a numerical score for use as input to subsequent Team decisions.

3.0 Definitions

Idea: A concept, if implemented, which would satisfy some or all of the Tank 18 Waste Removal System functions and/or requirements.

Ranking: The ordering of ideas (alternatives) based on the numerical scores (high to low) resulting from the application of weighted evaluation criteria.

Sensitivity Analysis: Determining if there are large changes in rankings based on small changes (±10%) in the evaluation criteria weights or UFV.

Stakeholders: Individuals or organizations potentially impacted by the recommended alternative(s).

Subject Matter Experts (SMEs): Individuals recognized by the Team as experts in a particular field(s).

Utility Function (UF): A statement describing a specific characteristic of an attribute.

Utility Function Value (UFV): The numerical value assigned to a specific UF. The most desirable UF is assigned a value of 100 and the least desirable is assigned a value of zero.

Weighted Evaluation Criteria: Key attributes (and their relative importance to each other) considered in the evaluation of ideas. Attributes have the following characteristics:

1. Independence from each other.
2. Address all necessary and sufficient functions and requirements.
3. Universally understood by evaluators.
4. Differentiate meaningfully among alternatives without bias.
5. Be quantifiable (e.g., analysis, subject matter expertise, Team judgement, etc.)

4.0 Responsibilities

The Team is responsible for review and approval of this desktop procedure. The Team approval of this desktop procedure shall be documented by the signature of the Team Leader in the approval block of the procedure.

The Team Leader is responsible for implementing this procedure.

The Team and identified Stakeholders and/or SMEs are responsible for performing the application of weighted evaluation criteria as defined in this procedure.

5.0 Discussion

The Team was formed to identify, evaluate, and select an integrated system (including technology) to remove and transfer HLW from Tank 18 to another HLW tank. The activities prescribed in this procedure use a systematic approach to facilitate the completion of the Team activities.

Application of the weighted evaluation criteria defined in this procedure will result in a ranking based on numerical scoring. This ranking will be used as input by the Team in subsequent alternative selection.

To provide consistency in understanding and application of the weighted evaluation criteria, Utility Functions (UF) are assigned to each evaluation criterion. This provides a basis for discussion and comparison of each idea versus the evaluation criteria.

A sensitivity analysis will be used to highlight changes in rankings based on small (e.g., $\leq \pm$ 10%) changes in weighted values of evaluation criteria or utility function values assigned.

6.0 Process

The overall process of ranking the Tank 18 waste removal (preparation and transfer) alternatives based on weighted evaluation criteria is depicted in Figure 1.

6.1 Define Evaluation Criteria

The evaluation criteria, associated definitions and basis selected by the Team will be documented.

The Team may elect to subdivide the evaluation criteria (which will be referred to as Level 1 criteria) into subcriteria (which will be referred to as Level 2 criteria) if further resolution is desired. If level 2 criteria are used, then at least two are required for the Level 1 criterion they represent.

Each Level 1 criterion will be identified by title (category), an identification number (1.0, 2.0, 3.0, etc.), a definition to facilitate the universal understanding of the criterion by the Team, and a stated basis for its selection. Each Level 2 criteria shall have the same type of information documented as that for Level 1 criteria. {Note: A Level 2 criterion identification number shall be traceable to its respective Level 1 criterion (1.1, 1.2, 1.3, etc).} See Attachment 1 for a typical method of documenting the required information.

6.2 Weighting of Evaluation Criteria

Once the evaluation criteria are defined, the Team will "weight" the criteria with respect to their relative importance to each other. The criterion judged to be most important will have the highest weight factor. The bases for the relative importance, i.e., weight, of the criteria shall be provided.

Level 1 and Level 2 criteria weight factors will be expressed as a decimal within a range of greater than zero to less than unity (>0.0 to <1.0). The *sum* of all weights for the Level 1 criteria shall equal 1.0. Level 2 criteria will also be comparison weighted, but only against the other Level 2 criteria within the same Level 1 criterion. Likewise, the *sum* of Level 2 criteria weights, within their assigned Level 1 criterion, shall equal 1.0.

6.3 Define Utility Functions and Values

Utility functions provide a means of quantifying aspects of the evaluation criteria for a more objective evaluation of the ideas or strategies to ensure a more consistent application.

Utility functions will only be developed and assigned at the lowest criterion level, i.e. if Level 2 criteria exist then utility functions are only defined for the Level 2 criterion and no utility functions

are defined for the parent Level 1 criterion. Figure 2 provides examples of assigned utility functions when only Level 1 criteria exist or when Level 2 criteria also exist.

Typically, three to five utility functions will be defined and assigned to an evaluation criterion. Utility functions define levels or scenarios of acceptability from "most desirable" to "least desirable" for the evaluation criterion to which they are assigned. The most desirable utility function will be assigned a value of 100 and the least desirable will be assigned a value of zero. The value of intermediate level utility functions are assigned numerical values greater than zero and less than 100 depending on the desirability of that specific utility function. Interpolation between stated utility function values (UFV) is permissible if it represents a more accurate evaluation.

Attachments 2 through 4 provide a typical method for recording utility functions and the associated values selected by the Team. Commercially available software programs, e.g. Logical Decisions® provide useable formats as well.

6.4 Evaluation of Alternatives

Each of the alternatives will be evaluated against each evaluation criterion (Level 1 or Level 2) and the respective utility functions. The utility function value which "best describes" the idea under consideration will be identified and recorded along with an explanatory note(s) to clarify the Team's decision. Inputs from risk assessments, SMEs, stakeholders, studies, etc., are useful at this step.

Attachments 2 through 4 also provide a typical method for recording the information generated in this step.

6.5 Consistency Check

After completion of the previous steps, a "vertical slice" assessment is conducted to compare the UFV assigned to each of the alternatives. Adjustments or changes shall be completed to ensure consistency in the assignment of UFVs between alternatives.

6.6 Weighted Scoring of Ideas

Weighted scoring of ideas is obtained by multiplying the evaluation criterion weights by the defined utility function values selected, and adding up the products to yield a total weighted score for each alternative. Higher scores represent better compliance with the evaluation criteria than lower scores. The formulae for computing weighted scores are listed on Attachments 2, 3 and 4.

A typical method for recording the idea being evaluated, the Level 1 or 2 evaluation criteria, weights, utility functions, values, and scores is shown in Attachments 2 through 4.

6.7 Sensitivity Analysis

A sensitivity analysis seeks to determine if small changes (±10%) in criteria weighting have a significant affect on the numerical scores calculated for each idea. Potential uncertainty and bias in assigning criteria weights can result based on the engineering judgements used to determine them.

If significant changes in idea ranking occur as a result of small changes in criteria weighting, then the criteria need to be re-evaluated/weighted to produce insensitive results.

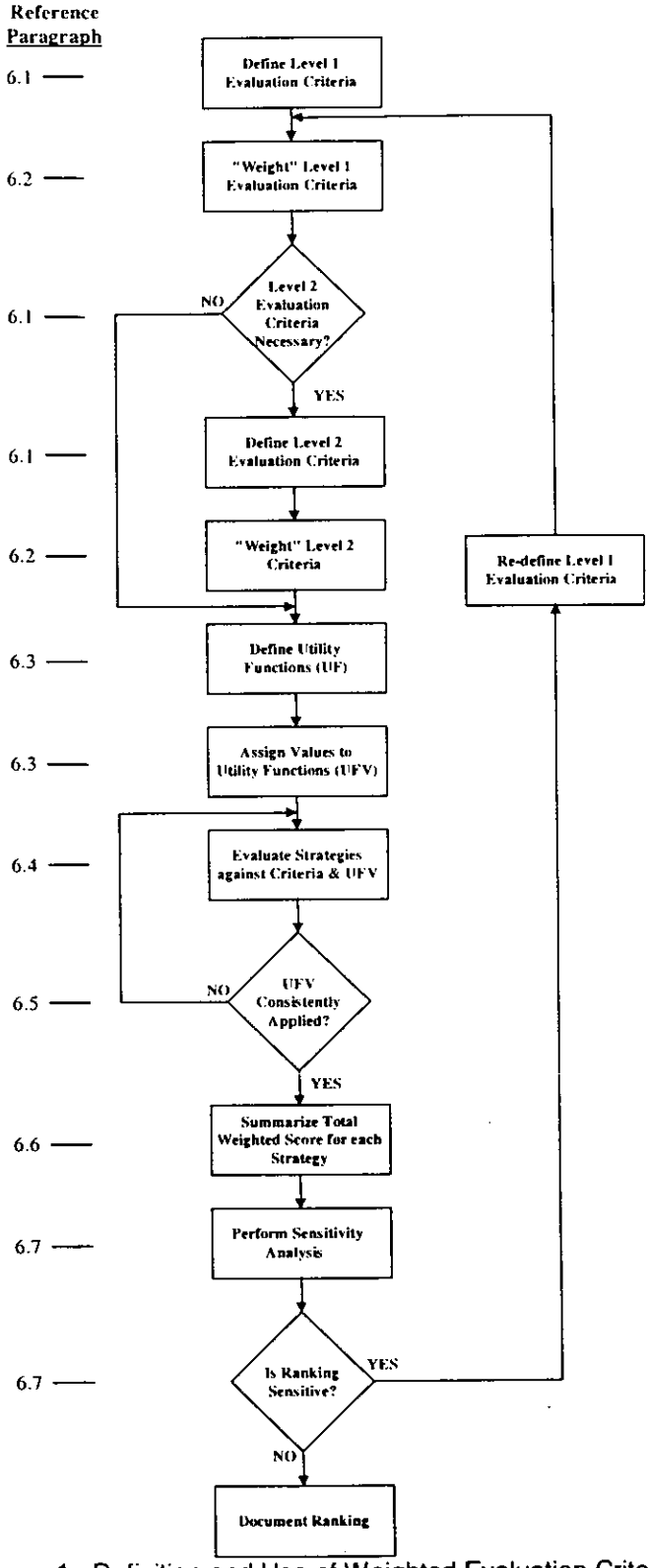


Figure 1: Definition and Use of Weighted Evaluation Criteria

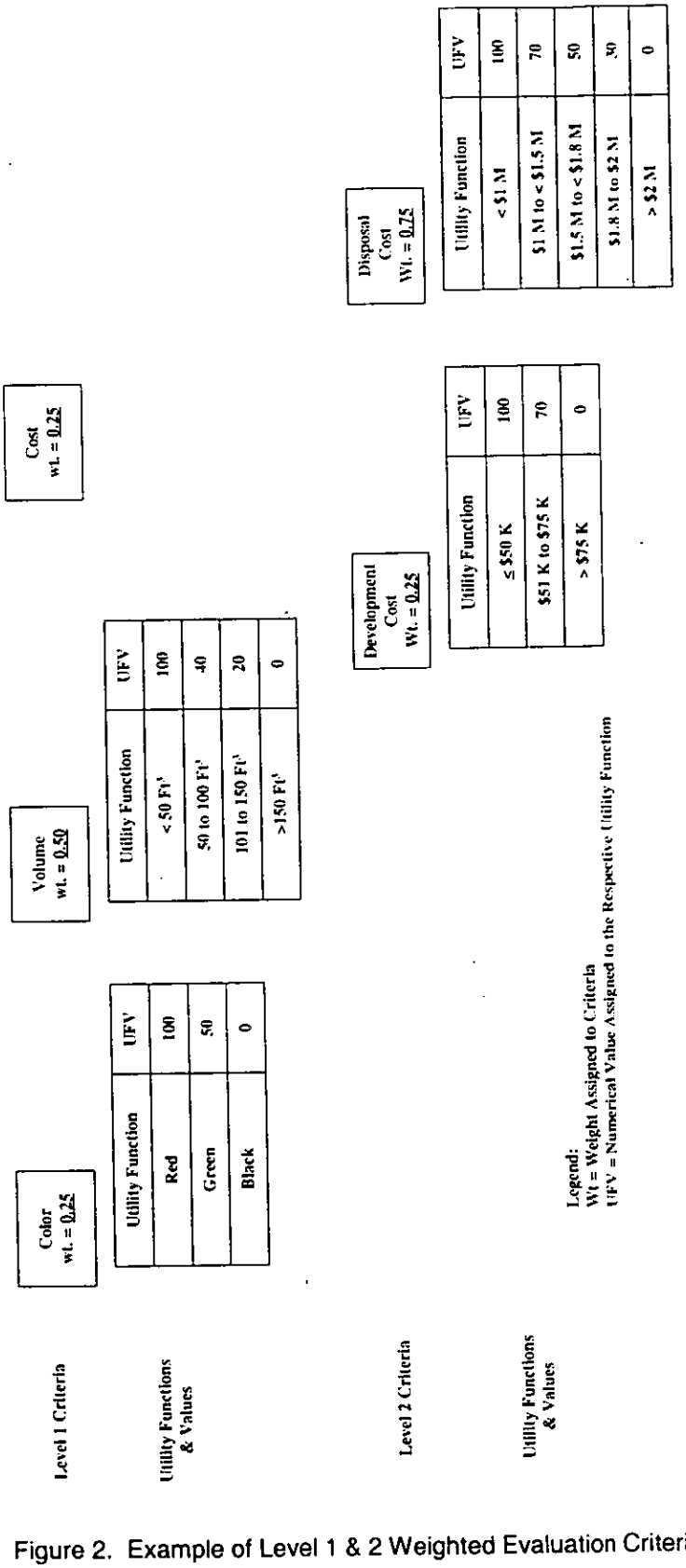


Figure 2. Example of Level 1 & 2 Weighted Evaluation Criteria and Associated Utility Functions and Values

7.0 Records

Documented results produced as a result of implementing this desktop procedure will be included in the Team's Final Report.

8.0 References

1. DTP-003, "Desktop Procedure for the Application Of Screening Criteria"

2. DTP-001, "Desktop Procedure For the Development, Approval And Control Of Desktop Procedures"

ATTACHMENT 1

HLW Tank 18 Waste Removal Technology Team Evaluation Criteria Definitions, Weights & Bases Identification Form

Level 1

Criterion Title: _____
Criterion Number: X.0
Criterion Definition: _____
_____
_____
Weight Assigned: 0.
Basis: _____

Level 2

Subcriterion Title: _____
Subcriterion Number: X.1
Subcriterion Definition: _____
_____
_____
Weight Assigned: 0.
Basis: _____

Level 2

Subcriterion Title: _____
Subcriterion Number: X.1
Subcriterion Definition: _____
_____
_____
Weight Assigned: 0.
Basis: _____

For additional Level 2 criterion, follow the same format as above.

Attachment 2
HLW Tank 18 Waste Removal Technology Team
Level 1 Evaluation Criteria Assessment Form

Strategy/Idea Number:_____ Strategy/Idea Title_____

Date:_____

A. Evaluation Criterion Title: _____

Evaluation Criterion Description: _____

B. Evaluation Criterion ID #: _____
(Note 1)

C. Evaluation Criterion Weighted Value: $W_1 =$ **0.00**

D. Utility Functions:

Utility Function (UF) Value (V_1) = Σ Level 2 Criterion Weighted Score (WS)

(Note 2)

E. UF Value Formula: $V_1 =$ _____
(Note 3)

F. Evaluation Criterion weighted score for the Alternative: $W_1 \times V_1$ = **Weighted Score** ∴ 0.00 × 0 = 00.0

Explanatory Notes for Weighted Score: _____

Notes:

1. *For Level 1 Evaluation Criterion, the ID# is described by X.0, where X = 1, 2, 3,etc. For Level 2 Evaluation Criterion, the ID# is described by X.1, X.2, X.3, etc. where 'X' is the Level 1 Evaluation Criterion ID#.*

2. *Utility Function values range from 0 (least desirable) to 100 (most desirable).*

3. *If Level 2 Criterion are used, the sum of the Level 2 "Weighted Scores" must be multiplied by the Level 1 Weight to determine the Level 1 Weighted Score.*

Attachment 3
HLW Tank 18 Waste Removal Technology Team
Level 1 Evaluation Criteria Assessment Form

Strategy/Idea Number:_____ Strategy/Item Title_____

Date:_____

A. Evaluation Criterion Title: _____

Evaluation Criterion Description: _____

B. Evaluation Criterion ID #: (Note 1) _____

C. Evaluation Criterion Weighted Value: $W_1 =$ 0.00

E. Utility Functions:

Utility Function (UF) Description:	UF Value (Note 2)
UF.1	0.0
UF.2	0.0
UF.3	0.0
UF.4	0.0
UF.5	0.0

E. UF Value: $V_1 =$ 0

Explanatory Notes for UF Selected: _____

F. Evaluation Criterion weighted score (WS) for the Alternative: $W_1 \times V_1 = WS \therefore$ 0.00 × 0 = 00.0

Notes:

1. *For Level 1 Evaluation Criterion, the ID# is described by X.0, where X = 1, 2, 3,etc. For Level 2 Evaluation Criterion, the ID# is described by X.1, X.2, X.3, etc. where 'X' is the Level 1 Evaluation Criterion ID#.*
2. *Utility Function values range from 0 (least desirable) to 100 (most desirable).*
3. *If Level 2 Criterion are used, the sum of the Level 2 "Weighted Scores" must be multiplied by the Level 1 Weight to determine the Level 1 Weighted Score*

Attachment 4
HLW Tank 18 Waste Removal Technology Team
Level 2 Evaluation Criteria Assessment Form

Strategy/Idea Number:____ Strategy/Idea Title_____

Date:_____

A. Evaluation Criterion Title: _____

Evaluation Criterion Description: _____

B. Evaluation Criterion ID #: (Note 1) _____

C. Evaluation Criterion Weighted Value: $W_2 =$ 0.00

F. Utility Functions:

Utility Function (UF) Description:	UF Value (Note 2)
UF.1	0.0
UF.2	0.0
UF.3	0.0
UF.4	0.0
UF.5	0.0

E. UF Value: $V_2 =$ 0

Explanatory Notes for UF Selected: _____

F. Evaluation Criterion weighted score (WS) for the Alternative: $W_2 \times V_2 = WS \therefore$ 0.00 × 0 = 00.0

Notes:

1. *For Level 1 Evaluation Criterion, the ID# is described by X.0, where X = 1, 2, 3,etc. For Level 2 Evaluation Criterion, the ID# is described by X.1, X.2, X.3, etc. where 'X' is the Level 1 Evaluation Criterion ID#.*

2. *Utility Function values range from 0 (least desirable) to 100 (most desirable).*

3. *If Level 2 Criterion are used, the sum of the Level 2 "Weighted Scores" must be multiplied by the Level 1 Weight to determine the Level 1 Weighted Score.*

DTP-006
Revision 0

SAVANNAH RIVER SITE

HIGH LEVEL WASTE

TANK 18 WASTE REMOVAL TECHNOLOGY TEAM

DESKTOP PROCEDURE

FOR THE

TANK 18 WASTE REMOVAL STRATEGY SELECTION PROCESS

APPROVED:_____ DATE:_____
Neil Davis
Tank 18 Waste Removal Technology Team Leader

1.0 Purpose

This desktop procedure provides the methodology for the HLW Tank 18 Waste Removal Technology Team (Team) to select a recommended Waste Removal (preparation/transfer) Strategy from the list of submitted ideas.

2.0 Scope

This procedure shall be used by the Team to select the recommended strategy based on stakeholder and SME input, advantages, disadvantages, risks, weighted evaluation criteria, and modeling (as needed). Team judgement and expertise will be used to make the final selection.

3.0 Definitions

Idea:	A concept which , if implemented, would satisfy some or all of the Tank 18 Waste Removal System functions and/or requirements.
Ranking:	The ordering of ideas and/or strategies based on the numerical scores (high to low) resulting from the application of weighted evaluation criteria
Risk:	An issue that may cause an uncertainty.
Risk Level:	The significance of the identified risk based on probability and consequence considerations.
Short List:	The list of the final (~5) Strategies to be evaluated by the Team from which the recommended Strategy will be selected.
Stakeholders:	Individuals or organizations potentially impacted by the recommended strategy(s).
Strategy:	An idea or combination of ideas that will satisfy the functions and requirements of the Tank 18 Waste Removal Program.
Subject Matter Expert (SMEs):	Individuals recognized by the Team as experts in a particular field(s).
Weighted Evaluation Criteria:	Key attributes (and their relative importance to each other) considered in the evaluation of ideas. Attributes have the following characteristics:

1. Independence from each other.
2. Address all necessary and sufficient functions and requirements.
3. Universally understood by evaluators.
4. Differentiate meaningfully among alternatives without bias.
5. Be quantifiable (e.g., analysis, subject matter expertise, Team judgement)

Waste Removal: The preparation and transfer of high level waste (e.g., sludge, salt, supernate, zeolite) from a waste tank to another waste tank. Waste removal may consist of "bulk waste removal" and "heel removal".

4.0 Responsibilities

The Team is responsible for review and approval of this desktop procedure. The Team approval of this desktop procedure shall be documented by the signature of the Team Leader in the approval block of the procedure.

The Team Leader is responsible for the implementing this procedure.

The Team is responsible for performing the selection of a recommended HLW Tank 18 Waste Removal Strategy.

5.0 Discussion

The Team was formed to identify, evaluate, and select an integrated system (including technology) to remove and transfer HLW from Tank 18 to another HLW tank. The activities prescribed in this procedure use a systematic approach to facilitate the completion of the Team activities.

Ideas were solicited for each of the four major functions to be performed, i.e., *bulk waste preparation, bulk waste transfer, heel preparation, and heel transfer.* Approximately 150 ideas were submitted to, or identified by, the Team for possible use in waste/heel preparation and/or transfer. These ideas were screened and further developed for clarity and understanding by the Team.

Application of the selection process defined in this procedure will result in the recommendation of an overall strategy for Tank 18 waste removal which is manageable, technically achievable, and implementable.

6.0 Process

The overall process of selecting the Tank 18 waste removal strategy is depicted in Figure 1. Due to the large number (~150) ideas submitted, the Team has defined a "down selection

6.1 Preliminary Screening Criteria

Each individual idea or strategy will be evaluated against the "five point" screening criteria[1]. Those which pass are carried forward for further consideration. Those that fail are identified in the Final Report.

6.2 Idea Ranking

The individual ideas will be scored against Weighted Evaluation Criteria[3] and ranked numerically. This will provide the Team some insight as to the overall value of each idea when compared to the evaluation criteria.

6.3 Strategy Development

The higher scoring ideas in each of the four functional areas (*bulk waste preparation, bulk waste transfer, heel preparation, heel transfer*) shall be reviewed and combined, as appropriate, by the Team (and SMEs as needed) into unique strategies to satisfy the waste removal from Tank 18. Lower scoring ideas may also be incorporated into the strategies if, in the Team's judgement, there is value added in doing so, e.g., synergy effects.

6.4 Risk Analysis

The Team shall determine if any strategies have high risks for which no reasonable risk handling strategy can be identified. Strategies falling into this category shall be eliminated from further consideration and identified in the Final Report. The remaining strategies are carried forward for further consideration.

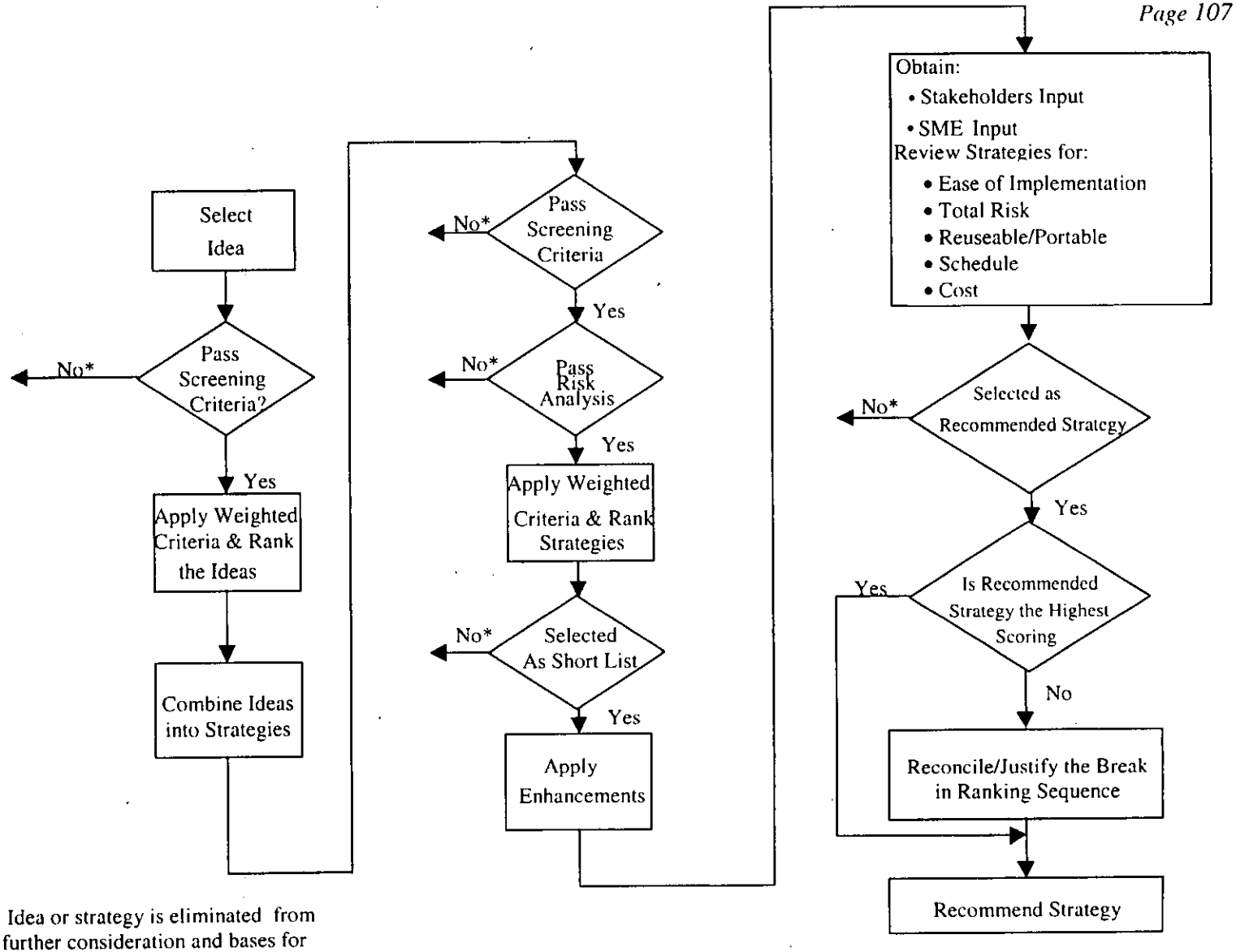
6.5 Strategy Ranking

The result of combining ideas into a strategy may affect how well the composite strategy meets the weighted criteria. As such, the strategies will be scored against the Weighted Evaluation Criteria [3] and ranked numerically. This will provide the Team some insight as to the overall value of each strategy when compared to the evaluation criteria. The Team will select a *Short List* of the most viable strategies for further consideration in the downselect process.

6.6 Strategy Selection

The Team will review the information developed on the *Short List* with Subject Matter Experts and Stakeholders, as necessary, and begin a detailed comparison and selection of the preferred strategy. Enhancements of strategies will also be considered at this time. The relative importance of factors considered, by the Team, to make its selection, shall be consistent with predecessor activities. Additional factors (e.g., schedule, costs, total risk level, ease of implementation, portability, integration) should be considered if not done so previously. The Team's proposed recommended Strategy will be compared to the

numerical rank within the *Short List*. If the proposed recommended Strategy is inconsistent with the ranking then a justification or reconciliation is required.



*No: Idea or strategy is eliminated from further consideration and bases for elimination are included in the Final Report.

FIGURE 1. TANK 18 WASTE REMOVAL (PREPARATION AND TRANSFER) STRATEGY DOWN SELECTION PROCESS

7.0 References

1. DTP-003, "Desktop Procedure for the Application of Screening Criteria"

2. DTP-004, "Desktop Procedure for the Risk Analysis"

3. DTP-005, "Desktop Procedure for the Application of Weighted Evaluation Criteria"

4. DTP-001, "Desktop Procedure for the Development, Approval and Control of Desktop Procedures"

ATTACHMENT 3

IDENTIFICATION OF IDEAS BRIEFING PACKAGE

SAVANNAH RIVER SITE

HIGH LEVEL WASTE

TANK 18 WASTE REMOVAL TECHNOLOGY

Identification of Ideas Briefing Package

Approved:

Neil Davis: HLW Tank 18 Waste Removal Technology Team Leader

Introduction

The Waste Removal Project, S-W183, is required to provide equipment and facilities necessary for the removal of radioactive salt and sludge waste from existing storage tanks in the F-Area and H-Area Tank Farms. The Tank 18 Waste Removal Technology Team has been formed with the charter to identify and select a preferred alternative for removing approximately 75,000 gallons of sludge from the tank. The term "removal" as defined by the Team includes both preparation and transfer of waste.

The Team has put this briefing package together to facilitate the solicitation of ideas and/or concepts which will be reviewed for viability and future consideration.

The contents of this package include:

1. A Problem Definition Statement
2. The Mission Need Statement
3. The top level functions and associated requirements which must be satisfied by any proposed idea
4. A simplified Tank 18 system boundary model
5. References used by the Team
6. Definitions

An idea description form (Pro-Forma) and instructions for completing

These items are intended to provide only general guidance to prospective participants who wish to submit ideas on the Pro-Forma description form. Anyone needing more detailed information should contact a member of the Tank 18 Waste Removal Technology Team.

Problem Statement

It is not known if the Tank 18 baseline waste removal method and system will perform as required.

Basis:

- Three standard 150 hp slurry pumps mounted in the three available risers were used to remove sludge from Tank 18 in the mid-1980's. The pumps were irregularly spaced in the east, west and northwest risers. An estimated 42,000 gallons of sludge remained after a prolonged sludge removal campaign. The pumps were unable to develop the required effective cleaning radius (ECR) in this orientation. The suspended sludge settled in the quiescent zones in the tank. The Tank 19 heel removal demonstration will add an estimated 33,000 gallons of sludge to Tank 18 in FY01.
- The baseline calls for refurbishing three standard slurry pumps and installing them in the same risers. This baseline was chosen as a financial "placeholder" in full recognition that it is not a viable means to remove the remaining sludge.
- Cognizant engineers associated with the waste removal project assumed that a standard slurry pump with a single discharge could be used to increase the ECR. This pump was tested at TNX and demonstrated to have a 40' ECR. The required ECR is 57' to reach the most remote part of the tank.
- Alternate sludge mobilization technologies (Flygt mixers) were demonstrated in Tanks 17 and 20 with marginal success on small volumes of sludge. Improved versions of these mixers will be deployed in Tank 19 during 9/00; however, much more development is required to remove the estimated 75,000 gallons that will be in Tank 18.

IMPACTS:

Tank 18 must be closed by March 2004. Failure to do so will result in a violation of the Federal Facilities Agreement. SCDHEC could levy fines and penalties.

Mission Need

Move HLW from Tank 18 to another HLW Tank.

HLW TANK 18
WASTE REMOVAL TECHNOLOGY

MISSION FUNCTION LEVEL 1

F-1: Move HLW from Tank 18 to another HLW Tank

MISSION REQUIREMENTS LEVEL 1

R-1-1: Shall meet the requirements of Site Standards.

R-1-2: Shall meet the requirements of the General Tank Closure Plan such as Performance Assessments, Residual Amounts, etc.

R-1-3: Shall meet the requirements of the FPR Rev. 0.

