WHC-EP-0249

Implementation Plan for Underground Waste Storage Tank Surveillance and Stabilization Improvements

Prepared for the U.S. Department of Energy
Assistant Secretary for Defense Programs

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Available from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

NTIS Price Codes:
Microfiche Copy: A01
Printed Copy:

Pages	Price Codes	Pages	Price Codes
001-025	A02	301-325	A14
026-050	A03	326-350	A15
051-075	A04	351-375	A16
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276-300	A13	576-600	A25

Printed in the United States of America

WHC-EP-0249

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Date Published
April 1989

Date Manuscript Completed
September 1988

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IMPLEMENTATION PLAN FOR UNDERGROUND WASTE STORAGE TANK SURVEILLANCE AND STABILIZATION IMPROVEMENTS

ABSTRACT

Several studies have addressed the need to upgrade the methods currently used for surveillance of underground waste storage tanks, particularly single-shell tanks (SST), which are susceptible to leaks and intrusions. Fifty tasks were proposed to enhance the existing surveillance program; however, prudent budget management dictates that only the tasks with the highest potential for success be selected and funded. This plan identifies fourteen inexpensive improvements that may be implemented in less than two years.

Recent developments stress the need to complete interim stabilization of these tanks more quickly than now budgeted and to identify methods to salvage or eliminate the interstitial liquid left behind after saltwell jet-pumping. The plan calls for the use of available resources to remove saltwell liquid from SSTs as rapidly as possible rather than committing to new surveillance technologies that might not lead to near-term improvements.

This plan describes the selection criteria and provides cost estimates and schedules for implementing the recommendations of the task forces. The proposed improvements result in completion of jet-pumping in FY 1994, two years ahead of the current FY 1996 milestone. While the accelerated plan requires more funding in the early years, the total cost will be the same as completing the work in FY 1996.

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IMPLEMENTATION PLAN FOR UNDERGROUND WASTE STORAGE TANK SURVEILLANCE AND STABILIZATION IMPROVEMENTS

EXECUTIVE SUMMARY

The *Implementation Plan for Underground Waste Storage Tank Surveillance and Stabilization Improvements* provides recommendations for upgrading existing single-shell tank (SST) surveillance methods, the estimated cost of implementing the upgrades, and the supporting schedules. Fifty surveillance improvement proposals were ranked for applicability; 14 were selected. These 14 can be implemented within the next two years at an estimated cost of $2.5 million.

The plan evaluates the opportunity for early completion of SST interim stabilization (saltwell pumping) activities currently scheduled for completion in FY 1996. The completion date is controlled by the amount of available double-shell tank (DST) storage space. Additional storage space options are identified which could advance the completion date by as much as two years to FY 1994 for all but two high-heat tanks in 241-C Tank Farm.

The order-of-magnitude costs and schedule for confirming the additional DST space, for preparing the additional space to receive saltwell liquid, and for accelerating saltwell pumping beginning in FY 1989 are provided. The completion cost for saltwell pumping is estimated to be $56.3 million; there is no significant cost difference between early completion in FY 1994 and completion in FY 1996 as now scheduled.

This document is a summary of work completed in September 1988 to identify outyear tasks and budgets required to improve SST surveillance and to accelerate SST saltwell pumping. Subsequent

impacts which may affect the conclusions, including the *Hanford Federal Facility Agreement Consent Order*,* delays in receipt of saltwell pumping acceleration funding, results of recent readiness reviews, and changes in waste volume generation rates (affecting DST storage space) have not been incorporated. These changes could significantly alter the conclusions and will be addressed in a later revision.

It is intended that the activities described in this plan commence as soon as budget and funding are arranged.

*EPA, 1989, *Hanford Federal Facility Agreement Consent Order*, U.S. Environmental Protection Agency, U.S. Department of Energy, and State of Washington Department of Ecology, Washington, D.C.

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1.0 INTRODUCTION

1.1 SURVEILLANCE

The surveillance program at the Hanford Site is designed to monitor the underground waste storage tanks. Surveillance is focused primarily on detecting leakage from those tanks, with a two-fold purpose: to minimize the volume which might leak before corrective actions are initiated, and to meet regulatory reporting requirements before final closure of the tanks. Another function of surveillance is the detection of liquid intrusions into tanks. Such intrusions can mask tank leaks and hinder stabilization and isolation of tanks. Several studies have addressed the need to upgrade the methods currently used for surveillance of tanks, particularly single-shell tanks (SST).

There are a number of reasons for upgrading the present surveillance program.

- Current surveillance practices and tank histories are not completely documented or are outdated.
- The data obtained using present techniques must be analyzed and trended more systematically and quickly to provide timely identification, reporting, and mitigation of tank leaks and liquid intrusions.
- Changes in the SST waste, particularly the decrease in free-standing liquid and decay of radioisotopes, require modified techniques and greater monitoring sensitivity to detect changing conditions in the tanks.
- Current methods of identifying liquid intrusions in tanks generally cannot identify the source of those intrusions.
- Regulatory reporting requirements are stringent, requiring the reporting of smaller leak volumes in shorter time periods, until tank closure.

More than 50 tasks have been proposed to enhance the surveillance program. However, prudent budget management dictated that only the tasks with highest success potential be selected and funded. An evaluation consolidated the various studies that have been performed and determined which of the proposed tasks should be developed and implemented.

The overall goal of this evaluation was to make the best use of the future funding available for surveillance development tasks. "Best use" was defined as (1) ensuring funding for tasks which are required to optimize current surveillance methods and (2) funding tasks which appeared to provide the greatest improvement over current surveillance methods, in terms of enhancing timeliness, reliability, and leak- and intrusion-detection capability in the most cost-efficient manner.

1.2 STABILIZATION

Recent events have highlighted the need to react more quickly to suggested loss of SST integrity. Detection of additional leaking SSTs emphasizes the need to complete interim stabilization more quickly than now budgeted and to identify further drying methods to scavenge or eliminate the last interstitial liquid left behind after saltwell jet-pumping is complete.

Numerous saltwell pumping tradeoffs, pumping preparedness requirements, and residual liquid recovery methods have been recommended, including suggestions for early pumping completion.

The implementation plan provides the order-of-magnitude cost estimate and schedule for evaluating and completing the recommendations.

The overall goals of this evaluation were as follows:

1. Identify tasks and logical task sequence needed to confirm a technical sound jet-pumping completion endpoint and quantify the impact of any endpoint change.

2. Develop a ramped saltwell pumping strategy that brings more pumping forward to early years.

3. Review candidate post-jet-pumping drying techniques for potential use.

4. Prepare the order-of-magnitude cost estimate and the supporting schedule for the technical work needed to verify the fiscal year (FY) 1994 completion date (except high-heat tanks 241-C-105 and 241-C-106), the field work needed to achieve early completion, and the proof-of-principle demonstration work for advanced drying viability.

2.0 SURVEILLANCE TASKS

2.1 SURVEILLANCE TASK RECOMMENDATIONS

In the last 2 yr, about 50 individual SST surveillance tasks have been identified as potential improvements. These tasks are described in Table A-1.

A strategy was developed to narrow the list of proposed tasks and develop a comprehensive improvement plan. The strategy (described in Appendix A) identified five tasks that are required for the basic surveillance program and ranked the remaining tasks according to a rating system developed for this purpose. Most tasks were discarded because they (1) did not have meaningful SST leak detection value, (2) gave irrelevant measurements, (3) had a long development time and questionable success, or (4) had high costs for questionable return. The rating system and task-selection criteria are presented in Appendix A.

Of the 50 surveillance tasks, 14 were retained; 5 of the 14 yield immediate improvement to the basic surveillance program in the following areas:

- Existing surveillance practices must have sound technical bases and be documented and current.
- Tank histories must be correct and current.
- Tank anomalies must be identified as early as possible from the available data.
- Response and reporting must be consistent and rapid.

The five tasks identified as immediately valuable are as follows:

1. Increase TFPE Support--Eliminate the SST anomaly investigation backlog and remain current thereafter. Current performance indicates that increased staffing is warranted to accelerate reviews and keep documentation current.
2. Establish a minimum detectable leak volume for SSTs--A defendable technical basis for the volume should be prepared, and agreed upon with the U.S. Department of Energy-Richland Operations Office (DOE-RL).
3. Revise leak detection criteria and bases--Revise to be consistent with current measurement limitations and sensitivities. This will include limitations on drywell and lateral data and liquid level decreases. This recommendation is a combination of several criteria review tasks listed in Table A-1 [including liquid observation well (LOW) monitoring frequency, drywell leak detection, psychrometric data review, LOW and leak detection pit measurement precision, vapor space temperature basis, and photographic criteria].
4. Complete update of tank surveillance histories--Convert to electronic database and update all chapters, including tank histories and surveillance criteria, with correct and current information. This recommendation is a combination of several tasks listed in Table A-1.
5. Complete implementation of interim trend analysis--Complete reevaluation of hand-plotted trends and preliminary conversion to personal computer plotting in advance of automated work station startup. Increased TFSA staff is required to support this. This recommendation is a combination of two tasks listed in Table A-1.

The nine additional tasks recommended for implementation are extensions of current surveillance technology or are candidate technologies requiring limited commitments to demonstrate applicability:

6. Implement automated trend analysis--This upgrade will apply to all current and future surveillance data and provide more timely, systematic analysis of that data.

7. Establish baseline neutron data for 200 West Area drywells--The baseline is necessary to begin systematic trending of the information from the drywells.

8. Provide routine use of neutron probe--The neutron probe is currently in use only for anomaly investigations. More frequent, routine use would provide regular monitoring and trend observation.

9. Develop double-shell tank annulus camera--The only non-SST-specific surveillance method; this is recommended as a backup for leak detection and resolving suspected leaks in the primary tanks. This will increase flexibility in using double-shell tanks (DST).

10. Improve acoustic probe coupling--The improved probe will reduce extraneous noise and improve interstitial liquid measurement resolution. In addition, it will permit use of the probe in LOW where it currently cannot be used (about one-third of all LOWs).

