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Table of Contents

Technical Task Plan
Engineering Test Protocol for Metallic Waste Forms

1.0 Introduction

The Savannah River Site (SRS) has the responsibility for the development and implementation of the technologies required to assure safe and efficient storage, handling, disposition and disposal of aluminum based spent nuclear fuels and their associated sludges. The 255 m^3 (62.4 Metric Tons of Heavy Metal) of aluminum based fuel includes ten different fuel types with ^{235}U enrichments from about 20% to in excess of 90%. Many of these fuels, including foreign research reactor (FRR) fuels, are currently in wet storage in basins throughout the world. Approximately 16.7 m^3 of the fuel is currently stored at SRS and the SRS inventory will increase to 255 m^3 by 2035 due to redistribution of the Spent Nuclear Fuel (SNF) from other DOE sites, domestic research reactors and foreign research reactors. Future storage options for these fuels include:

a) continued, interim, wet storage,

b) transfer to interim, dry storage.

Disposition options, if the fuel is not reprocessed, are basically restricted to

c) disposal in a repository.

The waste form for repository storage has not been established and may include several options such as direct disposal of the SNF and/or treatment-disposal alternatives. Until the interim, dry storage and disposition options are established, the bulk of the fuel will remain in interim, wet storage

The transfer from wet to dry storage will involve the characterization and classification of the fuels and fuel containing sludges. The results of the characterization will provide a technical basis for selecting the dry storage conditions and the possible segregation of the fuels into separate categories for treatment and interim dry storage. For example, some of the fuels may be considered suitable for direct disposal, some for co-disposal with other forms of nuclear waste such as the defence waste glasses, others may require the application of treatment options such as melting and dilution of the ^{235}U content by additions of depleted uranium. Alternatively, all of the fuels may be treated through a single disposal option, such as direct disposal. However, unless, or until that disposal option has been selected, all practical disposal options must be considered as potential alternatives. Additionally, the sludges may be incorporated into treatment options that were basically designed for the fuels or undergo treatments designed specifically to prepare that sludge for disposal. Regardless of dry storage/treatment option selected, the result of the characterization, treatment and transfer process will be a waste form that is ready for direct transfer to a repository ("road ready"). This "road ready" waste form will be placed in interim storage until a final decision is made concerning a geologic repository.

The objective of the tasks presented in this plan for waste forms from the aluminum based fuels and sludges is to:

I) develop test methodologies and associated technologies to assess the suitability of the waste forms for storage, handling, transfer and repository disposal,

II) validate the test methodologies with bench and/or pilot scale testing, and

III) use the validated test protocol to evaluate the suitability of potential waste forms.

This plan outlines the technology development necessary to accomplish these three objectives.

2.0 Background

Evaluation of the suitability of a waste from for "road ready" storage and subsequent geologic disposal must include tests and analysis that assess the potential for nuclear criticality and environmental consquences. Ultimately, the results of the assessment must demonstrate that inclusion of the waste forms will not adversely impact the performance assessment of the repository. The waste forms developed from the aluminum based fuels may differ significantly from direct disposed commercial nuclear fuels and from glasses manufactured in the Defense Waste Processing Facility (DWPF). These differences include:

a) ^{235}U enrichment, which may be as high as 93% if the waste form is created by direct disposal, and

b) waste form stability (i.e. chemical durability, mechanical integrity and radiation and thermal stability).

The waste forms for the aluminum based fuels are likely to be more reactive that other waste forms placed in the repository. Additionally, both the aluminum cladding and aluminum-uranium core material in the aluminum based fuels are more reactive than the alloys anticipated for use in the "road ready" canister. The Zircaloy cladding and uranium oxide fuel core from the commercial fuels and the glasses from the DWPF process will generally be less reactive than the canister materials. These differences, coupled with the potential for a higher ^{235}U content in the waste form, suggest that the compatibility of the waste form with the anticipated storage and repository environments must be established through the test protocol and the technologies used to establish that compatibility must be well understood. The understanding is necessary to provide a technical basis to extrapolate the short term test data into the long term regimes of geologic disposal.