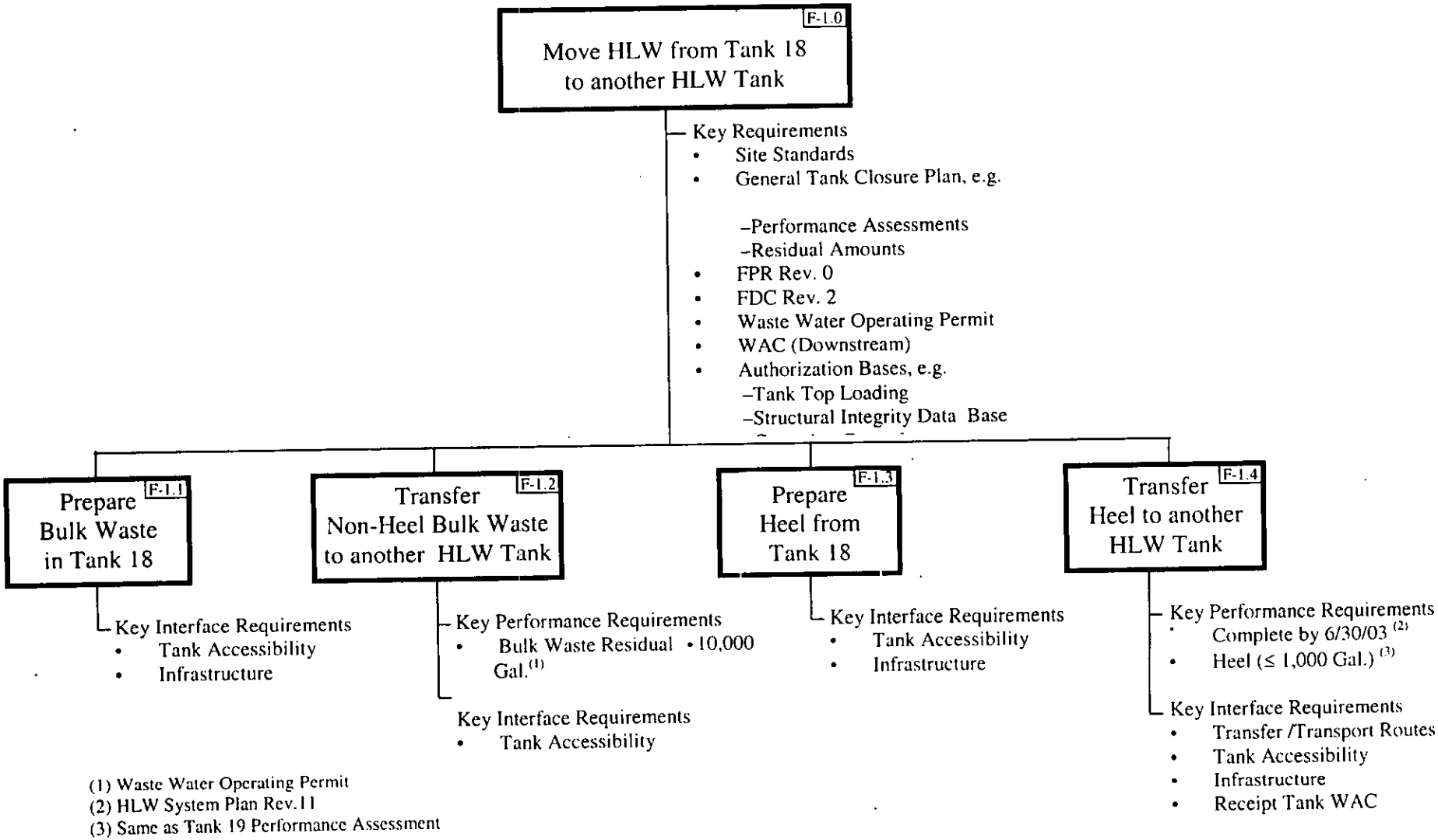
R-1-4: Shall meet the requirements of the FDC Rev. 2.

R-1-5: Shall meet the requirements of the Waste Water Operating Permit.

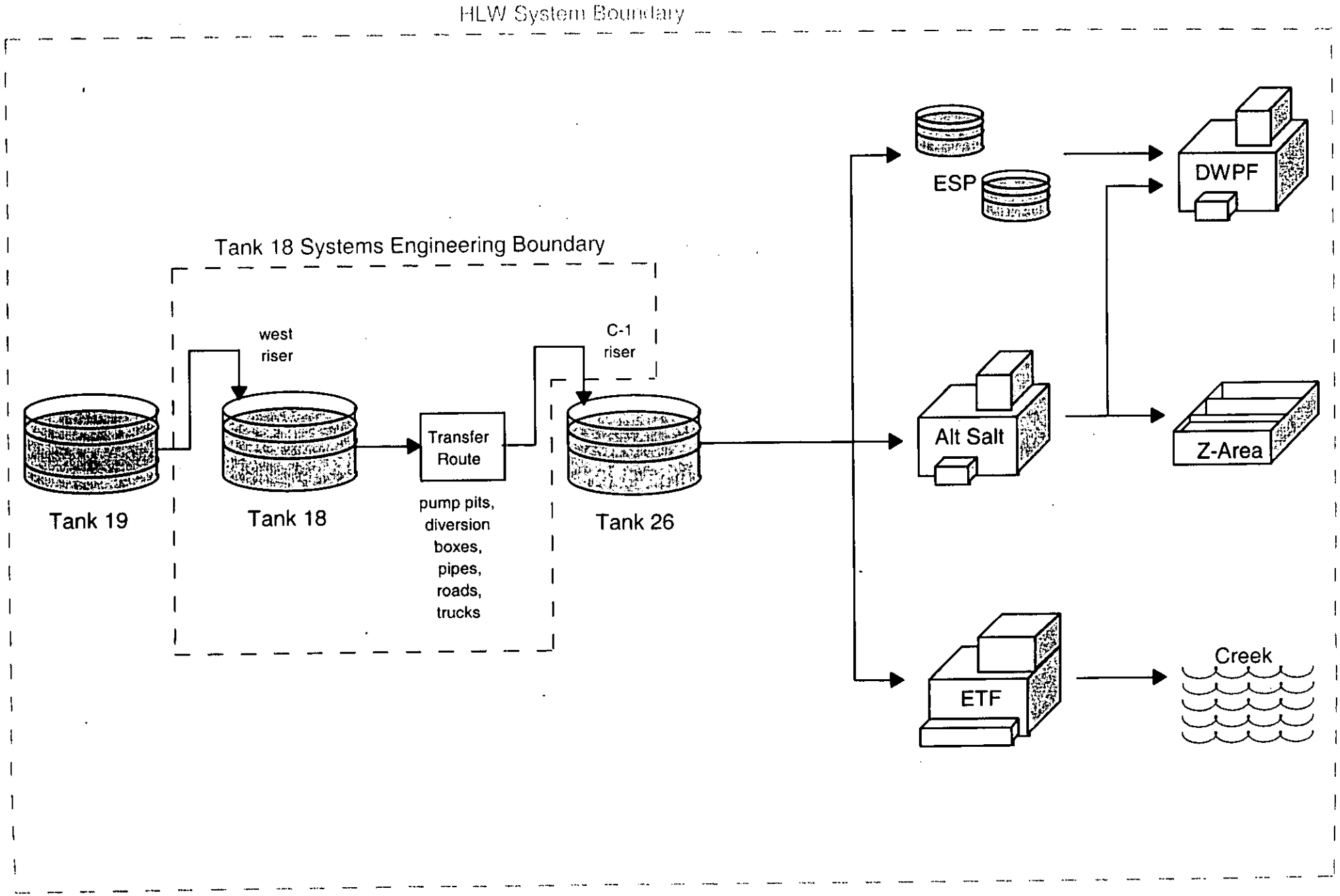
R-1-6: Shall meet the requirements of the Waste Acceptance Criteria (Downstream).

R-1-7: Shall meet the requirements of the Authorization Bases such as Tank Top Loading, Structural Integrity Data Base, Corrosion Control, etc.

HLW TANK 18 TECHNOLOGY WASTE REMOVAL SYSTEM



(1) Waste Water Operating Permit
(2) HLW System Plan Rev.11
(3) Same as Tank 19 Performance Assessment


HLW System Boundary
Tank 18 Systems Engineering Boundary
west riser
C-1 riser
Tank 19
Tank 18
Transfer Route
pump pits, diversion boxes, pipes, roads, trucks
Tank 26
ESP
DWPF
Alt Salt
Z-Area
ETF
Creek

REFERENCES

A. **Project Technical Baseline Documents**

B-1 G-FPR-G-00019, Rev. 0

G-FDC-G-00029, Rev. 2, and amendments

G-TRT-G-00006, "Interim Functional Classification of SSCs for Liquid Radioactive Facilities".

B. **Project Cost Baseline**

B-1. F&H Area Tank Farm Reconfiguration, Project # - S-183, Tank # 18 Reconfigured, 4/14/2000.

C. Project Schedule Baseline

C-1. HLW-2000-00019, Rev. 11, SRS HLW System Plan

D. **Authorization Basis**

D-1. WSRC-SA-33, "LRWHF Safety Analysis Report"

D-2. WSRC-TS-96-14, "Technical Safety Requirements for F-Area Tank Farm".

D-3. WSRC-TR-99-00205, "CST/WPT Facilities Justification for Continued Operation".

D-4. G-TRT-G-00003, "TSR Administrative Control Compliance Requirements".

E. **Regulatory Requirements**

E-1. Industrial Wastewater Closure Plan for F- and H-Area High-Level Waste Tank Systems, July 10, 1996

E-2. Federal Facility Agreement for the Savannah River Site, August 16, 1993

F. **Lessons Learned**

F-1. Savannah River Site – High Level Waste Tank Closure Lessons Learned, April 29-30, 1998, Atlanta, Georgia

F-2. Waste Removal Lessons Learned, N. Davis, February 3, 2000

F-3. Tank 8 Lessons Learned, draft

F-4 Hanford Tank 101-AZ Mixer Pump Lessons Learned, draft

F-5 Tank 19 Lessons Learned, draft

Definitions

Validation – provides the opportunity for stakeholder input and feedback at key points during the execution of the Systems Engineering Evaluation process.

Waste Removal – the preparation and removal of high level waste (e.g., sludge, salt, supernate, zeolite) from a waste tank to another location. Waste removal may consist of "bulk waste removal" and "heel removal".

Bulk Waste Removal – is defined as removing the first 99% of the original volume of waste which typically means leaving no more than 10,000 gallons of waste in the tank at the completion of bulk waste removal. This operation is typically done with slurry pumps.

Heel Removal – the purpose of heel removal is to remove as much of the remaining waste as required to enable the tank to pass a Performance Assessment indicating that the tank is ready to close. Preliminary calculations indicate that Tank 18 must have no more that 1,000 gallons of sludge remaining at the time of closure. Heel removal on Tanks 16, 17, and 20 employed several different techniques in addition to slurry pumps.

Decision-Makers – the HLW Program Board consisting of the Level 1 and 2 Managers in the HLW Division and matrixed support managers.

Baseline Technology – the waste removal technology for Tank 18 identified in project documentation (e.g., Functional Performance Requirements, Functional Design Criteria) which includes 3 standard slurry pumps and 1 telescoping transfer pump.

Stakeholders – Individuals or organizations potentially impacted by the recommended alternative(s).

Subject Matter Experts – SMEs are individuals recognized by the Team as experts in a particular field(s).

Idea – A concept, which if implemented would satisfy some or all of the Tank 18 Waste Removal system functions and/or requirements.

Attachment 1
HLW Tank 18 Waste Removal System
Pro-Forma Form

Idea #:_____ **Sponsor:**_____ **Date:**_____

Originator:_____ **Phone #:**_____

Title: _____

Description: _____

Technical Maturity: _____

Safety Issues: _____

Advantages: _____

Disadvantages: _____

Attachment 1 (cont'd)

Explanatory Notes for "Idea Pro-Forma"

Idea – To be inserted by the Team, or designee.

Sponsor - the originator, a suitable "champion" or a Team member.

Date - Date submitted.

Originator - name and phone number needed for follow-up purposes.

Title - should capture the key unit operations of the proposed idea.

Description - should be a single paragraph technical description of the steps involved in the proposed idea, clearly identifying where use is made of existing HLW processes/facilities or other process/facilities at the SRS.

Technical Maturity - a key criterion for screening ideas. Define the current development status of the process, (e.g., theoretical idea, chemistry proven in lab, fully commercialized for non-nuclear applications, full nuclear operation).

Safety Issues - a key criterion for screening ideas. What significant safety issues would have to be tackled on the proposed idea (e.g., hazardous chemicals, risk of explosion, high temp, pressure, etc.)?

Advantages and Disadvantages - apart from safety and technical maturity, what are the other principal advantages and disadvantages of the proposed idea, e.g., simplicity, cost, operability, use of existing facilities, etc., as compared to the baseline technology.

Process Diagram (Optional) - If you can, sketch the principal steps of the process, showing interaction with existing facilities, on the back of the sheet.

Completed Forms - Returned to Jim Menghi, either by E-mail or hard copy to 241-109F, or FAX 2-3780. Otherwise, return to another member of the Team: Gary Abell, Tommy Caldwell, Neil Davis, Nader Elraheb, Ed (Max) Howard, Bob Leishear, John McCullough, or Dave Stefanko.

ATTACHMENT 4

RESULTS OF THE IDEA SCREENING

Tank 18 Waste Removal Systems Eng Evaluation
(Table I: Acceptable Ideas)

	Idea No	Function	Idea Description	Category	Proforma Submitted	Screening Complete	Passed Screen	Comments
1	A1	F-1.1	Slurry pumps with quad volutes	Mixing Pump:Slurry	Yes	Yes	Y	
2	A2	F-1.1	Single discharge slurry pumps with submersible mixer (possibly with crawler/robotics)	Mixing Pump-Slurry	Yes	Yes	Y	
3	A3	F-1.1	Mini quad volute slurry pumps	Mixing Pump-Slurry	Yes	Yes	Y	
4	A4	F-1.1	Advanced Design Mixer Pump (ADMP)	Mixing Pump-ADMP	Yes	Yes	Y	Passes w/below grade line
5	A6	F-1.1	Water monitor sluicers	Sluicer	Yes	Yes	Y	
6	A8	F-1.1	Crawler with plow to push material around	Robotics	Yes	Yes	Y	
7	A10	F-1.1	Water cannon	Sluicer	Yes	Yes	Y	
8	A12	F-1.1	Submersible pump rigged to be movable (articulated)/(AZ-101)	Mixing Pump-Other	Yes	Yes	Y	
9	A14	F-1.1	Washing machine agitation method	Agitator	Yes	Yes	Y	
10	A15	F-1.1	Paddle agitator in center riser	Agitator	Yes	Yes	Y	
11	A16	F-1.1	Paddle agitator in center riser	Agitator	Yes	Yes	Y	
12	A18	F-1.1	Scraper deployed through outside of tank (like a squeegee)	Robotics	Yes	Yes	Y	
13	A19	F-1.1	Advanced Design Mixer Pump (ADMP) in center riser with portable control room and MCC	Mixing Pump-ADMP	Yes	Yes	Y	
14	A22	F-1.1	Dredge like in the ocean	Miscellaneous	Yes	Yes	Y	
15	A26	F-1.1	Dewater with lagoon cleaner	Robotics	Yes	Yes	Y	
16	A28	F-1.1	Partition tank and move sludge with crawler/plow	Robotics	Yes	Yes	Y	
17	A32	F-1.1	Bore hole miner	Sluicer	Yes	Yes	Y	
18	A33	F-1.1	Air sparging	Agitator	Yes	Yes	Y	
19	A34	F-1.1	Sewer sucker	Robotics	Yes	Yes	Y	Passes if collection tank is internal to Tk 18
20	A35	F-1.1	Modular jet mixing pump	Mixing Pump-Other	Yes	Yes	Y	
21	A36	F-1.1	Pulse tube mixer	Agitator	Yes	Yes	Y	
22	A37	F-1.1	Ultrasonic	Miscellaneous	Yes	Yes	Y	
23	A39	F-1.1	Confined sluicing	Sluicer	Yes	Yes	Y	
24	A41	F-1.1	Two modified Advanced Design Mixer Pumps (ADMP's)	Mixing Pump-ADMP	Yes	Yes	Y	
25	A42	F-1.1	One Advanced Design Mixer Pump (ADPM) in center riser	Mixing Pump-ADMP	Yes	Yes	Y	
26	A43	F-1.1	ARD service contract	Robotics	Yes	Yes	Y	
27	A44	F-1.1	Houdini with CSEE	Robotics	Yes	Yes	Y	
28	A45	F-1.1	EMMA	Robotics	Yes	Yes	Y	
29	A46	F-1.1	101-SY modified slurry pump	Mixing Pump-Slurry	Yes	Yes	Y	
30	A47	F-1.1	Submersible pump rigged to be movable (articulated)/(AZ-101)	Mixing Pump-Other	Yes	Yes	Y	
31	A49	F-1.1	SRS crawler with water monitor	Robotics	Yes	Yes	Y	
32	A50	F-1.1	SRS crawler with suction pump	Robotics	Yes	Yes	Y	
33	A51	F-1.1	Flygt mixers	Agitator	Yes	Yes	Y	
34	A52	F-1.1	Vertical Flygt mixers (150HP)	Agitator	Yes	Yes	Y	

Tank 18 Waste Removal Systems Eng Evaluation
(Table I: Acceptable Ideas)

35	A53	F-1.1	Modify existing slurry pumps	Mixing Pump-Slurry	Yes	Yes	Y	
36	A54'	F-1.1	Pulse tube mixers	Agitator	Yes	Yes	Y	
37	A55	F-1.1	22" quad volute slurry pumps	Mixing Pump-Slurry	Yes	Yes	Y	
38	A56	F-1.1	Single discharge slurry pumps with submersible mixer (possibly with crawler/robotics)	Mixing Pump-Slurry	Yes	Yes	Y	
39	A57	F-1.1	Flygt mixer in racetrack with vertical Flygt mixer in center	Agitator	Yes	Yes	Y	
40	A60	F-1.1	ARD service contract	Robotics	Yes	Yes	Y	
41	A61	F-1.1	Advanced Design Mixer Pump (ADMP) in center riser with portable control room and MCC	Mixing Pump-ADMP	Yes	Yes	Y	
42	A63	F-1.1	Modular jet mixing pump	Mixing Pump-Other	Yes	Yes	Y	
43	A64	F-1.1	Short shaft (12" or less) slurry pump	Mixing Pump-Slurry	Yes	Yes	Y	
44	A65	F-1.1	Hydraulic pump	Mixing Pump-Other	Yes	Yes	Y	
45	A66	F-1.1	Robotic arm with attached pumping mechanism (fixed suction-rotating nozzle)	Robotics	Yes	Yes	Y	
46	A67	F-1.1	Sluicing	Sluicer	Yes	Yes	Y	
47	A68	F-1.1	Sluicing with recirc	Sluicer	Yes	Yes	Y	
48	A69	F-1.1	Steam driven venturi mixer	Miscellaneous	Yes	Yes	Y	
49	A70	F-1.1	Additional standard slurry pump risers	Mixing Pump-Slurry	Yes	Yes	Y	
50	A72	F-1.1	Advanced Design Mixer Pump (ADMP) with two slurry pumps	Mixing Pump-ADMP	Yes	Yes	Y	
51	A73	F-1.1	Slurry pumps with TTP	Mixing Pump-Slurry	Yes	Yes	Y	Project Baseline
52	A74	F-1.1	Arm with suction	Robotics	Yes	Yes	Y	
53	B1	F-1.2	Refurbish/replace TTP	TTP	Yes	Yes	Y	
54	B2	F-1.2	Tie NE riser as you transfer out of East riser	Transfer Route	Yes	Yes	Y	
55	B3	F-1.2	Tank in tank with second pump	Subm Pump	Yes	Yes	Y	
56	B4	F-1.2	Overland express (above ground transfer line)	Transfer Route	Yes	Yes	Y	
57	B5	F-1.2	Through FDB-1	Transfer Route	Yes	Yes	Y	
58	B6	F-1.2	Pull top part of TTP off and use it's transfer line as the tank in tank transfer line	Transfer Route	Yes	Yes	Y	
59	B7	F-1.2	Tank to CTS	Transfer Route	Yes	Yes	Y	
60	B8	F-1.2	BIBO pump on mast	Subm Pump	Yes	Yes	Y	
61	B9	F-1.2	BIBO pump on floor	Subm Pump	Yes	Yes	Y	
62	B10	F-1.2	Modify TP with motor at bottom (subm pump)	TTP	Yes	Yes	Y	
63	B11	F-1.2	Air driven submersible pump (Wilden)	Subm Pump	Yes	Yes	Y	
64	B12	F-1.2	Raise tank level to max and dredge/recirc to destination tank	Miscellaneous	Yes	Yes	Y	
65	B13	F-1.2	Use evaporator feed pump and go through 1F cell	Transfer Route	Yes	Yes	Y	
66	B14	F-1.2	Make pit bull pump mobile	Subm Pump	Yes	Yes	Y	
67	B15	F-1.2	Truck with hoses	Transfer Route	Yes	Yes	Y	
68	B16	F-1.2	Diode pump	Subm Pump	Yes	Yes	Y	
69	B17	F-1.2	Lift pump to CTS	Transfer Route	Yes	Yes	Y	
70	B18	F-1.2	Sludge jets/Steam Jets	Subm Pump	Yes	Yes	Y	
71	B21	F-1.2	Replace TTP with standard TTP	TTP	Yes	Yes	Y	

Tank 18 Waste Removal Systems Eng Evaluation
(Table I: Acceptable Ideas)

72	B22	F-1.2	Fixed length TP vs. telescoping	TTP	Yes	Yes	Y	
73	B23	F-1.2	Hazleton TTP	TTP	Yes	Yes	Y	
74	B24	F-1.2	Sump pump on floor	Subm Pump	Yes	Yes	Y	
75	B25	F-1.2	Hydraulically driven vane pump	Subm Pump	Yes	Yes	Y	
76	B26	F-1.2	Diaphragm pump	Subm Pump	Yes	Yes	Y	
77	B27	F-1.2	Air piston pump	Subm Pump	Yes	Yes	Y	
78	B28	F-1.2	Screw centrifugal impeller pump	Subm Pump	Yes	Yes	Y	
79	B29	F-1.2	Macerator pump	Subm Pump	Yes	Yes	Y	
80	B30	F-1.2	Gear pump (like polyextrusion)	Subm Pump	Yes	Yes	Y	
81	B31	F-1.2	Progressive cavity pump	Subm Pump	Yes	Yes	Y	
82	B32	F-1.2	Sludge jets/Steam Jets	Subm Pump	Yes	Yes	Y	
83	B33	F-1.2	Modified deep well eductor pump	TTP	Yes	Yes	Y	
84	B34	F-1.2	Modified deep well eductor pump using existing DWPF style pump	TTP	Yes	Yes	Y	
85	B35	F-1.2	Tank 18 - Tank 26 via old evaporator feed line	Transfer Route	Yes	Yes	Y	
86	B37	F-1.2	Tank 18 - FDB1 - FDB2 - FDB3 - final destination (swap jet in downcomer to Tank 33)	Transfer Route	Yes	Yes	Y	
87	B38	F-1.2	Slurry pumps with TTP	Mixing Pump-Slurry	Yes	Yes	Y	Project Baseline
88	B39	F-1.2	ARD service contract	Robotics	Yes	Yes	Y	
89	B40	F-1.2	Tank 18 - FDB1 - FDB2 - final destination (hardpipe around FDB1)	Transfer Route	Yes	Yes	Y	
90	C1	F-1.3	ARD	Robotics	Yes	Yes	Y	
91	C2	F-1.3	Houdini with pump pack	Robotics	Yes	Yes	Y	
92	C5	F-1.3	SRS crawler with water monitor	Robotics	Yes	Yes	Y	
93	C6	F-1.3	SRS crawler with suction pump	Robotics	Yes	Yes	Y	
94	C7	F-1.3	Flygt mixers	Agitator	Yes	Yes	Y	
95	C8	F-1.3	Vertical Flygt mixers (150HP)	Agitator	Yes	Yes	Y	
96	C10	F-1.3	Tank in tank	Tank in Tank	Yes	Yes	Y	
97	C11	F-1.3	Tank in tank with Houdini	Tank in Tank	Yes	Yes	Y	
98	C12	F-1.3	Tank in tank with mobile Wilden pump	Tank in Tank	Yes	Yes	Y	
99	C13	F-1.3	Confined sluicing	Sluicer	Yes	Yes	Y	
100	C14	F-1.3	Houdini with CSEE	Robotics	Yes	Yes	Y	
101	C15	F-1.3	Advanced Design Mixer Pump (ADMP) with Flygt mixers	Mixing Pump-ADMP	Yes	Yes	Y	
102	C16	F-1.3	Slurry pump with TTP	Mixing Pump-Slurry	Yes	Yes	Y	
103	C17	F-1.3	Two Advanced Design Mixer Pumps (ADMP) in center riser with lots of water	Mixing Pump-ADMP	Yes	Yes	Y	
104	C20	F-1.3	Arm with suction	Robotics	Yes	Yes	Y	
105	C21	F-1.3	Acid dissolution	Chemical	Yes	Yes	Y	
106	C22	F-1.3	Convert existing slurry pumps (@central shops) to single discharge	Mixing Pump-Slurry	Yes	Yes	Y	

Tank 18 Waste Removal Systems Eng Evaluation
(Table I: Acceptable Ideas)

107	C24	F-1.3	Tank in tank with single device with multiple parts to mix and pump through entire cycle (centrifuging & settling)	Tank in Tank	Yes	Yes	Y	
108	C26	F-1.3	Mobile suction device	Robotics	Yes	Yes	Y	
109	C27	F-1.3	Arm based suction device	Robotics	Yes	Yes	Y	
110	C28	F-1.3	Street sweeper/grinder/pumper	Robotics	Yes	Yes	Y	
111	C32	F-1.3	Add Oxalic Acid	Chemical	Yes	Yes	Y	
112	C33	F-1.3	Use dilute nitric	Chemical	Yes	Yes	Y	
113	C39	F-1.3	Tankus erectus with recirc	Robotics	Yes	Yes	Y	
114	C44	F-1.3	For stubborn chunks add frit/particles to slurry media to increase erosion	Miscellaneous	Yes	Yes	Y	
115	C47	F-1.3	Tank in tank then treat in inner tank (identify options in Proforma)	Tank in Tank	Yes	Yes	Y	Passes if sludge is removed from Tank 18
116	C48	F-1.3	ARD	Robotics	Yes	Yes	Y	
117	C49	F-1.3	One Advanced Design Mixer Pump (ADMP) in center riser with lots of water	Mixing Pump-ADMP	Yes	Yes	Y	
118	C50	F-1.3	Advanced Design Mixer Pump (ADMP) with two slurry pumps	Mixing Pump-ADMP	Yes	Yes	Y	
119	C52	F-1.3	Make false floor by injecting grout to elevate/move sludge	Misc-Tk Partition	Yes	Yes	Y	
120	C53	F-1.3	CO2 suspension	Miscellaneous	Yes	Yes	Y	
121	C54	F-1.3	Additional standard slurry pump risers	Mixing Pump-Slurry	Yes	Yes	Y	
122	C55	F-1.3	Crawler with plow to push material around	Robotics	Yes	Yes	Y	
123	C56	F-1.3	Water monitor sluicers	Sluicer	Yes	Yes	Y	
124	D2	F-1.4	Tank in tank with BIBO pump	Subm Pump-Pnuem	Yes	Yes	Y	
125	D3	F-1.4	ARD contract	Robotics	Yes	Yes	Y	
126	D4	F-1.4	Air driven submersible pump (Wilden)	Subm Pump-Pnuem	Yes	Yes	Y	
127	D5	F-1.4	Tanker transfer	Transfer Route	Yes	Yes	Y	
128	D9	F-1.4	Tank 18 - FDB1 - FDB2 - final destination	Transfer Route	Yes	Yes	Y	
129	D10	F-1.4	Tank 18 - FDB1 - FDB2 - final destination (hardpipe around FDB1)	Transfer Route	Yes	Yes	Y	
130	D12	F-1.4	New line from Tank 18 to CTS, pumpline to Tank 26	Transfer Route	Yes	Yes	Y	
131	D13	F-1.4	Tie into 1F feedline (from Tank 26) to pump to Tank 26	Transfer Route	Yes	Yes	Y	
132	D14	F-1.4	Tie into 1F vent line to FDB6 to FPT-3 to Tank 34	Transfer Route	Yes	Yes	Y	
133	D15	F-1.4	Tank 18 to catch tank transfer line to FPT-3 to Tank 34	Transfer Route	Yes	Yes	Y	
134	D16	F-1.4	Tank 18 to catch tank transfer line to FPT-3 to Tank 34 (w/ agitator in FPT-3)	Transfer Route	Yes	Yes	Y	
135	D17	F-1.4	New above grade line to destination	Transfer Route	Yes	Yes	Y	
136	D19	F-1.4	Tank 18 - FDB1 - FDB2 - FDB3 - final destination (swap jet in downcomer to Tank 33)	Transfer Route	Yes	Yes	Y	
137	D20	F-1.4	Fill tank to max level and dredge with air lift	Robotics	Yes	Yes	Y	
138	D22	F-1.4	Centrifugal pump with mobile suction	Subm Pump-Misc	Yes	Yes	Y	
139	D27	F-1.4	Partition tank with grout	Misc-Tk Partition	Yes	Yes	Y	
140	D28	F-1.4	Refurbish/replace TTP	TTP	Yes	Yes	Y	

Tank 18 Waste Removal Systems Eng Evaluation
(Table I: Acceptable Ideas)

141	D29,	F-1.4	Modify TP with motor at bottom (subm pump)	TTP	Yes	Yes	Y	
142	D30	F-1.4	Raise tank level to max and dredge/recirc to destination tank	Miscellaneous	Yes	Yes	Y	
143	D31	F-1.4	Make pit bull pump mobile	Subm Pump-Misc	Yes	Yes	Y	
144	D32	F-1.4	Diode pump	Subm Pump-Pnuem	Yes	Yes	Y	
145	D33	F-1.4	Fixed length TP vs. telescoping	TTP	Yes	Yes	Y	
146	D34	F-1.4	Hazleton TTP	TTP	Yes	Yes	Y	
147	D35	F-1.4	Sump pump on floor	Subm Pump-Misc	Yes	Yes	Y	
148	D36	F-1.4	Hydraulically driven vane pump	Subm Pump-Misc	Yes	Yes	Y	
149	D37	F-1.4	Air piston pump	Subm Pump-Pnuem	Yes	Yes	Y	
150	D38	F-1.4	Screw centrifugal impeller pump	Subm Pump-Misc	Yes	Yes	Y	
151	D39	F-1.4	Macerator pump	Subm Pump-Misc	Yes	Yes	Y	
152	D40	F-1.4	Gear pump (like polyextrusion)	Subm Pump-Misc	Yes	Yes	Y	
153	D41	F-1.4	Progressive cavity pump	Subm Pump-Misc	Yes	Yes	Y	
154	D42	F-1.4	Modified deep well eductor pump	TTP	Yes	Yes	Y	
155	D43	F-1.4	Modified deep well eductor pump using existing DWPF style pump	TTP	Yes	Yes	Y	
156	D44	F-1.4	Slurry pumps with TTP	Mixing Pump-Slurry	Yes	Yes	Y	
157	D45	F-1.4	Arm with suction	Robotics	Yes	Yes	Y	

Tank 18 Waste Removal Systems Eng Evaluation
(Table II: Unacceptable Ideas)

	Idea No	Function	Idea Description	Category	Proforma Submitted	Screening Complete	Passed Screen	Solves Problem	Supports Schedule	Below TEC	New Glass	Reg Compl	Comments
1	A5	F-1.1	Polaris	Mixing Pump-Other	Yes	Yes	N	X					
2	A7	F-1.1	Scoop with remote bobcat	Robotics	Yes	Yes	N	X					
3	A8	F-1.1	Crawler with plow to push material around	Robotics	Yes	Yes	N	X					
4	A9	F-1.1	Chemical/microbial dissolution	Chemical	Yes	Yes	N		X		X		
5	A11	F-1.1	Dendritic erosion	Chemical	Yes	Yes	N		X				
6	A13	F-1.1	Deployment system with cables	Miscellaneous	Yes	Yes	N	X					Enhances other options
7	A17	F-1.1	Idea voided by submitter	Miscellaneous	N/A	Yes	N	X					Voided
8	A20	F-1.1	Run existing slurry pumps at overspeed until failure	Mixing Pump-Slurry	Yes	Yes	N	X	X				
9	A21	F-1.1	Dewater and vacuum	Miscellaneous	Yes	Yes	N		X				
10	A23	F-1.1	Do nothing	Miscellaneous	Yes	Yes	N		X			X	
11	A24	F-1.1	Aluminum dissolution and pump out	Chemical	Yes	Yes	N	X					
12	A25	F-1.1	Prep with zeolite (absorb)	Chemical	Yes	Yes	N					X	
13	A27	F-1.1	Use Hg and float material (high density fluid)	Miscellaneous	Yes	Yes	N					X	
14	A29	F-1.1	Tank in tank	Miscellaneous	Yes	Yes	N	X					
15	A30	F-1.1	Wave machine	Mech Agitator	Yes	Yes	N	X					
16	A31	F-1.1	Remove large section of tank top and convey	Miscellaneous	Yes	Yes	N		X				
17	A38	F-1.1	CO2 suspension	Miscellaneous	Yes	Yes	N	X					
18	A40	F-1.1	In situ vitrification	Miscellaneous	Yes	Yes	N		X			X	
20	A48	F-1.1	Pump dry with absorbent material and convey out	Dewater	Yes	Yes	N		X		X		
21	A58	F-1.1	Dry with HVAC and in situ grout	Dewater	Yes	Yes	N		X			X	
22	A59	F-1.1	Dry with HVAC and in situ grout with chemical treatment to remove technicium	Dewater	Yes	Yes	N		X			X	
23	A62	F-1.1	Demo Advanced Design Mixer Pump (ADMP) rotator	Mixing Pump-ADMP	Yes	Yes	N	X					Enhances other options
24	A71	F-1.1	In can vitrification	Miscellaneous	Yes	Yes	N		X			X	
25	B15	F-1.2	Truck with hoses	Transfer Route	Yes	Yes	N		X				

