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Tank Farm Waste Characterization Technology Program Plan

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

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Tank Farm Waste Characterization Technology Program Plan

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ABSTRACT

This document presents technological and analytical methods development activities required to characterize, process, and dispose of Hanford Site wastes stored in underground waste tanks in accordance with state and federal environmental regulations. The document also lists the need date, current (fiscal year 1989) funding, and estimate of future funding for each task. Also identified are the impact(s) if an activity is not completed. The document integrates these needs to minimize duplication of effort between the various programs involved.

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EXECUTIVE SUMMARY

This Technology Program Plan (TPP) addresses the tasks necessary for tank farm waste characterization. Knowledge of waste characteristics and properties is necessary to support the needs of the Grout Treatment Facility (GTF), Hanford Waste Vitrification Plant (HWVP), double-shell tank (DST) waste pretreatment and retrieval, single-shell tank (SST) current management and disposal issues, Plutonium-Uranium Extraction (PUREX) Plant transuranic (TRU) removal from neutralized cladding removal waste (NCRW) issues, tank farm process engineering (TFPE), and tank farm technology.

The TPP reviews existing sampling methods, documents, and previously identified sampling needs. It identifies deficiencies and duplication of effort and recommends system changes and development plans for efficient tank waste characterization. This includes obtaining, transporting, analyzing, archiving, and data managing the samples following the NQA-1* documentation requirements. Schedules that state the status of the past fiscal year (FY) sampling efforts, planned sampling for the current FY, and future sampling are also contained in the document. The TPP will be revised annually. The current FY sampling schedule will be revised as necessary.

Section 1.0 identifies the objectives of the TPP. Analytical development issues are discussed in Section 2.0. In situ characterization and sampling methods development are described in Sections 3.0 and 4.0, respectively. Section 5.0 discusses sample transportation and storage. Sample control and database management issues are included in Section 6.0. Section 7.0 presents a sample schedule for

*ANSI/ASME, 1983, *Quality Assurance Program Requirements for Nuclear Facilities*, NQA-1, American National Standards Institute/American Society of Mechanical Engineers.

FY 1989 and a preliminary schedule for outyear sampling. Section 8.0 addresses the role of Quality Assurance (QA) in tank waste characterization. Section 9.0 addresses characterization planning. Section 10.0 lists the overall program needs and integrates the TPP tasks that provide for those needs. In addition, Section 10.0 contains an integrated schedule and cost rollups by program.

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LIST OF TERMS

AA	atomic absorption
AL	RCRA Analytical Laboratory
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ASL	Analytical Systems Laboratories
ASME	American Society for Mechanical Engineers
CASS	Computer Automated Surveillance System
CC	complexant concentrate
CCS	composite core sampling
CENRTC	capital equipment not related to construction
CLP	Contract Laboratory Program
CRW	cladding removal waste
CST	core sampling truck
DCRT	double-contained receiver tank
DMA	dynamic mechanical analysis
DNAAS	delayed neutron activation analysis system
DOE	U.S. Department of Energy
DSC	differential scanning calorimetry
DSS	double-shell slurry
DSSF	double-shell slurry feed
DST	double-shell tank
DTA	differential thermal analysis
Ecology	Washington State Department of Ecology
EDS	energy-dispersive X-ray spectrometer
EF,EK	Environmental Restoration Programs
EP	extraction procedure (toxicity)
EPA	U.S. Environmental Protection Agency
EWR	engineering work request
FIA	flow injection analysis
FIC	Food Instrument Corporation
FY	fiscal year
GC	gas chromatography
GEA	gamma energy analysis
GFAA	graphite furnace atomic absorption
GTF	Grout Treatment Facility
HEC	Hanford Environmental Compliance
HEDL	Hanford Engineering Development Laboratory
HFW	Hanford facilities waste
HL	High Level Waste Management Program
HWMTP	Hanford Waste Management Technology Plan
HWVP	Hanford Waste Vitrification Plant
IC	ion chromatography
ICP	inductively coupled plasma
LC	Liquid Chromatography
LCCS	Laboratory Customer Communications System
LOW	liquid observation well
MS	mass spectrometer
NAS	National Academy of Science
NCAW	neutralized current acid waste