3.0 Reporting and Activity Milestones

The estimated period of performance for the development, qualification and validation of the test protocol for the assessment of metallic waste forms is from January 1997 to January 1999. The basic elements of the test protocol will be established by June 1997, and laboratory testing to refine the protocol will be initiated by July, 1997. The initial laboratory induced refinements to the protocol will be completed by January, 1998, and bench/pilot scale testing will be initiated by February, 1998. Laboratory testing will continue and parallel the bench scale testing throughout 1998. The initial use of the test protocol to evaluate actual waste forms will be initiated by January, 1999, and will include actual in-ground testing of simulated waste forms to bench mark the protocol standards. The in-ground testing/bench marking will continue into the 21st century. The task plan will be revised annually to incorporate changes in program scope and/or direction. Program accomplishments will be published in the Materials Technology Section Monthly Reports and in topical reports as appropriate. The schedule for the activities included in this task plan is shown in Appendix A. The major reporting milestones for FY-97 are:

1. Technical Task Plan for developing the test protocol to evaluate the suitability of waste forms from aluminum based fuels for repository storage. December, 31, 1996.

2 Literature review summarizing relevant established test protocols and evaluating the applicability those test methodologies and procedures to waste forms produced from aluminum based fuels. June 1, 1997.

3. Initiate laboratory evaluation of test protocol. June 30, 1997.

4. Preliminary draft of test protocol. August 31, 1997.

5. Initial specification, purchase and/or installation of equipment to validate test protocol in bench/pilot scale facility. October 31, 1997.

6. Peer review of the data, analysis and reports will be accomplished as as such items are developed in the program.

4.0 Technical Tasks Identified for Development of Test Protocol

Task 4.1 *Literature Review*

The literature which defines requirements for storage, transport and disposal of high level radioactive waste forms, including documents such as 10CFR60, 10CFR71, 10CFR72 will be reviewed. The applicable requirements in those documents will be interfaced with associated NRC, ASTM and DOE requirements for testing and analysis of nuclear waste forms. The review will also incorporate, as applicable, the WCP, WAPS and other specifications governing waste glass forms. The result of the review will be a document summarizing relevant established test protocols and evaluating the applicability those test methodologies and procedures to waste forms produced from aluminum based fuels. This document will provide:

a) an evaluation of waste form properties which must be defined to assure suitability,

b) an evaluation of mechanisms that could cause waste form degradation during storage, handling and transfer and/or the repository disposal period, and

c) the basis for developing the initial test protocol to measure the properties of interest and assess the potential for degradation.

Emphasis in the review will be placed on extending applicable test protocols to waste forms produced from aluminum based fuels and sludges.

Subtask 4.1.1 *Leaching of Radionuclides*

Repository data, the testing and analysis of glass waste forms and the testing and analysis of commercial spent fuel will be reviewed and evaluated. The review will focus on the appropriate transfer of test conditions, methodologies and procedures to waste forms produced from

aluminum based fuels. This transfer, coupled with the anticipated repository conditions, will provide the basis for a draft test protocol to define and evaluate the chemical behavior of the waste forms. Inertness is one of the most important inherent properties of the waste form. (Start 1/1/97; Complete 6/1/97)

Subtask 4.1.2 *Pyrophoricity*

The ASTM (ASTM Committee C-26) is working to develop a standard guide for pyrophoricity testing of metallic spent nuclear fuel. Although the ASTM work emphasis the metallic uranium fuels, the effort on this subtask will be to evaluate the guidelines developed through the ASTM committee and develop a pyrophoricity test protocol that is applicable to aluminum based spent fuels. (Start 2/1/97; Complete 6/1/97)