Tank 18 Waste Removal Systems Eng Evaluation
(Table II: Unacceptable Ideas)

26	B19	F-1.2	Recirc line - reuse slurry media	Miscellaneous	Yes	Yes	N	X					Enhances other options
27	B20	F-1.2	Process waste at tank with portable ESP/DWPF	Miscellaneous	Yes	Yes	N		X				
28	B36	F-1.3	After sludge is in suspension process it vs. send to another tank	Miscellaneous	Yes	Yes	N	X					
29	B37	F-1.2	Tank 18 - FDB1 - FDB2 - FDB3 - final destination (swap jet in downcomer to Tank 33)	Transfer Route	Yes	Yes	N	X					
32	C3	F-1.3	Polaris pool cleaner	Mixing Pump-Pneum	Yes	Yes	N	X					
33	C4	F-1.3	Leave it in tank via analysis	Miscellaneous	Yes	Yes	N	X					
34	C9	F-1.3	Suspend with pipe cleaner	Mixing Pump-Hydr	Yes	Yes	N	X					
35	C10	F-1.3	Tank in tank	Tank in Tank	Yes	Yes	N	X					Enhances other options
36	C17	F-1.3	Two Advanced Design Mixer Pumps (ADMP) in center riser with lots of water	Mixing Pump-ADMP	Yes	Yes	N			X			
37	C18	F-1.3	Chemical/microbial dissolution	Chemical	Yes	Yes	N	X					
38	C19	F-1.3	Slurry pumps with Wilden	Mixing Pump-Slurry	Yes	Yes	N	X					Covered by B11 & D4
39	C23	F-1.3	Single device with multiple parts to mix and pump through entire cycle (centrifuging & settling)	Mixing Pump-Slurry	Yes	Yes	N		X				
40	C25	F-1.3	Dewater heel and remove remaining dry/wet cake	Dewater	Yes	Yes	N					X	
41	C29	F-1.3	After sludge is in suspension process it vs. send to another tank	Miscellaneous	Yes	Yes	N	X					
42	C30	F-1.3	Chemical dissolution (Russian Regime)	Chemical	Yes	Yes	N		X				
43	C31	F-1.3	Chemical dissolution (Russian Regime) with a complexing agent	Chemical	Yes	Yes	N		X				
44	C34	F-1.3	Use a substance lighter than water to attach to sludge & aid suspension	Chemical	Yes	Yes	N		X		X		
45	C35	F-1.3	Grout injection leaving heel with binding agent	Chemical	Yes	Yes	N		X				
46	C36	F-1.3	Mobile grout machine in tank	Robotics	Yes	Yes	N	X				X	
47	C37	F-1.3	Tank in tank encapsulate when full	Tank in Tank	Yes	Yes	N					X	
48	C38	F-1.3	Do nothing with heel after evaluation	Miscellaneous	Yes	Yes	N	X					
49	C40	F-1.3	TC removal	Miscellaneous	Yes	Yes	N		X	X		X	
50	C41	F-1.3	Heat/bake sludge and vacuum out	Dewater	Yes	Yes	N		X			X	
51	C42	F-1.3	Heat/bake sludge and blow out	Dewater	Yes	Yes	N		X				
52	C43	F-1.3	In tank vitrification	Miscellaneous	Yes	Yes	N		X		X		
53	C44	F-1.3	For stubborn chunks add frit/particles to slurry media to increase erosion	Miscellaneous	Yes	Yes	N	X					Enhances SP options

Tank 18 Waste Removal Systems Eng Evaluation
(Table II: Unacceptable Ideas)

54	C45	F-1.3	Add multi ion exchange media in mix and leave in tank	Chemical	Yes	Yes	N		X			X	
55	C46	F-1.3	Stainless steel tank (sealable) in tank then grout	Tank in Tank	Yes	Yes	N					X	
56	C47	F-1.3	Tank in tank then treat in inner tank (identify options in Proforma)	Tank in Tank	Yes	Yes	N			X			
57	C51	F-1.4	Scoop with remote bobcat to tank in tank	Robotic	Yes	Yes	N		X				
58	C55	F-1.3	Crawler with plow to push material around	Robotics	Yes	Yes	N	X					Enhances other options
59	D1	F-1.4	Side wall drain box (external sump)	Miscellaneous	Yes	Yes	N		X				
60	D3	F-1.4	ARD contract	Robotics	Yes	Yes	N	X					Voided by submitter
61	D5	F-1.4	Tanker transfer	Transfer Route	Yes	Yes	N			X			
62	D6	F-1.4	Scoop with remote bobcat to tank in tank	Robotics	Yes	Yes	N	X					
63	D7	F-1.4	Dewater and vacuum	Misc-Dewater	Yes	Yes	N		X				
64	D8	F-1.4	Add absorbent and dry transfer	Dewater	Yes	Yes	N		X		X		
65	D11	F-1.4	Low volume HP pump	Subm Pump-Misc	Yes	Yes	N		X				
66	D14	F-1.4	Tie into 1F vent line to FDB6 to FPT-3 to Tank 34	Transfer Route	Yes	Yes	N	X					
67	D15	F-1.4	Tank 18 to catch tank transfer line to FPT-3 to Tank 34	Transfer Route	Yes	Yes	N	X					
68	D16	F-1.4	Tank 18 to catch tank transfer line to FPT-3 to Tank 34 (w/ agitator in FPT-3)	Transfer Route	Yes	Yes	N	X		X			
69	D18	F-1.4	Drum and truck	Miscellaneous	Yes	Yes	N					X	
70	D19	F-1.4	Tank 18 - FDB1 - FDB2 - FDB3 - final destination (swap jet in downcomer to Tank 33)	Transfer Route	Yes	Yes	N	X					
71	D21	F-1.4	Receive/send tank (recirc slurry media)	Miscellaneous	Yes	Yes	N	X					Enhances other options
72	D23	F-1.4	Find and use existing sump depression on tank floor (one plate)	Miscellaneous	Yes	Yes	N	X					
73	D24	F-1.4	Make a sump in tank (i.e. deformation)	Miscellaneous	Yes	Yes	N		X			X	
74	D25	F-1.4	Make false floor by injecting grout to elevate/move sludge	Misc-Tk Partition	Yes	Yes	N	X					
75	D26	F-1.4	Use tank at TNX to test different experiments	Miscellaneous	Yes	Yes	N	X					Enhances other options

Tank 18 Waste Removal Systems Eng Evaluation
(Table III: Acceptable Ideas/Combinations)

	Idea No	Function	Idea Description	Category	Score	Comments	
1	A4	F-1.1	Advanced Design Mixer Pump (ADMP)	Mixing Pump-ADMP	90.96	Includes A19, A42, & A61	4
2	A1'	F-1.1	Slurry pumps with quad volutes	Mixing Pump-Slurry	88.94		1
3	A70	F-1.1	Additional standard slurry pump risers	Mixing Pump-Slurry	87.74		30
4	A73	F-1.1	Slurry pumps with TTP	Mixing Pump-Slurry	84.72	Project Baseline	32
5	A72	F-1.1	Advanced Design Mixer Pump (ADMP) with two slurry pumps	Mixing Pump-ADMP	84.23		31
6	A74	F-1.1	Arm with suction	Robotics	82.61		33
7	A12	F-1.1	Submersible pump rigged to be movable (articulated)/(AZ-101)	Mixing Pump-Other	82.03	Includes A47 & A64	6
8	A41	F-1.1	Two modified Advanced Design Mixer Pumps (ADMP's)	Mixing Pump-ADMP	80.51		18
9	A53	F-1.1	Modify existing slurry pumps	Mixing Pump-Slurry	79.48		26
10	A46	F-1.1	101-SY modified slurry pump	Mixing Pump-Slurry	79.30		22
11	A44	F-1.1	Houdini with CSEE	Robotics	78.85	Includes A8 & A49	20
12	A66	F-1.1	Robotic arm with attached pumping mechanism (fixed suction-rotating nozzle)	Robotics	77.20		27
13	A35	F-1.1	Modular jet mixing pump	Mixing Pump-Other	76.40	Includes A63 & A65	15
14	A3	F-1.1	Mini quad volute slurry pumps	Mixing Pump-Slurry	75.92	Includes A55	3
15	A32	F-1.1	Bore hole miner	Sluicer	75.33		12
16	A2	F-1.1	Single discharge slurry pumps with submersible mixer (possibly with crawler/robotics)	Mixing Pump-Slurry	74.40	Includes A56	2
17	A6	F-1.1	Water monitor sluicers	Sluicer	71.79	Includes A10 & A67	5
18	A51	F-1.1	Flygt mixers	Agitator	70.26	Includes A57	24
19	A52	F-1.1	Vertical Flygt mixers (150HP)	Agitator	69.51		25
20	A50	F-1.1	SRS crawler with suction pump	Robotics	65.25		23
21	A68	F-1.1	Sluicing with recirc	Sluicer	60.69		28
22	A15	F-1.1	Paddle agitator in center riser	Agitator	54.07	Includes A14 & A16	7
23	A45	F-1.1	EMMA	Robotics	53.30		21
24	A36	F-1.1	Pulse tube mixer	Agitator	51.82	Includes A54	16
25	A69	F-1.1	Steam driven venturi mixer	Miscellaneous	50.48		29
26	A18	F-1.1	Scraper deployed through outside of tank (like a squeegee)	Robotics	49.88		8
27	A33	F-1.1	Air sparging	Agitator	48.13		13
28	A28	F-1.1	Partition tank and move sludge with crawler/plow	Robotics	45.05		11
29	A26	F-1.1	Dewater with lagoon cleaner	Robotics	41.40		10
30	A22	F-1.1	Dredge like in the ocean	Miscellaneous	38.66		9
31	A34	F-1.1	Sewer sucker	Robotics	38.30	Passes if collection tank is internal to Tk 18	14
32	A37	F-1.1	Ultrasonic	Miscellaneous	30.41		17
33	A43	F-1.1	ARD (SRS Procure/Deploy/Operate)	Robotics	0.00		19
34	B38	F-1.2	Slurry pumps with TTP	Mixing Pump-Slurry	96.70	Project Baseline	60
35	B22	F-1.2	Fixed length TP vs. telescoping	TTP	95.80		52
36	B16	F-1.2	Diode pump	Subm Pump	92.62		50
37	B8	F-1.2	BIBO pump on mast	Subm Pump	91.49	Includes B9 & B24	43

Tank 18 Waste Removal Systems Eng Evaluation
(Table III: Acceptable Ideas/Combinations)

38	B10	F-1.2	Modify TP with motor at bottom (subm pump)	TTP	89.15		44
39	B11	F-1.2	Air driven submersible pump (Wilden)	Subm Pump	88.35	Includes B26 & B27	45
40	B28	F-1.2	Screw pump	Subm Pump	86.65	Includes B30 & B31	54
41	B1	F-1.2	Refurbish/replace TTP	TTP	85.35	Includes B21 & B23	34
42	B34	F-1.2	Modified deep well eductor pump using existing DWPF style pump	TTP	85.10		57
43	B29	F-1.2	Macerator pump	Subm Pump	84.98		55
44	B3	F-1.2	Tank in tank with second pump	Subm Pump	82.43		37
45	B33	F-1.2	Modified deep well eductor pump	TTP	67.35		56
46	B25	F-1.2	Hydraulically driven vane pump	Subm Pump	59.45		53
47	B12	F-1.2	Raise tank level to max and dredge/recirc to destination tank	Miscellaneous	59.25		46
48	B14	F-1.2	Make pit bull pump mobile	Subm Pump	58.25		49
49	B18	F-1.2	Sludge jets/Steam Jets	Subm Pump	0.00	Includes B32; Need more info	51
50	B39	F-1.2	ARD (SRS Procure/Deploy/Operate)	Robotics	0.00		61
51	B2	F-1.2(TR)	Tie NE riser as you transfer out of East riser	Transfer Route	89.37		35
52	B40	F-1.2(TR)	Tank 18 - FDB1 - FDB2 - FDB3 - FDB4- Tk 26(hardpipe around FDB1)	Transfer Route	88.48		62
53	B2M	F-1.2(TR)	Tk 18NE-East Riser-FDB2-Tk 7 (Tk 7 riser 4: Use TTP dump leg)	Transfer Route	88.45		36
54	B40M	F-1.2(TR)	Tank 18 - FDB1 - FDB2 - FDB3 - FDB4- Tk 7(hardpipe around FDB1)	Transfer Route	87.80		63
55	B4M	F-1.2(TR)	Overland express to Tank 7 (above ground transfer line)	Transfer Route	85.55		39
56	B4	F-1.2(TR)	Overland express to Tank 26 (above ground transfer line)	Transfer Route	84.95		38
57	B35	F-1.2(TR)	Tank 18 - Tank 26 via old evaporator feed line	Transfer Route	81.63		58
58	B35M	F-1.2(TR)	Tk 18NE-Old Feed Line-FDB6-Tk 7	Transfer Route	81.63		59
59	B41M	F-1.2(TR)	Tk 18NE-FDB1-Tk Riser 6	Transfer Route	80.85		64
60	B5	F-1.2(TR)	Through FDB-1	Transfer Route	79.16	Includes B6	40
61	B5M	F-1.2(TR)	Tk 18-FDB1-FDB2-Tk 7	Transfer Route	78.48	Includes B6	41
62	B42M	F-1.2(TR)	Tk 18-FDB1-FDB2-Tk 7 (Riser 4: Use TTP dump leg)	Transfer Route	75.63		65
63	B13	F-1.2(TR)	Use evaporator feed pump and go through 1F cell	Transfer Route	63.85		47
64	B13M	F-1.2(TR)	Tk 18SE-1F Cell-FDB6-Tk 7	Transfer Route	63.85		48
65	B7	F-1.2(TR)	Tank to CTS	Transfer Route	50.95	Includes B17	42
66	C20R	F-1.3	Arm with suction	Robotics	92.12	Includes C27	77
67	C49	F-1.3	One Advanced Design Mixer Pump (ADMP) in center riser with lots of water	Mixing Pump-ADMP	87.35		85
68	C39R	F-1.3	Bore hole miner	Robotics	87.29		84
69	C50	F-1.3	Advanced Design Mixer Pump (ADMP) with two slurry pumps	Mixing Pump-ADMP	85.15		86
70	C20	F-1.3	Arm with suction	Robotics	84.41	Includes C27	76
71	C2	F-1.3	Houdini with pump pack	Robotics	84.26	Includes C13 & C14	67
72	C16	F-1.3	Slurry pumps with TTP	Mixing Pump-Slurry	79.90	Project Baseline; Includes C22	75
73	C11	F-1.3	Tank in tank with Houdini/CSEE	Tank in Tank	79.88		72
74	C15	F-1.3	Advanced Design Mixer Pump (ADMP) with Flygt mixers	Mixing Pump-ADMP	79.64		74

Tank 18 Waste Removal Systems Eng Evaluation
(Table III: Acceptable Ideas/Combinations)

75	C54	F-1.3	Additional standard slurry pump risers	Mixing Pump-Slurry	79.20		89
76	C39	F-1.3	Bore hole miner	Robotics	76.46		83
77	C21	F-1.3	Acid dissolution	Chemical	76.41	Includes C32	78
78	C52	F-1.3	Make false floor by injecting grout to elevate/move sludge	Misc-Tk Partition	76.25		87
79	C24	F-1.3	Tank in tank with single device with multiple parts to mix and pump through entire cycle (centrifuging & settling) (CSEE)	Tank in Tank	74.10		79
80	C26	F-1.3	Mobile suction device	Robotics	73.61		80
81	C7	F-1.3	Flygt mixers	Agitator	73.50		70
82	C6	F-1.3	SRS crawler with suction pump	Robotics	73.15		69
83	C33	F-1.3	Use dilute nitric	Chemical	72.12		82
84	C12	F-1.3	Tank in tank with mobile Wilden pump	Tank in Tank	69.55		73
85	C5	F-1.3	SRS crawler with water monitor	Robotics	69.15		68
86	C8	F-1.3	Vertical Flygt mixers (150HP)	Agitator	68.87		71
87	C53	F-1.3	CO2 suspension	Miscellaneous	57.00		88
88	C28	F-1.3	Street sweeper/grinder/pumper	Robotics	54.97		81
89	C1	F-1.3	ARD (SRS Procure/Deploy/Operate)	Robotics	0.00		66
90	D33R	F-1.4	Fixed length TP vs. telescoping	TTP	97.24		108
91	D28R	F-1.4	Refurbish/replace TTP	TTP	96.45	Includes D34	103
92	D44	F-1.4	Slurry pumps with TTP	Mixing Pump-Slurry	96.45	Project Baseline	117
93	D32R	F-1.4	Diode pump	Subm Pump-Pnuem	96.04		107
94	D45R	F-1.4	Arm with suction	Robotics	93.71		119
95	D35	F-1.4	Sump pump on floor	Subm Pump-Misc	93.01		109
96	D35R	F-1.4	Sump pump on floor	Subm Pump-Misc	93.01		110
97	D2R	F-1.4	Tank in tank with BIBO pump	Subm Pump-Pnuem	92.77		91
98	D38R	F-1.4	Screw pump	Subm Pump-Misc	92.10	Includes D40 & D41	114
99	D29R	F-1.4	Modify TP with motor at bottom (subm pump)	TTP	91.21		104
100	D39R	F-1.4	Macerator pump	Subm Pump-Misc	88.44		116
101	D38	F-1.4	Screw pump	Subm Pump-Misc	88.01	Includes D40 & D41	113
102	D45	F-1.4	Arm with suction	Robotics	87.19		118
103	D39	F-1.4	Macerator pump	Subm Pump-Misc	85.24		115
104	D2	F-1.4	Tank in tank with BIBO pump	Subm Pump-Pnuem	82.76		90
105	D31R	F-1.4	Make pit bull pump mobile	Subm Pump-Misc	78.95		106
106	D22R	F-1.4	Centrifugal pump with mobile suction	Subm Pump-Misc	78.55		102
107	D36R	F-1.4	Hydraulically driven vane pump	Subm Pump-Misc	78.44		112
108	D4	F-1.4	Air driven submersible pump (Wilden)	Subm Pump-Pnuem	70.60	Includes D37	93
109	D31	F-1.4	Make pit bull pump mobile	Subm Pump-Misc	68.65		105
110	D22	F-1.4	Centrifugal pump with mobile suction	Subm Pump-Misc	64.80		101
111	D36	F-1.4	Hydraulically driven vane pump	Subm Pump-Misc	64.69		111
112	D20	F-1.4	Fill tank to max level and dredge with air lift	Robotics	59.25	Includes D30	100
113	D3	F-1.4	ARD (SRS Procure/Deploy/Operate)	Robotics	0.00		92

Tank 18 Waste Removal Systems Eng Evaluation
(Table III: Acceptable Ideas/Combinations)

114	D17R	F-1.4 (TR)	New above grade line to destination	Transfer Route	96.75		99
115	D10R	F-1.4 (TR)	Tank 18 - FDB1 - FDB2 - final destination (hardpipe around FDB1)	Transfer Route	96.61		95
116	D9R	F-1.4 (TR)	Tank 18 - FDB1 - FDB2 - final destination	Transfer Route	96.40		94
117	D13R	F-1.4 (TR)	Tie into 1F feedline (from Tank 26) to pump to Tank 26	Transfer Route	93.89		97
118	D17	F-1.4 (TR)	New above grade line to destination	Transfer Route	84.95		98
119	D12R	F-1.4 (TR)	New line from Tank 18 to CTS, pumpline to Tank 26	Transfer Route	70.95		96

ATTACHMENT 5

APPLICATION OF WEIGHTED CRITERIA TO IDEAS

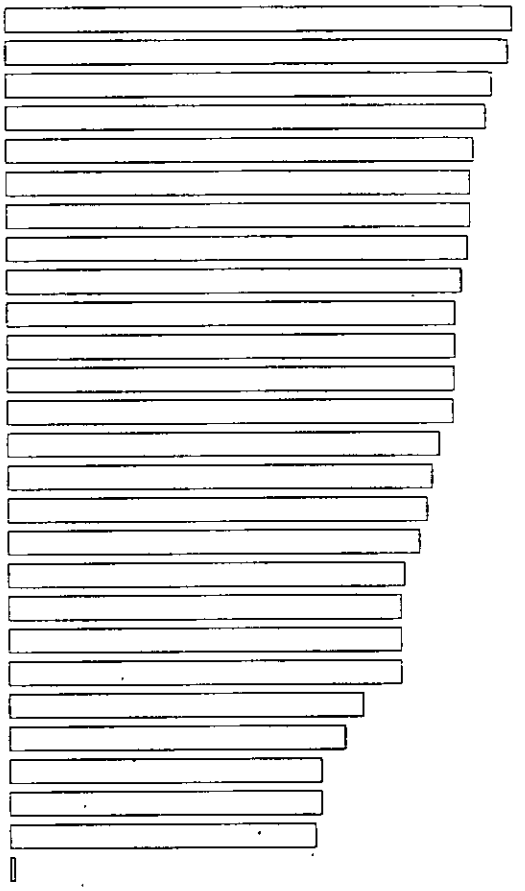
Ranking for OVERALL Goal

Alternative	Utility
A-4	89.52
A-1	88.94
A-70	87.74
A-73	84.72
A-72	84.23
A-43	83.61
A-74	82.61
A-12	82.03
A-41	80.51
A-53	79.48
A-46	79.30
A-44	78.85
A-66	77.20
A-35	76.40
A-3	75.92
A-32	75.33
A-2	74.40
A-6	71.79
A-51	70.26
A-52	69.51
A-50	65.25
A-68	60.69
A-15	54.07
A-45	53.30
A-36	51.82
A-69	50.48
A-18	49.88
A-33	48.13
A-28	45.05
A-26	41.40
A-22	38.66
A-34	38.30
A-37	30.41

Group A Overall Ranking
F-1.1

Ranking for OVERALL Goal

Alternative	Utility
B-38	96.70
B-22	95.80
B-16	92.62
B-8	91.49
B-10	89.15
B-2-M	88.45
B-11	88.35
B-40-M	87.80
B-28	86.65
B-4-M	85.55
B-1	85.35
B-34	85.10
B-29	84.98
B-3	82.43
B-41-M	80.85
B-35-M	79.94
B-5-M	78.48
B-42-M	75.63
B-39	74.86
B-44	74.86
B-45	74.86
B-33	67.35
B-13-M	63.85
B-25	59.45
B-12	59.25
B-14	58.25
B-18	0.00



Group B Overall Ranking
F-1.2

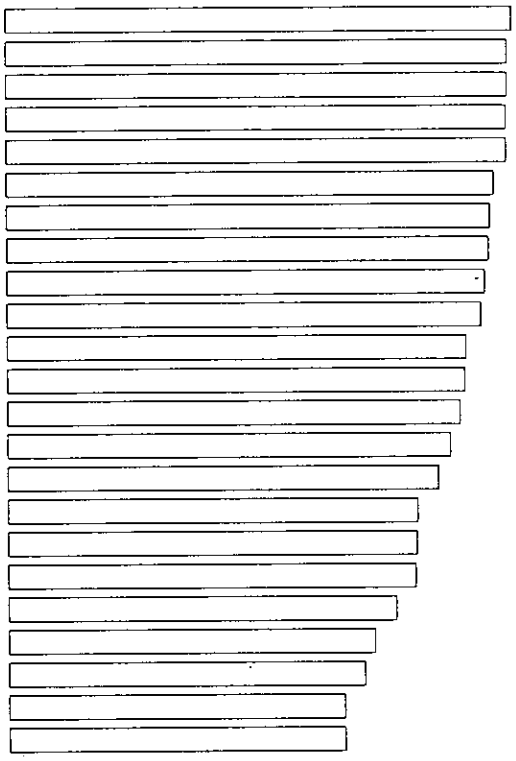
Ranking for OVERALL Goal

Alternative	Utility
C-59-R	93.37
C-60-R	92.95
C-20-R	92.12
C-58-R	87.72
C-49-R	87.35
C-39-R	87.29
C-1	86.44
C-50-R	85.15
C-20	84.41
C-2	84.26
C-16-R	79.90
C-11	79.88
C-15-R	79.64
C-54	79.20
C-56-R	77.65
C-39	76.46
C-21	76.41
C-52	76.25
C-57-R	74.39
C-24	74.10
C-26	73.61
C-7	73.50
C-6	73.15
C-33	72.12
C-12	69.55
C-56	69.17
C-5	69.15
C-8	68.87
C-53	57.00
C-28	54.97
C-47	5.00

Group C Overall Ranking
F-1.3

Ranking for OVERALL Goal

Alternative	Utility
D-33-R	97.24
D-44	96.45
D-28-R	96.45
D-35-R	96.19
D-32-R	96.04
D-45-R	93.71
D-35	93.01
D-2-R	92.77
D-38-R	92.10
D-29-R	91.21
D-39-R	88.44
D-38	88.01
D-45	87.19
D-39	85.24
D-2	82.76
D-31-R	78.95
D-22-R	78.55
D-36-R	78.44
D-3	74.86
D-4	70.60
D-31	68.65
D-22	64.80
D-36	64.69



Group D Overall Ranking

F-1.4

ALTERNATIVE SCORING
GROUP A
F-1.1

	Effectiveness	Design	Constr/Start-up	Operations	Technical Maturity	AB Impact	Reg Prgm/Processes	Infrastructure	Reliability	Safety
A-1	83	69	88	97	91	91	100	88	92	98
A-2	77	64	45	72	77	82	93	73	73	66
A-3	67	65	64	92	64	88	100	83	78	80
A-4	93	80	86	95	88	86	80	90	95	95
A-6	61	73	C	53	69	78	80	63	90	70
A-12	87	72	46	85	84	87	95	79	89	61
A-15	50	30	38	65	25	77	85	85	43	80
A-18	43	53	68	37	23	68	88	82	23	82
A-22	20	15	16	75	10	82	80	30	50	20
A-26	25	50	35	50	30	60	60	50	40	50
A-28	50	0	72	52	44	32	0	41	70	73
A-32	83	62	70	60	80	76	58	49	91	78
A-33	56	13	13	48	43	31	74	66	84	19
A-34	30	40	60	40	10	60	70	50	20	60
A-35	90	60	85	85	34	79	100	90	75	94
A-36	55	16	19	51	50	50	73	79	73	19
A-37	0	18	15	80	1	21	48	71	83	48
A-41	89	73	65	94	63	84	100	71	85	73
A-43	85	88	84	74	81	81	90	84	87	82
A-44	75	76	73	74	79	82	87	80	80	88
A-45	70	45	50	40	30	60	85	70	25	75
A-46	58	64	82	88	83	88	98	87	85	94
A-50	70	65	75	50	35	90	90	85	40	80
A-51	60	61	53	81	76	94	87	84	50	62
A-52	50	75	45	88	63	91	92	84	69	68
A-53	89	63	56	88	79	79	96	86	67	83
A-66	86	71	82	67	60	78	88	85	75	85
A-68	55	62	66	60	63	45	50	78	81	58
A-69	18	56	41	43	69	49	69	48	80	60
A-70	92	76	53	93	95	89	100	84	93	69
A-72	79	78	74	85	87	91	93	84	87	80
A-73	74	87	76	90	85	95	96	84	87	83
A-74	88	75	75	72	90	78	88	80	80	85

ALTERNATIVE SCORING
GROUP B
F-1.2

	Effectiveness	Design	Constr/Start-up	Operations	Technical Maturity	AB Impact	Reg Prgm/Processes	Infrastructure	Reliability	Safety
B-1	100	65	35	95	100	100	100	90	75	10
B-10	100	75	80	95	75	100	100	90	80	82
B-11	90	75	80	95	90	90	100	90	85	82
B-12	50	40	65	65	40	75	70	80	60	80
B-13-M	90	30	25	75	75	35	50	68	84	35
B-14	60	50	65	40	50	65	75	80	40	80
B-16	99	90	80	90	90	90	100	90	98	82
B-18	0	0	0	0	0	0	0	0	0	0
B-2-M	100	77	70	90	97	89	82	85	87	60
B-22	100	90	75	95	98	100	100	90	100	82
B-25	70	60	65	40	50	50	75	60	60	65
B-28	80	82	80	95	80	95	100	93	90	82
B-29	90	80	80	95	50	100	100	93	90	82
B-3	92	75	75	85	75	70	90	85	93	75
B-33	50	45	70	80	50	75	100	90	80	82
B-34	90	75	80	80	85	75	100	90	90	82
B-35-M	90	80	60	89	87	75	75	75	75	67
B-38	100	95	80	95	100	100	100	90	100	82
B-39	70	60	65	40	81	81	75	90	87	81
B-4-M	100	85	75	90	90	58	83	92	95	70
B-40-M	100	74	63	91	97	89	82	85	85	63
B-41-M	100	72	88	90	97	38	65	91	78	82
B-42-M	100	60	68	83	92	40	75	80	69	58
B-44	70	60	65	40	81	81	75	90	87	81
B-45	70	60	65	40	81	81	75	90	87	81
B-5-M	100	65	73	88	97	40	75	85	74	63
B-8	90	82	80	95	90	100	100	93	93	82

ALTERNATIVE SCORING
GROUP C
F-1.3

	Effectiveness	Design	Constr/Start-up	Operations	Technical Maturity	AB Impact	Reg Prgm/Processes	Infrastructure	Reliability	Safety
C-1	95	88	84	78	81	81	90	84	90	82
C-11	95	65	65	75	80	70	88	75	80	80
C-12	90	65	75	65	35	70	90	75	60	80
C-16-R	90	75	65	80	76	94	80	84	60	70
C-16-R	50	100	100	85	85	100	70	100	70	95
C-2	95	76	73	80	79	82	87	80	85	88
C-20	95	75	75	72	90	78	88	80	82	85
C-20-R	95	100	100	80	90	100	88	100	78	90
C-21	96	63	81	70	95	35	60	80	85	70
C-24	88	65	65	75	60	70	89	75	70	80
C-26	93	70	75	65	45	70	90	80	70	80
C-28	77	44	50	30	35	41	75	81	46	77
C-33	96	55	80	70	75	30	60	80	85	70
C-39	87	62	70	60	80	76	60	49	92	78
C-39-R	87	100	100	60	80	100	60	100	90	85
C-47	0	0	0	0	0	0	0	0	0	100
C-49-R	70	100	100	95	80	100	80	100	90	95
C-5	50	85	75	65	50	90	80	85	75	80
C-50-R	70	100	100	80	80	100	80	100	80	95
C-52	80	75	75	70	75	75	75	50	90	75
C-53	30	60	75	75	50	30	90	85	85	85
C-54	40	100	100	85	95	100	70	100	70	95
C-56	45	73	83	53	75	78	80	63	90	70
C-56-R	45	100	100	50	75	100	80	100	90	80
C-57-R	30	100	100	94	63	100	80	100	80	90
C-58-R	60	100	100	97	91	100	80	100	95	98
C-59-R	90	100	100	93	95	100	80	100	88	90
C-6	90	65	75	65	35	90	90	85	60	80
C-60-R	90	100	100	95	88	100	80	100	90	95
C-7	70	61	60	81	76	94	80	84	58	62
C-8	50	75	50	88	63	91	85	84	65	68

ALTERNATIVE SCORING
GROUP D
F-1.4

	Effectiveness	Design	Constr/Start-up	Operations	Technical Maturity	AB Impact	Reg Prgm/Processes	Infrastructure	Reliability	Safety
D-2	92	75	78	85	75	70	90	85	93	78
D-2-R	92	100	100	95	75	100	100	100	91	95
D-22	70	60	65	40	77	50	75	60	70	65
D-22-R	70	100	100	40	77	100	75	100	65	65
D-28-R	90	100	100	95	95	100	95	100	100	100
D-29-R	90	100	100	96	75	100	100	100	80	100
D-3	70	60	65	40	81	81	75	90	87	81
D-31	75	60	65	80	60	65	75	80	60	80
D-31-R	75	100	100	80	60	100	75	100	55	80
D-32-R	90	100	100	100	90	100	100	100	98	100
D-33-R	90	100	100	100	98	100	100	100	98	100
D-35	95	82	85	95	90	100	100	95	93	82
D-35-R	95	100	100	95	90	100	100	100	93	100
D-36	87	60	65	65	50	50	75	60	60	65
D-36-R	87	100	100	65	50	100	75	100	55	65
D-38	85	82	80	95	80	95	100	93	92	82
D-38-R	85	100	100	95	80	100	100	100	90	100
D-39	90	80	80	95	50	100	100	93	92	82
D-39-R	90	100	100	95	50	100	100	100	88	100
D-4	90	70	85	65	45	65	75	80	60	80
D-44	90	100	100	95	95	100	95	100	100	100
D-45	100	71	82	80	85	90	96	80	80	80
D-45-R	100	100	100	80	85	100	96	100	80	100