11. Develop fringe capacitance probe--This technique has not been tested onsite, but is a well-developed technology. It is a simple system for water determination in solids that could complement existing probes because it detects changes in a waste property (water saturation) that is not measured by other probes (e.g., gamma, acoustic, neutron).

12. Review LOW installation criteria--Only 57 tanks have been provided with a LOW, and several of these have failed. Part of the reason for limiting LOW installation is the uncertainty in the leak detection benefit obtained from LOWs. The justification and the current need for LOWs should be reviewed. If the probe systems discussed above improve the reliability of LOW data, it may enhance the desirability of installing new LOWs. If LOW data could be used more reliably, it would provide more timely leak/intrusion detection than drywell data. This may be necessary to satisfy regulations requiring improved leak detection.

13. Build neutron calibration facility--This would facilitate use of the neutron probe on a routine basis.

14. Employ enhanced scintillation probe--Already developed, this probe could be a more sensitive drywell monitor than existing probes.

NOTE: In FY 1989, task 3, Revise leak detection criteria and bases, has been funded. The equipment for task 6, Implement automated trend analysis, has been purchased with FY 1988 capital equipment not related to construction (CENRTC) money. Limited development work is proceeding with funding originally planned for task 4, Complete update of tank histories. The other tasks scheduled for FY 1989 have been deferred.

2.2 SURVEILLANCE FUNDING REQUIREMENTS

The order-of-magnitude funding required to implement the 14 surveillance enhancements and maintain them through FY 1994 is estimated to be about $5.2 million ($4.7 million expense and $0.5 million capital). Tables 1 and 2 show the required funding increment by task and compare the increment to the total surveillance budget for the same period, as shown in the FY 1990 budget submittal.

2.3 SURVEILLANCE TASK SCHEDULE

Figure 1 is the top-level implementation schedule for the surveillance tasks. The schedule separates the basic tasks, which ensure documented technical bases for current surveillance practices, current tank histories, and early leak reporting using existing surveillance practices, from improvements expected from technology extensions that reduce the leak-detection threshold.

Appendix C provides the detailed schedule for the surveillance tasks.

Table 1. Funding Required for Enhanced Surveillance[a] FY 1989 through FY 1994.

Task	Fiscal Year ($ million)						
	1989	1990	1991	1992	1993	1994	Total
Basic surveillance							
Revise leak detection criteria	[b]	[b]	[b]	[b]	[b]	[b]	[b]
Complete update of tank history surveillance	[b]	[b]	[b]	[b]	[b]	[b]	[b]
Complete implementation of interim trend analysis	0.2	0.2	0.2	0.2	0.2	0.2	1.2
Increase TFSA staff	[c]	[c]	[c]	[c]	[c]	[c]	--
Increase TFPE support	0.2	0.1	0.1	0.1	0.1	0.1	0.7
Establish a minimum detectable leak volume for SSTs	0.05	--	--	--	--	--	0.05
Enhanced surveillance							
Implement automated trend analysis	0.2	0.1	0.1	0.1	0.1	0.1	0.7
Establish baseline neutron data for 200 West Area drywells	0.1	0.1	0.1	0.1	0.1	0.1	0.6
Provide routine use of neutron probe	0.1	0.1	0.1	0.1	0.1	0.1	0.6
Develop DST annulus camera	--	0.15	0.15	--	--	--	0.3
Improve acoustic probe coupling	0.1	--	--	--	--	--	0.1
Develop fringe capacitance probe	0.075	--	--	--	--	--	0.1
Review LOW installation criteria	0.05	--	--	--	--	--	0.1
Build neutron calibration facility (expense/capital)	0/0.2	0/0.3	--	--	--	--	0/0.5
Employ enhanced scintillation probe	--	0.1	--	--	--	--	0.1
Additional technology needs	--	0.1	--	--	--	--	0.1
Funding (expense/capital)	1.1/0.2	1.0/0.3	0.8/0	0.6/0	0.6/0	0.6/0	4.7/0.5

[a]Dollars escalated through FY 1990.
[b]Will be supported by current budget.
[c]Will be supported by interim trend analysis.

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Table 2. Funding Required for Enhanced Surveillance[a] FY 1989 through FY 1994, Comparison with FY 1990 Budget Submittal.

	Fiscal Year ($ million) (Expense/Capital)			
	1989	1990	1991 through 1994	Total
Basic surveillance	8.2/0	8.3/0	35.4/0	51.9/0
Enhanced surveillance	0.7/0.2	0.6/0.3	1.4/0	2.7/0.5
Required funding	8.9/0.2	9.0/0.3	36.8/0	54.7/0.5
-FY 1989 guidance/FY 1990 budget submittal	-7.8/0	-8.0/0	-34.2/0	-50.0/0
Shortfall	1.1/0.2	1.0/0.3	2.6/0	4.7/0.5

[a]Dollars escalated through 1990.

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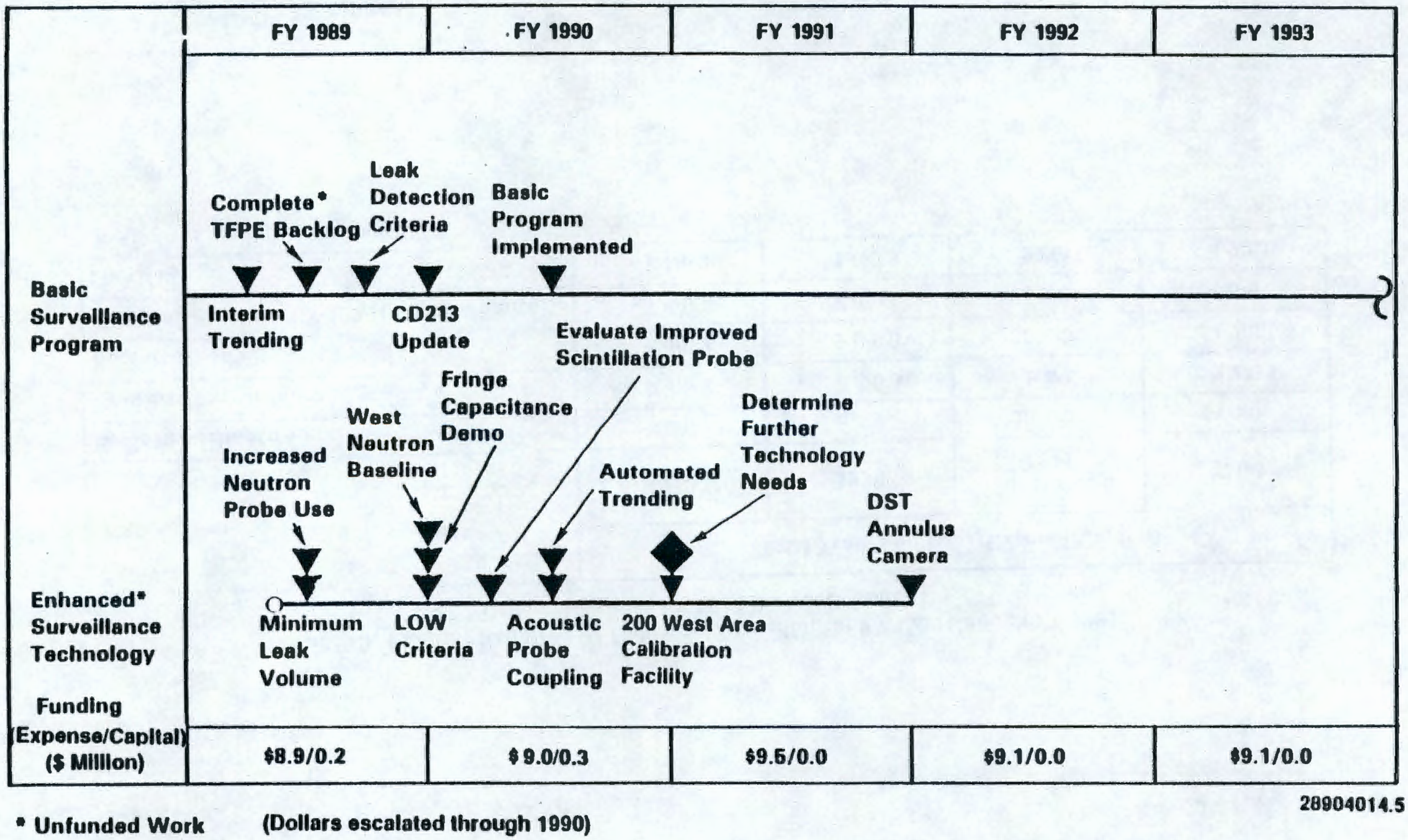


Figure 1. Basic Surveillance Program/Enhanced Surveillance Technology.

3.0 STABILIZATION TASKS

3.1 STABILIZATION TASK RECOMMENDATIONS

Currently, SST stabilization is delayed because of a projected shortage of DST space. This delay has limited saltwell production to 1.2 Mgal between FY 1986 and FY 1993 and resulted in an extension of the completion milestone to FY 1996. Because the 1.2 Mgal includes the emergency pumping contingency, and 25% of the space has already been used pumping leaking tanks in the past year, the space available for scheduled jet-pumping through FY 1993 is small.

Stabilization of SSTs can be completed by the end of FY 1994 (except for 241-C-105 and 241-C-106), 2 yr ahead of current schedule, provided that funding and DST space are available. Potentially, up to 5 Mgal of tank space could be used for saltwell production; however, technical confirmation work must be completed before committing any of this space to accelerated saltwell pumping. Changes in assumptions used to predict tank space, such as waste compatibility, contingency usage, and planned operation drastically alter the results.