Subtask 4.1.3 *Waste Form Integrity*

Repository issues such as waste form leachability and pyrophoricity will depend on the surface-to-volume ratio of the waste form. This dependence, coupled with the fact that any waste form must be handled, transferred and subjected to potential accident scenarios, illustrate the need to establish a test protocol that measures waste form integrity under anticipated conditions. Factors associated with waste form integrity include mechanical stability, radiation stability and thermal stability. The work to develop the test protocols for glass, and other, waste forms will be reviewed and used to establish the draft protocol for waste forms produced from aluminum based fuels. (Start 2/1/97; Complete 5/1/97)

Subtask 4.1.4 *Criticality*

Literature related to selective leaching of the various elements from the anticipated waste forms will be reviewed and combined with information on other potential methods for ^{235}U concentration and/or redistribution. This review will be used to establish a draft test/analytical procedure to assure against a criticality during the storage, handling and disposal of the waste form. (Start 3/1/97; Complete 6/1/97)

Subtask 4.1.5 *Other Test Needs*

The literature review may demonstrate that additional or alternative testing is necessary to assure that the waste forms are suitable for interim storage, transport and/or repository disposal. This subtask will identify those testing needs and provide the analysis necessary to establish draft plans to meet those needs. (Start 1/1/97; Complete 5/1/97)

Task 4.2 Draft Test Protocol

The literature review, defined in Task 4.1, will establish the technical basis for tests and analysis to assure that high level radioactive waste forms produced from aluminum based spent nuclear fuels are suitable for safe and efficient storage, handling, disposition and disposal. This task will couple that review with an analysis of established test techniques to

develop the initial draft of the test protocol for evaluation of aluminum based, metallic waste forms.

Subtask 4.2.1 *Property Measurements Required*

The development of a test protocol requires the identification of the specific and/or collective physical and chemical properties of the waste form(s) that are important to the safe and efficient:

a) storage,

b) handling,

c) transfer (including transportation), and

d) disposal.

Task 4.1 will be the primary source for the identification of the information needed and this subtask will begin to identify the specific material property data required to fulfill that need. (Start 3/1/97; Complete 6/1/97)

Subtask 4.2.2 *Evaluation and Analysis*

Material property data for the waste forms produced from aluminum based fuels will differ in many aspects from data now available for "repository accepted" waste forms such as DWPF glass and commercial nuclear fuels. This subtask will provide the evaluations necessary to develop the property measurements andwindows of acceptability required by the test protocol. This subtask will use the existing WACS and WAPC for glass waste forms as a basis for developing the test protocol requirements. (Start 3/1/97; Complete 7/1/97)

Subtask 4.2.3 *Measurement Techniques*

This subtask will identify the measurement technique(s) that is to be used to establish the materials property data required by subtask 4.2.1. Test and analysis procedures will also be established by this subtask. (Start 3/1/97; Complete 7/1/97)

Subtask 4.2.4 *Draft Protocol*

The initial draft of the test protocol will be prepared and issued. (Start 1/1/97; Complete 8/31/97)

Task 4.3 Test Protocol Development

The primary source of information for the draft test protocol (Task 4.2) will be the literature survey (Task 4.1). This survey will review and summarize relevant, established test protocols and evaluate the applicability test methodologies and procedures to waste forms produced from aluminum based fuels. This task will provide the laboratory information

necessary to develop and refine the draft document and assure that the test methodologies defined by the test protocol assess the short and long term safety of the waste form and provide the data and analysis necessary to screen candidate waste forms.

Subtask 4.3.1 *Testing of Waste Form Properties*

Laboratory evaluation of the test methodologies recommended in the draft test protocol is initially necessary to assure that the tests provide the required property data. Portions of this data will be sensitive to controllable test variables including, temperature, environment and waste form characteristics such as surface-to-volume ratio. The appropriate test environment will be related to both storage and disposal conditions and will be influenced by a variety of parameters, including: irradiation level (for example, radiolysis and the formation oxides of nitrogen), moisture level, canister and backfill materials. The draft test protocol will recommend specific tests to evaluate individual properties of the waste form. The laboratory data will demonstrate that the suitability of the recommended test and provide the refinements to the draft test protocol that are necessary to assure that the test variables simulate/duplicate waste form storage and disposal conditions and that the test results provide suitable screening criteria. Testing will be performed on several scales; a) parametric testing of waste forms under condition which are varied systematically in order to assess corrosion mechanisms, b) repository simulation tests to assess the effects of repository environments on performance, and, if possible, c) simulated field tests to validate waste form behavior. (Start 4/1/97, Continuing into FY 98)