ATTACHMENT 6

STRATEGY SCORING

Attachment 6: Strategy Scoring
Table IV Listing of Strategies

	Strat No	Type	Strategy Description	F1	F2 PM	F2 RT	F3	F3A	F4
1	S1	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	ADMP	None	Same as F2
2	S2	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	ADMP	ARD	Same as F2
3	S3	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	ADMP	Chem	Same as F2
4	S4	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	ADMP	Sluicer	Same as F2
5	S5	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	ADMP	None	Same as F2
6	S6	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	ADMP	ARD	Same as F2
7	S7	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	ADMP	Chem	Same as F2
8	S8	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	ADMP	Sluicer	Same as F2
9	S9	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	ADMP	None	Same as F2
10	S10	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	ADMP	ARD	Same as F2
11	S11	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	ADMP	Chem	Same as F2
12	S12	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	ADMP	Sluicer	Same as F2
13	S13	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	ADMP	None	Same as F2
14	S14	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	ADMP	ARD	Same as F2
15	S15	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	ADMP	Chem	Same as F2
16	S16	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	ADMP	Sluicer	Same as F2
17	S17	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	ADMP	None	Same as F2
18	S18	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	ADMP	ARD	Same as F2
19	S19	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	ADMP	Chem	Same as F2
20	S20	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	ADMP	Sluicer	Same as F2
21	S21	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	ADMP	None	Same as F2
22	S22	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	ADMP	ARD	Same as F2
23	S23	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	ADMP	Chem	Same as F2
24	S24	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	ADMP	Sluicer	Same as F2
25	S25	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	QVSP	None	Same as F2
26	S26	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	QVSP	ARD	Same as F2
27	S27	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	QVSP	Chem	Same as F2
28	S28	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	QVSP	Sluicer	Same as F2
29	S29	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	QVSP	None	Same as F2
30	S30	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	QVSP	ARD	Same as F2
31	S31	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	QVSP	Chem	Same as F2
32	S32	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	QVSP	Sluicer	Same as F2
33	S33	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	QVSP	None	Same as F2
34	S34	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	QVSP	ARD	Same as F2
35	S35	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	QVSP	Chem	Same as F2
36	S36	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	QVSP	Sluicer	Same as F2
37	S37	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	QVSP	None	Same as F2
38	S38	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	QVSP	ARD	Same as F2
39	S39	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	QVSP	Chem	Same as F2
40	S40	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	QVSP	Sluicer	Same as F2
41	S41	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	QVSP	None	Same as F2
42	S42	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	QVSP	ARD	Same as F2
43	S43	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	QVSP	Chem	Same as F2
44	S44	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	QVSP	Sluicer	Same as F2
45	S45	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	QVSP	None	Same as F2
46	S46	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	QVSP	ARD	Same as F2
47	S47	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	QVSP	Chem	Same as F2
48	S48	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	QVSP	Sluicer	Same as F2
49	S49	Pump	Modified QVSP/ADMP	Modified	TTP	TK1 Tie-In	Modified	None	Same as F2
50	S50	Pump	Modified QVSP/ADMP	Modified	TTP	TK1 Tie-In	Modified	ARD	Same as F2
51	S51	Pump	Modified QVSP/ADMP	Modified	TTP	TK1 Tie-In	Modified	Chem	Same as F2
52	S52	Pump	Modified QVSP/ADMP	Modified	TTP	TK1 Tie-In	Modified	Sluicer	Same as F2
53	S53	Pump	Modified QVSP/ADMP	Modified	TTP	TK1 Tie-In	Modified	Arm	Same as F2
54	S54	Pump	Modified QVSP/ADMP	Modified	TTP	Hose-in-Hose	Modified	None	Same as F2
55	S55	Pump	Modified QVSP/ADMP	Modified	TTP	Hose-in-Hose	Modified	ARD	Same as F2
56	S56	Pump	Modified QVSP/ADMP	Modified	TTP	Hose-in-Hose	Modified	Chem	Same as F2
57	S57	Pump	Modified QVSP/ADMP	Modified	TTP	Hose-in-Hose	Modified	Sluicer	Same as F2

Attachment 6: Strategy Scoring
Table IV Listing of Strategies

	Strat No	Type	Strategy Description	F1	F2 PM	F2 RT	F3	F3A	F4
58	S58	Pump	Modified QVSP/ADMP	Modified	TTP	Hose-in-Hose	Modified	Arm	Same as F2
59	S59	Pump	Modified QVSP/ADMP	Modified	BIBO	TK1 Tie-In	Modified	None	Same as F2
60	S60	Pump	Modified QVSP/ADMP	Modified	BIBO	TK1 Tie-In	Modified	ARD	Same as F2
61	S61	Pump	Modified QVSP/ADMP	Modified	BIBO	TK1 Tie-In	Modified	Chem	Same as F2
62	S62	Pump	Modified QVSP/ADMP	Modified	BIBO	TK1 Tie-In	Modified	Sluicer	Same as F2
63	S63	Pump	Modified QVSP/ADMP	Modified	BIBO	TK1 Tie-In	Modified	Arm	Same as F2
64	S64	Pump	Modified QVSP/ADMP	Modified	BIBO	Hose-in-Hose	Modified	None	Same as F2
65	S65	Pump	Modified QVSP/ADMP	Modified	BIBO	Hose-in-Hose	Modified	ARD	Same as F2
66	S66	Pump	Modified QVSP/ADMP	Modified	BIBO	Hose-in-Hose	Modified	Chem	Same as F2
67	S67	Pump	Modified QVSP/ADMP	Modified	BIBO	Hose-in-Hose	Modified	Sluicer	Same as F2
68	S68	Pump	Modified QVSP/ADMP	Modified	BIBO	Hose-in-Hose	Modified	Arm	Same as F2
69	S69	Pump	Modified QVSP/ADMP	Modified	Diode	TK1 Tie-In	Modified	None	Same as F2
70	S70	Pump	Modified QVSP/ADMP	Modified	Diode	TK1 Tie-In	Modified	ARD	Same as F2
71	S71	Pump	Modified QVSP/ADMP	Modified	Diode	TK1 Tie-In	Modified	Chem	Same as F2
72	S72	Pump	Modified QVSP/ADMP	Modified	Diode	TK1 Tie-In	Modified	Sluicer	Same as F2
73	S73	Pump	Modified QVSP/ADMP	Modified	Diode	TK1 Tie-In	Modified	Arm	Same as F2
74	S74	Pump	Modified QVSP/ADMP	Modified	Diode	Hose-in-Hose	Modified	None	Same as F2
75	S75	Pump	Modified QVSP/ADMP	Modified	Diode	Hose-in-Hose	Modified	ARD	Same as F2
76	S76	Pump	Modified QVSP/ADMP	Modified	Diode	Hose-in-Hose	Modified	Chem	Same as F2
77	S77	Pump	Modified QVSP/ADMP	Modified	Diode	Hose-in-Hose	Modified	Sluicer	Same as F2
78	S78	Pump	Modified QVSP/ADMP	Modified	Diode	Hose-in-Hose	Modified	Arm	Same as F2
79	S79	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	4SPs	None	Same as F2
80	S80	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	4SPs	ARD	Same as F2
81	S81	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	4SPs	Chem	Same as F2
82	S82	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	4SPs	Sluicer	Same as F2
83	S83	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	4SPs	Arm	Same as F2
84	S84	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	4SPs	None	Same as F2
85	S85	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	4SPs	ARD	Same as F2
86	S86	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	4SPs	Chem	Same as F2
87	S87	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	4SPs	Sluicer	Same as F2
88	S88	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	4SPs	Arm	Same as F2
89	S89	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	4SPs	None	Same as F2
90	S90	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	4SPs	ARD	Same as F2
91	S91	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	4SPs	Chem	Same as F2
92	S92	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	4SPs	Sluicer	Same as F2
93	S93	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	4SPs	Arm	Same as F2
94	S94	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	4SPs	None	Same as F2
95	S95	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	4SPs	ARD	Same as F2
96	S96	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	4SPs	Chem	Same as F2
97	S97	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	4SPs	Sluicer	Same as F2
98	S98	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	4SPs	Arm	Same as F2
99	S99	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	4SPs	None	Same as F2
100	S100	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	4SPs	ARD	Same as F2
101	S101	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	4SPs	Chem	Same as F2
102	S102	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	4SPs	Sluicer	Same as F2
103	S103	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	4SPs	Arm	Same as F2
104	S104	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	4SPs	None	Same as F2
105	3105	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	4SPs	ARD	Same as F2
106	S106	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	4SPs	Chem	Same as F2
107	S107	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	4SPs	Sluicer	Same as F2
108	S108	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	4SPs	Arm	Same as F2
109	S109	Robotics	ARD	ARD	ARD	TK1 Tie-In	ARD	None	Same as F2
110	S110	Robotics	ARD	ARD	ARD	Hose-in-Hose	ARD	None	Same as F2
111	S111	Robotics	Houdini/CSEE	Houdini	Houdini	TK1 Tie-In	Houdini	None	Same as F2
112	S112	Robotics	Houdini/CSEE	Houdini	Houdini	Hose-in-Hose	Houdini	None	Same as F2
113	S113	Arm	Arm/CSEE	Arm	Arm	TK1 Tie-In	Arm	None	Same as F2
114	S114	Arm	Arm/CSEE	Arm	Arm	Hose-in-Hose	Arm	None	Same as F2

Attachment 6: Strategy Scoring
Table IV.1 Strategy Weighted Scoring Summary
(Descending Order)

From Table IV.1: Weights

						J*.12 R	K*.2 S	L*.28 T	M*.25 U	N*.15 V	R+S+T+U+V		
	Strat No	F1	F2 PM	F2 RT	F3	Weighted Cost - Deploy	Weighted LCC Cost	Weighted Effectiveness	Weighted Complexity	Weighted AB Impacts	Weighted Total Score	Strat No	Line
60	S60	Modified	BIBO	TK1 Tie-In	ARD	9.36	14.4	25.928	20.4	13.1325	**83.22**	S60	1
62	S62	Modified	BIBO	TK1 Tie-In	Sluicer	10.44	15.15	25.228	19	12.975	**82.79**	S62	2
65	S65	Modified	BIBO	Hose-in-Hose	ARD	9.48	14.8	25.928	20.2875	11.2725	**81.77**	S65	3
67	S67	Modified	BIBO	Hose-in-Hose	Sluicer	10.56	15.55	25.228	18.8875	11.115	**81.34**	S67	4
70	S70	Modified	Diode	TK1 Tie-In	ARD	8.46	13.2	26.04	20.0125	12.9075	**80.62**	S70	5
72	S72	Modified	Diode	TK1 Tie-In	Sluicer	9.54	13.95	25.34	19.0125	12.75	**80.59**	S72	6
61	S61	Modified	BIBO	TK1 Tie-In	Chem	7.11	16.8	26.348	19.1	10.7175	**80.08**	S61	7
50	S50	Modified	TTP	TK1 Tie-In	ARD	8.64	12	25.872	20.05	13.1325	**79.69**	S50	8
52	S52	Modified	TTP	TK1 Tie-In	Sluicer	9.72	12.75	25.172	19.05	12.975	**79.67**	S52	9
75	S75	Modified	Diode	Hose-in-Hose	ARD	8.58	13.6	26.04	19.9	11.0475	**79.17**	S75	10
77	S77	Modified	Diode	Hose-in-Hose	Sluicer	9.66	14.35	25.34	18.9	10.89	**79.14**	S77	11
66	S66	Modified	BIBO	Hose-in-Hose	Chem	7.23	17.2	26.348	18.9875	8.8575	**78.62**	S66	12
55	S55	Modified	TTP	Hose-in-Hose	ARD	8.76	12.4	25.872	19.9375	11.2725	**78.24**	S55	13
57	S57	Modified	TTP	Hose-in-Hose	Sluicer	9.84	13.15	25.172	18.9375	11.115	**78.21**	S57	14
63	S63	Modified	BIBO	TK1 Tie-In	Arm	5.49	14.4	25.928	19.4	12.975	**78.19**	S63	15
71	S71	Modified	Diode	TK1 Tie-In	Chem	6.21	15.6	26.46	19.1125	10.4925	**77.88**	S71	16
109	S109	ARD	ARD	TK1 Tie-In	None	11.52	6	24.78	21.75	13.6275	**77.68**	S109	17
51	S51	Modified	TTP	TK1 Tie-In	Chem	6.39	14.4	26.292	19.15	10.7175	**76.95**	S51	18
68	S68	Modified	BIBO	Hose-in-Hose	Arm	5.61	14.8	25.928	19.2875	11.115	**76.74**	S68	19
76	S76	Modified	Diode	Hose-in-Hose	Chem	6.33	16	26.46	19	8.6325	**76.42**	S76	20
110	S110	ARD	ARD	Hose-in-Hose	None	11.64	6.4	24.78	21.6375	11.7675	**76.23**	S110	21
73	S73	Modified	Diode	TK1 Tie-In	Arm	4.59	13.2	26.04	19.4125	12.75	**75.99**	S73	22
56	S56	Modified	TTP	Hose-in-Hose	Chem	6.51	14.8	26.292	19.0375	8.8575	**75.50**	S56	23
53	S53	Modified	TTP	TK1 Tie-In	Arm	4.77	12	25.872	19.45	12.975	**75.07**	S53	24
78	S78	Modified	Diode	Hose-in-Hose	Arm	4.71	13.6	26.04	19.3	10.89	**74.54**	S78	25
111	S111	Houdini	Houdini	TK1 Tie-In	None	10.17	6	23.66	20.95	13.665	**74.45**	S111	26
58	S58	Modified	TTP	Hose-in-Hose	Arm	4.89	12.4	25.872	19.3375	11.115	**73.61**	S58	27
112	S112	Houdini	Houdini	Hose-in-Hose	None	10.29	6.4	23.66	20.8375	11.805	**72.99**	S112	28
113	S113	Arm	Arm	TK1 Tie-In	None	7.29	6	25.116	20.85	13.515	**72.77**	S113	29
10	S10	ADMP	BIBO	TK1 Tie-In	ARD	8.73	3	26.376	21.4	13.1325	**72.64**	S10	30
12	S12	ADMP	BIBO	TK1 Tie-In	Sluicer	9.9	3.75	25.676	20	12.975	**72.30**	S12	31
114	S114	Arm	Arm	Hose-in-Hose	None	7.41	6.4	25.116	20.7375	11.655	**71.32**	S114	32
14	S14	ADMP	BIBO	Hose-in-Hose	ARD	8.85	3.4	26.376	21.2875	11.2725	**71.19**	S14	33

Attachment 6: Strategy Scoring
Table IV.1 Strategy Weighted Scoring Summary
(Descending Order)

16	S16	ADMP	BIBO	Hose-in-Hose	Sluicer		10.02	4.15	25.676	19.8875	11.115	**70.85**	S16	34
34	S34	QVSP	BIBO	TK1 Tie-In	ARD		7.74	3	25.256	21.2	13.2075	**70.40**	S34	35
20	S20	ADMP	Diode	TK1 Tie-In	Sluicer		9	2.55	25.788	20.0125	12.75	**70.10**	S20	36
36	S36	QVSP	BIBO	TK1 Tie-In	Sluicer		8.91	3.75	24.556	19.8	13.05	**70.07**	S36	37
18	S18	ADMP	Diode	TK1 Tie-In	ARD		7.83	1.8	26.488	21.0125	12.9075	**70.04**	S18	38
11	S11	ADMP	BIBO	TK1 Tie-In	Chem		6.66	5.4	26.796	20.1	10.7175	**69.67**	S11	39
2	S2	ADMP	TTP	TK1 Tie-In	ARD		8.13	0.6	26.32	21.05	13.1325	**69.23**	S2	40
4	S4	ADMP	TTP	TK1 Tie-In	Sluicer		9.18	1.35	25.62	20.05	12.975	**69.18**	S4	41
38	S38	QVSP	BIBO	Hose-in-Hose	ARD		7.86	3.4	25.256	21.0875	11.3475	**68.95**	S38	42
24	S24	ADMP	Diode	Hose-in-Hose	Sluicer		9.12	2.95	25.788	19.9	10.89	**68.65**	S24	43
40	S40	QVSP	BIBO	Hose-in-Hose	Sluicer		9.03	4.15	24.556	19.6875	11.19	**68.61**	S40	44
22	S22	ADMP	Diode	Hose-in-Hose	ARD		7.95	2.2	26.488	20.9	11.0475	**68.59**	S22	45
15	S15	ADMP	BIBO	Hose-in-Hose	Chem		6.78	5.8	26.796	19.9875	8.8575	**68.22**	S15	46
44	S44	QVSP	Diode	TK1 Tie-In	Sluicer		8.01	2.55	24.668	19.8125	12.825	**67.87**	S44	47
42	S42	QVSP	Diode	TK1 Tie-In	ARD		6.84	1.8	25.368	20.8125	12.9825	**67.80**	S42	48
8	S8	ADMP	TTP	Hose-in-Hose	Sluicer		9.3	1.75	25.62	19.9375	11.115	**67.72**	S8	49
90	S90	4SPs	BIBO	TK1 Tie-In	ARD		6.12	2.4	26.264	19.7	13.1775	**67.66**	S90	50
6	S6	ADMP	TTP	Hose-in-Hose	ARD		8.13	1	26.32	20.9375	11.2725	**67.66**	S6	51
19	S19	ADMP	Diode	TK1 Tie-In	Chem		5.76	4.2	26.908	20.1125	10.4925	**67.47**	S19	52
35	S35	QVSP	BIBO	TK1 Tie-In	Chem		5.67	5.4	25.676	19.9	10.7925	**67.44**	S35	53
92	S92	4SPs	BIBO	TK1 Tie-In	Sluicer		7.38	3.15	25.564	18.3	13.02	**67.41**	S92	54
28	S28	QVSP	TTP	TK1 Tie-In	Sluicer		8.19	1.35	24.5	19.85	13.05	**66.94**	S28	55
26	S26	QVSP	TTP	TK1 Tie-In	ARD		7.02	0.6	25.2	20.85	13.2075	**66.88**	S26	56
3	S3	ADMP	TTP	TK1 Tie-In	Chem		5.94	3	26.74	20.15	10.7175	**66.55**	S3	57
48	S48	QVSP	Diode	Hose-in-Hose	Sluicer		8.13	2.95	24.668	19.7	10.965	**66.41**	S48	58
46	S46	QVSP	Diode	Hose-in-Hose	ARD		6.96	2.2	25.368	20.7	11.1225	**66.35**	S46	59
95	S95	4SPs	BIBO	Hose-in-Hose	ARD		6.24	2.8	26.264	19.5875	11.3175	**66.21**	S95	60
23	S23	ADMP	Diode	Hose-in-Hose	Chem		5.88	4.6	26.908	20	8.6325	**66.02**	S23	61
39	S39	QVSP	BIBO	Hose-in-Hose	Chem		5.79	5.8	25.676	19.7875	8.9325	**65.99**	S39	62
97	S97	4SPs	BIBO	Hose-in-Hose	Sluicer		7.5	3.55	25.564	18.1875	11.16	**65.96**	S97	63
32	S32	QVSP	TTP	Hose-in-Hose	Sluicer		8.31	1.75	24.5	19.7375	11.19	**65.49**	S32	64
30	S30	QVSP	TTP	Hose-in-Hose	ARD		7.14	1	25.2	20.7375	11.3475	**65.43**	S30	65
43	S43	QVSP	Diode	TK1 Tie-In	Chem		4.77	4.2	25.788	19.9125	10.5675	**65.24**	S43	66
102	S102	4SPs	Diode	TK1 Tie-In	Sluicer		6.48	1.95	25.676	18.3125	12.795	**65.21**	S102	67
7	S7	ADMP	TTP	Hose-in-Hose	Chem		6.06	3.4	26.74	20.0375	8.8575	**65.10**	S7	68
100	S100	4SPs	Diode	TK1 Tie-In	ARD		5.22	1.2	26.376	19.3125	12.9525	**65.06**	S100	69
91	S91	4SPs	BIBO	TK1 Tie-In	Chem		4.14	4.8	26.684	18.4	10.7625	**64.79**	S91	70
27	S27	QVSP	TTP	TK1 Tie-In	Chem		4.95	3	25.62	19.95	10.7925	**64.31**	S27	71
82	S82	4SPs	TTP	TK1 Tie-In	Sluicer		6.66	0.75	25.508	18.35	13.02	**64.29**	S82	72
80	S80	4SPs	TTP	TK1 Tie-In	ARD		5.4	0	26.208	19.35	13.1775	**64.14**	S80	73

Attachment 6: Strategy Scoring
Table IV.1 Strategy Weighted Scoring Summary
(Descending Order)

47	S47	QVSP	Diode	Hose-in-Hose	Chem		4.89	4.6	25.788	19.8	8.7075	**63.79**	S47	74
107	S107	4SPs	Diode	Hose-in-Hose	Sluicer		6.6	2.35	25.676	18.2	10.935	**63.76**	S107	75
105	3105	4SPs	Diode	Hose-in-Hose	ARD		5.34	1.6	26.376	19.2	11.0925	**63.61**	3105	76
96	S96	4SPs	BIBO	Hose-in-Hose	Chem		4.26	5.2	26.684	18.2875	8.9025	**63.33**	S96	77
31	S31	QVSP	TTP	Hose-in-Hose	Chem		5.07	3.4	25.62	19.8375	8.9325	**62.86**	S31	78
87	S87	4SPs	TTP	Hose-in-Hose	Sluicer		6.78	1.15	25.508	18.2375	11.16	**62.84**	S87	79
93	S93	4SPs	BIBO	TK1 Tie-In	Arm		2.34	2.4	26.264	18.7	13.02	**62.72**	S93	80
85	S85	4SPs	TTP	Hose-in-Hose	ARD		5.52	0.4	26.208	19.2375	11.3175	**62.68**	S85	81
101	S101	4SPs	Diode	TK1 Tie-In	Chem		3.24	3.6	26.796	18.4125	10.5375	**62.59**	S101	82
81	S81	4SPs	TTP	TK1 Tie-In	Chem		3.42	2.4	26.628	18.45	10.7625	**61.66**	S81	83
98	S98	4SPs	BIBO	Hose-in-Hose	Arm		2.46	2.8	26.264	18.5875	11.16	**61.27**	S98	84
106	S106	4SPs	Diode	Hose-in-Hose	Chem		3.36	4	26.796	18.3	8.6775	**61.13**	S106	85
103	S103	4SPs	Diode	TK1 Tie-In	Arm		1.44	1.2	26.376	18.7125	12.795	**60.52**	S103	86
86	S86	4SPs	TTP	Hose-in-Hose	Chem		3.54	2.8	26.628	18.3375	8.9025	**60.21**	S86	87
83	S83	4SPs	TTP	TK1 Tie-In	Arm		1.62	0	26.208	18.75	13.02	**59.60**	S83	88
108	S108	4SPs	Diode	Hose-in-Hose	Arm		1.56	1.6	26.376	18.6	10.935	**59.07**	S108	89
88	S88	4SPs	TTP	Hose-in-Hose	Arm		1.74	0.4	26.208	18.6375	11.16	**58.15**	S88	90
115							**J*.12**	**K*.2**	**L*.28**	**M*.25**	**N*.15**			
116							**R**	**S**	**T**	**U**	**V**	**R+S+T+U+V**		

Attachment 6: Strategy Scoring
Table IV. 2 Cost Scores
(Includes Deploy and LCC)

Deploy=F*.75+J*.15+N*.1

LCC=G*.6+K*.15+O*.1+R*.15

					F	G		J	K		N	O		R	S		V	W
	Strat No	Type	Strategy Description	F1	Deploy	LCC	F2 PM	Deploy	LCC	F2 RT	Deploy	LCC	F3	Deploy	LCC		Total Deploy	Total LCC
1	S1	Pump	Advanced Design Mixer Pump	ADMP	0	0	TTP	0	0	TK1 Tie-In	0	0	None	0	0		0	0
2	S2	Pump	Advanced Design Mixer Pump	ADMP	71	5	TTP	50	0	TK1 Tie-In	70	0	ARD	100	0		67.75	3
3	S3	Pump	Advanced Design Mixer Pump	ADMP	48	5	TTP	50	0	TK1 Tie-In	60	0	Chem	100	80		49.5	15
4	S4	Pump	Advanced Design Mixer Pump	ADMP	84	5	TTP	50	0	TK1 Tie-In	60	0	Sluicer	100	25		76.5	6.75
5	S5	Pump	Advanced Design Mixer Pump	ADMP	0	0	TTP	0	0	Hose-in-Hose	0	0	None	0	0		0	0
6	S6	Pump	Advanced Design Mixer Pump	ADMP	71	5	TTP	50	0	Hose-in-Hose	70	20	ARD	100	0		67.75	5
7	S7	Pump	Advanced Design Mixer Pump	ADMP	48	5	TTP	50	0	Hose-in-Hose	70	20	Chem	100	80		50.5	17
8	S8	Pump	Advanced Design Mixer Pump	ADMP	84	5	TTP	50	0	Hose-in-Hose	70	20	Sluicer	100	25		77.5	8.75
9	S9	Pump	Advanced Design Mixer Pump	ADMP	0	0	BIBO	0	0	TK1 Tie-In	60	0	None	0	0		6	0
10	S10	Pump	Advanced Design Mixer Pump	ADMP	71	5	BIBO	90	80	TK1 Tie-In	60	0	ARD	100	0		72.75	15
11	S11	Pump	Advanced Design Mixer Pump	ADMP	48	5	BIBO	90	80	TK1 Tie-In	60	0	Chem	100	80		55.5	27
12	S12	Pump	Advanced Design Mixer Pump	ADMP	84	5	BIBO	90	80	TK1 Tie-In	60	0	Sluicer	100	25		82.5	18.75
13	S13	Pump	Advanced Design Mixer Pump	ADMP	0	0	BIBO	0	0	Hose-in-Hose	0	0	None	0	0		0	0
14	S14	Pump	Advanced Design Mixer Pump	ADMP	71	5	BIBO	90	80	Hose-in-Hose	70	20	ARD	100	0		73.75	17
15	S15	Pump	Advanced Design Mixer Pump	ADMP	48	5	BIBO	90	80	Hose-in-Hose	70	20	Chem	100	80		56.5	29
16	S16	Pump	Advanced Design Mixer Pump	ADMP	84	5	BIBO	90	80	Hose-in-Hose	70	20	Sluicer	100	25		83.5	20.75
17	S17	Pump	Advanced Design Mixer Pump	ADMP	0	0	Diode	0	0	TK1 Tie-In	0	0	None	0	0		0	0
18	S18	Pump	Advanced Design Mixer Pump	ADMP	71	5	Diode	40	40	TK1 Tie-In	60	0	ARD	100	0		65.25	9
19	S19	Pump	Advanced Design Mixer Pump	ADMP	48	5	Diode	40	40	TK1 Tie-In	60	0	Chem	100	80		48	21
20	S20	Pump	Advanced Design Mixer Pump	ADMP	84	5	Diode	40	40	TK1 Tie-In	60	0	Sluicer	100	25		75	12.75
21	S21	Pump	Advanced Design Mixer Pump	ADMP	0	0	Diode	0	0	Hose-in-Hose	0	0	None	0	0		0	0
22	S22	Pump	Advanced Design Mixer Pump	ADMP	71	5	Diode	40	40	Hose-in-Hose	70	20	ARD	100	0		66.25	11
23	S23	Pump	Advanced Design Mixer Pump	ADMP	48	5	Diode	40	40	Hose-in-Hose	70	20	Chem	100	80		49	23
24	S24	Pump	Advanced Design Mixer Pump	ADMP	84	5	Diode	40	40	Hose-in-Hose	70	20	Sluicer	100	25		76	14.75
25	S25	Pump	Quad Volute Slurry Pump	QVSP	0	0	TTP	0	0	TK1 Tie-In	0	0	None	0	0		0	0
26	S26	Pump	Quad Volute Slurry Pump	QVSP	60	5	TTP	50	0	TK1 Tie-In	60	0	ARD	100	0		58.5	3
27	S27	Pump	Quad Volute Slurry Pump	QVSP	37	5	TTP	50	0	TK1 Tie-In	60	0	Chem	100	80		41.25	15
28	S28	Pump	Quad Volute Slurry Pump	QVSP	73	5	TTP	50	0	TK1 Tie-In	60	0	Sluicer	100	25		68.25	6.75
29	S29	Pump	Quad Volute Slurry Pump	QVSP	0	0	TTP	0	0	Hose-in-Hose	0	0	None	0	0		0	0
30	S30	Pump	Quad Volute Slurry Pump	QVSP	60	5	TTP	50	0	Hose-in-Hose	70	20	ARD	100	0		59.5	5
31	S31	Pump	Quad Volute Slurry Pump	QVSP	37	5	TTP	50	0	Hose-in-Hose	70	20	Chem	100	80		42.25	17
32	S32	Pump	Quad Volute Slurry Pump	QVSP	73	5	TTP	50	0	Hose-in-Hose	70	20	Sluicer	100	25		69.25	8.75
33	S33	Pump	Quad Volute Slurry Pump	QVSP	0	0	BIBO	0	0	TK1 Tie-In	0	0	None	0	0		0	0
34	S34	Pump	Quad Volute Slurry Pump	QVSP	60	5	BIBO	90	80	TK1 Tie-In	60	0	ARD	100	0		64.5	15
35	S35	Pump	Quad Volute Slurry Pump	QVSP	37	5	BIBO	90	80	TK1 Tie-In	60	0	Chem	100	80		47.25	27

Attachment 6: Strategy Scoring
Table IV. 2 Cost Scores
(Includes Deploy and LCC)

36	S36	Pump	Quad Volute Slurry Pump	QVSP	73	5	BIBO	90	80	TK1 Tie-In	60	0	Sluicer	100	25		74.25	18.75
37	S37	Pump	Quad Volute Slurry Pump	QVSP	0	0	BIBO	0	0	Hose-in-Hose	0	0	None	0	0		0	0
38	S38	Pump	Quad Volute Slurry Pump	QVSP	60	5	BIBO	90	80	Hose-in-Hose	70	20	ARD	100	0		65.5	17
39	S39	Pump	Quad Volute Slurry Pump	QVSP	37	5	BIBO	90	80	Hose-in-Hose	70	20	Chem	100	80		48.25	29
40	S40	Pump	Quad Volute Slurry Pump	QVSP	73	5	BIBO	90	80	Hose-in-Hose	70	20	Sluicer	100	25		75.25	20.75
41	S41	Pump	Quad Volute Slurry Pump	QVSP	0	0	Diode	0	0	TK1 Tie-In	0	0	None	0	0		0	0
42	S42	Pump	Quad Volute Slurry Pump	QVSP	60	5	Diode	40	40	TK1 Tie-In	60	0	ARD	100	0		57	9
43	S43	Pump	Quad Volute Slurry Pump	QVSP	37	5	Diode	40	40	TK1 Tie-In	60	0	Chem	100	80		39.75	21
44	S44	Pump	Quad Volute Slurry Pump	QVSP	73	5	Diode	40	40	TK1 Tie-In	60	0	Sluicer	100	25		66.75	12.75
45	S45	Pump	Quad Volute Slurry Pump	QVSP	0	0	Diode	0	0	Hose-in-Hose	0	0	None	0	0		0	0
46	S46	Pump	Quad Volute Slurry Pump	QVSP	60	5	Diode	40	40	Hose-in-Hose	70	20	ARD	100	0		58	11
47	S47	Pump	Quad Volute Slurry Pump	QVSP	37	5	Diode	40	40	Hose-in-Hose	70	20	Chem	100	80		40.75	23
48	S48	Pump	Quad Volute Slurry Pump	QVSP	73	5	Diode	40	40	Hose-in-Hose	70	20	Sluicer	100	25		67.75	14.75
49	S49	Pump	Modified ADMP	Modified	0	0	TTP	0	0	TK1 Tie-In	0	0	None	0	0		0	0
50	S50	Pump	Modified ADMP	Modified	78	100	TTP	50	0	TK1 Tie-In	60	0	ARD	100	0		72	60
51	S51	Pump	Modified ADMP	Modified	53	100	TTP	50	0	TK1 Tie-In	60	0	Chem	100	80		53.25	72
52	S52	Pump	Modified ADMP	Modified	90	100	TTP	50	0	TK1 Tie-In	60	0	Sluicer	100	25		81	63.75
53	S53	Pump	Modified ADMP	Modified	35	100	TTP	50	0	TK1 Tie-In	60	0	Arm	100	0		39.75	60
54	S54	Pump	Modified ADMP	Modified	0	0	TTP	0	0	Hose-in-Hose	0	0	None	0	0		0	0
55	S55	Pump	Modified ADMP	Modified	78	100	TTP	50	0	Hose-in-Hose	70	20	ARD	100	0		73	62
56	S56	Pump	Modified ADMP	Modified	53	100	TTP	50	0	Hose-in-Hose	70	20	Chem	100	80		54.25	74
57	S57	Pump	Modified ADMP	Modified	90	100	TTP	50	0	Hose-in-Hose	70	20	Sluicer	100	25		82	65.75
58	S58	Pump	Modified ADMP	Modified	35	100	TTP	50	0	Hose-in-Hose	70	20	Arm	100	0		40.75	62
59	S59	Pump	Modified ADMP	Modified	0	0	BIBO	0	0	TK1 Tie-In	0	0	None	0	0		0	0
60	S60	Pump	Modified ADMP	Modified	78	100	BIBO	90	80	TK1 Tie-In	60	0	ARD	100	0		78	72
61	S61	Pump	Modified ADMP	Modified	53	100	BIBO	90	80	TK1 Tie-In	60	0	Chem	100	80		59.25	84
62	S62	Pump	Modified ADMP	Modified	90	100	BIBO	90	80	TK1 Tie-In	60	0	Sluicer	100	25		87	75.75
63	S63	Pump	Modified ADMP	Modified	35	100	BIBO	90	80	TK1 Tie-In	60	0	Arm	100	0		45.75	72
64	S64	Pump	Modified ADMP	Modified	0	0	BIBO	0	0	Hose-in-Hose	0	0	None	0	0		0	0
65	S65	Pump	Modified ADMP	Modified	78	100	BIBO	90	80	Hose-in-Hose	70	20	ARD	100	0		79	74
66	S66	Pump	Modified ADMP	Modified	53	100	BIBO	90	80	Hose-in-Hose	70	20	Chem	100	80		60.25	86
67	S67	Pump	Modified ADMP	Modified	90	100	BIBO	90	80	Hose-in-Hose	70	20	Sluicer	100	25		88	77.75
68	S68	Pump	Modified ADMP	Modified	35	100	BIBO	90	80	Hose-in-Hose	70	20	Arm	100	0		46.75	74
69	S69	Pump	Modified ADMP	Modified	0	0	Diode	0	0	TK1 Tie-In	0	0	None	0	0		0	0
70	S70	Pump	Modified ADMP	Modified	78	100	Diode	40	40	TK1 Tie-In	60	0	ARD	100	0		70.5	66
71	S71	Pump	Modified ADMP	Modified	53	100	Diode	40	40	TK1 Tie-In	60	0	Chem	100	80		51.75	78
72	S72	Pump	Modified ADMP	Modified	90	100	Diode	40	40	TK1 Tie-In	60	0	Sluicer	100	25		79.5	69.75
73	S73	Pump	Modified ADMP	Modified	35	100	Diode	40	40	TK1 Tie-In	60	0	Arm	100	0		38.25	66
74	S74	Pump	Modified ADMP	Modified	0	0	Diode	0	0	Hose-in-Hose	0	0	None	0	0		0	0
75	S75	Pump	Modified ADMP	Modified	78	100	Diode	40	40	Hose-in-Hose	70	20	ARD	100	0		71.5	68
76	S76	Pump	Modified ADMP	Modified	53	100	Diode	40	40	Hose-in-Hose	70	20	Chem	100	80		52.75	80