The seven stabilization tasks are described below:

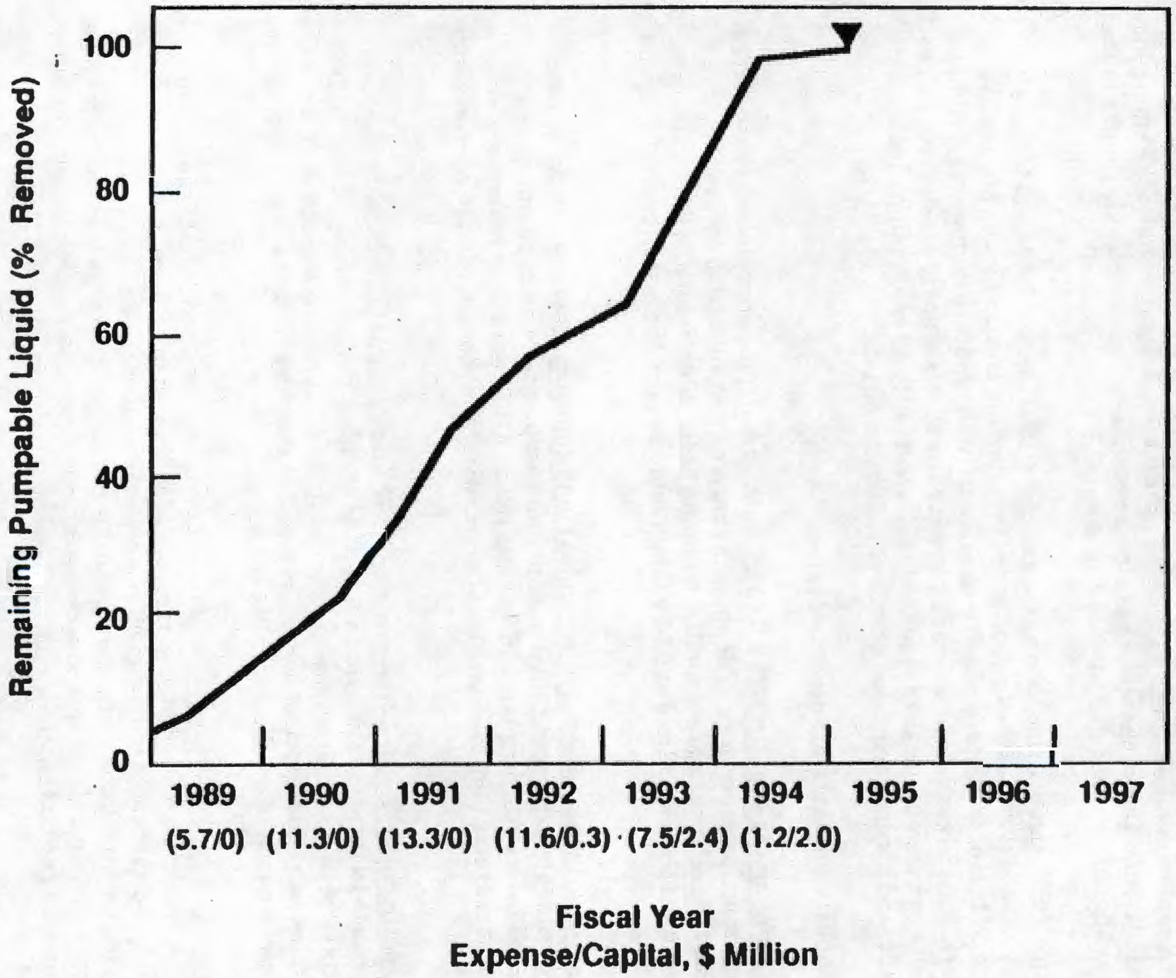
1. Confirm jet-pumping endpoint--The 0.05 gal/min jet-pumping endpoint was based on early saltwell production experience. The endpoint must be reevaluated to ensure that it represents the technical and economical pumping limit. If it does not, a tank that starts to leak after it has been stabilized at 0.05 gal/min could require the installation of a second jet pump.

2. Reevaluate interim-stabilized non-jet-pumped tank endpoint--Seventy-one SSTs were stabilized without jet-pumping. In five additional, jet-pumped tanks, pumping was discontinued before reaching the 0.05 gal/min limit. All 76 need to be reassessed, considering the endpoint reevaluation, to ensure that the technical and economic liquid recovery limit was reached.

3. Recover additional DST space--The volume of DST space available for receiving saltwell pumping has to be increased by about 4.5 Mgal to stabilize the remaining 52 tanks. Several methods have been proposed to recover about 5 Mgal additional storage space. Each of these methods must be validated, since some may result in undesirable loss of waste segregation, or require dedicated use of contingency tank space.

4. Revise saltwell pumping strategy--An endpoint revision, the potential additional liquid from the 76 SSTs, accelerated jet-pumping, recovery of additional tank space, pumping with submersible and vertical turbine pumps to accelerate production while the jet pumps are being readied for installation, and changes to the pumping order of the tank farms to share common control rooms all need to be factored into the overall saltwell pumping strategy. Figure 2 shows a ramped pumping plan developed during preparation of the implementation plan.

5. Confirm early jet-pumping completion--The revised saltwell pumping strategy is expected to confirm early jet-pumping completion. This work must be supported by special waste volume projection studies and laboratory analysis to confirm time phasing, waste compatibility, and assumptions that will form a part of the strategy revision.



[a] Does not include stabilization of high-heat tanks 241-C-105 and -106. Assumes DST space is adequate.

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Figure 2. Interim Stabilization of Single-Shell Tanks.

6. Review advanced drying techniques--Once the technical and economical pumping limit has been reached, SST stabilization will be complete. If a new leak is detected after that time, there will be no way of responding with current pumping technology unless a follow-up technology to pumping is pursued. Follow-up technologies, including advanced drying techniques will be assessed for effectiveness, cost, and impact on final closure. Promising technologies will receive small-scale demonstrations.

7. Review high-heat tanks--After completion of jet-pumping, stabilization efforts will be continuing on high-heat Tanks 241-C-105 and 241-C-106. Eight tanks in 241-SX Tank Farm are believed to contain sufficient radiolytic heat to exceed the concrete structural strength specification for the tanks if heat removal were to be suspended indefinitely. These tanks will be evaluated and contingency plans developed if the evaluation shows that such plans are warranted.

A detailed description of each task can be found in Appendix B.

NOTE: In FY 1989, task 1, Confirm jet-pumping end point, task 2, Re-evaluate interim-stabilized non-jet-pumped tanks, and task 4, Revise saltwell pumping strategy have been funded. The other tasks scheduled for FY 1989 have been deferred.

3.2 STABILIZATION FUNDING REQUIREMENTS

The order-of-magnitude funding required to accelerate saltwell pumping and complete stabilization by the end of FY 1994 is estimated to be about $56.3 million, or about $1.0 million per stabilized tank. While more funding is required in the early years, the total cost is equal to or less than completing stabilization on the current FY 1996 schedule. Table 3 presents a comparison of past budget submittals. Note that the estimated cost per tank during the proposed acceleration compares favorably to that of previous years.

Table 3. Budget Submittal Comparison for Single-Shell Tank Stabilization.

Fiscal year	Tanks remaining	Total estimated cost ($ million)	Cost per tank ($ million)	Expected completion (fiscal year)
1986	86	74.6	0.9	1989
1987	67	66.9	1.0	1990
1988	64	--	[a]	1994
1989	54	--	[a]	1996
1990	54	22.1	0.4	1996
Proposed acceleration	54	56.3	1.0	1994

[a]Double-shell tank space restriction FY 1989 through 1993; incomplete funding data.

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Tables 4 and 5 show the required funding by task, and compare the required funding to the FY 1990 budget submittal.

3.3 STABILIZATION TASK SCHEDULE

Figure 3 shows the top-level implementation schedule for accelerated stabilization. The schedule includes interim isolation of the tanks (assumed to be complete a year after stabilization), continuation of Tanks 241-C-105 and 241-C-106 drying, and preliminary work on advanced drying techniques. Appendix C provides the second level detailed schedule for the stabilization tasks.

Table 4. Funding Required for Enhanced Stabilization[a] FY 1989 through FY 1994. (Sheet 1 of 2)

Task	Fiscal year ($ million)						
	1989	1990	1991	1992	1993	1994	Total
Tank space recovery evaluations							
PFP loadout ES	0.2	--	--	--	--	--	0.2
241-AY-101 third aging waste tank	0.05	--	--	--	--	--	0.05
241-AY-102/244-AR HWVP feed storage	0.05	--	--	--	--	--	0.05
241-AW-103, -105 NCRW supernate	--	0.2	--	--	[c]	--	0.2
241-AW-101 grout staging tank	--	--	0.05	--	--	--	0.05
Tank space recovery							
PFP loadout (expense/capital)	--	--	--	0.25/0.3	0.25/0.9	--	0.5/1.2
241-AY-101	0.5	--	--	--	--	--	0.5
241-AY-102	0.1	--	--	--	--	--	0.1
241-AW-103, -105	--	--	--	0.5	--	--	0.5
241-AW-101	--	--	--	--	0.1	--	0.1
Interim stabilization							
Jet pumping endpoint criterion	0.05	--	--	--	--	--	0.05
Non-jet-pumping tank evaluation	0.1	--	--	--	--	--	0.1
Saltwell strategy/early confirmation	0.05	--	--	--	--	--	0.05
Accelerated jet pumping	3.7	7.4	7.85	5.25	4.9	--	29.1
241-C-105/241-C-106 (expense/capital)	0.5/0	0.5/0	0.6/1.0	0.7	0.2/1.5	0/2.0	2.5/4.5
Re-jet-pumping (5/5)	--	--	--	0.6	0.6	0.6	1.8
Supernatant repumping (15/71)	--	--	0.5	0.5	0.5	--	1.5

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Table 4. Funding Required for Enhanced Stabilization[a] FY 1989 through FY 1994. (Sheet 2 of 2)

Task	Fiscal year ($ million)						
	1989	1990	1991	1992	1993	1994	Total
Interim stabilization (cont.)							
Failed line bypass (2,000 ft)	--	--	1.0	0.5	0.5	--	2.0
GTF acceleration	--	3.0	3.0	3.0	--	--	9.0
Advanced stabilization							
Advanced drying survey	0.1	--	--	--	--	--	0.1
Advanced drying demonstration	--	0.2	--	--	--	--	0.2
Interim isolation							
Eliminate backlog (8)	0.3	--	--	--	--	--	0.3
Isolate remaining tanks	--	--	0.3	0.3	0.4	0.6[b]	1.6
Funding (expense/capital)	5.7/0	11.3/0	13.3/1.0	11.6/0.3	7.5/2.4	1.2/2.0	50.6/5.7

[a]Dollars escalated through FY 1990.
[b]Assumes carryover for FY 1995 completion.
ES = Engineering study.
GTF = Grout Treatment Facility.
PFP = Plutonium Finishing Plant.