Subtask 4.3.2 *Testing of Degradation Mechanisms*

This subtask will demonstrate that the tests recommended in the draft protocol provide sensitive measures of the effects of anticipated handling, storage and disposal conditions on waste form properties. Laboratory and field work are necessary to correlate leaching data with, for example, radionuclide release from a waste form. The evolution of the repository environments as water passes through the repository backfill, corrodes the canister and begins to interact with the waste form must be simulated and related to the anticipated irradiation levels. In this case, tendencies for localized forms of corrosion (pitting, intergranular attack, etc.) must be assessed and correlated with the waste form microstructure, radionuclide distribution and corrosion tendencies to demonstrate the ability of a test to predict the time dependence of waste form properties. This subtask will either demonstrate that the recommended test protocol assesses the effects of time and exposure on waste form properties or provide refinements to the protocol to assure that such assessments can be made satisfactorily. (Start 5/1/97: Continuing into FY 98)

Subtask 4.3.3 *Evaluation of Test Methodologies*

The data and analysis developed in Subtask 4.3.1 and 4.3.2 will demonstrate the technologies necessary measure the properties and behavior of candidate waste forms. The technologies developed during the execution of those subtasks will be used to evaluate the recommended test methodologies for accuracy, reproducibility and efficiency. (Start 7/1/97: Continuing into FY 98)

Subtask 4.3.4 *Revision of Draft Test Protocol*

Revisions to the draft test protocol will be made as appropriate and will be based on the information developed in subtasks 4.3.1, 4.3.2, and 4.3.3. (Start 10/1/97: Continuing into FY 98)

Task 4.4 Integration of Technical Basis for Test Protocol

The test protocol developed through this program must be compatible with established protocol used to evaluate other candidate waste forms. The literature review (Task 4.1) is designed to assure such compatibility. However, review alone, will not assure that the test protocol developed for waste forms produced from aluminum based fuels is fully integrated with the test methodologies used to assess waste forms based on commercial nuclear fuels. Such integration can be obtained through programmatic cooperation with the laboratories that have maintained a high profile in the assessment of commercial nuclear fuels. Additionally, the use of the experience and facilities which already exist at these laboratories should reduce the cost of developing the test protocol. To accomplish this integration, the Savannah River Technology Center will work with the other laboratories within the DOE complex such as Argonne, Pacific Northwest and Lawrence Livermore National Laboratories. This task will provide direct interfaces with the participating laboratories for coordinated assessments of the leachability of candidate waste forms.

Subtask 4.4.1 *Long Term Corrosion Contract*

Laboratories such as LLNL have the facilities and experience to measure the long term corrosion behavior of candidate waste forms in simulated repository environments. This subtask will contract a selected laboratory to conduct a cooperative program to test candidate waste forms, including the forms from the direct and melt-dilute disposal options, under simulated repository environments similar to those previously used to test commercial nuclear fuels. (Start 3/1/97: Continuing into FY 98)

Subtask 4.4.2 *Leachability Contract*

Laboratories such as PNNL have the facilities and experience to measure the leachability of candidate waste forms in simulated J-13 ground water. This water duplicates the chemical conditions found in a well in the tuff formation at Yucca Mountain. The J-13 water is, therefore, anticipated to represent water in the repository, should

Yucca Mountain be selected. This subtask will contract the selected laboratory to conduct a cooperative program to test the leachability of candidate waste forms, beginning with forms from the direct disposal option, in J-13 water. (Start 3/1/97: Continuing into FY 98)