Attachment 6: Strategy Scoring
Table IV.2 Cost Scores
(Includes Deploy and LCC)

77	S77	Pump	Modified ADMP	Modified	90	100	Diode	40	40	Hose-in-Hose	70	20	Sluicer	100	25		80.5	71.75
78	S78	Pump	Modified ADMP	Modified	35	100	Diode	40	40	Hose-in-Hose	70	20	Arm	100	0		39.25	68
79	S79	Pump	Slurry Pumps	4SPs	0	0	TTP	0	0	TK1 Tie-In	0	0	None	0	0		0	0
80	S80	Pump	Slurry Pumps	4SPs	42	0	TTP	50	0	TK1 Tie-In	60	0	ARD	100	0		45	0
81	S81	Pump	Slurry Pumps	4SPs	20	0	TTP	50	0	TK1 Tie-In	60	0	Chem	100	80		28.5	12
82	S82	Pump	Slurry Pumps	4SPs	56	0	TTP	50	0	TK1 Tie-In	60	0	Sluicer	100	25		55.5	3.75
83	S83	Pump	Slurry Pumps	4SPs	0	0	TTP	50	0	TK1 Tie-In	60	0	Arm	100	0		13.5	0
84	S84	Pump	Slurry Pumps	4SPs	0	0	TTP	0	0	Hose-in-Hose	0	0	None	0	0		0	0
85	S85	Pump	Slurry Pumps	4SPs	42	0	TTP	50	0	Hose-in-Hose	70	20	ARD	100	0		46	2
86	S86	Pump	Slurry Pumps	4SPs	20	0	TTP	50	0	Hose-in-Hose	70	20	Chem	100	80		29.5	14
87	S87	Pump	Slurry Pumps	4SPs	56	0	TTP	50	0	Hose-in-Hose	70	20	Sluicer	100	25		56.5	5.75
88	S88	Pump	Slurry Pumps	4SPs	0	0	TTP	50	0	Hose-in-Hose	70	20	Arm	100	0		14.5	2
89	S89	Pump	Slurry Pumps	4SPs	0	0	BIBO	0	0	TK1 Tie-In	0	0	None	0	0		0	0
90	S90	Pump	Slurry Pumps	4SPs	42	0	BIBO	90	80	TK1 Tie-In	60	0	ARD	100	0		51	12
91	S91	Pump	Slurry Pumps	4SPs	20	0	BIBO	90	80	TK1 Tie-In	60	0	Chem	100	80		34.5	24
92	S92	Pump	Slurry Pumps	4SPs	56	0	BIBO	90	80	TK1 Tie-In	60	0	Sluicer	100	25		61.5	15.75
93	S93	Pump	Slurry Pumps	4SPs	0	0	BIBO	90	80	TK1 Tie-In	60	0	Arm	100	0		19.5	12
94	S94	Pump	Slurry Pumps	4SPs	0	0	BIBO	0	0	Hose-in-Hose	0	0	None	0	0		0	0
95	S95	Pump	Slurry Pumps	4SPs	42	0	BIBO	90	80	Hose-in-Hose	70	20	ARD	100	0		52	14
96	S96	Pump	Slurry Pumps	4SPs	20	0	BIBO	90	80	Hose-in-Hose	70	20	Chem	100	80		35.5	26
97	S97	Pump	Slurry Pumps	4SPs	56	0	BIBO	90	80	Hose-in-Hose	70	20	Sluicer	100	25		62.5	17.75
98	S98	Pump	Slurry Pumps	4SPs	0	0	BIBO	90	80	Hose-in-Hose	70	20	Arm	100	0		20.5	14
99	S99	Pump	Slurry Pumps	4SPs	0	0	Diode	0	0	TK1 Tie-In	0	0	None	0	0		0	0
100	S100	Pump	Slurry Pumps	4SPs	42	0	Diode	40	40	TK1 Tie-In	60	0	ARD	100	0		43.5	6
101	S101	Pump	Slurry Pumps	4SPs	20	0	Diode	40	40	TK1 Tie-In	60	0	Chem	100	80		27	18
102	S102	Pump	Slurry Pumps	4SPs	56	0	Diode	40	40	TK1 Tie-In	60	0	Sluicer	100	25		54	9.75
103	S103	Pump	Slurry Pumps	4SPs	0	0	Diode	40	40	TK1 Tie-In	60	0	Arm	100	0		12	6
104	S104	Pump	Slurry Pumps	4SPs	0	0	Diode	0	0	Hose-in-Hose	0	0	None	0	0		0	0
105	3105	Pump	Slurry Pumps	4SPs	42	0	Diode	40	40	Hose-in-Hose	70	20	ARD	100	0		44.5	8
106	S106	Pump	Slurry Pumps	4SPs	20	0	Diode	40	40	Hose-in-Hose	70	20	Chem	100	80		28	20
107	S107	Pump	Slurry Pumps	4SPs	56	0	Diode	40	40	Hose-in-Hose	70	20	Sluicer	100	25		55	11.75
108	S108	Pump	Slurry Pumps	4SPs	0	0	Diode	40	40	Hose-in-Hose	70	20	Arm	100	0		13	8
109	S109	Robotics	ARD	ARD	100	0	ARD	100	100	TK1 Tie-In	60	0	None	100	100		96	30
110	S110	Robotics	ARD	ARD	100	0	ARD	100	100	Hose-in-Hose	70	20	None	100	100		97	32
111	S111	Robotics	Houdini/CSEE	Houdini	85	0	Houdini	100	100	TK1 Tie-In	60	0	None	100	100		84.75	30
112	S112	Robotics	Houdini/CSEE	Houdini	85	0	Houdini	100	100	Hose-in-Hose	70	20	None	100	100		85.75	32
113	S113	Arm	Arm/CSEE	Arm	53	0	Arm	100	100	TK1 Tie-In	60	0	None	100	100		60.75	30
114	S114	Arm	Arm/CSEE	Arm	53	0	Arm	100	100	Hose-in-Hose	70	20	None	100	100		61.75	32
115					F	G		J	K		N	O		R	S		V	W

Attachment 6: Strategy Scoring
Table IV.3 Effectivness Scores

			Effectiveness N=F*.4+H*.1+L*.5		F		H		K		L		N
	Strat No	Type	Strategy Description	F1	Effect	F2 PM	Effect	F2 RT	Effect	F3	Effect		Overa Scor
1	S1	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	TK1 Tie-In	100	None	85		89
2	S2	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	TK1 Tie-In	100	ARD	95		94
3	S3	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	TK1 Tie-In	100	Chem	98		95.5
4	S4	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	TK1 Tie-In	100	Sluicer	90		91.5
5	S5	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	Hose-in-Hose	100	None	85		89
6	S6	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	Hose-in-Hose	100	ARD	95		94
7	S7	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	Hose-in-Hose	100	Chem	98		95.5
8	S8	Pump	Advanced Design Mixer Pump	ADMP	93	TTP	93	Hose-in-Hose	100	Sluicer	90		91.5
9	S9	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	TK1 Tie-In	100	None	85		89.2
10	S10	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	TK1 Tie-In	100	ARD	95		94.2
11	S11	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	TK1 Tie-In	100	Chem	98		95.7
12	S12	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	TK1 Tie-In	100	Sluicer	90		91.7
13	S13	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	Hose-in-Hose	100	None	85		89.2
14	S14	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	Hose-in-Hose	100	ARD	95		94.2
15	S15	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	Hose-in-Hose	100	Chem	98		95.7
16	S16	Pump	Advanced Design Mixer Pump	ADMP	93	BIBO	95	Hose-in-Hose	100	Sluicer	90		91.7
17	S17	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	TK1 Tie-In	100	None	85		89.6
18	S18	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	TK1 Tie-In	100	ARD	95		94.6
19	S19	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	TK1 Tie-In	100	Chem	98		96.1
20	S20	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	TK1 Tie-In	100	Sluicer	90		92.1
21	S21	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	Hose-in-Hose	100	None	85		89.6
22	S22	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	Hose-in-Hose	100	ARD	95		94.6
23	S23	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	Hose-in-Hose	100	Chem	98		96.1
24	S24	Pump	Advanced Design Mixer Pump	ADMP	93	Diode	99	Hose-in-Hose	100	Sluicer	90		92.1
25	S25	Pump	Quad Volute Slurry Pump	QVSP	83	TTP	93	TK1 Tie-In	100	None	80		82.5
27	S27	Pump	Quad Volute Slurry Pump	QVSP	83	TTP	93	TK1 Tie-In	100	Chem	98		91.5
28	S28	Pump	Quad Volute Slurry Pump	QVSP	83	TTP	93	TK1 Tie-In	100	Sluicer	90		87.5
29	S29	Pump	Quad Volute Slurry Pump	QVSP	83	TTP	93	Hose-in-Hose	100	None	80		82.5
30	S30	Pump	Quad Volute Slurry Pump	QVSP	83	TTP	93	Hose-in-Hose	100	ARD	95		90
31	S31	Pump	Quad Volute Slurry Pump	QVSP	83	TTP	93	Hose-in-Hose	100	Chem	98		91.5
32	S32	Pump	Quad Volute Slurry Pump	QVSP	83	TTP	93	Hose-in-Hose	100	Sluicer	90		87.5
33	S33	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	TK1 Tie-In	100	None	80		82.7
34	S34	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	TK1 Tie-In	100	ARD	95		90.2
35	S35	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	TK1 Tie-In	100	Chem	98		91.7
36	S36	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	TK1 Tie-In	100	Sluicer	90		87.7
37	S37	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	Hose-in-Hose	100	None	80		82.7
38	S38	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	Hose-in-Hose	100	ARD	95		90.2
39	S39	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	Hose-in-Hose	100	Chem	98		91.7

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Table IV.3 Effectiveness Scores

40	S40	Pump	Quad Volute Slurry Pump	QVSP	83	BIBO	95	Hose-in-Hose	100	Sluicer	90		87.7
41	S41	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	TK1 Tie-In	100	None	80		83.1
42	S42	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	TK1 Tie-In	100	ARD	95		90.6
43	S43	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	TK1 Tie-In	100	Chem	98		92.1
44	S44	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	TK1 Tie-In	100	Sluicer	90		88.1
45	S45	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	Hose-in-Hose	100	None	80		83.1
46	S46	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	Hose-in-Hose	100	ARD	95		90.6
47	S47	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	Hose-in-Hose	100	Chem	98		92.1
48	S48	Pump	Quad Volute Slurry Pump	QVSP	83	Diode	99	Hose-in-Hose	100	Sluicer	90		88.1
49	S49	Pump	Modified ADMP	Modified	89	TTP	93	TK1 Tie-In	100	None	50		69.9
50	S50	Pump	Modified ADMP	Modified	89	TTP	93	TK1 Tie-In	100	ARD	95		92.4
51	S51	Pump	Modified ADMP	Modified	89	TTP	93	TK1 Tie-In	100	Chem	98		93.9
52	S52	Pump	Modified ADMP	Modified	89	TTP	93	TK1 Tie-In	100	Sluicer	90		89.9
53	S53	Pump	Modified ADMP	Modified	89	TTP	93	TK1 Tie-In	100	Arm	95		92.4
54	S54	Pump	Modified ADMP	Modified	89	TTP	93	Hose-in-Hose	100	None	50		69.9
55	S55	Pump	Modified ADMP	Modified	89	TTP	93	Hose-in-Hose	100	ARD	95		92.4
56	S56	Pump	Modified ADMP	Modified	89	TTP	93	Hose-in-Hose	100	Chem	98		93.9
57	S57	Pump	Modified ADMP	Modified	89	TTP	93	Hose-in-Hose	100	Sluicer	90		89.9
58	S58	Pump	Modified ADMP	Modified	89	TTP	93	Hose-in-Hose	100	Arm	95		92.4
59	S59	Pump	Modified ADMP	Modified	89	BIBO	95	TK1 Tie-In	100	None	50		70.1
60	S60	Pump	Modified ADMP	Modified	89	BIBO	95	TK1 Tie-In	100	ARD	95		92.6
61	S61	Pump	Modified ADMP	Modified	89	BIBO	95	TK1 Tie-In	100	Chem	98		94.1
62	S62	Pump	Modified ADMP	Modified	89	BIBO	95	TK1 Tie-In	100	Sluicer	90		90.1
63	S63	Pump	Modified ADMP	Modified	89	BIBO	95	TK1 Tie-In	100	Arm	95		92.6
64	S64	Pump	Modified ADMP	Modified	89	BIBO	95	Hose-in-Hose	100	None	50		70.1
65	S65	Pump	Modified ADMP	Modified	89	BIBO	95	Hose-in-Hose	100	ARD	95		92.6
66	S66	Pump	Modified ADMP	Modified	89	BIBO	95	Hose-in-Hose	100	Chem	98		94.1
67	S67	Pump	Modified ADMP	Modified	89	BIBO	95	Hose-in-Hose	100	Sluicer	90		90.1
68	S68	Pump	Modified ADMP	Modified	89	BIBO	95	Hose-in-Hose	100	Arm	95		92.6
69	S69	Pump	Modified ADMP	Modified	89	Diode	99	TK1 Tie-In	100	None	50		70.5
70	S70	Pump	Modified ADMP	Modified	89	Diode	99	TK1 Tie-In	100	ARD	95		93
71	S71	Pump	Modified ADMP	Modified	89	Diode	99	TK1 Tie-In	100	Chem	98		94.5
72	S72	Pump	Modified ADMP	Modified	89	Diode	99	TK1 Tie-In	100	Sluicer	90		90.5
73	S73	Pump	Modified ADMP	Modified	89	Diode	99	TK1 Tie-In	100	Arm	95		93
74	S74	Pump	Modified ADMP	Modified	89	Diode	99	Hose-in-Hose	100	None	50		70.5
75	S75	Pump	Modified ADMP	Modified	89	Diode	99	Hose-in-Hose	100	ARD	95		93
76	S76	Pump	Modified ADMP	Modified	89	Diode	99	Hose-in-Hose	100	Chem	98		94.5
77	S77	Pump	Modified ADMP	Modified	89	Diode	99	Hose-in-Hose	100	Sluicer	90		90.5
78	S78	Pump	Modified ADMP	Modified	89	Diode	99	Hose-in-Hose	100	Arm	95		93
79	S79	Pump	Slurry Pumps	4SPs	92	TTP	93	TK1 Tie-In	100	None	85		88.6
80	S80	Pump	Slurry Pumps	4SPs	92	TTP	93	TK1 Tie-In	100	ARD	95		93.6
81	S81	Pump	Slurry Pumps	4SPs	92	TTP	93	TK1 Tie-In	100	Chem	98		95.1
82	S82	Pump	Slurry Pumps	4SPs	92	TTP	93	TK1 Tie-In	100	Sluicer	90		91.1
83	S83	Pump	Slurry Pumps	4SPs	92	TTP	93	TK1 Tie-In	100	Arm	95		93.6

Attachment 6: Strategy Scoring
Table IV.3 Effectiveness

84	S84	Pump	Slurry Pumps	4SPs	92	TTP	93	Hose-in-Hose	100	None	85		88.6
85	S85	Pump	Slurry Pumps	4SPs	92	TTP	93	Hose-in-Hose	100	ARD	95		93.6
86	S86	Pump	Slurry Pumps	4SPs	92	TTP	93	Hose-in-Hose	100	Chem	98		95.1
87	S87	Pump	Slurry Pumps	4SPs	92	TTP	93	Hose-in-Hose	100	Sluicer	90		91.1
88	S88	Pump	Slurry Pumps	4SPs	92	TTP	93	Hose-in-Hose	100	Arm	95		93.6
89	S89	Pump	Slurry Pumps	4SPs	92	BIBO	95	TK1 Tie-In	100	None	85		88.8
90	S90	Pump	Slurry Pumps	4SPs	92	BIBO	95	TK1 Tie-In	100	ARD	95		93.8
91	S91	Pump	Slurry Pumps	4SPs	92	BIBO	95	TK1 Tie-In	100	Chem	98		95.3
92	S92	Pump	Slurry Pumps	4SPs	92	BIBO	95	TK1 Tie-In	100	Sluicer	90		91.3
93	S93	Pump	Slurry Pumps	4SPs	92	BIBO	95	TK1 Tie-In	100	Arm	95		93.8
94	S94	Pump	Slurry Pumps	4SPs	92	BIBO	95	Hose-in-Hose	100	None	85		88.8
95	S95	Pump	Slurry Pumps	4SPs	92	BIBO	95	Hose-in-Hose	100	ARD	95		93.8
96	S96	Pump	Slurry Pumps	4SPs	92	BIBO	95	Hose-in-Hose	100	Chem	98		95.3
97	S97	Pump	Slurry Pumps	4SPs	92	BIBO	95	Hose-in-Hose	100	Sluicer	90		91.3
98	S98	Pump	Slurry Pumps	4SPs	92	BIBO	95	Hose-in-Hose	100	Arm	95		93.8
99	S99	Pump	Slurry Pumps	4SPs	92	Diode	99	TK1 Tie-In	100	None	85		89.2
100	S100	Pump	Slurry Pumps	4SPs	92	Diode	99	TK1 Tie-In	100	ARD	95		94.2
101	S101	Pump	Slurry Pumps	4SPs	92	Diode	99	TK1 Tie-In	100	Chem	98		95.7
102	S102	Pump	Slurry Pumps	4SPs	92	Diode	99	TK1 Tie-In	100	Sluicer	90		91.7
103	S103	Pump	Slurry Pumps	4SPs	92	Diode	99	TK1 Tie-In	100	Arm	95		94.2
104	S104	Pump	Slurry Pumps	4SPs	92	Diode	99	Hose-in-Hose	100	None	85		89.2
105	3105	Pump	Slurry Pumps	4SPs	92	Diode	99	Hose-in-Hose	100	ARD	95		94.2
106	S106	Pump	Slurry Pumps	4SPs	92	Diode	99	Hose-in-Hose	100	Chem	98		95.7
107	S107	Pump	Slurry Pumps	4SPs	92	Diode	99	Hose-in-Hose	100	Sluicer	90		91.7
108	S108	Pump	Slurry Pumps	4SPs	92	Diode	99	Hose-in-Hose	100	Arm	95		94.2
109	S109	Robotics	ARD	ARD	85	ARD	70	TK1 Tie-In	100	None	95		88.5
110	S110	Robotics	ARD	ARD	85	ARD	70	Hose-in-Hose	100	None	95		88.5
111	S111	Robotics	Houdini/CSEE	Houdini	75	Houdini	70	TK1 Tie-In	100	None	95		84.5
112	S112	Robotics	Houdini/CSEE	Houdini	75	Houdini	70	Hose-in-Hose	100	None	95		84.5
113	S113	Arm	Arm/CSEE	Arm	88	Arm	70	TK1 Tie-In	100	None	95		89.7
114	S114	Arm	Arm/CSEE	Arm	88	Arm	70	Hose-in-Hose	100	None	95		89.7
115			**Effectiveness N=F*.4+H*.1+L*.5**		F		H		K		L		N

Attachment 6: Strategy Scoring
Table IV.4 Complexity Scores

			Complexity N=F*.4+H*.05+J*.15+L*.4		F		H		J		L	N
	Strat No	Type	Strategy Description	F1	Complex	F2 PM	Complex	F2 RT	Complex	F3	Complex	Overal Score
1	S1	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	TK1 Tie-In	86	None	98	91.4
2	S2	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	TK1 Tie-In	86	ARD	80	84.2
3	S3	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	TK1 Tie-In	86	Chem	71	80.6
4	S4	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	TK1 Tie-In	86	Sluicer	70	80.2
5	S5	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	Hose-in-Hose	83	None	98	90.95
6	S6	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	Hose-in-Hose	83	ARD	80	83.75
7	S7	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	Hose-in-Hose	83	Chem	71	80.15
8	S8	Pump	Advanced Design Mixer Pump	ADMP	87	TTP	90	Hose-in-Hose	83	Sluicer	70	79.75
9	S9	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	TK1 Tie-In	86	None	98	91.2
10	S10	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	TK1 Tie-In	86	ARD	84	85.6
11	S11	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	TK1 Tie-In	86	Chem	71	80.4
12	S12	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	TK1 Tie-In	86	Sluicer	70	80
13	S13	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	Hose-in-Hose	83	None	98	90.75
14	S14	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	Hose-in-Hose	83	ARD	84	85.15
15	S15	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	Hose-in-Hose	83	Chem	71	79.95
16	S16	Pump	Advanced Design Mixer Pump	ADMP	87	BIBO	86	Hose-in-Hose	83	Sluicer	70	79.55
17	S17	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	TK1 Tie-In	86	None	98	91.25
18	S18	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	TK1 Tie-In	86	ARD	80	84.05
19	S19	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	TK1 Tie-In	86	Chem	71	80.45
20	S20	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	TK1 Tie-In	86	Sluicer	70	80.05
21	S21	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	Hose-in-Hose	83	None	98	90.8
22	S22	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	Hose-in-Hose	83	ARD	80	83.6
23	S23	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	Hose-in-Hose	83	Chem	71	80
24	S24	Pump	Advanced Design Mixer Pump	ADMP	87	Diode	87	Hose-in-Hose	83	Sluicer	70	79.6
25	S25	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	TK1 Tie-In	86	None	99	91
26	S26	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	TK1 Tie-In	86	ARD	80	83.4
27	S27	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	TK1 Tie-In	86	Chem	71	79.8
28	S28	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	TK1 Tie-In	86	Sluicer	70	79.4
29	S29	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	Hose-in-Hose	83	None	99	90.55
30	S30	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	Hose-in-Hose	83	ARD	80	82.95
31	S31	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	Hose-in-Hose	83	Chem	71	79.35
32	S32	Pump	Quad Volute Slurry Pump	QVSP	85	TTP	90	Hose-in-Hose	83	Sluicer	70	78.95
33	S33	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	TK1 Tie-In	86	None	99	90.8
34	S34	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	TK1 Tie-In	86	ARD	84	84.8
35	S35	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	TK1 Tie-In	86	Chem	71	79.6
36	S36	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	TK1 Tie-In	86	Sluicer	70	79.2
37	S37	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	Hose-in-Hose	83	None	99	90.35
38	S38	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	Hose-in-Hose	83	ARD	84	84.35
39	S39	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	Hose-in-Hose	83	Chem	71	79.15
40	S40	Pump	Quad Volute Slurry Pump	QVSP	85	BIBO	86	Hose-in-Hose	83	Sluicer	70	78.75
41	S41	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	TK1 Tie-In	86	None	99	90.85
42	S42	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	TK1 Tie-In	86	ARD	80	83.25
43	S43	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	TK1 Tie-In	86	Chem	71	79.65
44	S44	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	TK1 Tie-In	86	Sluicer	70	79.25
45	S45	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	Hose-in-Hose	83	None	99	90.4
46	S46	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	Hose-in-Hose	83	ARD	80	82.8
47	S47	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	Hose-in-Hose	83	Chem	71	79.2
48	S48	Pump	Quad Volute Slurry Pump	QVSP	85	Diode	87	Hose-in-Hose	83	Sluicer	70	78.8
49	S49	Pump	Modified ADMP	Modified	77	TTP	90	TK1 Tie-In	86	None	98	87.4
50	S50	Pump	Modified ADMP	Modified	77	TTP	90	TK1 Tie-In	86	ARD	80	80.2
51	S51	Pump	Modified ADMP	Modified	77	TTP	90	TK1 Tie-In	86	Chem	71	76.6
52	S52	Pump	Modified ADMP	Modified	77	TTP	90	TK1 Tie-In	86	Sluicer	70	76.2
53	S53	Pump	Modified ADMP	Modified	77	TTP	90	TK1 Tie-In	86	Arm	74	77.8
54	S54	Pump	Modified ADMP	Modified	77	TTP	90	Hose-in-Hose	83	None	98	86.95
55	S55	Pump	Modified ADMP	Modified	77	TTP	90	Hose-in-Hose	83	ARD	80	79.75
56	S56	Pump	Modified ADMP	Modified	77	TTP	90	Hose-in-Hose	83	Chem	71	76.15

Attachment 6: Strategy Scoring
Table IV.4 Complexity Scores

57	S57	Pump	Modified ADMP	Modified	77	TTP	90	Hose-in-Hose	83	Sluicer	70	75.75
58	S58	Pump	Modified ADMP	Modified	77	TTP	90	Hose-in-Hose	83	Arm	74	77.35
59	S59	Pump	Modified ADMP	Modified	77	BIBO	86	TK1 Tie-In	86	None	98	87.2
60	S60	Pump	Modified ADMP	Modified	77	BIBO	86	TK1 Tie-In	86	ARD	84	81.6
61	S61	Pump	Modified ADMP	Modified	77	BIBO	86	TK1 Tie-In	86	Chem	71	76.4
62	S62	Pump	Modified ADMP	Modified	77	BIBO	86	TK1 Tie-In	86	Sluicer	70	76
63	S63	Pump	Modified ADMP	Modified	77	BIBO	86	TK1 Tie-In	86	Arm	74	77.6
64	S64	Pump	Modified ADMP	Modified	77	BIBO	86	Hose-in-Hose	83	None	98	86.75
65	S65	Pump	Modified ADMP	Modified	77	BIBO	86	Hose-in-Hose	83	ARD	84	81.15
66	S66	Pump	Modified ADMP	Modified	77	BIBO	86	Hose-in-Hose	83	Chem	71	75.95
67	S67	Pump	Modified ADMP	Modified	77	BIBO	86	Hose-in-Hose	83	Sluicer	70	75.55
68	S68	Pump	Modified ADMP	Modified	77	BIBO	86	Hose-in-Hose	83	Arm	74	77.15
69	S69	Pump	Modified ADMP	Modified	77	Diode	87	TK1 Tie-In	86	None	98	87.25
70	S70	Pump	Modified ADMP	Modified	77	Diode	87	TK1 Tie-In	86	ARD	80	80.05
71	S71	Pump	Modified ADMP	Modified	77	Diode	87	TK1 Tie-In	86	Chem	71	76.45
72	S72	Pump	Modified ADMP	Modified	77	Diode	87	TK1 Tie-In	86	Sluicer	70	76.05
73	S73	Pump	Modified ADMP	Modified	77	Diode	87	TK1 Tie-In	86	Arm	74	77.65
74	S74	Pump	Modified ADMP	Modified	77	Diode	87	Hose-in-Hose	83	None	98	86.8
75	S75	Pump	Modified ADMP	Modified	77	Diode	87	Hose-in-Hose	83	ARD	80	79.6
76	S76	Pump	Modified ADMP	Modified	77	Diode	87	Hose-in-Hose	83	Chem	71	76
77	S77	Pump	Modified ADMP	Modified	77	Diode	87	Hose-in-Hose	83	Sluicer	70	75.6
78	S78	Pump	Modified ADMP	Modified	77	Diode	87	Hose-in-Hose	83	Arm	74	77.2
79	S79	Pump	Slurry Pumps	4SPs	70	TTP	90	TK1 Tie-In	86	None	98	84.6
80	S80	Pump	Slurry Pumps	4SPs	70	TTP	90	TK1 Tie-In	86	ARD	80	77.4
81	S81	Pump	Slurry Pumps	4SPs	70	TTP	90	TK1 Tie-In	86	Chem	71	73.8
82	S82	Pump	Slurry Pumps	4SPs	70	TTP	90	TK1 Tie-In	86	Sluicer	70	73.4
83	S83	Pump	Slurry Pumps	4SPs	70	TTP	90	TK1 Tie-In	86	Arm	74	75
84	S84	Pump	Slurry Pumps	4SPs	70	TTP	90	Hose-in-Hose	83	None	98	84.15
85	S85	Pump	Slurry Pumps	4SPs	70	TTP	90	Hose-in-Hose	83	ARD	80	76.95
86	S86	Pump	Slurry Pumps	4SPs	70	TTP	90	Hose-in-Hose	83	Chem	71	73.35
87	S87	Pump	Slurry Pumps	4SPs	70	TTP	90	Hose-in-Hose	83	Sluicer	70	72.95
88	S88	Pump	Slurry Pumps	4SPs	70	TTP	90	Hose-in-Hose	83	Arm	74	74.55
89	S89	Pump	Slurry Pumps	4SPs	70	BIBO	86	TK1 Tie-In	86	None	98	84.4
90	S90	Pump	Slurry Pumps	4SPs	70	BIBO	86	TK1 Tie-In	86	ARD	84	78.8
91	S91	Pump	Slurry Pumps	4SPs	70	BIBO	86	TK1 Tie-In	86	Chem	71	73.6
92	S92	Pump	Slurry Pumps	4SPs	70	BIBO	86	TK1 Tie-In	86	Sluicer	70	73.2
93	S93	Pump	Slurry Pumps	4SPs	70	BIBO	86	TK1 Tie-In	86	Arm	74	74.8
94	S94	Pump	Slurry Pumps	4SPs	70	BIBO	86	Hose-in-Hose	83	None	98	83.95
95	S95	Pump	Slurry Pumps	4SPs	70	BIBO	86	Hose-in-Hose	83	ARD	84	78.35
96	S96	Pump	Slurry Pumps	4SPs	70	BIBO	86	Hose-in-Hose	83	Chem	71	73.15
97	S97	Pump	Slurry Pumps	4SPs	70	BIBO	86	Hose-in-Hose	83	Sluicer	70	72.75
98	S98	Pump	Slurry Pumps	4SPs	70	BIBO	86	Hose-in-Hose	83	Arm	74	74.35
99	S99	Pump	Slurry Pumps	4SPs	70	Diode	87	TK1 Tie-In	86	None	98	84.45
100	S100	Pump	Slurry Pumps	4SPs	70	Diode	87	TK1 Tie-In	86	ARD	80	77.25
101	S101	Pump	Slurry Pumps	4SPs	70	Diode	87	TK1 Tie-In	86	Chem	71	73.65
102	S102	Pump	Slurry Pumps	4SPs	70	Diode	87	TK1 Tie-In	86	Sluicer	70	73.25
103	S103	Pump	Slurry Pumps	4SPs	70	Diode	87	TK1 Tie-In	86	Arm	74	74.85
104	S104	Pump	Slurry Pumps	4SPs	70	Diode	87	Hose-in-Hose	83	None	98	84
105	3105	Pump	Slurry Pumps	4SPs	70	Diode	87	Hose-in-Hose	83	ARD	80	76.8
106	S106	Pump	Slurry Pumps	4SPs	70	Diode	87	Hose-in-Hose	83	Chem	71	73.2
107	S107	Pump	Slurry Pumps	4SPs	70	Diode	87	Hose-in-Hose	83	Sluicer	70	72.8
108	S108	Pump	Slurry Pumps	4SPs	70	Diode	87	Hose-in-Hose	83	Arm	74	74.4
109	S109	Robotics	ARD	ARD	82	ARD	82	TK1 Tie-In	86	None	93	87
110	S110	Robotics	ARD	ARD	82	ARD	82	Hose-in-Hose	83	None	93	86.55
111	S111	Robotics	Houdini/CSEE	Houdini	74	Houdini	74	TK1 Tie-In	86	None	94	83.8
112	S112	Robotics	Houdini/CSEE	Houdini	74	Houdini	74	Hose-in-Hose	83	None	94	83.35
113	S113	Arm	Arm/CSEE	Arm	74	Arm	74	TK1 Tie-In	86	None	93	83.4
114	S114	Arm	Arm/CSEE	Arm	74	Arm	74	Hose-in-Hose	83	None	93	82.95
115			**Complexity N=F*.4+H*.05+J*.15+L*.4**		F		H		J		L	N