NCRW	neutralized cladding removal waste
NPH	normal paraffin hydrocarbons
NRC	U.S. Nuclear Regulatory Commission
PCEL	Process Chemistry and Engineering Laboratory
PCL	Process Chemistry Laboratory
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
PSW	phosphate-sulfate waste
PUREX	Plutonium-Uranium Extraction (Plant)
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
SEM	scanning electron microscopy
SRL	Savannah River Laboratory
SST	single-shell tank
SWL	saltwell liquid
TBD	to be determined
TBP	tributyl phosphate
TC	total carbon
TCLP	toxicity characteristic leaching procedure
TFPE	tank farm process engineering
TGA	thermal gravimetric analysis
TMA	thermal mechanical analysis
TMI	Three Mile Island
TRAC	Tracks Radioactive Components
TOC	total organic carbon
TPP	Technology Program Plan
TRU	transuranic
TRUEX	Transuranic extraction
TTT	time-temperature-temperature
VOST	volatile organic sampling train
WB,WL,WP	Waste Management Programs
WCP	Waste Characterization Plan
Westinghouse Hanford	Westinghouse Hanford Company
WFQ	waste form qualification
WTC	waste tank characterization
XRD	X-ray diffraction
XRF	X-ray fluorescence

TANK FARM WASTE CHARACTERIZATION TECHNOLOGY PROGRAM PLAN

1.0 OBJECTIVE

The primary objective of this Technology Program Plan (TPP) is to provide documentation of the required technology, resources, equipment, and plans to integrate single-shell tank (SST) and double-shell tank (DST) sampling and characterization. Planned activities through fiscal year (FY) 1994 support Grout Treatment Facility (GTF), Hanford Waste Vitrification Plant (HWVP), DST waste pretreatment, DST waste retrieval, SST current management and disposal issues, neutralized cladding removal waste (NCRW) issues, tank farm process engineering (TFPE), and tank farm technology. This TPP is intended to integrate sampling and characterization activities into a comprehensive, cost-effective characterization program.

Section 10.0 summarizes the program needs and the development tasks. Integrated schedules and cost summaries are provided for program planning.

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2.0 ANALYTICAL METHODS

2.1 GENERAL ANALYTICAL CAPABILITIES

Most analytical methods for the characterization of tank farm wastes are available at Westinghouse Hanford Company's (Westinghouse Hanford) Resource Conservation and Recovery Act (RCRA) Analytical Laboratory (AL) and Process Chemistry and Engineering Laboratory (PCEL) Sections in the Chemical Processing Division. These laboratories are all located in the 222-S facility and are collectively referred to as the 222-S laboratories. The Pacific Northwest Laboratory (PNL), operated by Battelle Memorial Institute, can perform many of the same sample analyses as well as provide more complete organic and rheological analyses.

Tank farm samples are generally analyzed at AL. Routine TFPE samples containing no solids and requiring no special sample preparation are submitted directly to AL. All other tank farm waste samples are sent to the Process Chemistry Laboratories (PCL) Unit of PCEL. The PCL performs the necessary sample preparation and submits samples to the Research Support Unit of AL. The PCL performs most physical analyses and evaluates and documents all analytical results. The AL performs all routine chemical and radiochemical analyses of tank farm samples (e.g., ion chromatography (IC), inductively coupled plasma (ICP), gamma energy analysis (GEA)). The Analytical Systems Laboratories (ASL) Unit of PCEL is responsible for the development of new analytical methods and also performs some nonroutine analyses.

Current analytical capabilities at Westinghouse Hanford and PNL are shown in the analytical capabilities matrix (Tables 2-1 and 2-2, respectively). Detection limits given are generally representative of detection limits for tank farm samples; exceptions are noted. Problems encountered with some of the methods are briefly described in the analytical capabilities matrix and are also discussed in Section 2.2. Current analytical capabilities at Westinghouse Hanford need to be upgraded to incorporate RCRA quality control protocols and test methods where applicable.