Subtask 4.4.3 *Other Contracts*

The execution of Tasks 4.1, 4.2 and 4.3 will identify additional areas where contractual interactions with universities and/or other laboratories is the most efficient method to accomplish the needed testing or analysis. This subtask is designed to use such contractual arrangements to compliment/supplement the available resources. (Start - as appropriate; Complete - as appropriate)

Subtask 4.4.4 *Integration into Test Protocol*

The data and analysis developed in subtasks 4.4.1 and 4.4.2 will be used to validate and refine the test methodologies recommended in the draft test protocol. (Start 6/1/97: Continuing into FY 98)

Task 4.5 Test Protocol Optimization and Standardization

The approved test protocol developed under this program must assure that any qualified waste forms produced from aluminum based fuels meet applicable codes and standards and have been evaluated for environments consistent with handling, storage and disposal conditions. As the test methodologies and screening criteria are selected (Task 4.2), evaluated and refined (Task 4.3) and validated (Task 4.4) the protocol will become increasing standard. This task is to assure that the program produces an approved protocol standard that has been optimized for both test methodologies and screening criteria.

Subtask 4.5.1 *Optimization of Test Methods*

Detailed procedures for each test methodology will be prepared. These procedures will incorporate appropriate codes and standards and the lessons learned during the execution of Tasks 4.3 and 4.4. Test standards or control samples, similar to the test blocks for hardness calibrations, will be developed and used to evaluate and certify the procedures. The procedures will then be optimized through a round robin evaluation that will include at least three laboratories (SRTC, PNNL and LLNL). The round robin data will also be used to assure that reproducible results are produced by application of the test protocol. (Start 10/1/97; Continuing into FY 98)

Subtask 4.5.2 *Optimization of Screening Criteria*

The waste forms will be characterized through the application of the test protocol. A window of suitability or acceptability for each test result will be established and a "value" for that characteristic will be developed. The assignment of "value" will be designed to provide a waste form evaluator to place the "values" determined from the protocol testing into an equation (fundamental or empirical) and calculate a relative suitability or merit for the waste form. Weighting

factors, to address the relative importance of a specific property or characteristic, will be incorporated in the equation. This will provide a technique for numerical comparison of candidate waste forms and therefore establish a technical basis for screening and selecting candidate waste forms for disposal. The comparison technique will be evaluated through the use of independent review groups when significant data and analysis are available (Start 9/30/97 and continuing)

Subtask 4.5.3 *Approval of Protocol*

The approval process, including the selection of approving agency, for the test protocol will be established. Preliminary interactions with the anticipated approving agency will be initiated as soon as practical. Because ASTM is a strong candidate, interactions with ASTM Committee C-26 (Nuclear Fuel Cycle) will be initiated as will participation on subcommittees of C-26. (Start 1/1/97: Continuing into FY 98)

Subtask 4.5.4 *Issue Approved Protocol Standard*

The draft test protocol will be made available to the anticipated approval agency; however, no formal action toward obtaining approval for the test protocol is anticipated in FY 97.

APPENDIX A -QUALITY ASSURANCE PLAN

The task activities described in SRT-MTS-96-2064 are governed by the requirements of the WSRC 1Q and WSRC E7 manuals and the implementing procedures of the WSRC-SRTC L1 manual (latest revisions of each). Per the TTR (#EF&RFSR/SNFP 97-04), the QA requirements of DOE/RW-0333P will be met. Revisions to SRT-MTS-96-2064 and the task and QA plans will be made as necessary to reflect programmatic and/or technical changes.

The activities described in Appendix A are not expected to affect any established technical baselines of SRS. However, the data and results produced under the activities defined in Appendix A may affect the creation of a new baseline. Consequently these activities are non-baseline and are designated as Research and Development tasks per 1Q QAP 2-3, Rev. 1 and shall be conducted as "Scientific Investigations" as outlined in DOE/RW-0333P Supplement III.