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Table 5. Funding Required for Enhanced Stabilization[a] FY 1989 through FY 1994, Comparison with FY 1990 Budget Submittal.

Task	Fiscal Year ($ million)(Expense/Capital)			
	1989	1990	1991 through 1994	Total
DST space recovery	0.9/0	0.2/0	1.2/1.2	2.3/1.2
Interim stabilization	4.4/0	11.1/0	30.7/4.5	46.2/4.5
Advanced drying	0.1/0	TBD	TBD	0.1/0
Isolation	0.3/0	0/0	1.7/0	2.0/0
Required funding	5.7/0	11.3/0	33.6/5.7	50.6/5.7
–FY 1989 guidance/FY 1990 budget submittal	–0.3/0	–3.3/0	–8.3/4.0	–11.9/4.0
Shortfall	5.4/0	8.0/0	25.3/1.7	38.7/1.7

[a]Dollars escalated through 1990.

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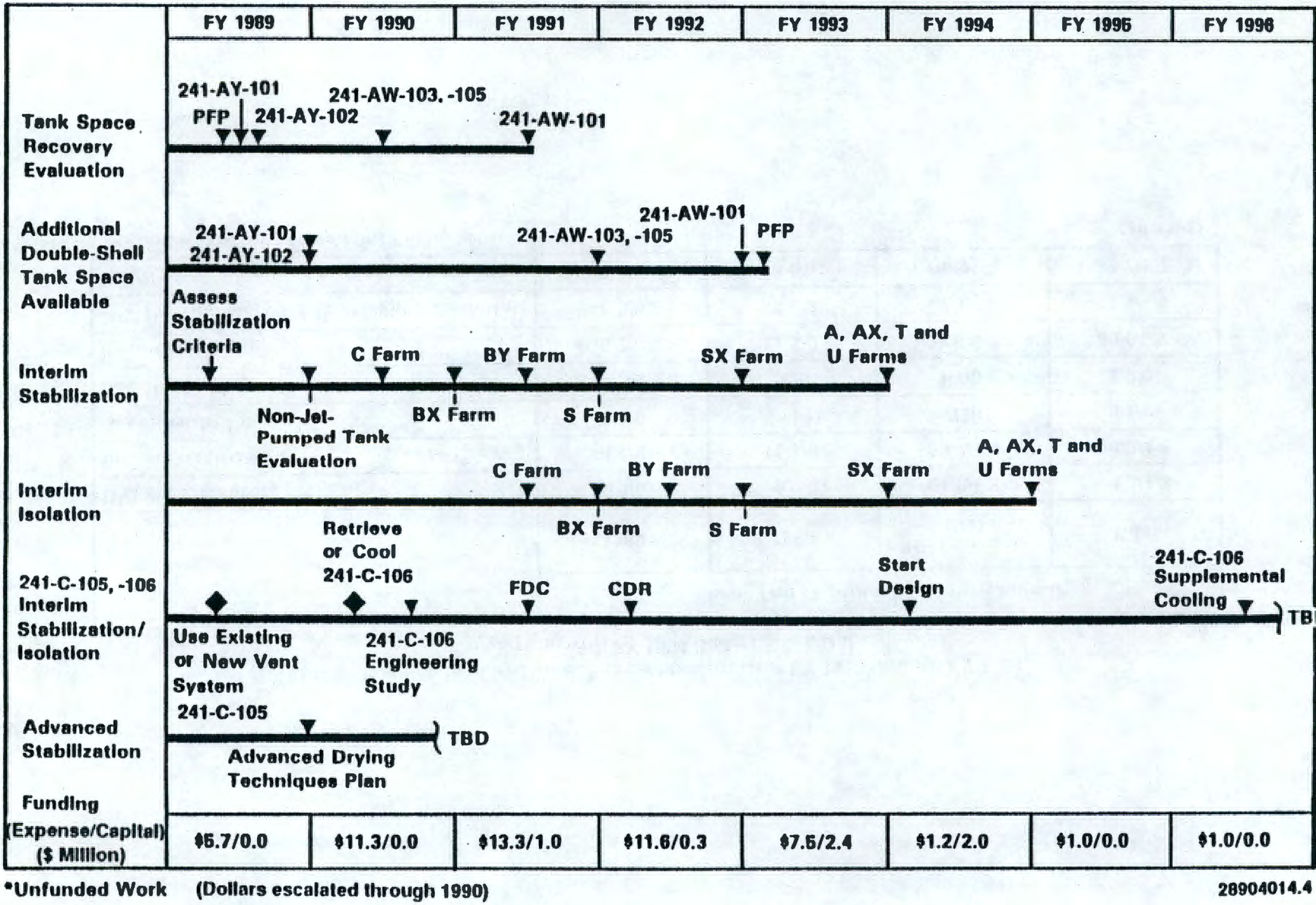

Figure 3. Accelerated Stabilization of Single-Shell Tanks.

APPENDIX A

PRIORITIZATION OF SURVEILLANCE DEVELOPMENT TASKS

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PRIORITIZATION OF SURVEILLANCE DEVELOPMENT TASKS

A.1 STRATEGY FOR PRIORITIZATION

The basic strategy for evaluating the surveillance development tasks was as follows.

1. Identify all proposed tasks to be included in evaluation.
2. Establish tasks required for the basic surveillance program.
3. Develop criteria and rating system for evaluating remaining tasks.
4. Reject tasks which fail key criteria.
5. Rate remaining tasks according to criteria.
6. Rank tasks based on requirements and rating.

A.1.1 Identify Proposed Surveillance Development Tasks

Fifty tasks were identified from past work and from discussions with cognizant personnel; a brief description of each is provided in Table A-1.

A.1.2 Establish Basic Surveillance Program Required Tasks

The tasks are those that are required to support current surveillance operations and those that are enhancements over current operations. Given the methods presently used to monitor the tanks, the needs of the basic surveillance program are generally as follows:

- Existing surveillance practices must have a sound technical basis and be documented and current.
- Tank histories must be correct and current.
- Tank anomalies must be identified as early as possible from the available data.
- Response and reporting must be as consistent and rapid.

Tasks which meet these needs are basic to the surveillance program, because they optimize the existing system. Funding for these tasks is essential to maintain adequate performance. These tasks are listed in Section A.3.

A.1.3 Develop Criteria and Rating System

Thirteen criteria were considered in rating the surveillance tasks. The criteria were valued on a scale of 0 to 10, with 10 being the most favorable score. The criteria were weighted on an importance scale of 1 to 3, with a weighting of 3 being given to the criteria considered most important to satisfy when implementing the particular task. The specific criteria are discussed further in Section A.2.

Table A-1. Proposed Surveillance Upgrades. (Sheet 1 of 4)

Task title	Description
Trend surveillance data	Automate the analysis of surveillance data trending. Purpose of trending is to detect changes from steady state in surveillance data; automation would provide more consistent and timely detection of anomalies. Requires new engineering work stations.
Increase tank farm surveillance and analysis (TFSA) staff	Increase staff to facilitate more rapid data analysis and reporting, assimilate additional field data, and provide for conversion to automatic trending.
Revise leak detection criteria	Revise criteria and bases to be more consistent with current measurement limitations and sensitivities.
Establish minimum leak detection requirements	Reach an agreement with the U.S. Department of Energy (DOE) to establish reporting requirements which can be met using currently available surveillance technology.
Revise drywell leak detection criteria	Review the action criteria level. A smaller increase in radiation levels observed at drywells is more meaningful now that tank farm stabilization and isolation have progressed and false alarms have decreased.
Establish baseline neutron probe data for 200 West Area	Develop baseline data for 200 West Area drywells to facilitate leak monitoring.
Revise liquid observation well (LOW) monitoring frequencies	Review frequency bases. Current frequencies are based on routine use of the acoustic probe. When use of the probe was curtailed, the frequencies were not revised.
Review LOW installation criteria	Review criteria in light of current environmental reporting requirements, the type of detection probes currently used, intrusions being experienced and ^{106}Ru decay.
Update tank surveillance histories	Revise to make tank surveillance histories current and complete. Document would be converted to an electronic database.
Improve acoustic coupling probe for LOWs	Improve the acoustic probe coupling to eliminate previously encountered problems and provide consistent, accurate data.
Deepen drywells	Increase selected drywells depths to better map plumes.
Improve intrusion detection	Develop new or revised methods of detecting intrusions. Current methods do not appear to be adequate; an intrusion may mask a tank leak and intrusions may delay isolation.