Attachment 6: Strategy Scoring
Table IV.5 Authorization Basis Impacts Scores

			AB Impacts N=F*.1+H*.15+J*.4+L*.35		F		H		J		L		N
	Strat No	Type	Strategy Description	F1	AB	F2 PM	AB	F2 RT	AB	F3	AB		Overall Score
1	S1	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	TK1 Tie-In	89	None	100		94.2
2	S2	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	TK1 Tie-In	89	ARD	81		87.55
3	S3	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	TK1 Tie-In	89	Chem	35		71.45
4	S4	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	TK1 Tie-In	89	Sluicer	78		86.5
5	S5	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	Hose-in-Hose	58	None	100		81.8
6	S6	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	Hose-in-Hose	58	ARD	81		75.15
7	S7	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	Hose-in-Hose	58	Chem	35		59.05
8	S8	Pump	Advanced Design Mixer Pump	ADMP	86	TTP	100	Hose-in-Hose	58	Sluicer	78		74.1
9	S9	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	TK1 Tie-In	89	None	100		94.2
10	S10	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	TK1 Tie-In	89	ARD	81		87.55
11	S11	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	TK1 Tie-In	89	Chem	35		71.45
12	S12	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	TK1 Tie-In	89	Sluicer	78		86.5
13	S13	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	Hose-in-Hose	58	None	100		81.8
14	S14	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	Hose-in-Hose	58	ARD	81		75.15
15	S15	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	Hose-in-Hose	58	Chem	35		59.05
16	S16	Pump	Advanced Design Mixer Pump	ADMP	86	BIBO	100	Hose-in-Hose	58	Sluicer	78		74.1
17	S17	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	TK1 Tie-In	89	None	100		92.7
18	S18	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	TK1 Tie-In	89	ARD	81		86.05
19	S19	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	TK1 Tie-In	89	Chem	35		69.95
20	S20	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	TK1 Tie-In	89	Sluicer	78		85
21	S21	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	Hose-in-Hose	58	None	100		80.3
22	S22	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	Hose-in-Hose	58	ARD	81		73.65
23	S23	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	Hose-in-Hose	58	Chem	35		57.55
24	S24	Pump	Advanced Design Mixer Pump	ADMP	86	Diode	90	Hose-in-Hose	58	Sluicer	78		72.6
25	S25	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	TK1 Tie-In	89	None	100		94.7
26	S26	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	TK1 Tie-In	89	ARD	81		88.05
27	S27	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	TK1 Tie-In	89	Chem	35		71.95
28	S28	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	TK1 Tie-In	89	Sluicer	78		87
29	S29	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	Hose-in-Hose	58	None	100		82.3
30	S30	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	Hose-in-Hose	58	ARD	81		75.65
31	S31	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	Hose-in-Hose	58	Chem	35		59.55
32	S32	Pump	Quad Volute Slurry Pump	QVSP	91	TTP	100	Hose-in-Hose	58	Sluicer	78		74.6
33	S33	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	TK1 Tie-In	89	None	100		94.7
34	S34	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	TK1 Tie-In	89	ARD	81		88.05
35	S35	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	TK1 Tie-In	89	Chem	35		71.95
36	S36	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	TK1 Tie-In	89	Sluicer	78		87
37	S37	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	Hose-in-Hose	58	None	100		82.3
38	S38	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	Hose-in-Hose	58	ARD	81		75.65
39	S39	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	Hose-in-Hose	58	Chem	35		59.55
40	S40	Pump	Quad Volute Slurry Pump	QVSP	91	BIBO	100	Hose-in-Hose	58	Sluicer	78		74.6
41	S41	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	TK1 Tie-In	89	None	100		93.2
42	S42	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	TK1 Tie-In	89	ARD	81		86.55
43	S43	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	TK1 Tie-In	89	Chem	35		70.45
44	S44	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	TK1 Tie-In	89	Sluicer	78		85.5
45	S45	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	Hose-in-Hose	58	None	100		80.8
46	S46	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	Hose-in-Hose	58	ARD	81		74.15
47	S47	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	Hose-in-Hose	58	Chem	35		58.05
48	S48	Pump	Quad Volute Slurry Pump	QVSP	91	Diode	90	Hose-in-Hose	58	Sluicer	78		73.1
49	S49	Pump	Modified ADMP	Modified	86	TTP	100	TK1 Tie-In	89	None	100		94.2
50	S50	Pump	Modified ADMP	Modified	86	TTP	100	TK1 Tie-In	89	ARD	81		87.55
51	S51	Pump	Modified ADMP	Modified	86	TTP	100	TK1 Tie-In	89	Chem	35		71.45
52	S52	Pump	Modified ADMP	Modified	86	TTP	100	TK1 Tie-In	89	Sluicer	78		86.5
53	S53	Pump	Modified ADMP	Modified	86	TTP	100	TK1 Tie-In	89	Arm	78		86.5
54	S54	Pump	Modified ADMP	Modified	86	TTP	100	Hose-in-Hose	58	None	100		81.8
55	S55	Pump	Modified ADMP	Modified	86	TTP	100	Hose-in-Hose	58	ARD	81		75.15
56	S56	Pump	Modified ADMP	Modified	86	TTP	100	Hose-in-Hose	58	Chem	35		59.05

Attachment 6: Strategy Scoring
Table IV.5 Authorization Basis Impacts Scores

57	S57	Pump	Modified ADMP	Modified	86	TTP	100	Hose-in-Hose	58	Sluicer	78		74.1
58	S58	Pump	Modified ADMP	Modified	86	TTP	100	Hose-in-Hose	58	Arm	78		74.1
59	S59	Pump	Modified ADMP	Modified	86	BIBO	100	TK1 Tie-In	89	None	100		94.2
60	S60	Pump	Modified ADMP	Modified	86	BIBO	100	TK1 Tie-In	89	ARD	81		87.55
61	S61	Pump	Modified ADMP	Modified	86	BIBO	100	TK1 Tie-In	89	Chem	35		71.45
62	S62	Pump	Modified ADMP	Modified	86	BIBO	100	TK1 Tie-In	89	Sluicer	78		86.5
63	S63	Pump	Modified ADMP	Modified	86	BIBO	100	TK1 Tie-In	89	Arm	78		86.5
64	S64	Pump	Modified ADMP	Modified	86	BIBO	100	Hose-in-Hose	58	None	100		81.8
65	S65	Pump	Modified ADMP	Modified	86	BIBO	100	Hose-in-Hose	58	ARD	81		75.15
66	S66	Pump	Modified ADMP	Modified	86	BIBO	100	Hose-in-Hose	58	Chem	35		59.05
67	S67	Pump	Modified ADMP	Modified	86	BIBO	100	Hose-in-Hose	58	Sluicer	78		74.1
68	S68	Pump	Modified ADMP	Modified	86	BIBO	100	Hose-in-Hose	58	Arm	78		74.1
69	S69	Pump	Modified ADMP	Modified	86	Diode	90	TK1 Tie-In	89	None	100		92.7
70	S70	Pump	Modified ADMP	Modified	86	Diode	90	TK1 Tie-In	89	ARD	81		86.05
71	S71	Pump	Modified ADMP	Modified	86	Diode	90	TK1 Tie-In	89	Chem	35		69.95
72	S72	Pump	Modified ADMP	Modified	86	Diode	90	TK1 Tie-In	89	Sluicer	78		85
73	S73	Pump	Modified ADMP	Modified	86	Diode	90	TK1 Tie-In	89	Arm	78		85
74	S74	Pump	Modified ADMP	Modified	86	Diode	90	Hose-in-Hose	58	None	100		80.3
75	S75	Pump	Modified ADMP	Modified	86	Diode	90	Hose-in-Hose	58	ARD	81		73.65
76	S76	Pump	Modified ADMP	Modified	86	Diode	90	Hose-in-Hose	58	Chem	35		57.55
77	S77	Pump	Modified ADMP	Modified	86	Diode	90	Hose-in-Hose	58	Sluicer	78		72.6
78	S78	Pump	Modified ADMP	Modified	86	Diode	90	Hose-in-Hose	58	Arm	78		72.6
79	S79	Pump	Slurry Pumps	4SPs	89	TTP	100	TK1 Tie-In	89	None	100		94.5
80	S80	Pump	Slurry Pumps	4SPs	89	TTP	100	TK1 Tie-In	89	ARD	81		87.85
81	S81	Pump	Slurry Pumps	4SPs	89	TTP	100	TK1 Tie-In	89	Chem	35		71.75
82	S82	Pump	Slurry Pumps	4SPs	89	TTP	100	TK1 Tie-In	89	Sluicer	78		86.8
83	S83	Pump	Slurry Pumps	4SPs	89	TTP	100	TK1 Tie-In	89	Arm	78		86.8
84	S84	Pump	Slurry Pumps	4SPs	89	TTP	100	Hose-in-Hose	58	None	100		82.1
85	S85	Pump	Slurry Pumps	4SPs	89	TTP	100	Hose-in-Hose	58	ARD	81		75.45
86	S86	Pump	Slurry Pumps	4SPs	89	TTP	100	Hose-in-Hose	58	Chem	35		59.35
87	S87	Pump	Slurry Pumps	4SPs	89	TTP	100	Hose-in-Hose	58	Sluicer	78		74.4
88	S88	Pump	Slurry Pumps	4SPs	89	TTP	100	Hose-in-Hose	58	Arm	78		74.4
89	S89	Pump	Slurry Pumps	4SPs	89	BIBO	100	TK1 Tie-In	89	None	100		94.5
90	S90	Pump	Slurry Pumps	4SPs	89	BIBO	100	TK1 Tie-In	89	ARD	81		87.85
91	S91	Pump	Slurry Pumps	4SPs	89	BIBO	100	TK1 Tie-In	89	Chem	35		71.75
92	S92	Pump	Slurry Pumps	4SPs	89	BIBO	100	TK1 Tie-In	89	Sluicer	78		86.8
93	S93	Pump	Slurry Pumps	4SPs	89	BIBO	100	TK1 Tie-In	89	Arm	78		86.8
94	S94	Pump	Slurry Pumps	4SPs	89	BIBO	100	Hose-in-Hose	58	None	100		82.1
95	S95	Pump	Slurry Pumps	4SPs	89	BIBO	100	Hose-in-Hose	58	ARD	81		75.45
96	S96	Pump	Slurry Pumps	4SPs	89	BIBO	100	Hose-in-Hose	58	Chem	35		59.35
97	S97	Pump	Slurry Pumps	4SPs	89	BIBO	100	Hose-in-Hose	58	Sluicer	78		74.4
98	S98	Pump	Slurry Pumps	4SPs	89	BIBO	100	Hose-in-Hose	58	Arm	78		74.4
99	S99	Pump	Slurry Pumps	4SPs	89	Diode	90	TK1 Tie-In	89	None	100		93
100	S100	Pump	Slurry Pumps	4SPs	89	Diode	90	TK1 Tie-In	89	ARD	81		86.35
101	S101	Pump	Slurry Pumps	4SPs	89	Diode	90	TK1 Tie-In	89	Chem	35		70.25
102	S102	Pump	Slurry Pumps	4SPs	89	Diode	90	TK1 Tie-In	89	Sluicer	78		85.3
103	S103	Pump	Slurry Pumps	4SPs	89	Diode	90	TK1 Tie-In	89	Arm	78		85.3
104	S104	Pump	Slurry Pumps	4SPs	89	Diode	90	Hose-in-Hose	58	None	100		80.6
105	3105	Pump	Slurry Pumps	4SPs	89	Diode	90	Hose-in-Hose	58	ARD	81		73.95
106	S106	Pump	Slurry Pumps	4SPs	89	Diode	90	Hose-in-Hose	58	Chem	35		57.85
107	S107	Pump	Slurry Pumps	4SPs	89	Diode	90	Hose-in-Hose	58	Sluicer	78		72.9
108	S108	Pump	Slurry Pumps	4SPs	89	Diode	90	Hose-in-Hose	58	Arm	78		72.9
109	S109	Robotics	ARD	ARD	81	ARD	81	TK1 Tie-In	89	None	100		90.85
110	S110	Robotics	ARD	ARD	81	ARD	81	Hose-in-Hose	58	None	100		78.45
111	S111	Robotics	Houdini/CSEE	Houdini	82	Houdini	82	TK1 Tie-In	89	None	100		91.1
112	S112	Robotics	Houdini/CSEE	Houdini	82	Houdini	82	Hose-in-Hose	58	None	100		78.7
113	S113	Arm	Arm/CSEE	Arm	78	Arm	78	TK1 Tie-In	89	None	100		90.1
114	S114	Arm	Arm/CSEE	Arm	78	Arm	78	Hose-in-Hose	58	None	100		77.7
115			**AB Impacts N=F*.1+H*.15+J*.4+L*.35**		F		H		J		L		N

Attachment 6: Strategy Scoring
Table IV.6 Strategy Unweighted Score Summary

								Taken From:	TAB IV.2 V	TAB IV.2 W	TAB IV.3 N	TAB IV.4 N	TAB IV.5 N	
								Formula:	J	K	L	M	N	J+K+L+M+N
	Strat No	Type	Strategy Description	F1	F2 PM	F2 RT	F3		Cost to Deploy	LCC Cost	Effectiveness	Complexity	AB Impacts	Raw Score
1	S1	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	None		0	0	0	0	0	0
2	S2	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	ARD		67.75	3	94	84.2	87.55	334
3	S3	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	Chem		49.5	15	95.5	80.6	71.45	297
4	S4	Pump	Advanced Design Mixer Pump	ADMP	TTP	TK1 Tie-In	Sluicer		76.5	6.75	91.5	80.2	86.5	335
5	S5	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	None		0	0	0	0	0	0
6	S6	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	ARD		67.75	5	94	83.75	75.15	321
7	S7	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	Chem		50.5	17	95.5	80.15	59.05	285
8	S8	Pump	Advanced Design Mixer Pump	ADMP	TTP	Hose-in-Hose	Sluicer		77.5	8.75	91.5	79.75	74.1	323
9	S9	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	None		0	0	0	0	0	0
10	S10	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	ARD		72.75	15	94.2	85.6	87.55	340
11	S11	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	Chem		55.5	27	95.7	80.4	71.45	303
12	S12	Pump	Advanced Design Mixer Pump	ADMP	BIBO	TK1 Tie-In	Sluicer		82.5	18.75	91.7	80	86.5	341
13	S13	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	None		0	0	0	0	0	0
14	S14	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	ARD		73.75	17	94.2	85.15	75.15	328
15	S15	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	Chem		56.5	29	95.7	79.95	59.05	291
16	S16	Pump	Advanced Design Mixer Pump	ADMP	BIBO	Hose-in-Hose	Sluicer		83.5	20.75	91.7	79.55	74.1	329
17	S17	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	None		0	0	0	0	0	0
18	S18	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	ARD		65.25	9	94.6	84.05	86.05	330
19	S19	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	Chem		48	21	96.1	80.45	69.95	295
20	S20	Pump	Advanced Design Mixer Pump	ADMP	Diode	TK1 Tie-In	Sluicer		75	12.75	92.1	80.05	85	332
21	S21	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	None		0	0	0	0	0	0
22	S22	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	ARD		66.25	11	94.6	83.6	73.65	318
23	S23	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	Chem		49	23	96.1	80	57.55	283
24	S24	Pump	Advanced Design Mixer Pump	ADMP	Diode	Hose-in-Hose	Sluicer		76	14.75	92.1	79.6	72.6	320
25	S25	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	None		0	0	0	0	0	0
26	S26	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	ARD		58.5	3	90	83.4	88.05	320
27	S27	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	Chem		41.25	15	91.5	79.8	71.95	285
28	S28	Pump	Quad Volute Slurry Pump	QVSP	TTP	TK1 Tie-In	Sluicer		68.25	6.75	87.5	79.4	87	322
29	S29	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	None		0	0	0	0	0	0
30	S30	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	ARD		59.5	5	90	82.95	75.65	308
31	S31	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	Chem		42.25	17	91.5	79.35	59.55	273

Attachment 6: Strategy Scoring
Table IV. 6 Strategy Unweighted Score Summary

32	S32	Pump	Quad Volute Slurry Pump	QVSP	TTP	Hose-in-Hose	Sluicer	69.25	8.75	87.5	78.95	74.6	310
33	S33	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	None	0	0	0	0	0	0
34	S34	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	ARD	64.5	15	90.2	84.8	88.05	328
35	S35	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	Chem	47.25	27	91.7	79.6	71.95	291
36	S36	Pump	Quad Volute Slurry Pump	QVSP	BIBO	TK1 Tie-In	Sluicer	74.25	18.75	87.7	79.2	87	328
37	S37	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	None	0	0	0	0	0	0
38	S38	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	ARD	65.5	17	90.2	84.35	75.65	316
39	S39	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	Chem	48.25	29	91.7	79.15	59.55	279
40	S40	Pump	Quad Volute Slurry Pump	QVSP	BIBO	Hose-in-Hose	Sluicer	75.25	20.75	87.7	78.75	74.6	316
41	S41	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	None	0	0	0	0	0	0
42	S42	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	ARD	57	9	90.6	83.25	86.55	317
43	S43	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	Chem	39.75	21	92.1	79.65	70.45	282
44	S44	Pump	Quad Volute Slurry Pump	QVSP	Diode	TK1 Tie-In	Sluicer	66.75	12.75	88.1	79.25	85.5	320
45	S45	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	None	0	0	0	0	0	0
46	S46	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	ARD	58	11	90.6	82.8	74.15	306
47	S47	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	Chem	40.75	23	92.1	79.2	58.05	270
48	S48	Pump	Quad Volute Slurry Pump	QVSP	Diode	Hose-in-Hose	Sluicer	67.75	14.75	88.1	78.8	73.1	308
49	S49	Pump	Modified ADMP	Modified	TTP	TK1 Tie-In	None	0	0	0	0	0	0
50	S50	Pump	Modified ADMP	Modified	TTP	TK1 Tie-In	ARD	72	60	92.4	80.2	87.55	332
51	S51	Pump	Modified ADMP	Modified	TTP	TK1 Tie-In	Chem	53.25	72	93.9	76.6	71.45	295
52	S52	Pump	Modified ADMP	Modified	TTP	TK1 Tie-In	Sluicer	81	63.75	89.9	76.2	86.5	334
53	S53	Pump	Modified ADMP	Modified	TTP	TK1 Tie-In	Arm	39.75	60	92.4	77.8	86.5	296
54	S54	Pump	Modified ADMP	Modified	TTP	Hose-in-Hose	None	0	0	0	0	0	0
55	S55	Pump	Modified ADMP	Modified	TTP	Hose-in-Hose	ARD	73	62	92.4	79.75	75.15	320
56	S56	Pump	Modified ADMP	Modified	TTP	Hose-in-Hose	Chem	54.25	74	93.9	76.15	59.05	283
57	S57	Pump	Modified ADMP	Modified	TTP	Hose-in-Hose	Sluicer	82	65.75	89.9	75.75	74.1	322
58	S58	Pump	Modified ADMP	Modified	TTP	Hose-in-Hose	Arm	40.75	62	92.4	77.35	74.1	285
59	S59	Pump	Modified ADMP	Modified	BIBO	TK1 Tie-In	None	0	0	0	0	0	0
60	S60	Pump	Modified ADMP	Modified	BIBO	TK1 Tie-In	ARD	78	72	92.6	81.6	87.55	340
61	S61	Pump	Modified ADMP	Modified	BIBO	TK1 Tie-In	Chem	59.25	84	94.1	76.4	71.45	301
62	S62	Pump	Modified ADMP	Modified	BIBO	TK1 Tie-In	Sluicer	87	75.75	90.1	76	86.5	340
63	S63	Pump	Modified ADMP	Modified	BIBO	TK1 Tie-In	Arm	45.75	72	92.6	77.6	86.5	302
64	S64	Pump	Modified ADMP	Modified	BIBO	Hose-in-Hose	None	0	0	0	0	0	0
65	S65	Pump	Modified ADMP	Modified	BIBO	Hose-in-Hose	ARD	79	74	92.6	81.15	75.15	328
66	S66	Pump	Modified ADMP	Modified	BIBO	Hose-in-Hose	Chem	60.25	86	94.1	75.95	59.05	289
67	S67	Pump	Modified ADMP	Modified	BIBO	Hose-in-Hose	Sluicer	88	77.75	90.1	75.55	74.1	328
68	S68	Pump	Modified ADMP	Modified	BIBO	Hose-in-Hose	Arm	46.75	74	92.6	77.15	74.1	291
69	S69	Pump	Modified ADMP	Modified	Diode	TK1 Tie-In	None	0	0	0	0	0	0
70	S70	Pump	Modified ADMP	Modified	Diode	TK1 Tie-In	ARD	70.5	66	93	80.05	86.05	330
71	S71	Pump	Modified ADMP	Modified	Diode	TK1 Tie-In	Chem	51.75	78	94.5	76.45	69.95	293
72	S72	Pump	Modified ADMP	Modified	Diode	TK1 Tie-In	Sluicer	79.5	69.75	90.5	76.05	85	331
73	S73	Pump	Modified ADMP	Modified	Diode	TK1 Tie-In	Arm	38.25	66	93	77.65	85	294
74	S74	Pump	Modified ADMP	Modified	Diode	Hose-in-Hose	None	0	0	0	0	0	0
75	S75	Pump	Modified ADMP	Modified	Diode	Hose-in-Hose	ARD	71.5	68	93	79.6	73.65	318
76	S76	Pump	Modified ADMP	Modified	Diode	Hose-in-Hose	Chem	52.75	80	94.5	76	57.55	281
77	S77	Pump	Modified ADMP	Modified	Diode	Hose-in-Hose	Sluicer	80.5	71.75	90.5	75.6	72.6	319
78	S78	Pump	Modified ADMP	Modified	Diode	Hose-in-Hose	Arm	39.25	68	93	77.2	72.6	282
79	S79	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	None	0	0	0	0	0	0
80	S80	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	ARD	45	0	93.6	77.4	87.85	304
81	S81	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	Chem	28.5	12	95.1	73.8	71.75	269
82	S82	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	Sluicer	55.5	3.75	91.1	73.4	86.8	307
83	S83	Pump	Slurry Pumps	4SPs	TTP	TK1 Tie-In	Arm	13.5	0	93.6	75	86.8	269
84	S84	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	None	0	0	0	0	0	0
85	S85	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	ARD	46	2	93.6	76.95	75.45	292
86	S86	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	Chem	29.5	14	95.1	73.35	59.35	257
87	S87	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	Sluicer	56.5	5.75	91.1	72.95	74.4	295
88	S88	Pump	Slurry Pumps	4SPs	TTP	Hose-in-Hose	Arm	14.5	2	93.6	74.55	74.4	257
89	S89	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	None	0	0	0	0	0	0
90	S90	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	ARD	51	12	93.8	78.8	87.85	311

Attachment 6: Strategy Scoring
Table IV.6 Strategy Unweighted Score Summary

91	S91	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	Chem	34.5	24	95.3	73.6	71.75	275
92	S92	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	Sluicer	61.5	15.75	91.3	73.2	86.8	313
93	S93	Pump	Slurry Pumps	4SPs	BIBO	TK1 Tie-In	Arm	19.5	12	93.8	74.8	86.8	275
94	S94	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	None	0	0	0	0	0	0
95	S95	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	ARD	52	14	93.8	78.35	75.45	300
96	S96	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	Chem	35.5	26	95.3	73.15	59.35	263
97	S97	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	Sluicer	62.5	17.75	91.3	72.75	74.4	301
98	S98	Pump	Slurry Pumps	4SPs	BIBO	Hose-in-Hose	Arm	20.5	14	93.8	74.35	74.4	263
99	S99	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	None	0	0	0	0	0	0
100	S100	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	ARD	43.5	6	94.2	77.25	86.35	301
101	S101	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	Chem	27	18	95.7	73.65	70.25	267
102	S102	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	Sluicer	54	9.75	91.7	73.25	85.3	304
103	S103	Pump	Slurry Pumps	4SPs	Diode	TK1 Tie-In	Arm	12	6	94.2	74.85	85.3	266
104	S104	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	None	0	0	0	0	0	0
105	3105	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	ARD	44.5	8	94.2	76.8	73.95	289
106	S106	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	Chem	28	20	95.7	73.2	57.85	255
107	S107	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	Sluicer	55	11.75	91.7	72.8	72.9	292
108	S108	Pump	Slurry Pumps	4SPs	Diode	Hose-in-Hose	Arm	13	8	94.2	74.4	72.9	255
109	S109	Robotics	ARD	ARD	ARD	TK1 Tie-In	None	96	30	88.5	87	90.85	362
110	S110	Robotics	ARD	ARD	ARD	Hose-in-Hose	None	97	32	88.5	86.55	78.45	351
111	S111	Robotics	Houdini/CSEE	Houdini	Houdini	TK1 Tie-In	None	84.75	30	84.5	83.8	91.1	344
112	S112	Robotics	Houdini/CSEE	Houdini	Houdini	Hose-in-Hose	None	85.75	32	84.5	83.35	78.7	332
113	S113	Arm	Arm/CSEE	Arm	Arm	TK1 Tie-In	None	60.75	30	89.7	83.4	90.1	324
114	S114	Arm	Arm/CSEE	Arm	Arm	Hose-in-Hose	None	61.75	32	89.7	82.95	77.7	312
115								**TAB IV.2 V**	**TAB IV.2 W**	**TAB IV.3 N**	**TAB IV.4 N**	**TAB IV.5 N**	
116								**J**	**K**	**L**	**M**	**N**	**J+K+L+M+N**

Attachment IV.7
Tank 18 SEE Strategy Scoring Notes

Description	Initial Cost to Deploy	Score	Life Cycle Cost	Score
F1				
ADMP	TEC= 3M-1(TFA)=2M 0 (ADMP)+0.04 (Flygt)+X(Mods)-X(TFA)=0.04M Deployment: modify existing steel Relocate H&V 1 new drive new turntable no new riser	50	Ok for 18 Use with 11 and 4 center riser, but requires steel modification Not able to reuse	5
QVSP	TEC=2.8M-0(TFA)=2.8M 0.25 (QVSP)+0.04 (Flygt)+0.1(Mods)-0(TFA)=0.39M Deployment: modify existing steel Relocate H&V 1 new drive no new riser	25	Ok for 18 Use with 11 and 4 center riser, but requires steel modification Not able to reuse	5
Modified ADMP	TEC=2.0M-0.5M(TFA)=1.5M 0.75 (Mod)+0(Mods)-0.375(TFA)=0.375M Deployment: D&R 1 SP 2 new drives	60	All tanks No additional steel work 3pumps would save ~15M over the Baseline for this period	100
4 SPs	TEC=4M-0M=4M 1.0 (Mod)+0.25(Mods)-0(TFA)=1.25M Deployment: D&R 2 SP New S riser New platform 4 new drives	0	All tanks; equal to the baseline Unable to reuse due to limited pump life	0
ARD	TEC=1M Specifications 50K Procurement 150K Design & Install 250K Riser Power Supply Housing for equipment Control Console TFA –150K	100	Reuse everything but robot Does not work in Type I, II, III tanks due to cooling coils Could be reused in Type IV tanks 21-24 after 8 yr LCC period	0
Houdini/CSEE	TEC=$1.5 M Move TTP to west riser Put into NE riser Steel modifications Power to skids Tether management Electronic console Interface with equipment	60	Does not work in Type I, II, III tanks due to cooling coils Could be reused in Type IV tanks 21-24 after 8 yr LCC period	0
Arm/CSEE	TEC=$3.0 M Same as Houdini only harder to deploy Move TTP to west riser Put into NE riser Steel modifications Power to skids Tether management Electronic console Interface with equipment	20	Does not work in Type I, II, III tanks due to cooling coils Could be reused in Type IV tanks 21-24 after 8 yr LCC period	0
F2 PM				

Attachment IV.7
Tank 18 SEE Strategy Scoring Notes

Description	Initial Cost to Deploy	Score	Life Cycle Cost	Score
TTP	Procure and deploy = 350K Deployment: D&R 1 TTP Replace drive; cable	50	Baseline 1,400 – 1,400 = 0K	0
BIBO	Procure and deploy = 100K Deployment: D&R 1 TTP	90	Lower up front costs 1,400 – 400 = 1,000K	80
Diode	Procure and deploy = 750-375(TFA)=375K Deployment: D&R 1 TTP	40	Reuse, cost to move in 2 more tanks 1,400 – 1,150 = 250K	40
F2 RT				
Tk1 Tie-In	Shallow excavation Interferences No transfer concerns 2 hot tie-ins initial 1 hot tie-in at end Cost = 150K>x>350K	60	No savings, can only be used on Tk 18	0
Hose in Hose	Shallow excavation (much longer) up rock bank; w/CLSM No transfer concerns 2 hot tie-ins initial 2 hot dis-connections at end ALARA Concerns D&R of hose Cost = $400/ft (X ft) – 400K(TFA) = 0K	70	AB CGD Hose Route Design for Tie-ins Not reuse of hose The need for the dedicated transfer routes for the Tanks within our plan do not exist. Tank 18 is not appropriate; Tank 4 already has a good route to FDB-2; Tank 11 has work underway to compete its transfer route (tie in with new TTP); Tank 26 is a Type III tank and has a good transfer route; Tank 15 is a high heat waste tank with ~15 leaks, the Hose-In-Hose may not be the tank to do this for the first time due to high Ci content.	20
F3				
ARD	Specifications 50K Procurement 150K Design & Install 250K Riser Power Supply Housing for equipment Control Console TFA –150 Total = 300K	75	Reuse everything but robot Does not work in Type I, II, III tanks due to cooling coils Could be reused in Type IV tanks 21-24 after 8 yr LCC period	0
Chemical Cleaning	R&D Tank Chemistry: TK18, TK7, DWPF Design & Install; Metering system Raw Materials Total = 2,500K	10	Reuse as long as pump tank or agitated tank available in route Raw material is the only major new cost	80
Sluicer	Sluicer Procurement Nozzles Streamline Spray wash Tank use	90	Reuse in remaining tanks Commandeer inspection port/new hole as needed	25

Attachment IV.7
Tank 18 SEE Strategy Scoring Notes

Description	Initial Cost to Deploy	Score	Life Cycle Cost	Score
	Total = 100K			

ATTACHMENT 7

RISK ANALYSIS SHEETS

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-1 Function F-1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology? Longer Shaft use		X	
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?		X	
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test? TEST AT 55' LENGTH		X	
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-1 Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern? TYPE IV TANK/DROPPED PUMP IN TANK		X	
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path? 6-7 MONTH PROCUREMENT		X	
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
4. ECR Adequate		X	

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-3 (Modified) Function F.1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?	X		
4. Modernized/advanced technology in existing application? R & D New wet end of pump		X	
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential? Compressed gas issue		X	
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R? Movement of SP		X	
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-3(Modified) Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)? R & D	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?		X	
7. Is there insufficient experience with the O&M of the proposed system?		X	
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path? NEW PUMP		X	
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
4. ECR Adequate?		X	

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **H-1** Date: **1/11/01** Idea/Strategy Number: **A-3**

Idea/Strategy Title: **Modidied QVSP/ADMP**

A. Statement of Risk *(What are we concerned about?)*

Time to develop and test new pump wet end may exceed allotted time

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **Previous experience w/ R&D Activities**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: Non-compliance with FFA

D. Risk Level (RL): ● High ○ Moderate ○ Low

C. Handling Strategy (RHS):

Sole source R & D to ADMP vendor

Fast track R & D

Full Scale testing @ TNX

Estimated Cost: **OSM** **$0.5 M** Estimated Schedule: **18 Months**

D. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ● Unlikely ○ Very Unlikely

Basis: Strong business growth potential.