The control of the task activities is shown below. Measurements and testing will be performed by the appropriate technical sections (Materials Technology, Applied Technology, Equipment Engineering) of SRTC. Existing guides for routine functions and new special procedures, technical guides, or both are anticipated and will be developed and used as appropriate.

Customer approval will be secured for all technical and programmatic reports.

Training to DOE/RW-0333P requirements shall be documented. All task and subtask leaders shall read this task plan.

Engineers performing the subtasks or their designees are responsible for maintaining their own records for subtasks in progress. The anticipated QA records will be maintained as required by 1Q QAP 2-3, Rev. 1, paragraph 5.0. A copy of the records of completed tasks will be stored by B. J. Wiersma or a designee until program completion. At that time, the task records will be transferred to SRS site records for permanent retention. The task records include the deliverables as outlined in the subtasks per the TTP (Appendix A to SRT-MTS-97-2004). Deliverables to include inter-departmental memorandum issued to the customer.

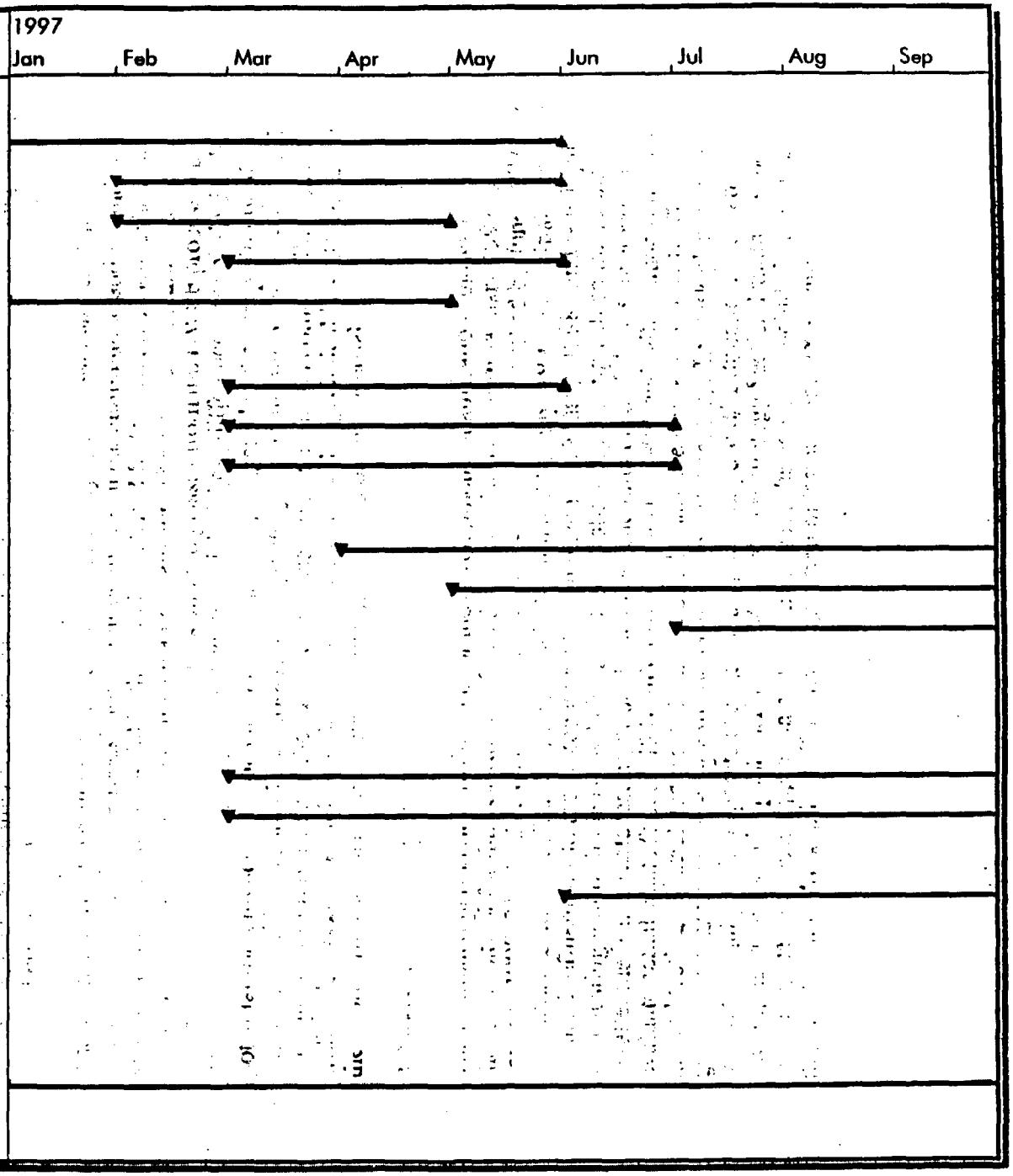
This task was assessed per L1, 7.10 Rev.2, Attachment 3 for impact of failed equipment or technology on the programmatic cost and schedule. Multiple paths are being used to minimize effect of cost and schedule.