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Table A-1. Proposed Surveillance Upgrades. (Sheet 2 of 4)

Task title	Description
Provide surveillance overview by tank farm plant engineering (TFPE)	Establish quarterly review of surveillance data by TFPE to provide additional level of data interpretation.
Install a neutron probe calibration facility in 200 West Area	The current facility is used for both 200 East and 200 West Area tank farms. A new facility would allow enhanced use of the probe.
Revise interim isolation criteria	Review isolation program and develop a strategy to balance the effectiveness and cost of better isolation versus the effectiveness and cost of better intrusion detection.
Institute "Smart System" computer analysis	This calls for hardware and software capable of interfacing with surveillance devices and integrating, analyzing and reporting data results. New modules would be required for each new surveillance method.
Improve in-tank photography	Develop dual camera system for obtaining in-tank photographs. This would provide more stereoscopic viewing and better delineation of solid and liquid surfaces.
Develop optical radar	This system would use a modulated low-power laser beam for radar mapping of surfaces in tank. Provides a three-dimensional image.
Develop infrared thermography	This in-tank inspection system would provide the capability to detect wet surfaces in the tank interior through temperature difference. Currently envisioned as a part of the optical radar system, may be beneficial to develop separately for intrusion detection.
Develop fringe capacitance probe	This high-spatial resolution probe determines water content and could be used for interstitial liquid level observation through LOWs.
Develop eddy current probe	Used in the LOWs, the probe detects interstitial liquid level (ILL) by determining changes in electrical resistivity in the solids.
Institute online LOW fringe capacitance probe	This would involve replacing the online intrusion-mode liquid level devices with bobbing online fringe capacitance probes located in fiberglass LOWs and tied in the the computer-automated surveillance system (CASS) system. This would provide an earlier indication of changes in the ILL.
Develop gamma camera	A gamma-ray camera would be used to determine the spatial distribution of gamma activity in the tank; assuming that liquid density follows from gamma energy density, this would provide a measure of the total ILL volume.

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Table A-1. Proposed Surveillance Upgrades. (Sheet 3 of 4)

Task title	Description
Employ enhanced scintillation probe	Initiate use of manual or semi-automated drywell monitoring system which contains an intrinsic germanium detector and large-volume sodium iodide (NaI) detector. This would increase sensitivity and resolution, and decrease response time.
Develop ground-penetrating radar	Requires development for use at Hanford. Pulsed radar is used for vertical imaging of liquid volumes in the soil around tanks. Used in plume mapping.
Develop neutron activation analysis (NAA)	An NAA system used in drywells would be a method to changes in concentrations of specific chemical constituents in the soil.
Develop DST annulus camera	4-in.-diameter annulus camera for visual inspection of primary walls in DSTs. Suitable for 26 out of 28 tanks.
Develop gypsum block detector	Involves encasing an electrically conductive or fringe capacitance probe in gypsum blocks, to be placed in leak detection pits of DSTs or implanted at the footings of SSTs.
Replace failed thermocouples	Replace in-tank SST thermocouples which are no longer working.
Establish routine use of neutron probe	Use this probe for more frequent and routine drywell monitoring. Requires preparation of procedures. Currently used for anomaly investigations.
Improve psychrometric instrumentation	Improve devices capable of measuring moisture and temperature of air into/out of tanks. This would refine calculations of liquid loss through evaporation.
Review psychrometric data	Review data for usefulness in evaluating tank conditions.
Upgrade 241-AX leak detection pit instrumentation	Specifically calls for upgrades to instrumentation in the leak detection pits provided for the four 241-AX single-shell tanks.
Document bases for LOW and leak detection pit precision	Review and update documentation of bases.
Review thermal analysis	Review temperature limits and effects of varying thermal conductivity, heat load, and solids depth to evaluate thermal constraints in tanks.
Review dome survey bases	Review bases for dome survey frequencies and for non-steady state conditions requiring dome surveys.

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Table A-1. Proposed Surveillance Upgrades. (Sheet 4 of 4)

Task title	Description
Develop vapor space temperature basis	Develop technical basis for evaluating vapor space temperature changes.
Revise photographic criteria	Review, revise, and update photographic evaluation criteria.
Develop CASS requirements document	Develop document based on study of upgrade needs for CASS system.
Evaluate CASS data entry	Evaluate manual entry system for improvements to eliminate errors in data entry.
Upgrade CASS software	Develop software to facilitate retrieval of CASS data.
Develop CASS configuration control	Develop configuration control for changes to CASS system.
Upgrade CASS micros	Upgrade substation microcomputer systems.
Improve CASS maintenance	Provide system to ensure proper maintenance of CASS alarms.
Review CASS requirements	Review all CASS sensor and instrumentation requirements.
Replace gamewell loop	Replace the older gong and message system at the 242-A Evaporator with a updated alarm system
Replace liquid level FIC gages	Recommended at the time new tank farm construction was planned. New FICs would not be compatible with existing system; therefore, replacement of all FICS in tank farms was suggested.
Provide CASS as-built drawings	Provide updated drawings for system.
Complete interim trend analysis	Complete reevaluation of SST hand-plotted trends and do preliminary conversion to PC plotting, prior to completion of automated trend analysis system.
Increase TFPE support	Additional manpower would be provided to eliminate the TFPE investigation backlog and maintain current.

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A.1.4 Defer or Reject Tasks that Fail Key Criteria

If the potential benefit from a task was low, it was either rejected outright or deferred for possible future consideration. First, the tasks were assessed for technical viability both before and after single-shell tank (SST) stabilization and possible duplication of effort among proposed actions. In addition, four of the criteria were considered "must haves" in recommending that a given task be pursued. A task which received a very low rating in an initial screening against any one of the "must have" criteria was eliminated from further consideration for funding. "Must have" criteria included general applicability to SSTs, timeliness of implementation, initial development cost, and compatibility with existing site programs.

A.1.5 Rate Tasks According to Criteria

After the initial screening, the remaining tasks were rated for each of the criteria, by a team composed of personnel from Tank Farm Process Technology, Tank Farm and Evaporator Plant Engineering, and Tank Farm Programs Office. The overall score for a task was the sum of the appropriately weighted individual scores. These tasks were ranked from high to low.

A.2 CRITERIA FOR PRIORITIZATION

Four criteria were considered "must haves" in accepting or deferring or rejecting proposed tasks. These criteria were assigned importance weighting factors of 2 or 3.

- <u>Timeliness of deployment</u>--Tasks that can be implemented early provide greater benefit than those which would be delayed several years due to development time. It was considered key that any improved surveillance technique must be available by 1996, while the stabilization and isolation program is ongoing and pumpable liquid resides in the tanks. Surveillance and reporting of tanks will continue after that time, but the capability of responding to a leak will have decreased substantially. Scoring: 10 = deployment by fiscal year (FY) 1990, 0 = deployment by FY 1996. Weighting = 3.

- <u>Applicability to SSTs</u>--Leak detection methods which are applicable to a wide range of tanks are more desirable than those which are limited to a few tanks with very specific waste characteristics. A task that would be beneficial for only a particular few tanks was deferred or rejected. Scoring: 10 = broad applicability, 0 = limited to individual tanks. Weighting = 3.

- <u>Compatibility with other programs</u>--Surveillance methods which do not preclude future closure options, retard the stabilization and isolation program, or perturb parallel programs are better than those that have an impact. Scoring: 10 = no incompatibility, 0 = complete incompatibility with other programs. A zero score would exclude the task from further consideration. Weighting = 3.

- <u>Development costs</u>--Tasks that entail low development costs (those that can be completed within one budget cycle, for instance) have a better chance for completion than those with high costs. Scoring: 10 = \$0, 0 = \$0.5 million. Significant development requirements imply uncertainty about future funding viability. Therefore, a task was rejected outright if development alone would cost greater than \$1 million. Weighting = 2.

A task that scored very low for any one of the above criteria would not be expected to provide an overall benefit and was therefore rejected in the initial screening. In addition to these criteria, the initial screening also considered general technical feasibility and applicability to the surveillance program both before and after tank stabilization, and possible duplication of effort between two tasks.

The following criteria were assigned a weighting of three.

- Compliance with 2.2# Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) leak reporting threshold--No method yet identified for SST surveillance will achieve compliance with the CERCLA reporting requirement. However, a task that increases leak sensitivity and thus approaches the reporting requirement more closely would be beneficial. Scoring: 10 = meets 2.2# limit, 0 = no detection improvement over current sensitivity.

- Response time for detecting change--Tasks that reduce the time to detect a change in a tank condition relating to a leak are better than those that provide no method of improvement or that increase response time. Scoring: 10 = major decrease in response time, 5 = no change, 0 = longer response time than current methods.

- Reliability/Confidence level--Surveillance methods with greater reliability (good precision, unambiguous) allow for more timely, effective leak response and are less subject to false interpretation. Scoring: 10 = significant improvement in reliability, 5 = no change, 0 = significant regression in reliability.

The following criteria were assigned a weighting of two.

- Conclusiveness of measurement technique--Methods that detect leakage or intrusions by direct observation or measurement are generally more effective than methods which require inferred conclusions, or indirect measurements that detect the results of leakage or intrusion. Scoring: 10 = provides direct detection, 5 = inferred measurement, 0 = no detection enhancement over current methods.

- Interpretive skill/cost--Surveillance methods that require lower skill levels and less manpower for interpretation are more easily and accurately used than those that require specialized skills or are manpower intensive. Scoring: 10 = comparable to current skill level, 0 = very specialized.

- Installation/operation/maintenance costs--Installation costs were assumed to amortize over 20 yr and were added to estimated yearly operational costs. It was assumed that simple methods would generate lower costs than those requiring extensive or specialized support. Scoring: ($8 million- annual cost)/$1 million.

- Extensions of current methods--Surveillance methods based on current Hanford technology for which an experience base exists will be easier to work with than methods for which a new base will need to be developed. Scoring: 10 = direct extension of present methods, 0 = no correlation to current base.

The following criteria were assigned a weighting of one.

- Applicability to double-shell tanks--The primary focus of this evaluation was surveillance of SST, since a leak results in a direct environmental release. However, it was considered an additional benefit if a task was also applicable to double-shell tanks (DST). Scoring: 10 = applicable to all DSTs, 0 = not applicable.

- ALARA--All current and future surveillance practices are required to be performed in such a way that current radiation exposure limits are observed. Some tasks may reduce exposure even further and thus could be considered more beneficial. Others may involve greater amounts of operator time in the tank farms, resulting in greater exposure. Scoring: 10 = less exposure, 5 = no change, 0 = more exposure.

A.3 BASIC SURVEILLANCE PROGRAM IMPROVEMENTS

The basic surveillance tasks which must be funded, based on the needs identified in Section A.1.2, are as follows.