New Consequence (C_h): ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis

Residual Risk Level (RL_h): ○ High ● Moderate ○ Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # A-4 (ADMP) Function F.1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?No Rad Experience		X	
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES	X		
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?Compressed gas Issue			X
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?Move out of center run		X	
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?Test at 55' length		X	
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?Run for 4,000 hrs of testing refurbished		X	

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-4 (ADMP) Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?Type IV tank/dropped pump in Tank		X	
7. Is there insufficient experience with the O&M of the proposed system?		X	
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
4. ECR adequate		X	

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **C5-1** Date: **1/11/01** Idea/Strategy Number: **A-4**

Idea/Strategy Title: **ADMP**

A. Statement of Risk *(What are we concerned about?)*

The pump column contains high pressure gas in a contaminated vapor space

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ○ Likely ● Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **Engineered systems and passive controls exit to prevent the occurrence.**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ○ Critical ● Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Release of airborne contamination to personnel & environment**

D. Risk Level (RL): ○ High ● Moderate ○ Low

E. Risk Handling Strategy (RHS):

Assembly specs for pump; special handling instr; leak check prior to installation

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ○ Very Unlikely Basis:

New Consequence (C_h): ○ Crisis ○ Critical ○ Significant ○ Marginal ○ Negligible Basis

Residual Risk Level (RL_h): ○ High ○ Moderate ○ Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # A-41 (Modified ADMP) Function F.1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?No Rad Experience	X		
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES	X		
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?Compressed gas issue	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?Move out of center run	X		
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?Test at 55' length	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?Run for 4,000 hrs of testing refurbished	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-41 (Modified ADMP) Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?Type IV tank/dropped pump in Tank	X		
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?			X
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
4. ECR adequate	X		

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **G1-1** Date: **1/11/01** Idea/Strategy Number: **A-41**

Idea/Strategy Title: **Modified ADMP**

A. Statement of Risk *(What are we concerned about?)*

The vendor may take too long to develop the pump.

Basis for the risk: **This is a completely new design that must be ready to install in 18 months.**

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **This is a very high capacity pump in a very small package.**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ○ Critical ● Significant ○ Marginal ○ NNegligible

Basis for Consequence Factor *(State consequences)*: **FFA tank closure date could be missed.**

D. Risk Level (RL): ● High ○ Moderate ○ Low

E. Risk Handling Strategy (RHS):

Provide $500,000 incentive to vendor to accelerate R & D, also, refurbish existing ADMP to serve as backup.

Estimated Cost: **$500,000** Estimated Schedule: **N/A**

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ● Very Unlikely

Basis: **Existing ADMP should be ready if needed.**

New Consequence (C_h): ○ Crisis ○ Critical ● Significant ○ Marginal ○ Negligible

Basis: **No change**

Residual Risk Level (RL_h): ○ High ● Moderate ○ Low ○ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number:_**E7-1** _____ Date:__**1/11/01**_____ Idea/Strategy Number:____**A-4**_____

Idea/Strategy Title:_____

A. Statement of Risk *(What are we concerned about?)*

ADMP had bearing failure at 4,000 hrs of operation_____

_____

Basis for the risk: _____

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ◯ Likely ● Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence:__**Inspected; and retest refurbished ADMP will be completed prior to use for this application.**_____

Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ◯ Critical ● Significant ◯ Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*:_**ADMP fails before sludge removal complete**___

_____

D. Risk Level (RL): ◯ High ● Moderate ◯ Low

E. Risk Handling Strategy (RHS):

_Develop critical spare parts list_____

_Enhance heel removal_____

_Purchase Spare_____

Estimated Cost: _____ Estimated Schedule: _____

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

Basis:_____

_____

New Consequence (C_h): ◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis_____

_____

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number:__**I4-1** _____ Date:_**1/11/01**_____ Idea/Strategy Number:_____**A-4**_____

Idea/Strategy Title:__**ADMP**_____

A. Statement of Risk *(What are we concerned about?)*

Excess solids may be left in tank if ADMP also used for heel removal _____

_____

Basis for the risk: _____

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence:**Testing at TNX showed potential for leaving bathtub ring of solids**

_____

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*:_May not be able to get to 4,000 gal of residual sludge

_____

D. Risk Level (RL): ● High ○ Moderate ○ Low

E. Risk Handling Strategy (RHS):

Enhance mixing by adding additional mixer (0.2 m)_____

Provide contingency heel removal method and hardware (1.0 m)_____

_____

Estimated Cost: _____ Estimated Schedule: __**No extension**_____

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ● Very Unlikely

Basis:_**Backup methods provide assurance < 1,000 Gal can be achieved**_____

New Consequence (C_h): ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis_____

_____

Residual Risk Level (RL_h): ○ High ○ Moderate ● Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # A-43 (ARD) Function F.1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?No experience at SRS HLW tank		X	
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?	X		
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?installation & tie-in to transfer system		X	
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-43 (ARD) Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concems?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?	X		
7. Is there insufficient experience with the O&M of the proposed system?			X
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?Sole Source		X	
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
4. ECR adequate?	X		
5. Pump requirements?			X
6. Tether management?			X

-On board pump adequate to get to 7
-Footprint of the job

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **F7-1** Date: **1/11/01** Idea/Strategy Number: **A-43**

Idea/Strategy Title: **ARD**

A. Statement of Risk *(What are we concerned about?)*

SRS lacks robotic experience in HLW tank

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ◯ Likely ● Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence: **Training can be utilized**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ● Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*: **ARD may not work in our application thus jeopardizing FFA**

D. Risk Level (RL): ◯ High ● Moderate ◯ Low

E. Risk Handling Strategy (RHS):

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): Basis:

◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

New Consequence (C_h): Basis

◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **I5-1** Date: **1/11/01** Idea/Strategy Number: **A-43**

Idea/Strategy Title: **ARD**

A. Statement of Risk *(What are we concerned about?)*

Required on Board pump to pump sludge to Tk 7 may be too heavy for the robot

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **off the shelf item**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Application may jeopardize FFA**

D. Risk Level (RL): ● High ○ Moderate ○ Low

E. Risk Handling Strategy (RHS):

Determine rheology
Specs to vendor
Utilize booster

Estimated Cost: **Incr. < $100 k** Estimated Schedule: **None**

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ● Very Unlikely

Basis: **Leaveraging vendor experience**

New Consequence (C_h): ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis

Residual Risk Level (RL_h): ○ High ○ Moderate ● Low ○ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **I6-1** Date: **1/11/01** Idea/Strategy Number: **A-43**

Idea/Strategy Title: **ARD**

A. Statement of Risk *(What are we concerned about?)*

Cumbersome hose and cabling inhibit mobility of robot

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ○ Likely ● Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **Previous experience at other facility**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements,. etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Cannot direct robot to all areas of tank in order to Remove sludge will not meet FFA**

D. Risk Level (RL): ○ High ● Moderate ○ Low

E. Risk Handling Strategy (RHS):

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ○ Very Unlikely Basis:

New Consequence (C_h): ○ Crisis ○ Critical ○ Significant ○ Marginal ○ Negligible Basis

Residual Risk Level (RL_h): ○ High ○ Moderate ○ Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # A-44 (Houdini) Function F.1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology? No experience in HLW tanks		X	
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?	X		
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?Installation & tie-in to transfer system		X	
4. Difficult to perform functional test?			X
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?Houidini already in use; can't decon/test		X	

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-44 (Houdini) Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?	X		
7. Is there insufficient experience with the O&M of the proposed system?(No new)			X
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
4. ECR Adequate		X	
5. Pump requirements	X		
6. Tether management (No new)			X

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **E4-1** Date: **1/11/01** Idea/Strategy Number: **A-44**

Idea/Strategy Title: **Houdini w/CSEE**

A. Statement of Risk *(What are we concerned about?)*

Houdini has significant operating hours; is contaminated and cannot be tested at TNX; reliability is questionable

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence:

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Untested system may not perform as required; thereby missing FFA**

D. Risk Level (RL): ● High ○ Moderate ○ Low

E. Risk Handling Strategy (RHS):

Buy new Houdini

Create testing area

Estimated Cost: **0.25 M** Estimated Schedule: **no impact**

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ● Unlikely ○ Very Unlikely

Basis: **New equipment & tested**

New Consequence (C_h): ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis

Residual Risk Level (RL_h): ○ High ● Moderate ○ Low ○ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **E7-2** Date: **1/12/01** Idea/Strategy Number: **A-44**

Idea/Strategy Title: **Houdini w/CSEE**

A. Statement of Risk *(What are we concerned about?)*

Due to extensive prior use, reliablility is questionable

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **Extensive prior use**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Equipment may fail causing missed FFA commitment.**

D. Risk Level (RL): ● High ○ Moderate ○ Low

E. Risk Handling Strategy (RHS):

Procure additional Houdini (indulging supports/repair procedures)

Set up contaminated test area and conduct complete

Estimated Cost: **$500 K** Estimated Schedule: **None**

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ○ Very Unlikely Basis:

New Consequence (C_h): ○ Crisis ○ Critical ○ Significant ○ Marginal ○ Negligible Basis

Residual Risk Level (RL_h): ○ High ○ Moderate ○ Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # A-70 (4 SPs) Function F.1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?	X		
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?New hole in tank top			X
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?		X	
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?2 SP D & R			X
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-70 (4 SPs) Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?		X	
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
4. ECR Adequate?		X	

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **B3-1** Date: **1/11/00** Idea/Strategy Number: **A-70**

Idea/Strategy Title: **4 SPs**

A. Statement of Risk *(What are we concerned about?)*

Installing new riser may compromise SS tank (Type IV) Structure

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ○ Likely ○ Unlikely ● Very Unlikely

Basis for Probability of Occurrence: **Completed similar activities on TK 19**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Tank failure**

D. Risk Level (RL): ○ High ○ Moderate ● Low

E. Risk Handling Strategy (RHS):

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): Basis:

○ Very Likely ○ Likely ○ Unlikely ○ Very Unlikely

New Consequence (C_h): Basis

○ Crisis ○ Critical ○ Significant ○ Marginal ○ Negligible

Residual Risk Level (RL_h): ○ High ○ Moderate ○ Low ○ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **D4-1** Date: **1/11/01** Idea/Strategy Number: **A-70**

Idea/Strategy Title: 4 SPs

A. Statement of Risk *(What are we concerned about?)*

D & R of 2 highly contaminated and very large SPs

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **Extensive experience of disposing of CLE**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ○ Critical ○ Significant ● Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **D & R may result in high exposure to personnel and disposition issues with CLE**

D. Risk Level (RL): ○ High ● Moderate ○ Low

E. Risk Handling Strategy (RHS):

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): Basis:

○ Very Likely ○ Likely ○ Unlikely ○ Very Unlikely

New Consequence (C_h): Basis

○ Crisis ○ Critical ○ Significant ○ Marginal ○ Negligible

Residual Risk Level (RL_h): ○ High ○ Moderate ○ Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # A-74 (ARM w/CSEE) Function F.1

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?Not as SRS		X	
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?Huge Structure		X	
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?	X		
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)? II/I			X
4. Difficult to perform functional test?Contaminated		x	
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?			x

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # A-74 (ARM w/CSEE) Function F.1

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?25 mph wind constraint		X	
6. Are critical lifts a concern?		X	
7. Is there insufficient experience with the O&M of the proposed system?		X	
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?Fix of equip-long lead			X
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?			X

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **E7-3** Date: **1/11/01** Idea/Strategy Number: **A-74**

Idea/Strategy Title: **ARM w/CSEE**

A. Statement of Risk *(What are we concerned about?)*

It is unknown if the equipment can be repaired in a timely manner

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence: **1. Extensive prior use 2. Currently broken; 3. Equipment design not understood by SRS**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Equipment may fail causing missed FFA Commitment**

D. Risk Level (RL): ● High ○ Moderate ○ Low

E. Risk Handling Strategy (RHS):

Procure parts ASAP (including spare/repair procedures
Subcontracting vendor to repair
Set up contaminated test area and conduct complete

Estimated Cost: **$1.5 M** Estimated Schedule: **2 yrs (currently in schedule)-no float**

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ● Very Unlikely

Basis: **Up front work will be sufficient to eliminate**

New Consequence (C_h): ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis:

Residual Risk Level (RL_h): ○ High ○ Moderate ● Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # B4M Hose in Hose Function F.3

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?Bigger/better hose		X	
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?overlanding route (CR in the way)			X
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?(SEE B5)	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?(SEE B5/D4)	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?		X	
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R? D & R of hose in hose when comp.			X
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # B4M (Hose in Hose) Function F.3

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?	X		
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?Used at RL		X	
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number:_**B5-1**_____ Date:___**1/12/01**_____ Idea/Strategy Number:___**B4M**_

Idea/Strategy Title:_**Hose in Hose**_____

A. Statement of Risk *(What are we concerned about?)*

Co-occupancy issues to route hose such that other Tank Farm activities are minimally impacted become difficult_____

Basis for the risk: _____

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ● Likely ◯ Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence:_____

_____

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ◯ Critical ◯ Significant ● Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*:_**Cost to route hose increases or Tk activities Shutdown**_____

D. Risk Level (RL): ◯ High ● Moderate ◯ Low

E. Risk Handling Strategy (RHS):

Develop route away from occupied areas_____

Intergrate xfer with other activities/outages to reduce impacts_____

Additional shield up_____

Estimated Cost: ___**300K**_____ Estimated Schedule: _____

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ◯ Very Likely ◯ Likely ◯ Unlikely ● Very Unlikely

Basis:_____

_____

New Consequence (C_h): ◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis:_____

_____

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number:_**D4-2**_____ Date:_**1/12/01**_____ Idea/Strategy Number:_**B4M**_____

Idea/Strategy Title:_Hose in Hose_____

A. Statement of Risk *(What are we concerned about?)*

D & R of Hose may create radiological & disposal issues_____

_____

Basis for the risk: _____

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ● Likely ◯ Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence:_____

_____

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ◯ Critical ◯ Significant ● Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*:_**Cost & schedule overruns;expend personnel resources to D & R**_____

D. Risk Level (RL): ◯ High ● Moderate ◯ Low

E. Risk Handling Strategy (RHS):

Develop D & R Plan Early_____

Dems/mockup D & R techniques_____

Leverage Hanford lessons learned & FFA $_____

Estimated Cost: ___**100K**_____ Estimated Schedule: _____

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ◯ Very Likely ◯ Likely ● Unlikely ◯ Very Unlikely

Basis:_____

_____

New Consequence (C_h): ◯ Crisis ◯ Critical ◯ Significant ● Marginal ◯ Negligible

Basis_____

_____

Residual Risk Level (RL_h): ◯ High ◯ Moderate ● Low ◯ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # B-8 (Bibo) Function F.2

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?	X		
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?		X	
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # B-8 (Bibo) Function F.2

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?		X	
7. Is there insufficient experience with the O&M of the proposed system?Rad field use		X	
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # B-16 (Diode) Function F.2

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?Not in US/Not in SRS			X
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?(AEA)		X	
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?Atomisation of waste (in A3)			X
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?		x	
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **HI-2** Date: **1/12/01** Idea/Strategy Number: **B-16**

Idea/Strategy Title: **Diode**

A. Statement of Risk *(What are we concerned about?)*

Significant AB issue result in unknown costs and schedules to mitigate

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ◯ Likely ◯ Unlikely ● Very Unlikely

Basis for Probability of Occurrence: **Previous experience; similar equipment**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ● Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*: **Missed FFA**

D. Risk Level (RL): ◯ High ◯ Moderate ● Low

E. Risk Handling Strategy (RHS):

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): Basis:

◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

New Consequence (C_h): Basis

◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # B-38 (TTP) Function F.2

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?	X		
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?D & R/ Refurbished		X	
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?		X	
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # B-38 Function F.2

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?	X		
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path? Refurbished 6-9m		X	
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
	X		

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # B43M (Tk1 Tie-in) Function F.3

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	**Potential for Risk?**		
	No	**Low**	**Yes**
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?	X		
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?Tk1 taken o/s;need to be returned		X	
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?Tk 7-on similar WR schedule		x	
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?	X		
5. Emergency transfers needed?Need plan on Tk1 Emerg xfer		X	
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?High pt vent;condition of old line; to do flowing water test		x	
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	x		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # B43 M (Tk 1 Tie-in) Function F.3

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?	X		
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		
	X		

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **D5-1** Date: **1/12/01** Idea/Strategy Number: **B43M**

Idea/Strategy Title: **Tk 1 Tie-in**

A. Statement of Risk *(What are we concerned about?)*

Development and implementation of Emergency Transfer strategy during tie-in of Tk 18 transfer line maybe
Difficult/expensive

Basis for the risk: _____

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ◯ Likely ● Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence: **Needs to be sold to DOE**

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ◯ Critical ◯ Significant ● Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*: **Drive up cost (selling a cost-effective solution)**

D. Risk Level (RL): ◯ High ◯ Moderate ● Low

E. Risk Handling Strategy (RHS):

Plan Tk 18-Tk7 Cut over as to minimize time Tk 18 is w/o transfer emergency
Cut Tk1 line first & test back to Tk 7; Have the spool piece fab'd ready or have qualified hose section available;
Cut Tk 18 to FDB-1 line and test back to Tk 18; Tie-in spool piece; in event of emergency retie originial
Configuration, tie in spool or hose (depend on how far along tie-in mod is)

Estimated Cost: _____ Estimated Schedule: _____

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely Basis: _____

New Consequence (C_h): ◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible Basis _____

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **E4-2** Date: **1/12/01** Idea/Strategy Number: **B43M**

Idea/Strategy Title: **Tk 1 Tie-in**

A. Statement of Risk *(What are we concerned about?)*

Core Jacket pipe integrity may not be able to be proven adeq; has not been tested recently

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ○ Likely ● Unlikely ○ Very Unlikely

Basis for Probability of Occurrence:

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ○ Critical ● Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Maybe come difficult to qualify lines and therefore increase cost/schedule**

D. Risk Level (RL): ○ High ● Moderate ○ Low

E. Risk Handling Strategy (RHS):

Do earlier in project schedule; Design tie-in to facilitate pressure or water test of jacket; Flowing water

Test core early; Flowing water, pressure test or He test jacket early; Fix as needed

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ● Very Unlikely Basis:

New Consequence (C_h): ○ Crisis ○ Critical ○ Significant ○ Marginal ○ Negligible Basis

Residual Risk Level (RL_h): ○ High ○ Moderate ○ Low ○ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # C-21 (Chemical) Function F.3

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?Chemical compatability w/ down stream process			X
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?Need an area to neutralize (see A3)			X
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?DWPF glass issue (see A3)	X		
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?		X	
4. Hazardous material issues?(Personnel)		X	
5. Process hazard potential?(Process)		X	
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?	X		
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?	X		
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # C-21 (Chemical) Function F.3

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?	X		
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE **R & D Process development**			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?(inA3)			X
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **A3-2** Date: **1/12/01** Idea/Strategy Number: **C-21**

Idea/Strategy Title: **Chemical**

A. Statement of Risk *(What are we concerned about?)*

Cost & Schedule to develop chemical cleaning process compatible w/downstream process is unknown

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ● Likely ○ Unlikely ○ Very Unlikely

Basis for Probability of Occurrence:

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **Doesn't support WR in Tk 18 in Accordance w/FFA. Significant. Cost Impact**

D. Risk Level (RL): ● High ○ Moderate ○ Low

E. Risk Handling Strategy (RHS):

Commission dedicated team to develop process and facilities for neutralization; Conduct real waste Testing on fast track (incremental cost of $500K) to fast track; Leverage TFA funding

Estimated Cost: **$500K** Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ● Unlikely ○ Very Unlikely Basis:

New Consequence (C_h): ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible Basis

Residual Risk Level (RL_h): ○ High ● Moderate ○ Low ○ Eliminated

Note: If Tk 18 schedule is removed from consequences residual risk would be lowered further

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **B1-1** Date: **1/12/01** Idea/Strategy Number: **C-21**

Idea/Strategy Title: **Chemical Cleaning**

A. Statement of Risk *(What are we concerned about?)*

Need an area to neutralize (included in A3-2)

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence:

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*:

D. Risk Level (RL): ◯ High ◯ Moderate ◯ Low

E. Risk Handling Strategy (RHS):

Estimated Cost: Estimated Schedule:

F. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): Basis:

◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

New Consequence (C_h): Basis

◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

ATTACHMENT 2
HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **G1-1** Date: **1/12/01** Idea/Strategy Number: **C-21**

Idea/Strategy Title: Chemical

A. Statement of Risk *(What are we concerned about?)*

R & D and process development (included in A3-2)

Basis for the risk:

B. Probability (P) *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

Basis for Probability of Occurrence:

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis for Consequence Factor *(State consequences)*:

D. Risk Level (RL): ◯ High ◯ Moderate ◯ Low

C. Risk Handling Strategy (RHS):

Estimated Cost: Estimated Schedule:

D. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ◯ Very Likely ◯ Likely ◯ Unlikely ◯ Very Unlikely

Basis:

New Consequence (C_h): ◯ Crisis ◯ Critical ◯ Significant ◯ Marginal ◯ Negligible

Basis

Residual Risk Level (RL_h): ◯ High ◯ Moderate ◯ Low ◯ Eliminated

ATTACHMENT 1 - HLW Tank 18 Waste Removal Team
Risk Screening Criteria

Rev. 11/8/00

Idea # C-56 (Sluicer) Function F.3

Screenings are performed to determine if the project or activity has the potential for risk. Judgement must be exercised in determining whether the screening item results in a potential risk. Categories that pose *No* risk to the project are identified as such. A *Low* risk is marked accordingly and should be justified under separate documentation. A *Yes* response indicates the potential for risk. If any of the questions are answered as *Yes*, a Risk Analysis is required.

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
A. TECHNOLOGY			
1. New technology?	X		
2. Unknown or unclear technology?	X		
3. New application of existing technology?	X		
4. Modernized/advanced technology in existing application?	X		
B. INTERFACES			
1. Multiple system interfaces (e.g., canyons, transfer routes) an issue?	X		
2. Multiple technical agencies an issue?	X		
3. Interfaces with operating SSCs during construction/installation present issues?	X		
4. Interfaces with operating SSCs including testing present issues?	X		
5. Involves co-occupancy issues?	X		
6. H&V/Negative pressure loss issues?	X		
7. Multiple Project/Facility interfaces cause issues?			X
C. SAFETY			
1. Criticality potential?	X		
2. Significant exposure/contamination potential?	X		
3. Any significant impact or challenge to the Facility's Authorization Basis?	X		
4. Hazardous material issues?	X		
5. Process hazard potential?	X		
6. Will hazardous materials inventories exceed the OSHA or Radiation Management Plan total quantities?	X		
D. REGULATORY/ENVIRONMENTAL			
1. Environmental assessment/impact statement issues?	X		
2. Additional releases?	X		
3. Undefined disposal methods?	X		
4. Requires substantial equipment D&R?	X		
5. Emergency transfers needed?	X		
6. Political vulnerabilities (DOE, Congress, local government) create significant issues?	X		
E. DESIGN			
1. Undefined, incomplete or unclear functional requirements?			
2. Undefined, incomplete or unclear design criteria?	X		
3. Complex design features (e.g., controls, seismic, compatibility)?	X		
4. Difficult to perform functional test?	X		
5. Issues with the content, number or clarity of assumptions?	X		
6. Precludes portability of infrastructure?	X		
7. RAMI issues?	X		

ATTACHEMENT 1 - HLW Tank 18 Waste Removal Team

Risk Screening Criteria

Rev. 11/8/00

Idea # C-56 (Sluicer) Function F.3

Risk Screening Criteria	Potential for Risk?		
	No	Low	Yes
F. RESOURCES/CONDITIONS			
1 Are adequate and timely resources, material, or equipment a concern?	X		
2. Specialty resource requirements create concerns?	X		
3. Are existing utility locations a concern (above/below ground)?	X		
4. Are geological conditions a concern?	X		
5. Is weather a concern?	X		
6. Are critical lifts a concern?	X		
7. Is there insufficient experience with the O&M of the proposed system?	X		
G. SCHEDULE			
1. Project Schedule uncertainties or restraints that may impact project completion or milestone dates?	X		
2. Fast track critical needs issues?	X		
H. PROCUREMENT			
1. Long lead items that may affect critical path?	X		
2. Potential unavailable qualified vendors or contractors?	X		
3. Is the procurement strategy inadequate?	X		
4. Is it a first-use subcontractor/vendor that presents issues?	X		
5. Do vendor support issues exist?	X		
I. OTHER			
1. Contract issues?	X		
2. Direct hire/subcontract issues?	X		
3. Systems startup concerns?	X		

ATTACHMENT 2

HLW TANK 18 WASTE REMOVAL AND TRANSFER RISK IDENTIFICATION FORM

Risk Assessment Identification Form
HLW Tank 18 Waste Removal and Transfer

Risk Number: **B7-1** Date: **1/12/01** Idea/Strategy Number: **C-56**

Idea/Strategy Title: Sluicer

G. **Statement of Risk** *(What are we concerned about?)*

Amount of water required to remove residual sludge may exceed available receipt tank space

Basis for the risk:

H. **Probability (P)** *(What is the probability that the "unhandled" risk will come true?)*

Probability of Occurrence: ○ Very Likely ○ Likely ● Unlikely ○ Very Unlikely

Basis for Probability of Occurrence:

C. Consequence (C) *(What is/are the consequences if the "unhandled" risk comes true? Examples are life-threatening, property damage, schedule delays, noncompliance with regulations or site requirements, etc.)*

Consequence Factor: ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis for Consequence Factor *(State consequences)*: **May have to slow down sluicer to conserve receipt Tank space thus jeop. FFA and impacting other key scope activities.**

D. Risk Level (RL): ○ High ● Moderate ○ Low

I. Risk Handling Strategy (RHS):

Develop enhanced sluicer nozzles ($100K); high press, low volume, focused spray pattern; Test, mock Up demo ($100K)

Estimated Cost: **$200K** Estimated Schedule:

J. Impact of Strategy on Risk Level (RL_h):

New Probability (P_h): ○ Very Likely ○ Likely ○ Unlikely ● Very Unlikely

Basis:

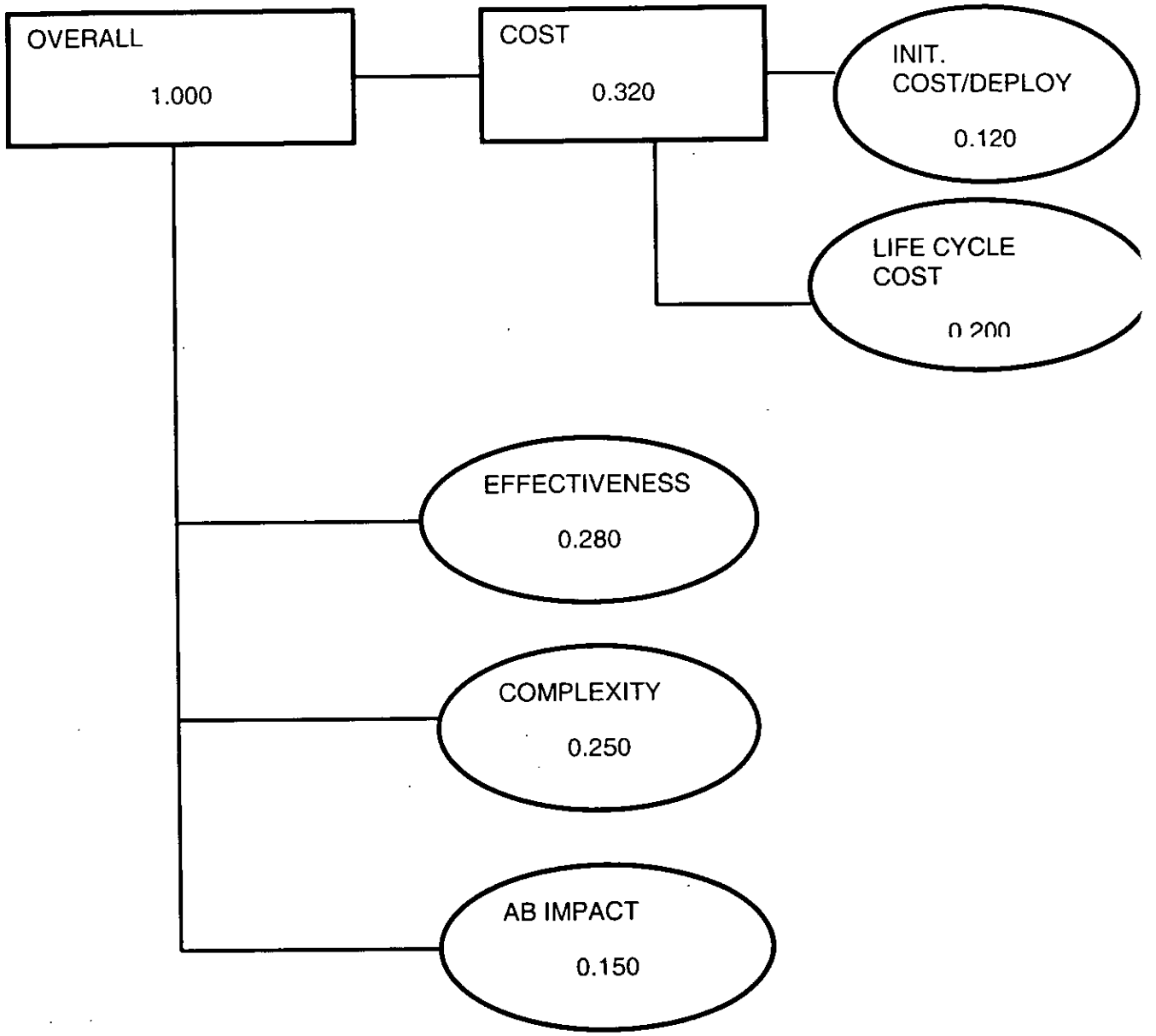
New Consequence (C_h): ○ Crisis ● Critical ○ Significant ○ Marginal ○ Negligible

Basis

Residual Risk Level (RL_h): ○ High ○ Moderate ● Low ○ Eliminated

ATTACHMENT 8

STRATEGY SENSITIVITY ANALYSIS


OVERALL
1.000
COST
0.320
INIT.
COST/DEPLOY
0.120
LIFE CYCLE
COST
0.200
EFFECTIVENESS
0.280
COMPLEXITY
0.250
AB IMPACT
0.150

TANK 18: STRATEGY SCORING

STRATEGY	INITIAL COST TO DEPLOY (0.12)	LIFE CYCLE COST (0.20)	EFFECTIVENESS (0.28)	COMPLEXITY (0.25)	AB IMPACT (0.15)	TOTAL SCORE WEIGHTED
S2	67.75	3	94	84.2	87.55	69.2
S3	49.5	15	95.5	80.6	71.45	66.5
S4	76.5	6.75	91.5	80.2	86.5	69.2
S6	67.75	5	94	83.75	75.15	67.7
S7	50.5	17	95.5	80.15	59.05	65.1
S8	77.5	8.75	91.5	79.75	74.1	67.7
S10	72.75	15	94.2	85.6	87.55	72.6
S11	55.5	27	95.7	80.4	71.45	69.7
S12	82.5	18.75	91.7	80	86.5	72.3
S14	73.75	17	94.2	85.15	75.15	71.2
S15	56.5	29	95.7	79.95	59.05	68.2
S16	83.5	20.75	91.7	79.55	74.1	70.8
S18	65.25	9	94.6	84.05	86.05	70.0
S19	48	21	96.1	80.45	69.95	67.5
S20	75	12.75	92.1	80.05	85	70.1
S22	66.25	11	94.6	83.6	73.65	68.6
S23	49	23	96.1	80	57.55	66.0
S24	76	14.75	92.1	79.6	72.6	68.6
S26	58.5	3	90	83.4	88.05	66.9
S27	41.25	15	91.5	79.8	71.95	64.3
S28	68.25	6.75	87.5	79.4	87	66.9
S30	59.5	5	90	82.95	75.65	65.4
S31	42.45	17	91.5	79.35	59.55	62.9
S32	69.25	8.75	87.5	78.95	74.6	65.5
S34	64.5	15	90.2	84.8	88.05	70.4
S35	47.25	27	91.7	79.6	71.95	67.4
S36	74.25	18.75	87.7	79.2	87	70.1
S38	65.5	17	90.2	84.35	75.65	69.0
S39	48.25	29	91.7	79.15	59.55	66.0
S40	75.25	20.75	87.7	78.75	74.6	68.6
S42	57	9	90.6	83.25	86.55	67.8
S43	39.75	21	92.1	79.65	70.45	65.2
S44	66.75	12.75	88.1	79.25	85.5	67.9
S46	58	11	90.6	82.8	74.15	66.4
S47	40.75	23	92.1	79.2	58.05	63.8
S48	67.75	14.75	88.1	78.8	73.1	66.4
S50	72	60	92.4	80.2	87.55	79.7
S51	53.25	72	93.9	76.6	71.45	76.9
S52	81	63.75	89.9	76.2	86.5	79.7
S53	39.75	60	92.4	77.8	86.5	75.1
S55	73	62	92.4	79.75	75.15	78.2
S56	54.25	74	93.9	76.15	59.05	75.5
S57	82	65.75	89.9	75.75	74.1	78.2
S58	40.75	62	92.4	77.35	74.1	73.6
S60	78	72	92.6	81.6	87.55	83.2