2.2 ANALYTICAL DEVELOPMENT NEEDS

Several analytical problems and development needs are discussed which must be resolved before the following wastes can be processed for disposal:

- Neutralized current acid waste (NCAW)
- NCRW
- Double-shell slurry/double-shell slurry feed (DSS/DSSF)
- SST wastes
- Plutonium finishing plant (PFP) waste
- Complexant concentrate (CC) waste
- HWVP Feed.

Table 2-1. Analytical Capabilities Matrix Westinghouse Hanford Laboratories: Process Chemistry Laboratories Unit, Analytical Systems Unit, and Research Support Unit. (Sheet 1 of 6)

Analyte type	Method	Analyte	Detection limit (M)[a]	Comments, problems, and method limitations
Chemical inorganic	ICP	Ag	9 E-05	High salt matrices like most tank farm samples require dilution to reduce salt effects. This results in increased detection limits. Detection limits shown here are representative of those for DST wastes. High actinide and uranium contents also raise background levels and increase detection limits. High fluoride samples (waste with high fluoride or solids dissolved in HNO_3/HF) must be further diluted for analysis. Additional development work will be needed to reduce some detection limits to meet regulatory requirements.
		Al	1 E-03	
		B	6E-04	
		Ba	4 E-05	
		Bi	5 E-04	
		Ca	2 E-05	
		Cd	2 E-04	
		Ce	8 E-04	
		Co	2 E-04	
		Cr	6 E-05	
		Cu	5 E-05	
		Fe	2 E-04	
		K	5 E-03	
		La	2 E-04	
		Li	6 E-03	
		Mg	4 E-05	
		Mn	4 E-03	
		Mo	6 E-04	
		Na	9 E-03	
		Nd	3 E-04	
		Ni	3 E-04	
		P	1 E-03	
		Pb	4 E-04	
		Pd	6 E-04	
		Si	7 E-04	
		Sn	2 E-03	
		Sr	1 E-05	
		Ta	3E-04	
		Ti	1 E-04	
		Zn	8 E-05	
		Zr	5 E-04	
	IC	F^-	7 E-04	High salt matrices like most tank farm samples cause equipment and operational problems. Dilution of samples to reduce salt effects result in increased detection limits. Detection limits shown here are representative of DST wastes. Some problems experienced with fluoride analysis on IC. Improved fluroide results may be possible with a new IC with gradient elution. Fluoride can also be done by ion specific electrodes. Interferences are expected with PSW.
		Cl^-	5 E-04	
		NO_3^-	2 E-03	
		SO_4^{2-}	1 E-03	
	Thermal titration	Al	1 E-01	CC cannot be analyzed by this method due to unknown interferences; OH and Al in CC can be determined by titration and ICP respectively. Wastes with large amounts of Zr, NH_3, or CO_3 (e.g., NCRW) can cause problems.
		OH^-		

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Table 2-1. Analytical Capabilities Matrix Westinghouse Hanford Laboratories: Process Chemistry Laboratories Unit, Analytical Systems Unit, and Research Support Unit. (Sheet 2 of 6)