WSRC 1Q Manual Section	Applies to Task (Y, N, AR)	Applicable Procedures	Procedures Used
Organization	AR	1Q; 1-2 Stop Work	
QA Program	Y	L1; 8.21, Supplemental QA Requirements for DOE/RW-0333P	
-Training and Qualification			
	AR	1Q; 2-2, Personnel Training & Qual.	
	AR	L1; 5.03, SRTC Training Records	
-R&D Activities			
	Y	L1; 7.10, Control of Technical Work	
	Y	E7; 3.12, Non-Baseline Tech. Ass. Requests	
	Y	1Q; 2-3, Control of R&D Activities	
	Y	L1; 4.19 Technical Notebook Use	
	AR	E7; 3.70, Qualification of Existing Data	
Design Control			
-Initiation	Y	E7; 2.02, Baseline Technical Task Request	
	N	E7; 2.05, Plant Modification Traveler	
-Design Control	N	E7; 2.10 Func. Performance Requirements	
	N	E7; 2.11, Function Design Criteria	
	N	E7; 2.13 Task Requirements and Criteria	
	N	E7; 2.15, Alternative Studies	
	N	E7; 2.25, Functional Classifications	
	N	L1; 1.13, Process Hazards Reviews	
	N	E7; 2.37, Design Change Form	
-Calculations	N	E7; 2.16, Technology Risk Assessment	
	AR	E7; 2.31 Engineering Calculations	
-Reviews	AR	E7; 2.40, Design Verification and Checking	
	N	E7; 2.60, Plant Mod. Technical Review	
	N	E7; 3.14, Design Authority Tech. Reviews	
-Outputs	N	E7; 2.12, Fac. Des. Descrip. and Sys. Des. Desctip.	
	N	E7; 2.41, Interface Coordination	
	Y	E7; 3.60, Technical Reports	
	N	L1; 1.22, SRTC Green Letters (Tech. Rec.) for SRS	
	AR	L1; 4.01, Preparing Scien. and Tech. Rep. and Papers	
Procurement Document Control	Y	WSRC-3E, Procurement Spec. Manual	
	N	7B; 1.1, Purchase Requisitioning	
	Y	1Q; 4-1, Procurement Document Control	
Instructions, Procedures, and Drawings	AR	E7; 2.30 Drawings	
	Y	L1; 1.01, Procedure Adm. (Field)	
	N	L1; 4.02, Generation and Rev. of Process Tech. Manuals	
	AR	1B; 3.11 Documentation	
Document Control	AR	E7; 1.20, Engr. Doc. Numbering System	
	N	E7; 2.03, Tracking and Turnover of Tech. Baseline Tasks	
	AR	1B; 3.11, Doc. and Corr. Numbering System	
Control of Purchased Items and Services	AR	1Q; 7-2, Control of Purchased Items & Services	
	N	E7; 3.42, Replacement Item Eval.	
	N	E7; 3.46, Commercial Grade Item Dedication and Material Upgrade	
Identification and Control of Items	N	E7; 1.30, Component Numbering System	