1. Increase Tank Farm Process Engineering (TFPE) Support--Eliminate the SST anomaly investigation backlog and remain current thereafter. Current performance indicates that increased staffing is warranted to accelerate reviews and keep documentation current.

2. Establish a minimum detectable leak volume for SSTs--A defendable technical basis for the volume should be prepared, and agreed upon with the U.S. Department of Energy Richland Operations Office (DOE-RL).

3. Revise leak detection criteria and bases--Revise to be consistent with current measurement limitations and sensitivities. This will include limitations on drywell and lateral data and liquid level decreases. This recommendation is a combination of several criteria review tasks listed in Table A-1 [including liquid observation well (LOW) monitoring frequency, drywell leak detection, psychrometric data review, LOW and leak detection pit measurement precision, vapor space temperature basis, and photographic criteria].

4. Complete update of tank surveillance histories--Convert to electronic database and update all chapters, including tank histories and surveillance criteria, with correct and current information. This recommendation is a combination of several tasks listed in Table A-1.

5. Complete implementation of interim trend analysis--Complete reevaluation of hand-plotted trends and preliminary conversion to personal computer plotting in advance of automated work station startup. Increased TFSA staff is required to support this. This recommendation is a combination of two tasks listed in Table A-1.

A.4 DEFERRED OR REJECTED TASKS

A number of surveillance upgrade tasks were rejected in the initial screening, with the primary reasons being technical feasibility, timeliness, or applicability. These tasks are listed below, along with the reason for which they were rejected.

1. Deepen drywells--This task is applicable to groundwater monitoring but not to direct tank surveillance.

2. Provide surveillance overview by TFPE--Cognizance of surveillance data is already within the work scope of TFPE, and computerized trend analysis will reduce the need. Identification as a new task is not considered to be useful.

3. Improve intrusion detection--Although previously identified in other work, specific actions are not provided and the methods for improvement are not well defined. Other tasks considered here do provide for improved intrusion detection.

4. Revise interim isolation criteria--While this may be a beneficial task for optimizing SST management, it does not fall under the scope of surveillance upgrades.

5. Develop "Smart System"--This computer interface system was rejected since it would duplicate many of the functions of the proposed automated trending system and other computer upgrades. It was intended for application to many of the new surveillance techniques, most of which could be used with existing or built-in computer software. Certain aspects may be given consideration in the future if the need is identified.

6. Develop eddy current probe--This probe, for use in LOWs, was rejected because its performance is affected by the presence of iron, nickel and cobalt (all of which are present in SST waste) and because in other respects it would duplicate the utility of the fringe capacitance probe.

7. Develop online LOW fringe capacitance probe--This task was deferred for later consideration, after the initial development and testing of the fringe capacitance probe (discussed in Section A.5 as a recommended task). The viability of the probe itself must be demonstrated before planning is done to add it as a permanent continuous CASS system measurement.

8. Develop gypsum block detector--The tank farm excavation required to implant detection blocks at the foot of SSTs was considered impractical, untimely and prohibitively expensive.

9. Replace failed thermocouples--Temperature monitoring does not present any particular benefit in leak or intrusion detection. Further, the majority of the SST contain waste with very low heat generation.

10. Upgrade 241-AX Leak Detection Pit Instrumentation--This upgrade would be applicable to only the four 241-AX tanks and thus was deferred in favor of more generally applicable surveillance enhancements.

11. Review thermal analysis--Similar to Task 9, this task does not benefit leak and intrusion detection, and is primarily applicable to operation of select DST or stabilization of SSTs. Even for the latter, no additional information is available for reanalysis.

12. Review dome survey bases--There is no new information to indicate that revisions to the current bases are desirable or necessary.

13. Replace gamewell loop--Although this system is somewhat outdated, it is still functional, and adequately maintainable, and therefore was not considered a beneficial surveillance upgrade.

14. Replace FIC gauges--Replacement is no longer necessary. New tank farms will not be constructed; therefore, the existing FIC system is adequate.

A.5 ENHANCED SURVEILLANCE TASKS

The following ranking of enhanced surveillance upgrade tasks is based on the score received in evaluating the tasks against the criteria in Section A.2. The tasks that received the highest scores, and thus the greatest priority, are presented first.

1. Implement automated trend analysis--This upgrade is of highest priority because it can be implemented quickly, will be applicable to all current and future surveillance data, and will provide more timely, systematic analysis of that data.

2. Establish baseline neutron data for 200 West Area drywells--The baseline is necessary to begin systematic trending of the information from the drywells.

3. Establish routine use of the neutron probe--In use for anomaly investigations. More frequent, routine use in tank farms would provide regular monitoring and trend observation.

4. Develop DST annulus camera--The only non-SST-specific surveillance method; this is recommended as a backup for leak detection and resolving suspected leaks in the primary tanks. This will increase flexibility in using DSTs.

5. Improve acoustic coupling probe--Improved probe will reduce extraneous noise and improve interstitial liquid measurement resolution. In addition, it will permit use of the probe in LOWs where it currently cannot be used (about one-third of all LOWs).

6. Develop fringe capacitance probe--This technique has not been tested onsite, but is a well-developed technology. It is a simple system for water determination in solids that could complement existing probes because it detects changes in a waste property (e.g., water saturation) that is not measured by other probes (e.g., gamma, acoustic, neutron). The development cost and timeliness were additional factors in the high ranking.

7. Review LOW installation criteria--Only 57 tanks have been provided with an LOW, and several of these have failed. Part of the reason for limiting LOW installation is the uncertainty in the leak detection benefit obtained from LOWs. The justification and the current need for LOWs should be reviewed. If the probe systems discussed above improve the reliability of LOW data, it may enhance the desirability of installing new LOWs. If LOW data could be used more reliably, it would provide more timely leak and intrusion detection than drywell data. This may be necessary to satisfy regulations requiring improved leak detection.

8. Install neutron probe calibration facility in 200 West Area--This would facilitate use of the neutron probe on a routine basis.

9. Employ enhanced scintillation probe--Already developed, this probe could be a more sensitive drywell monitor than existing probes.

10. Improve in-tank photography--This could be of benefit for intrusion detection. In addition, the three-dimensional effect would provide a means of better estimating liquid pool sizes and observing changes in the solids formation. Because most of the free liquid has been removed from the SST, this task would provide minimal benefit for leak detection.

11. Develop infrared thermography--This surveillance technique, which could detect water on the interior of the tank structure, might be useful in identifying intrusions, and prototype development and testing is recommended. Since it would be focused on liquid surfaces in the tank, it would provide minimal leak detection capabilities.

12. Develop gamma camera--If it performed as proposed, this system could provide information about actual interstitial liquid volumes rather than just interstitial liquid level (ILL) levels at the LOW. The cost and time for development and uncertain benefit in all tanks gave this task a mid-level ranking.

13. Develop ground-penetrating radar--In theory, this system would be very useful, since it could detect leakage immediately outside a tank before a volume large enough to reach the drywells had been released. Limitations which give this a low priority are the specialized nature of the system, the undemonstrated ability to discriminate between burial objects and liquid, and the strong possibility that it could not be used on a frequent and routine basis because of the complexity of use and interpretation.

14. Improve psychrometric instrumentation--Because of the low heat/vapor generation in most of the tanks, this would not be applicable to a wide range of SST. In addition, because of uncertainties about the waste characterization and layering, this information would be of limited utility in improving the reliable evaluation of tank intrusions/leaks.

15. Upgrade CASS--This task (a combination of the eight listed in Table A-1) received a low priority because the role CASS will play in the future Tank Farm Surveillance Program is uncertain, thus the utility of upgrades cannot be evaluated. In addition, the upgrades are expensive and lengthy to implement.

16. Develop optical radar--This task would be a complex and expensive system to implement, and would essentially duplicate the efforts to improved in-tank photography in attempting to achieve a three-dimensional image of surfaces in the tanks. The duplication of effort in combination with the complexity and expense led to a low ranking of this task.

17. Develop neutron activation analysis--This system would be difficult to utilize because of similar chemical components in Hanford's soil and plumes from tank leaks. It may have potential as a specialized evaluation tool, but could not be utilized for routine operation.

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APPENDIX B

PRIORITIZATION OF STABILIZATION TASKS

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CONTENTS

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PRIORITIZATION OF STABILIZATION TASKS

B.1 STRATEGY

The basic strategy for ordering the stabilization tasks was to prepare the best sequence for the work to be conducted: confirm pumping basis, confirm additional double-shell tanks (DST) space, establish ramped pumping based on projected tank space, and prepare for advanced drying after jet-pumping ends. The schedule and time-phased budget would be prepared to reflect the sequence. Contingency funding would be incorporated to ensure recovery from expected failures, such as deteriorating direct-buried lines, and to accommodate shortfalls in projected DST space that may occur.

B.2 PROPOSED STABILIZATION TASKS

The following tasks were reviewed to prepare the plan:

1. Recover additional DST space.

2. Confirm jet-pumping endpoint.

3. Reevaluate interim-stabilized non-jet-pumped tank endpoint.

4. Revise the saltwell pumping strategy.

5. Confirm early jet-pumping completion.

6. Review high-heat tanks.

7. Review advanced drying techniques.

B.2.1 Recover Additional Double-Shell Tank Space

The DST space available for jet-pumping through FY 1993 is about 1.2 Mgal. Therefore, an additional 4.5 Mgal of DST space are required (assuming a 45% porosity) to stabilize all of the remaining SSTs. Tasks for increasing the amount of DST space are listed as the committee ranked them. Completion of saltwell pumping by FY 1994 (except high-heat tanks 241-C-105 and -106) requires that each of the first four options be completed.

B.2.1.1 Option 1. Use the supernatant space in the Plutonium-Uranium Extraction (PUREX) Plant neutralized cladding removal waste (NCRW) receiver tanks, 241-AW-103 and -105.