Analyte type	Method	Analyte	Detection limit (M)[a]	Comments, problems, and method limitations
Chemical inorganic (cont.)	Kjeldahl	NH_3	2.5 E-02	Method not successful on NCAW.
	Various spectrophotometric methods	NO_2^- PO_4^{3-} Cr^{6+}	4.7 E-03 4 E-04 1.1 E-03	Interferences in NCAW and some other wastes can raise the detection limit given for Cr^{6+} by a factor of 100. Cr^{3+} is inferred by subtracting Cr^{6+} from the value of Cr from ICP analysis.
	Hydride atomic absorption	As Se	0.5 mg/L 0.5 mg/L	Limited demonstration on SST and DST wastes.
Chemical, organic	TOC analyzers	TOC Total carbon Total inorganic carbon Total organic carbon	2 E-02 µg TBD TBD TBD	Hot-cell capability may be required for NCAW samples. New instrument. Detection limits are expected to be in the µg/L range but effects of sample matrix are not yet known. The TOC result will not include purgeable organics. The NPH used in core sampling will invalidate results.
	LC	EDTA HEDTA Citrate Oxalate Glycolate Dibutyl Phosphate Monobutyl Phosphate	~E-02 ~E-02	Analysis performed by ASL. These detection limits may be raised by some matrix interferences. These are not routine methods and some development may still be needed. HPLC and LC may provide more complete analysis for carboxylic acids. Further development of these methods is necessary.
	GC	TBP NPH		Analysis performed by ASL.
Radionuclide	GEA	^{108m}Ag[c] ^{110m}Ag[c] ^{241}Am[d] ^{243}Am[d] ^{41}Ar[b] ^{198}Au[b] ^{133}Ba[b] ^{139}Ba[b]	4.6 E+01 µCi/L 1.3 E+02 µCi/L 2.2 E+02 µCi/L 6.0 E+01 µCi/L 1.3 E+01 µCi/L 3.9 E+01 µCi/L 4.9 E+01 µCi/L 1.1 E+02 µCi/L	Detection limits are given in µCi/L. Detection limits are highly dependent on other radionuclides present in the sample. For example, large amounts of ^{137}Cs, as is common in tank farm samples, will result in higher detection limits than those given here.

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Table 2-1. Analytical Capabilities Matrix Westinghouse Hanford Laboratories: Process Chemistry Laboratories Unit, Analytical Systems Unit, and Research Support Unit. (Sheet 3 of 6)

Analyte type	Method	Analyte	Detection limit ($\underline{M}$)[a]	Comments, problems, and method limitations
Radionuclide (cont.)	GEA	^{140}Ba	2.0 E+03 µCi/L	A low background alpha counting capability for analyzing Hanford wastes needs to be added. Present alpha counting systems limit detection levels.
		$^{141}Ba^{b}$	6.7 E+01 µCi/L	
		$^{7}Be^{b}$	4.0 E+02 µCi/L	
		$^{207}Bi^{b}$	5.2 E+01 µCi/L	A method to remove ^{137}Cs should be developed. Removal of ^{137}Cs would permit analysis of minor gamma-emitting isotopes.
		$^{212}Bi^{b}$	1.1 E+03 µCi/L	
		$^{214}Bi^{b}$	1.4 E+02 µCi/L	
		$^{109}Cd^{c}$	7.7 E+02 µCi/L	Development and installation of methodology to measure long-lived isotopes may improve detection limits.
		$^{139}Ce^{b}$	2.7 E+01 µCi/L	
		^{141}Ce	4.2 E+01 µCi/L	
		^{144}Ce		Due to the infrequency that an analysis is performed, and/or matrix interferences, detection limits for a few radioisotopes have not been determined.
		$^{144}CePr$		
		$^{56}Co^{b}$	1.9 E+01 µCi/L	
		$^{57}Co^{b}$	2.3 E+01 µCi/L	
		^{58}Co	2.1 E+01 µCi/L	
		^{60}Co	1.1 E+01 µCi/L	
		^{51}Cr	3.0 E+02 µCi/L	
		^{134}Cs	2.0 E+01 µCi/L	
		^{136}Cs	2.1 E+01 µCi/L	
		^{137}Cs	1.0 E-02 µCi/L	
		$^{138}Cs^{b}$	1.2 E+01 µCi/L	
		^{152}Eu	5.5 E+01 µCi/L	
		^{154}Eu	3.5 E+01 µCi/L	
		^{155}Eu	9.3 E+01 µCi/L	
		^{59}Fe	2.7 E+01 µCi/L	
		^{181}Hf	5.1 E+01 µCi/L	
		^{203}Hg	3.7 E+01 µCi/L	
		$^{129}I^{d}$	1.0 E-03 µCi/L	
		^{131}I	3.8 E+01 µCi/L	
		$^{132}I^{c}$	6.8 E+01 µCi/L	
		$^{133}I^{b}$	5.8 E+01 µCi/L	
		$^{134}I^{b}$	2.5 E+01 µCi/L	
		$^{135}I^{b}$	4.5 E+01 µCi/L	
		$^{40}K^{b}$	9.5 E+01 µCi/L	
		^{85}Kr	1.2 E+04 µCi/L	
		$^{85m}Kr^{b}$	2.5 E+01 µCi/L	
		$^{87}Kr^{b}$	7.8 E+01 µCi/L	
		$^{89}Kr^{b}$	5.2 E+02 µCi/L	
		^{140}La	5.0 E+00 µCi/L	
		$^{142}La^{b}$	1.0 E+02 µCi/L	
		^{54}Mn	2.1 E+01 µCi/L	
		$^{56}Mn^{b}$	2.1 E+01 µCi/L	