TANK 18: STRATEGY SCORING (Contd)

STRATEGY	INITIAL COST TO DEPLOY (0.12)	LIFE CYCLE COST (0.20)	EFFECTIVENESS (0.28)	COMPLEXITY (0.25)	AB IMPACT (0.15)	TOTAL SCORE WEIGHTED
S61	59.25	84	94.1	76.4	71.45	80.1
S62	87	75.75	90.1	76	86.5	82.8
S63	45.75	72	92.6	77.6	86.5	78.2
S65	79	74	92.6	81.15	75.15	81.8
S66	60.25	86	94.1	75.95	59.05	78.6
S67	88	77.75	90.1	75.55	74.1	81.3
S68	46.75	74	92.6	77.15	74.1	76.7
S70	70.5	66	93	80.05	86.05	80.6
S71	51.75	78	94.5	76.45	69.95	77.9
S72	79.5	69.75	90.5	76.05	85	80.6
S73	38.25	66	93	77.65	85	76.0
S75	71.5	68	93	79.6	73.65	79.2
S76	52.75	80	94.5	76	57.55	76.4
S77	80.5	71.75	90.5	75.6	72.6	79.1
S78	39.25	68	93	77.2	72.6	74.5
S80	45	0	93.6	77.4	87.85	64.1
S81	28.5	12	95.1	73.8	71.75	61.7
S82	55.5	3.75	91.1	73.4	86.8	64.3
S83	13.5	0	93.6	75	86.8	59.6
S85	46	2	93.6	76.95	75.45	62.7
S86	29.5	14	95.1	73.35	59.35	60.2
S87	56.5	5.75	91.1	72.95	74.4	62.8
S88	14.5	2	93.6	74.55	74.4	58.1
S90	51	12	93.8	78.8	87.85	67.7
S91	34.5	24	95.3	73.6	71.75	64.8
S92	61.5	15.75	91.3	73.2	86.8	67.4
S93	19.5	12	93.8	74.8	86.8	62.7
S95	52	14	93.8	78.35	75.45	66.2
S96	35.5	26	95.3	73.15	59.35	63.3
S97	62.5	17.75	91.3	72.75	74.4	66.0
S98	20.5	14	93.8	74.35	74.4	61.3
S100	43.5	6	94.2	77.25	86.35	65.1
S101	27	18	95.7	73.65	70.25	62.6
S102	54	9.75	91.7	73.25	85.3	65.2
S103	12	6	94.2	74.85	85.3	60.5
S105	44.5	8	94.2	76.8	73.95	63.6
S106	28	20	95.7	73.2	57.85	61.1
S107	55	11.75	91.7	72.8	72.9	63.8
S108	13	8	94.2	74.4	72.9	59.1
S109	96	30	88.5	87	90.85	77.7
S110	97	32	88.5	86.55	78.45	76.2
S111	84.75	30	84.5	83.8	91.1	74.4
S112	85.75	32	84.5	83.35	78.7	73.0
S113	60.75	30	89.7	83.4	90.1	72.8
S114	61.75	32	89.7	82.95	77.7	71.3

TANK 18: STRATEGY RANKING SCORE (Contd)

STRATEGY	INITIAL COST TO DEPLOY (0.12)	LIFE CYCLE COST (0.20)	EFFECTIVENESS (0.28)	COMPLEXITY (0.25)	AB IMPACT (0.15)	TOTAL SCORE WEIGHTED
S60	78	72	92.6	81.6	87.55	83.2
S62	87	75.75	90.1	76	86.5	82.8
S65	79	74	92.6	81.15	75.15	81.8
S67	88	77.75	90.1	75.55	74.1	81.3
S70	70.5	66	93	80.05	86.05	80.6
S72	79.5	69.75	90.5	76.05	85	80.6
S61	59.25	84	94.1	76.4	71.45	80.1
S50	72	60	92.4	80.2	87.55	79.7
S52	81	63.75	89.9	76.2	86.5	79.7
S75	71.5	68	93	79.6	73.65	79.2
S77	80.5	71.75	90.5	75.6	72.6	79.1
S66	60.25	86	94.1	75.95	59.05	78.6
S55	73	62	92.4	79.75	75.15	78.2
S57	82	65.75	89.9	75.75	74.1	78.2
S63	45.75	72	92.6	77.6	86.5	78.2
S71	51.75	78	94.5	76.45	69.95	77.9
S109	96	30	88.5	87	90.85	77.7
S51	53.25	72	93.9	76.6	71.45	76.9
S68	46.75	74	92.6	77.15	74.1	76.7
S76	52.75	80	94.5	76	57.55	76.4
S110	97	32	88.5	86.55	78.45	76.2
S73	38.25	66	93	77.65	85	76.0
S56	54.25	74	93.9	76.15	59.05	75.5
S53	39.75	60	92.4	77.8	86.5	75.1
S78	39.25	68	93	77.2	72.6	74.5
S111	84.75	30	84.5	83.8	91.1	74.4
S58	40.75	62	92.4	77.35	74.1	73.6
S112	85.75	32	84.5	83.35	78.7	73.0
S113	60.75	30	89.7	83.4	90.1	72.8
S10	72.75	15	94.2	85.6	87.55	72.6
S12	82.5	18.75	91.7	80	86.5	72.3
S114	61.75	32	89.7	82.95	77.7	71.3
S14	73.75	17	94.2	85.15	75.15	71.2
S16	83.5	20.75	91.7	79.55	74.1	70.8
S34	64.5	15	90.2	84.8	88.05	70.4
S20	75	12.75	92.1	80.05	85	70.1
S36	74.25	18.75	87.7	79.2	87	70.1
S18	65.25	9	94.6	84.05	86.05	70.0
S11	55.5	27	95.7	80.4	71.45	69.7
S2	67.75	3	94	84.2	87.55	69.2
S4	76.5	6.75	91.5	80.2	86.5	69.2
S38	65.5	17	90.2	84.35	75.65	69.0
S22	66.25	11	94.6	83.6	73.65	68.6
S24	76	14.75	92.1	79.6	72.6	68.6
S40	75.25	20.75	87.7	78.75	74.6	68.6

TANK 18: STRATEGY RANKING SCORE (Contd)

STRATEGY	INITIAL COST TO DEPLOY (0.12)	LIFE CYCLE COST (0.20)	EFFECTIVENESS (0.28)	COMPLEXITY (0.25)	AB IMPACT (0.15)	TOTAL SCORE WEIGHTED
S15	56.5	29	95.7	79.95	59.05	68.2
S44	66.75	12.75	88.1	79.25	85.5	67.9
S42	57	9	90.6	83.25	86.55	67.8
S6	67.75	5	94	83.75	75.15	67.7
S8	77.5	8.75	91.5	79.75	74.1	67.7
S90	51	12	93.8	78.8	87.85	67.7
S19	48	21	96.1	80.45	69.95	67.5
S35	47.25	27	91.7	79.6	71.95	67.4
S92	61.5	15.75	91.3	73.2	86.8	67.4
S26	58.5	3	90	83.4	88.05	66.9
S28	68.25	6.75	87.5	79.4	87	66.9
S3	49.5	15	95.5	80.6	71.45	66.5
S46	58	11	90.6	82.8	74.15	66.4
S48	67.75	14.75	88.1	78.8	73.1	66.4
S95	52	14	93.8	78.35	75.45	66.2
S23	49	23	96.1	80	57.55	66.0
S39	48.25	29	91.7	79.15	59.55	66.0
S97	62.5	17.75	91.3	72.75	74.4	66.0
S32	69.25	8.75	87.5	78.95	74.6	65.5
S30	59.5	5	90	82.95	75.65	65.4
S43	39.75	21	92.1	79.65	70.45	65.2
S102	54	9.75	91.7	73.25	85.3	65.2
S7	50.5	17	95.5	80.15	59.05	65.1
S100	43.5	6	94.2	77.25	86.35	65.1
S91	34.5	24	95.3	73.6	71.75	64.8
S27	41.25	15	91.5	79.8	71.95	64.3
S82	55.5	3.75	91.1	73.4	86.8	64.3
S80	45	0	93.6	77.4	87.85	64.1
S47	40.75	23	92.1	79.2	58.05	63.8
S107	55	11.75	91.7	72.8	72.9	63.8
S105	44.5	8	94.2	76.8	73.95	63.6
S96	35.5	26	95.3	73.15	59.35	63.3
S31	42.45	17	91.5	79.35	59.55	62.9
S87	56.5	5.75	91.1	72.95	74.4	62.8
S85	46	2	93.6	76.95	75.45	62.7
S93	19.5	12	93.8	74.8	86.8	62.7
S101	27	18	95.7	73.65	70.25	62.6
S81	28.5	12	95.1	73.8	71.75	61.7
S98	20.5	14	93.8	74.35	74.4	61.3
S106	28	20	95.7	73.2	57.85	61.1
S103	12	6	94.2	74.85	85.3	60.5
S86	29.5	14	95.1	73.35	59.35	60.2
S83	13.5	0	93.6	75	86.8	59.6
S108	13	8	94.2	74.4	72.9	59.1
S88	14.5	2	93.6	74.55	74.4	58.1

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0

COST SENSITIVITY DECREASED BY 10%

Alternative	Utility
S60	0.845
S62	0.832
S65	0.826
S70	0.825
S50	0.819
S72	0.816
S67	0.813
S52	0.811
S109	0.810
S61	0.809
S75	0.806
S63	0.806
S55	0.800
S77	0.797
S71	0.793
S57	0.792
S110	0.791
S73	0.790
S66	0.790
S51	0.787
S68	0.786
S53	0.784
S111	0.780
S10	0.779
S76	0.774
S113	0.774
S78	0.771
S56	0.768
S12	0.767
S58	0.765
S112	0.761
S14	0.760
S18	0.759
S34	0.758
S114	0.755
S2	0.754
S20	0.751
S16	0.748
S36	0.746
S4	0.745
S11	0.744
S22	0.740
S38	0.739
S42	0.738
S90	0.737
S6	0.734
S26	0.732
S24	0.732
S44	0.730
S19	0.728
S40	0.726
S8	0.726
S92	0.725
S15	0.725
S28	0.724
S35	0.723
S3	0.722
S46	0.719
S95	0.718
S100	0.717
S30	0.713
S48	0.711
S80	0.711
S102	0.709
S23	0.709
S43	0.707
S97	0.706
S32	0.705
S39	0.704
S82	0.703
S7	0.703
S91	0.702
S27	0.701
S105	0.698
S93	0.698
S85	0.692
S107	0.690
S47	0.688
S101	0.686
S87	0.684
S96	0.683
S31	0.682
S103	0.682
S81	0.681
S98	0.679
S83	0.676
S106	0.667
S108	0.663
S86	0.661
S88	0.657

Member	Weight
INIT. COST/DEPLOY	8.2
LIFE CYCLE COST	13.8
EFFECTIVENESS	32.1
COMPLEXITY	28.7

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.825
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S61	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.688
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

COST SENSITIVITY INCREASED BY 10%

Alternative	Utility
S62	0.824
S60	0.819
S67	0.814
S65	0.809
S72	0.795
S61	0.793
S70	0.787
S77	0.785
S66	0.783
S52	0.783
S75	0.777
S50	0.775
S57	0.773
S55	0.765
S71	0.764
S63	0.758
S76	0.754
S51	0.752
S68	0.748
S109	0.743
S56	0.742
S110	0.733
S73	0.730
S78	0.720
S53	0.717
S111	0.709
S58	0.707
S112	0.699
S113	0.682
S12	0.679
S10	0.673
S114	0.672
S16	0.669
S14	0.663
S36	0.656
S20	0.651
S34	0.650
S11	0.650
S40	0.646
S18	0.642
S24	0.641
S38	0.640
S15	0.640
S4	0.638
S22	0.632
S2	0.631
S8	0.628
S44	0.627
S35	0.626
S92	0.623
S19	0.621
S6	0.619
S42	0.618
S48	0.617
S90	0.616
S39	0.616
S28	0.615
S97	0.613
S23	0.611
S3	0.609
S46	0.608
S95	0.606
S26	0.605
S32	0.605
S7	0.599
S43	0.598
S30	0.595
S102	0.595
S91	0.594
S47	0.588
S27	0.585
S107	0.585
S100	0.584
S96	0.584
S82	0.582
S31	0.575
S105	0.574
S87	0.572
S80	0.572
S101	0.565
S85	0.562
S93	0.557
S106	0.555
S81	0.553
S98	0.547
S86	0.543
S103	0.528
S108	0.518
S83	0.516
S88	0.506

Member	Weight
INIT COST/DEPLOY	15.7
LIFE CYCLE COST	26.2
EFFECTIVENESS	23.9
COMPLEXITY	21.3
AB IMPACT	12.8

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

INIT. COST TO DEPLOY SENSITIVITY DECREASED BY 10%

Alternative	Utility
S60	0.838
S61	0.824
S62	0.823
S65	0.821
S63	0.819
S70	0.818
S71	0.808
S72	0.807
S66	0.807
S67	0.806
S50	0.806
S73	0.803
S68	0.801
S75	0.800
S51	0.796
S52	0.795
S76	0.791
S53	0.791
S77	0.790
S55	0.788
S78	0.786
S56	0.779
S57	0.778
S58	0.773
S109	0.756
S113	0.741
S110	0.739
S111	0.733
S10	0.726
S114	0.724
S112	0.715
S11	0.713
S12	0.711
S34	0.711
S14	0.709
S18	0.706
S35	0.697
S19	0.697
S36	0.696
S90	0.696
S15	0.696
S20	0.695
S16	0.694
S2	0.694
S38	0.693
S42	0.690
S22	0.689
S3	0.685
S4	0.683
S91	0.682
S43	0.681
S92	0.681
S39	0.680
S44	0.680
S23	0.680
S40	0.679
S26	0.678
S95	0.678
S24	0.678
S6	0.676
S93	0.676
S100	0.675
S46	0.673
S27	0.669
S28	0.668
S7	0.668
S101	0.666
S8	0.666
S96	0.665
S102	0.665
S47	0.664
S97	0.664
S80	0.663
S48	0.663
S30	0.661
S103	0.660
S98	0.659
S105	0.658
S81	0.654
S82	0.653
S31	0.652
S32	0.651
S106	0.649
S83	0.648
S107	0.648
S85	0.646
S108	0.643
S86	0.637
S87	0.636
S88	0.631

Member	Weight
INIT. COST/DEPLOY	2.0
LIFE CYCLE COST	22.3
EFFECTIVENESS	31.2
COMPLEXITY	27.8
AB IMPACT	16.7

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	26.0
COMPLEXITY	25.0
AB IMPACT	15.0

INIT. COST TO DEPLOY SENSITIVITY INCREASED BY 10%

Alternative	Utility
S62	0.833
S60	0.826
S67	0.821
S65	0.815
S72	0.805
S52	0.798
S109	0.798
S70	0.795
S77	0.793
S50	0.788
S57	0.786
S110	0.786
S75	0.783
S61	0.777
S55	0.776
S66	0.765
S111	0.756
S71	0.749
S63	0.745
S112	0.744
S51	0.743
S76	0.737
S12	0.735
S68	0.733
S56	0.731
S10	0.727
S16	0.723
S73	0.717
S14	0.715
S113	0.714
S53	0.711
S20	0.707
S36	0.705
S78	0.705
S114	0.702
S4	0.700
S58	0.699
S34	0.697
S18	0.695
S24	0.695
S40	0.694
S2	0.691
S8	0.688
S38	0.686
S22	0.683
S11	0.681
S44	0.677
S6	0.677
S28	0.671
S15	0.669
S92	0.667
S42	0.666
S48	0.666
S26	0.659
S32	0.659
S90	0.658
S97	0.656
S46	0.654
S19	0.653
S35	0.651
S30	0.648
S3	0.646
S95	0.646
S23	0.641
S39	0.640
S102	0.639
S7	0.634
S82	0.633
S107	0.628
S100	0.626
S43	0.623
S87	0.621
S80	0.620
S27	0.617
S105	0.614
S91	0.613
S47	0.612
S85	0.608
S31	0.606
S96	0.602
S101	0.585
S81	0.579
S93	0.578
S106	0.574
S86	0.567
S98	0.566
S103	0.550
S83	0.544
S108	0.538
S88	0.532

Member	Weight
INIT. COST/DEPLOY	22.0
LIFE CYCLE COST	17.7
EFFECTIVENESS	24.8
COMPLEXITY	22.2
AB IMPACT	13.3

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

LIFE CYCLE COST SENSITIVITY DECREASED BY 10%

Alternative	Utility
S60	0.846
S62	0.837
S109	0.836
S65	0.827
S70	0.824
S50	0.822
S72	0.819
S67	0.818
S110	0.818
S52	0.817
S75	0.806
S55	0.803
S77	0.801
S111	0.800
S10	0.798
S57	0.798
S61	0.796
S12	0.790
S63	0.790
S113	0.781
S112	0.781
S14	0.780
S71	0.779
S66	0.777
S18	0.777
S51	0.776
S2	0.775
S34	0.773
S20	0.773
S73	0.772
S16	0.771
S68	0.771
S4	0.770
S53	0.770
S36	0.765
S114	0.762
S76	0.760
S22	0.758
S56	0.757
S6	0.755
S38	0.754
S24	0.754
S78	0.754
S42	0.752
S8	0.751
S58	0.751
S11	0.750
S26	0.749
S44	0.748
S90	0.746
S40	0.746
S28	0.745
S92	0.739
S19	0.733
S46	0.733
S15	0.731
S3	0.730
S30	0.730
S48	0.729
S95	0.727
S32	0.726
S35	0.725
S100	0.724
S80	0.722
S102	0.721
S97	0.720
S82	0.719
S23	0.714
S7	0.711
S43	0.708
S39	0.706
S105	0.706
S27	0.705
S85	0.703
S107	0.703
S87	0.700
S91	0.699
S93	0.691
S47	0.689
S31	0.686
S101	0.682
S96	0.680
S81	0.679
S103	0.673
S98	0.672
S83	0.670
S106	0.663
S86	0.660
S108	0.655
S88	0.652

Member	Weight
INIT. COST/DEPLOY	13.5
LIFE CYCLE COST	10.0
EFFECTIVENESS	31.5
COMPLEXITY	28.1
AB IMPACT	16.9

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

INIT. COST TO DEPLOY SENSITIVITY INCREASED BY 10%

Alternative	Utility
S62	0.833
S60	0.826
S67	0.821
S65	0.815
S72	0.805
S52	0.798
S109	0.798
S70	0.795
S77	0.793
S50	0.788
S57	0.786
S110	0.786
S75	0.783
S61	0.777
S55	0.776
S66	0.765
S111	0.756
S71	0.749
S63	0.745
S112	0.744
S51	0.743
S76	0.737
S12	0.735
S68	0.733
S56	0.731
S10	0.727
S16	0.723
S73	0.717
S14	0.715
S113	0.714
S53	0.711
S20	0.707
S36	0.705
S78	0.705
S114	0.702
S4	0.700
S58	0.699
S34	0.697
S18	0.695
S24	0.695
S40	0.694
S2	0.691
S8	0.688
S38	0.686
S22	0.683
S11	0.681
S44	0.677
S6	0.677
S28	0.671
S15	0.669
S92	0.667
S42	0.666
S48	0.666
S26	0.659
S32	0.659
S90	0.658
S97	0.656
S46	0.654
S19	0.653
S35	0.651
S30	0.648
S3	0.646
S95	0.646
S23	0.641
S39	0.640
S102	0.639
S7	0.634
S82	0.633
S107	0.628
S100	0.626
S43	0.623
S87	0.621
S80	0.620
S27	0.617
S105	0.614
S91	0.613
S47	0.612
S85	0.608
S31	0.606
S96	0.602
S101	0.585
S81	0.579
S93	0.578
S106	0.574
S86	0.567
S98	0.566
S103	0.550
S83	0.544
S108	0.538
S88	0.532

Member	Weight
INIT. COST/DEPLOY	22.0
LIFE CYCLE COST	17.7
EFFECTIVENESS	24.8
COMPLEXITY	22.2
AB IMPACT	13.3

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

EFFECTIVENESS SENSITIVITY DECREASED BY 10%

Alternative	Utility
S60	0.819
S62	0.818
S65	0.803
S67	0.801
S72	0.792
S70	0.789
S52	0.782
S61	0.781
S50	0.779
S77	0.776
S75	0.772
S57	0.766
S66	0.765
S55	0.763
S63	0.762
S109	0.762
S71	0.756
S51	0.746
S68	0.745
S110	0.745
S76	0.739
S73	0.736
S111	0.730
S56	0.729
S53	0.727
S78	0.720
S112	0.714
S58	0.710
S113	0.704
S10	0.696
S12	0.696
S114	0.688
S14	0.680
S16	0.680
S34	0.677
S36	0.676
S20	0.670
S18	0.666
S4	0.661
S11	0.661
S38	0.660
S40	0.660
S2	0.658
S24	0.654
S44	0.651
S22	0.650
S42	0.646
S8	0.644
S15	0.644
S92	0.641
S28	0.641
S35	0.641
S90	0.640
S6	0.640
S26	0.637
S19	0.635
S48	0.634
S46	0.630
S3	0.625
S97	0.624
S32	0.624
S39	0.624
S95	0.624
S30	0.620
S23	0.618
S102	0.615
S43	0.615
S100	0.610
S7	0.609
S82	0.606
S91	0.605
S27	0.605
S80	0.600
S107	0.599
S47	0.599
S105	0.594
S87	0.589
S31	0.589
S96	0.589
S93	0.584
S85	0.584
S101	0.580
S81	0.570
S98	0.568
S106	0.563
S103	0.558
S86	0.554
S83	0.549
S108	0.542
S88	0.532

Member	Weight
INIT. COST/DEPLOY	13.7
LIFE CYCLE COST	22.8
EFFECTIVENESS	18.0
COMPLEXITY	28.5
AB IMPACT	17.1

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

EFFECTIVENESS SENSITIVITY INCREASED BY 10%

Alternative	Utility
S60	0.845
S62	0.838
S65	0.833
S67	0.826
S70	0.823
S61	0.820
S72	0.820
S50	0.815
S75	0.811
S52	0.811
S66	0.808
S77	0.807
S55	0.802
S63	0.802
S71	0.802
S57	0.796
S51	0.793
S109	0.792
S68	0.789
S76	0.789
S73	0.784
S56	0.781
S110	0.779
S53	0.775
S78	0.771
S58	0.762
S111	0.758
S10	0.756
S113	0.751
S12	0.750
S112	0.746
S14	0.744
S114	0.739
S16	0.737
S18	0.734
S11	0.733
S20	0.732
S34	0.732
S2	0.727
S36	0.725
S4	0.723
S22	0.722
S15	0.720
S24	0.719
S38	0.719
S19	0.714
S6	0.713
S90	0.713
S40	0.713
S8	0.710
S42	0.710
S35	0.708
S92	0.707
S44	0.707
S3	0.706
S23	0.702
S26	0.701
S95	0.700
S28	0.698
S46	0.697
S39	0.696
S97	0.695
S48	0.694
S7	0.693
S100	0.691
S91	0.690
S43	0.690
S102	0.689
S30	0.688
S32	0.685
S80	0.682
S27	0.681
S82	0.680
S105	0.679
S96	0.678
S47	0.677
S107	0.676
S101	0.672
S93	0.670
S85	0.670
S31	0.669
S87	0.668
S81	0.663
S106	0.659
S98	0.658
S103	0.652
S86	0.651
S83	0.643
S108	0.640
S88	0.631

Member	Weight
INIT. COST/DEPLOY	10.3
LIFE CYCLE COST	17.2
EFFECTIVENESS	38.0
COMPLEXITY	21.5
AB IMPACT	12.9

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	26.0
COMPLEXITY	25.0
AB IMPACT	15.0

COMPLEXITY SENSITIVITY DECREASED BY 10%

Alternative	Utility
S62	0.837
S60	0.834
S67	0.821
S65	0.819
S72	0.812
S70	0.807
S61	0.806
S52	0.801
S50	0.796
S77	0.796
S75	0.791
S66	0.790
S57	0.785
S63	0.783
S71	0.781
S55	0.780
S51	0.770
S68	0.767
S76	0.765
S109	0.764
S73	0.758
S56	0.754
S110	0.748
S53	0.747
S78	0.742
S111	0.732
S58	0.731
S112	0.716
S113	0.714
S12	0.713
S10	0.709
S114	0.698
S16	0.697
S14	0.693
S36	0.688
S20	0.688
S34	0.685
S11	0.682
S18	0.682
S4	0.677
S40	0.673
S2	0.672
S24	0.672
S38	0.669
S15	0.667
S92	0.666
S22	0.666
S44	0.663
S90	0.662
S8	0.661
S35	0.658
S42	0.657
S19	0.657
S6	0.655
S28	0.653
S97	0.651
S48	0.648
S26	0.647
S3	0.647
S95	0.646
S39	0.642
S46	0.642
S23	0.642
S102	0.641
S32	0.637
S91	0.636
S100	0.634
S43	0.633
S30	0.631
S7	0.631
S82	0.631
S107	0.626
S80	0.624
S27	0.622
S96	0.620
S105	0.618
S47	0.617
S87	0.615
S93	0.611
S101	0.611
S85	0.608
S31	0.607
S81	0.600
S98	0.595
S106	0.595
S103	0.586
S86	0.585
S83	0.575
S108	0.570
S88	0.560

Member	Weight
INIT. COST/DEPLOY	13.6
LIFE CYCLE COST	22.7
EFFECTIVENESS	31.7
COMPLEXITY	15.0
AB IMPACT	17.0

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SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

COMPLEXITY SENSITIVITY INCREASED BY 10%

Alternative	Utility
S60	0.830
S62	0.819
S65	0.817
S67	0.806
S70	0.805
S72	0.800
S50	0.798
S61	0.796
S75	0.792
S52	0.792
S109	0.789
S77	0.787
S55	0.784
S66	0.783
S63	0.781
S57	0.779
S71	0.777
S110	0.776
S51	0.769
S68	0.768
S76	0.764
S73	0.762
S111	0.757
S56	0.756
S53	0.754
S78	0.749
S112	0.744
S10	0.744
S113	0.742
S58	0.741
S12	0.733
S14	0.730
S114	0.729
S34	0.723
S16	0.720
S18	0.719
S20	0.714
S36	0.713
S2	0.712
S11	0.711
S38	0.710
S4	0.706
S22	0.706
S24	0.701
S40	0.700
S42	0.699
S6	0.698
S15	0.698
S44	0.694
S8	0.693
S19	0.692
S90	0.691
S26	0.691
S35	0.691
S28	0.686
S46	0.685
S3	0.684
S92	0.682
S48	0.681
S23	0.679
S95	0.678
S30	0.678
S39	0.677
S32	0.673
S43	0.672
S7	0.671
S97	0.669
S100	0.667
S27	0.664
S102	0.663
S91	0.660
S80	0.659
S47	0.658
S82	0.655
S105	0.654
S31	0.651
S107	0.650
S96	0.646
S85	0.646
S93	0.643
S87	0.642
S101	0.641
S81	0.633
S98	0.630
S106	0.627
S103	0.624
S86	0.620
S83	0.617
S108	0.611
S88	0.603

Member	Weight
INIT. COST/DEPLOY	10.4
LIFE CYCLE COST	17.3
EFFECTIVENESS	24.3
COMPLEXITY	35.0
AB IMPACT	13.0

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

AB IMPACT SENSITIVITY DECREASED BY 10%

Alternative	Utility
S60	0.827
S65	0.825
S62	0.824
S67	0.822
S61	0.811
S66	0.809
S72	0.801
S70	0.800
S77	0.799
S75	0.798
S52	0.789
S71	0.788
S50	0.788
S57	0.787
S76	0.786
S55	0.786
S51	0.776
S56	0.774
S63	0.772
S68	0.771
S109	0.761
S110	0.760
S73	0.749
S78	0.748
S53	0.737
S58	0.736
S111	0.725
S112	0.723
S10	0.709
S113	0.707
S14	0.707
S12	0.706
S114	0.706
S16	0.705
S11	0.695
S15	0.693
S20	0.683
S34	0.683
S24	0.682
S38	0.682
S18	0.682
S36	0.681
S22	0.680
S40	0.679
S19	0.672
S4	0.671
S2	0.671
S23	0.670
S8	0.670
S35	0.669
S6	0.668
S39	0.667
S3	0.660
S7	0.658
S44	0.658
S48	0.656
S42	0.656
S46	0.654
S90	0.653
S92	0.651
S95	0.651
S97	0.650
S43	0.646
S28	0.646
S47	0.645
S32	0.644
S26	0.644
S30	0.642
S91	0.640
S96	0.638
S27	0.634
S31	0.633
S102	0.629
S107	0.627
S100	0.626
S105	0.624
S101	0.617
S82	0.616
S106	0.615
S87	0.615
S80	0.613
S85	0.612
S81	0.605
S86	0.603
S93	0.599
S98	0.597
S103	0.576
S108	0.574
S83	0.564
S88	0.562

Member	Weight
INIT. COST/DEPLOY	13.4
LIFE CYCLE COST	22.4
EFFECTIVENESS	31.3
COMPLEXITY	27.9
AB IMPACT	5.0

SENSITIVITY OF OVERALL RANKING

Alternative	Utility
S60	0.832
S62	0.828
S65	0.818
S67	0.813
S70	0.806
S72	0.806
S61	0.801
S50	0.797
S52	0.797
S75	0.792
S77	0.791
S66	0.786
S55	0.782
S57	0.782
S63	0.782
S71	0.779
S109	0.777
S51	0.769
S68	0.767
S76	0.764
S110	0.762
S73	0.760
S56	0.755
S53	0.751
S78	0.745
S111	0.744
S58	0.736
S112	0.730
S113	0.728
S10	0.726
S12	0.723
S114	0.713
S14	0.712
S16	0.708
S34	0.704
S20	0.701
S36	0.701
S18	0.700
S11	0.697
S2	0.692
S4	0.692
S38	0.690
S24	0.686
S40	0.686
S22	0.686
S15	0.682
S44	0.679
S42	0.678
S8	0.677
S90	0.677
S6	0.677
S19	0.675
S35	0.674
S92	0.674
S28	0.669
S26	0.669
S3	0.665
S48	0.664
S46	0.664
S95	0.662
S23	0.660
S39	0.660
S97	0.660
S32	0.655
S30	0.654
S43	0.652
S102	0.652
S7	0.651
S100	0.651
S91	0.648
S27	0.643
S82	0.643
S80	0.641
S47	0.638
S107	0.638
S105	0.636
S96	0.633
S31	0.629
S87	0.628
S93	0.627
S85	0.627
S101	0.626
S81	0.617
S98	0.613
S106	0.611
S103	0.605
S86	0.602
S83	0.596
S108	0.591
S88	0.581

Member	Weight
INIT. COST/DEPLOY	12.0
LIFE CYCLE COST	20.0
EFFECTIVENESS	28.0
COMPLEXITY	25.0
AB IMPACT	15.0

AB IMPACT SENSITIVITY INCREASED BY 10%

Alternative	Utility
S60	0.837
S62	0.832
S70	0.813
S72	0.811
S65	0.810
S50	0.806
S67	0.805
S52	0.805
S109	0.792
S63	0.792
S61	0.791
S75	0.785
S77	0.784
S55	0.779
S57	0.777
S73	0.771
S71	0.769
S110	0.765
S68	0.764
S53	0.764
S111	0.764
S66	0.763
S51	0.763
S113	0.748
S10	0.744
S78	0.743
S76	0.742
S12	0.740
S58	0.737
S112	0.737
S56	0.736
S34	0.725
S114	0.721
S36	0.721
S18	0.719
S20	0.719
S14	0.717
S2	0.714
S16	0.712
S4	0.712
S90	0.700
S42	0.700
S44	0.699
S11	0.699
S38	0.697
S92	0.697
S26	0.694
S40	0.693
S28	0.693
S22	0.692
S24	0.691
S6	0.685
S8	0.685
S35	0.680
S19	0.678
S102	0.676
S100	0.676
S95	0.673
S46	0.673
S48	0.672
S15	0.671
S3	0.671
S97	0.670
S82	0.669
S80	0.669
S30	0.666
S32	0.666
S43	0.659
S91	0.656
S93	0.656
S39	0.652
S27	0.652
S23	0.650
S107	0.648
S105	0.648
S7	0.644
S87	0.642
S85	0.642
S101	0.635
S103	0.634
S47	0.631
S96	0.629
S81	0.628
S98	0.628
S83	0.628
S31	0.625
S106	0.607
S108	0.607
S86	0.601
S88	0.601

Member	Weight
INIT. COST/DEPLOY	10.6
LIFE CYCLE COST	17.6
EFFECTIVENESS	24.7
COMPLEXITY	22.1
AB IMPACT	25.0