Control of Processes	N N N N N	1Q; 9-1, Control of Processes 1Q; 9-2, Control of NDE 1Q; 9-3, Control of Welding and Other Joining Processes E7; 2.06, Temporary Modification Control E7; 2.38, Design Change Package	
Inspection	N N	E7; 2.35, Quality Assessment E7; 2.38, Quality Inspection Plan	
Test Control	N N	E7; 2.26, Post-Mod. Acceptance Criteria 1Q; 11-1, Test Control	
Control of Measuring and Test Equipment	Y N	1Q; 12-1, Control of M&TE 1Q; 2-7, QA Program Req'ts. for Analytical Measuring Systems	
Packaging, Handling, Shipping, & Storage	AR AR	1Q; 13-1, Packaging, Handling, Shipping and Storage L1; 2.17, Procurement, Labeling, Handling, and Disposition of Hazardous Material	
Inspection, Test, and Operating Status	AR N	1Q; 14-1, Inspection, Test, and Operating Status L1; 3.03, Off-Shift Coverage of Experimental Equipment	
Control of Nonconforming Items & Action	Y N	1Q; 15-1, Control of Non-conf. Items 1Q; 15-2, Control of Non-conf. Activities	
Corrective Action System	AR	1Q; 16-1, Corrective Action System	
Quality Assurance Records	Y Y	L1; 8.17, QA Records Management 1Q; 17-1, Quality Assurance Records Management	
Audits	N N N	1Q; 18-2, Quality Assurance Surveillances L1; 1.07, Management Assessments L1; 1.08, Self Assessment	
Quality Improvement	N N	1Q; 19-1, Quality Assurance Trending 1Q; 19-2, Quality Improvement	
Software Quality Assurance	N	1Q; 20-1, Software Quality Assurance	
Environmental Quality Assurance	N	1Q; 21-1, Environmental Quality Assurance	

Schedule for SNF Engineering Test Protocol Tasks

TASK NAME	Planned Start	Planned Finish
4.1 LITERATURE REVIEW		
4.1.1 Leaching of Radionuclides	1/1/97	6/1/97
4.1.2 Pyrophoricity	2/1/97	6/1/97
4.1.3 Waste Form Integrity	2/1/97	5/1/97
4.1.4 Criticality	3/1/97	6/1/97
4.1.5 Other Test Needs	1/1/97	5/1/97
4.2 DRAFT TEST PROTOCOL		
4.2.1 Property Measurement Required	3/1/97	6/1/97
4.2.2 Evaluation and Analysis	3/1/97	7/1/97
4.2.3 Measurement Technique	3/1/97	7/1/97
4.3 TEST PROTOCOL DEVELOPMENT		
4.3.1 Testing of Waste Form Properties	4/1/97	FY98*
4.3.2 Testing of Degradation Mechanisms	5/1/97	FY98*
4.3.3 Evaluation of Test Methodologies	7/1/97	FY98*
4.3.4 Revision of Draft Test Protocol	9/30/97	FY98*
4.4 INTEGRATION OF TECHNICAL BASIS FOR TEST PROTOCOL		
4.4.1 Long Term Corrosion Contract	3/1/97	FY98*
4.4.2 Leachability Contract	3/1/97	FY98*
4.4.3 Other Contracts		FY98*
4.4.4 Integration into Test Protocol	6/1/97	FY98*
4.5 TEST PROTOCOL OPTIMIZATION AND STANDARDIZATION		
4.5.1 Optimization of Test Methods	10/1/97	FY98*
4.5.2 Optimization of Screening Criteria	9/30/97	FY98*
4.5.3 Approval of Protocol	1/1/97	FY98*
4.5.4 Issue Approved Protocol Standard		



* Task will continue into FY98