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Table 2-1. Analytical Capabilities Matrix Westinghouse Hanford Laboratories: Process Chemistry Laboratories Unit, Analytical Systems Unit, and Research Support Unit. (Sheet 4 of 6)

Analyte type	Method	Analyte	Detection limit ($\underline{M}$)[a]	Comments, problems, and method limitations
Radionuclide (cont.)	GEA	^{22}Na[b]	1.2 E+01 µCi/L	
		^{24}Na[b]	1.2 E+01 µCi/L	
		^{95}Nb	2.0 E-02 µCi/L	
		^{97}Nb[b]	1.2 E+02 µCi/L	
		^{238}Np[b]	8.0 E+01 µCi/L	
		^{239}Np[b]	2.0 E+02 µCi/L	
		^{233}Pa[b]	8.0 E+01 µCi/L	
		^{234}Pa[b]	2.9 E+03 µCi/L	
		^{210}Pb[b]		
		^{212}Pb[b]	6.0 E+01 µCi/L	
		^{214}Pb[b]	1.0 E+02 µCi/L	
		^{210}Po[b]	1.7 E+06 µCi/L	
		^{214}Po[b]	3.0 E+04 µCi/L	
		^{216}Po[b]	6.5 E+09 µCi/L	
		^{238}Pu[d]	7.6 E+05 µCi/L	
		^{239}Pu[d]	2.5 E+06 µCi/L	
		^{240}Pu[d]	5.4 E+05 µCi/L	
		^{241}Pu[d]	1.0 E+05 µCi/L	
		^{242}Pu[d]	6.0 E+05 µCi/L	
		^{224}Ra[b]	6.7 E+02 µCi/L	
		^{226}Ra[b]	7.1 E+02 µCi/L	
		^{88}Rb[b]	3.4 E+01 µCi/L	
		^{89}Rb[b]	4.4 E+01 µCi/L	
		^{106}Ru	1.5 E-02 µCi/L	
		^{106}RhRu	3.0 E-02 µCi/L	
		^{220}Rn[b]	7.1 E+05 µCi/L	
		^{103}Ru	5.3 E+01 µCi/L	
		^{124}Sb	5.2 E+01 µCi/L	
		^{125}Sb		
		^{46}Sc[c]	1.5 E+01 µCi/L	
		^{75}Se	3.7 E+01 µCi/L	
		^{113}Sn	5.5 E+01 µCi/L	
		^{85}Sr[b]	5.3 E+01 µCi/L	
		^{91}Sr[b]	9.5 E+01 µCi/L	
		^{92}Sr[b]	1.2 E+01 µCi/L	
		^{182}Ta	2.6 E+01 µCi/L	
		^{99m}Tc[d]	2.1 E+01 µCi/L	
		^{123m}Te[c]	2.5 E+01 µCi/L	
		^{125m}Te	1.3 E+03 µCi/L	
		^{132}Te[c]	2.7 E+01 µCi/L	
		^{228}Th[b]	1.1 E+03 µCi/L	
		^{208}Ti[b]	5.1 E+01 µCi/L	

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Table 2-1. Analytical Capabilities Matrix Westinghouse Hanford Laboratories: Process Chemistry Laboratories Unit, Analytical Systems Unit, and Research Support Unit. (Sheet 5 of 6)