By mid FY 1990, all of the PUREX Plant NCRW streams will be low level. These streams will be routed to the 241-AP Farm. The original proposal was to retrieve the solids from one of the tanks and combine them with the other. Funding limitations do not appear to make retrieval promising before FY 1995. The new proposal is to remove the supernatant from both tanks to use for double-shell slurry feed (DSSF) and refill the supernatant space with liquid compatible with the transuranic (TRU) waste solids in the tanks. When retrieval or pretreatment was scheduled (post-FY 1994) to start for Tank 241-AW-103 or -105, the pumpable liquid would be transferred to other tank space created by the Grout Disposal Program. This option would create about 1.0 Mgal space.

B.2.1.2 Option 2. Use the 244-AR Vault to store the glass feed from the B Plant pretreatment demonstration run. This proposal makes Tank 241-AY-102 available for 1.5 yr until the B Plant production run starts in mid-FY 1994, at which time more DST would be available. The current plan is to receive the glass feed solids into 241-AY-102 and keep them in suspension using the airlift circulators, thereby using the entire tank for a small amount of solids. By FY 1993, the solids should have decayed adequately so as to not require suspension and could be stored in the 002-AR tank. If necessary, the cooling coil and agitator could be used in 002-AR to cool the solids. An engineering study is needed to confirm the heat expected, and adequacy of the agitator to keep the solids in suspension. There will also need to be a modification of the method used for flushing the line between the 244-AR Vault and B Plant to avoid conflicts with the use of the 002-AR tank. As a backup plan, the solids could be mixed with the original tank, 241-AZ-101, with a cost penalty for reseparating at B Plant during the production run.

B.2.1.3 Option 3. Delay the cleanout of 241-SY-103 beyond the FY 1994 start date. Waste volume projections assume the cleanout will require two tanks to receive the liquid in 200 East Area in FY 1994; however, space is required for more saltwell liquid that year and the equivalent of possibly 2 Mgal is saved if the cleanout is delayed. In addition, space is needed for the B Plant production run. The reason for the original cleanout was to create tank space for the low-level solids from the PFP TRUEX process, which still must be addressed. An option for handling the PFP waste would be to transport the acidic liquid waste by truck or rail to 200 East Area and neutralize at the 204-AR unloading facility (transporting the waste in this form would minimize solids in the truck or railcar). Although the waste would be low level, a containment building might be needed. This would increase the cost of a loading facility. An alternative would be to mix the low-level waste with the TRU waste solids but would likely increase the pretreatment an disposal costs. A third alternative would be to install facilities at PFP to dehydrate the solids and dispose of them in the burial ground.

B.2.1.4 Option 4. Eliminate the need for a third aging waste tank (241-AY-101) by implementing the 5.5M sodium process test and reducing current PUREX Plant aging waste generation. Increasing the sodium concentration in both 241-AZ-101 and -102 to 5.5M will permit about 10% more concentration for a 200,000-gal gain in space. Current projections indicate 250,000 gal are generated in the third aging tank so PUREX Plant would have to cut back by 50,000 gal (30 to 50 gal/MTU reduction) so that the third tank was not used. This reduction appears very reasonable because PUREX Plant has achieved 245 gal/ton (previously imposed goal) but in the last operating period has gone up to 320 gal/ton. The reason for this waste increase is believed to be due to the non-steady state PUREX Plant operation, the processing of the additional Critical Mass Laboratory material, and a relaxation of the lower goal due to no perceived alternate need for the third aging waste tank. By accomplishing both items above, an additional 1 Mgal of space is available.

B.2.1.5 Option 5. Provide an additional $8 million in FY 1990 for the Grout Disposal Program to recover additional 1.5 tanks of space by FY 1992.

The additional funds will provide the vaults and equipment necessary to add three more grout campaigns by FY 1992 (total of 13 by FY 1993). With the dilution required, this will provide about 1.5 more tanks.

B.2.1.6 Option 6. Use the tank that contained the grout feed used in FY 1992 for additional storage.

The current plan is to use the DSSF in 241-AW-101 for the grout campaigns in FY 1992. A residual solids heel of about 200,000 gal will be left and the 800,000-gal supernatant space would not be used. The proposal is to use the 800,000-gal space for spare space, contingency, saltwell liquid or other liquid that was compatible with the solids heel.

B.2.2 Criteria and Pumping Strategy

The Criteria and Pumping Strategy tasks break down to three phases: jet-pumping endpoint validation to ensure that all the technically and economically recoverable liquid has been removed at the designated pumping endpoint; accounting for the additional production if the new endpoint is lower than the present 0.05 gal/min endpoint; and revising to the pumping strategy based upon the outcome of the foregoing tasks.

1. Confirm jet-pumping endpoint--The 0.05 gal/min jet-pumping endpoint was based on early saltwell production experience. The endpoint must be verified to assure it represents the technical and economical pumping limit. If it does not, a tank that starts to leak after it has been stabilized at 0.05 gal/min could require a second jet pump be installed.

2. Reevaluate interim-stabilized non-jet-pumped tank endpoint--Seventy-one SSTs were stabilized without jet-pumping. In five additional jet-pumped tanks, pumping was discontinued before reaching the 0.05 gal/min limit. All 76 need to be reassessed, considering the endpoint reevaluation, to ensure the technical and economic liquid recovery limit was reached.

3. Revise saltwell pumping strategy--An endpoint revision, the potential additional liquid from the 76 SSTs, accelerated pumping, and recovery of additional tank space needs to be factored into the overall saltwell pumping strategy. The current document projects an FY 1996 completion date, but must be revised to account for increased DST storage space, and the results of the accelerated stabilization tasks.

4. Confirm early jet-pumping completion--The revised Saltwell Pumping Strategy is expected to affirm early jet-pumping completion. This work must be supported by special waste volume projection studies, and laboratory analysis to confirm time phasing, waste compatibility, and the assumptions that will form a part of the strategy revision.

5. Review high-heat tanks--After completion of jet-pumping, stabilization efforts will be continuing on high-heat Tanks 241-C-105 and 241-C-106. Eight tanks in 241-SX Tank Farm are believed to contain sufficient radiolytic heat to exceed the concrete structural strength specification for the tanks if heat removal were to be suspended indefinitely. These tanks will be evaluated and contingency plans developed if the evaluation shows that such plans are warranted.

B.2.3 Post-Stabilization Advanced Drying Techniques

When interim stabilization is completed, there will be some amount of liquid remaining in the tank solids. Some method may be required to remove the remaining liquid. An engineering study will be required to determine if this task is necessary. Proposed methods all rely on heating to enhance evaporation or adsorption of the liquid.

None of the methods has been evaluated on a large scale and assessment was made with the following criteria in mind:

- Time required to dry the waste
- Cost for drying development and operation
- Effectiveness through solids
- Effect on solids and the tank.

The following methods were recommended for further study:

- Heated ventilation air for tanks with low solids level
- Microwave drying
- Electrical current drying (considered a backup alternate).

Evaluation of these methods should be made based on actual effectiveness, tank temperature elevation, energy consumption, implementation and operating costs and effect on the solids characteristics.

The following proposed methods were not recommended for further study:

- Self heating because of excessive drying time
- Electro-osmosis which is ineffective at depths greater than 2 ft
- Capillary pumps because of repeated need to drill the solids
- Reduced pressure pump, which is not a true drying method.

B.3 DEFERRED OR REJECTED TASKS

The following tasks were not incorporated in the implementation plan.

B.3.1 Eliminate the Need for a Contingency Double-Shell Tank

Current Interim Waste Management philosophy requires a non-aging waste contingency tank be held to accommodate prediction errors inherent in making waste volume projections. The contingency tar.k equivalent space is being continually used as a dilute receiver.

This space is used for unusual waste generation such as the B Plant Process Condensate (BCP) the A08 Crib streams currently routed to the tanks. Once these streams are turned back to their cribs, the extra space could be utilized for saltwell production for about 2 yr, starting in FY 1992.

This extra space comes too late to have an impact on the early ramped production, but the option to use the tank will be held as contingency backup in the event earlier space does not become available as projected.

B.3.2 Increase Waste Generator Control and Waste Generation Visibility

An option to curtail all production, and place the production facilities in standby was considered. This would reduce waste generation by 90% and allow all saltwell liquid to be pumped by FY 1994. This is not a realistic option and was rejected.

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APPENDIX C

SCHEDULES

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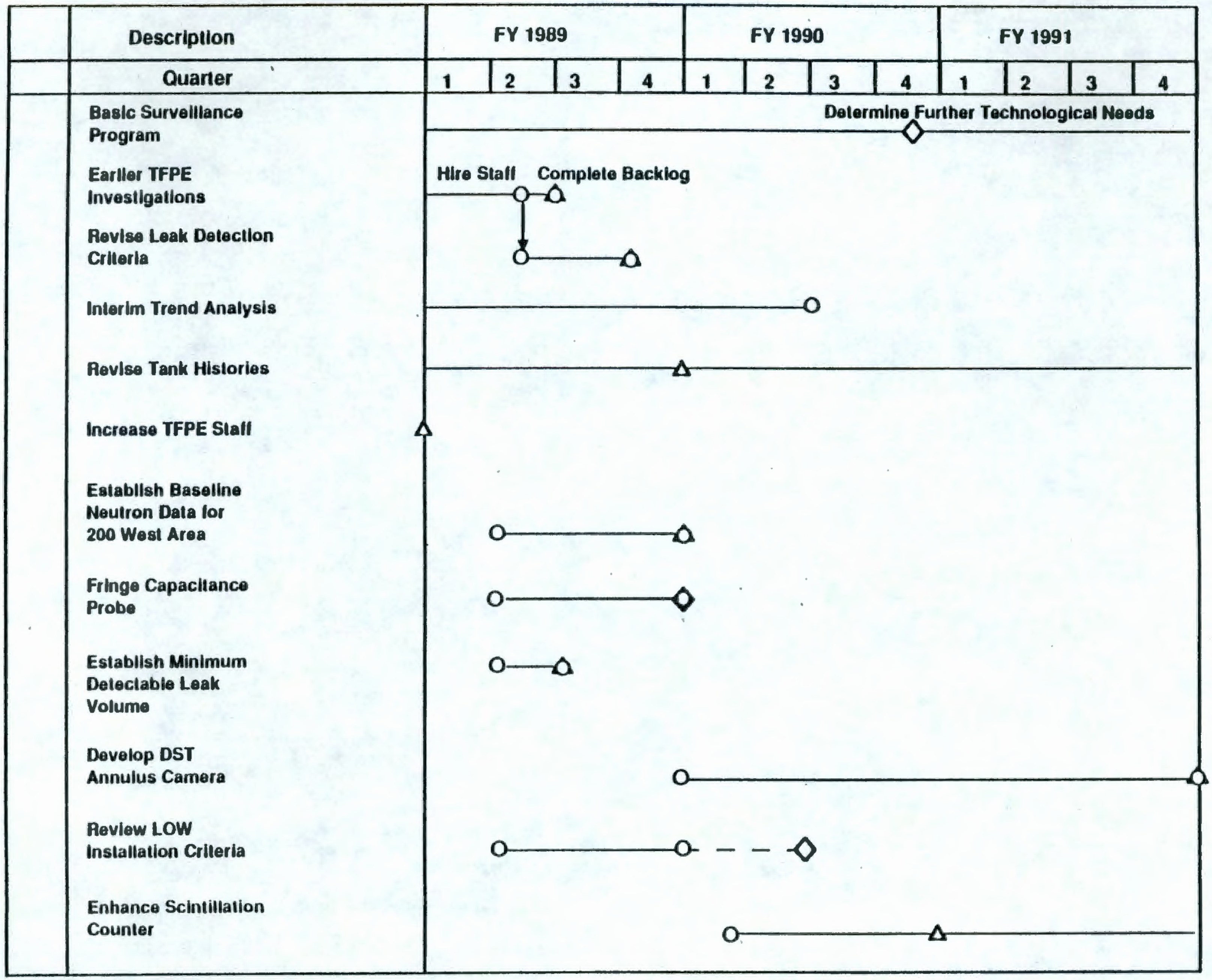

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Figure C-1. Surveillance Schedule.

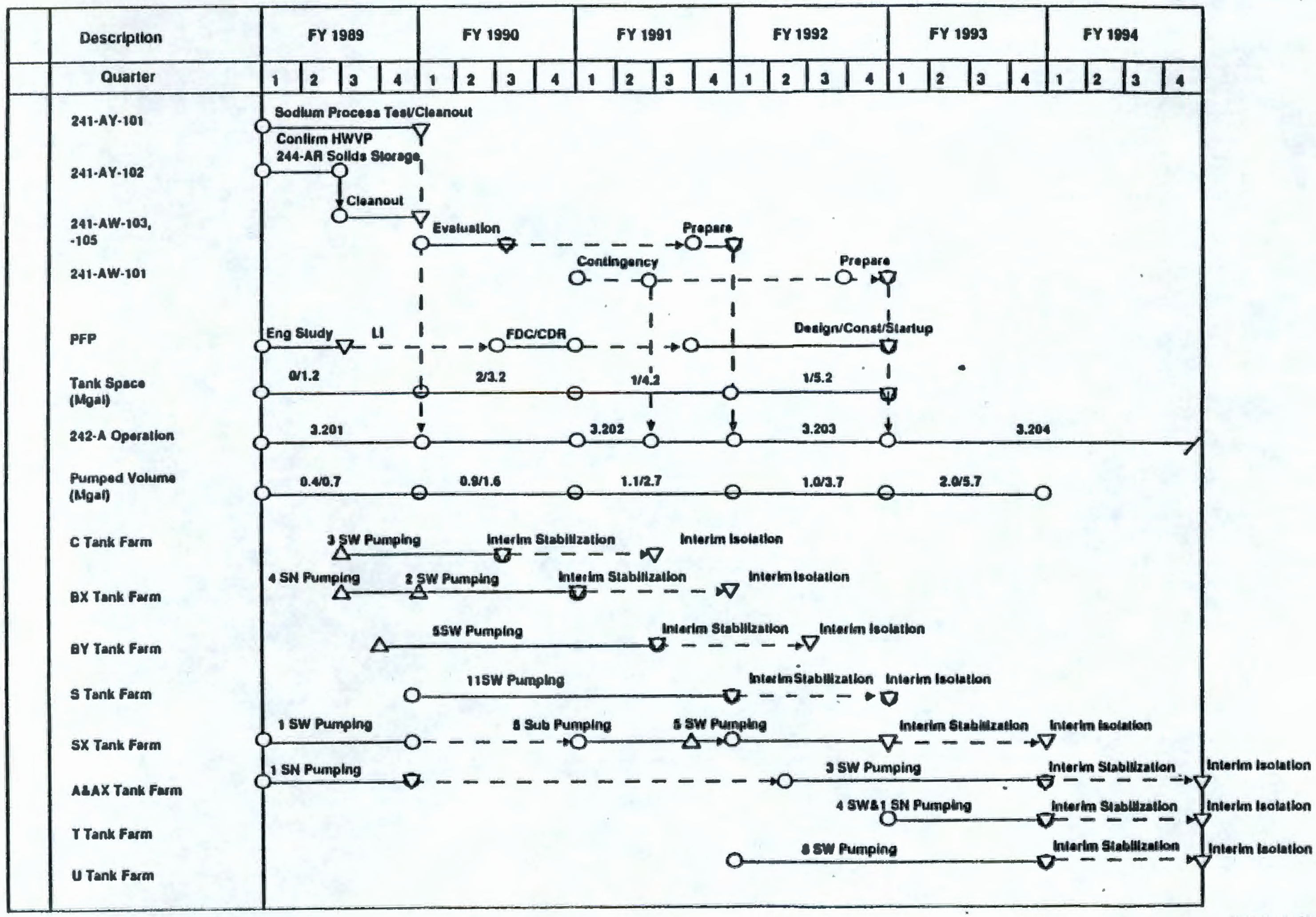

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Figure C-2. Stabilization Schedules. (Sheet 1 of 2)

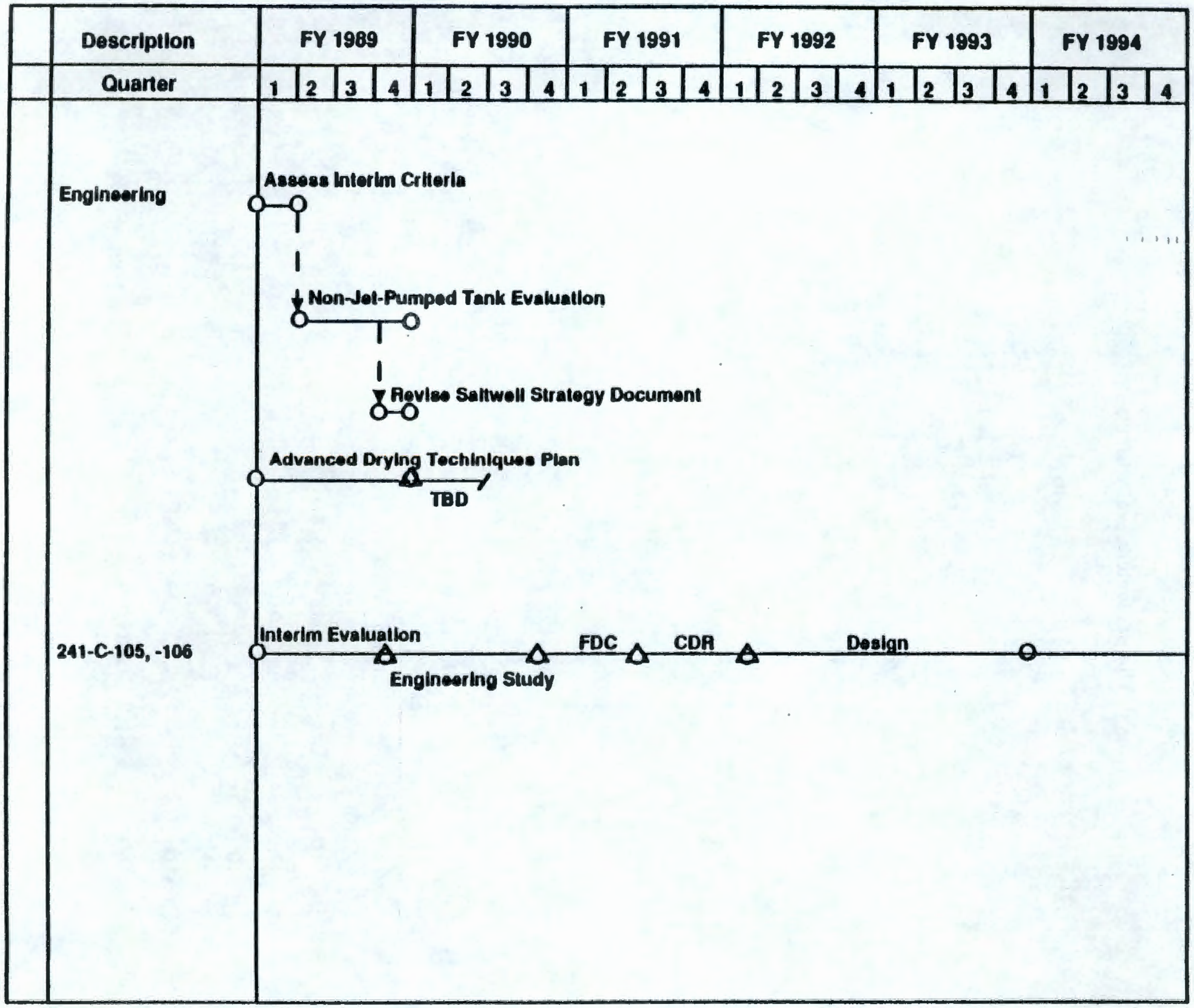

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Figure C-2. Stabilization Schedules. (Sheet 2 of 2)

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