Analyte type	Method	Analyte	Detection limit (M)[a]	Comments, problems, and method limitations
Radionuclide (cont.)	GEA	^{235}U	3.9 E+01 µCi/L	
		^{237}U[b]	1.2 E+02 µCi/L	
		^{187}W[b]	9.3 E+01 µCi/L	
		^{131m}Xe[c]	1.1 E+03 µCi/L	
		^{133}Xe[c]		
		^{133m}Xe[c]	2.6 E+02 µCi/L	
		^{135}Xe[b]	3.0 E+01 µCi/L	
		^{138}Xe[b]	1.4 E+02 µCi/L	
		^{88}Y[b]	2.2 E+01 µCi/L	
		^{91}Y	4.3 E+02 µCi/L	
		^{91m}Y[b]	6.0 E+01 µCi/L	
		^{65}Zn[c]	3.1 E+01 µCi/L	
		^{95}Zr	2.0 E-02 µCi/L	
		^{97}Zr[b]	3.3 E+01 µCi/L	
	Elemental separation by CMPO and AEA	$^{239,240}Pu$ ^{241}Am ^{237}Np	1 nCi/g 1 nCi/g 1.5 E-03 g/L	Recently developed. Has been demonstrated on NCAW, DSS, and synthetic CRW. Work is ongoing to improve method.
	DDCP reagent and AEA	$^{239,240}Pu$ ^{241}Am		Used on SST waste only. Method above is used for DST waste.
	Laser fluorimeter	U	2 E-05 g/L	Some interferences exist. A relatively new method is being used.
	Spectrophotometry	Th	10 ppm	Measurement by ICP also seems to be applicable.
	Radiochemical separation and beta counting	^{90}Sr ^{99}Tc	1 E-02 µCi/L 4 E-01 µCi/L	All radiochemical and separation methods should be automated to comply with ALARA and permit analysis of highly radioactive samples.
	Radiochemical separation and low gamma energy	^{129}I	1 E-03 µCi/L	A relatively new method. Has been run on NCAW, SST waste, and DSSF.
		Total alpha	1.4 E-01 µCi/L	Interferences exist with high salt or high beta, alpha samples.
		Total beta	1.2 E-01 µCi/L	Interferences exist with high salt samples.
	Per sulfate oxidation/liquid scintillation	^{14}C	10 pCi/Sample	The detection limit is really a quantification limit. At 10 pCi one can confirm the presence of ^{14}C, but not really convert to molarity. Sample size is dependent on the activity of other radionuclides.

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Table 2-1. Analytical Capabilities Matrix Westinghouse Hanford Laboratories: Process Chemistry Laboratories Unit, Analytical Systems Unit, and Research Support Unit. (Sheet 6 of 6)

Analyte type	Method	Analyte	Detection limit ($\underline{M}$)[a]	Comments, problems, and method limitations
Physical and miscellaneous analyses	Physical measurements	Volume percent Solids Weight percent Solids Density Specific gravity Solids settling rate	~1%	Detection limits are dependent on sample size and relative amounts of solids present in sample. Trailing edge settling rate usually measured.
	Particle size	Brinkman and Elzone Particle Size Analyzers	0.5 to 150 µm range 1 to 300 µm range	Agglomerates and certain types of large particles can be broken up during measurement. This can result in inaccurate sizings.
	Microscopy	Optical Scanning Electron Microscope		Sample radioactivity (dose rate) limitation to be determined. Can be used for crystal identification.
	X-ray diffraction (XRD) X-ray fluorescence (XRF)			Qualitative analysis of solids. Cannot be used to analyze highly radioactive samples because samples are handled outside a hood.
	Thermal analysis	Thermal Gravimetric Analysis (TGA) Differential Scanning Calorimetry (DSC)		

[a]Except as noted.
[b]Concentration is not reported in ORIGEN fission or activation products or is reported as zero.
[c]Amount reported in ORIGEN would not be detected.
[d]Analysis is performed by different methods (mass spectroscopy, AEA, beta counting, or low energy gamma, depending on species).

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Table 2-2. Analytical Capabilities Matrix Pacific Northwest Laboratory. (Sheet 1 of 7)

Analyte type	Method	Analyte	Detection limit ($\underline{M}$)[a]	Comments, problems, and method limitations
Chemical inorganic	ICP	Ag	9 E-05	Detection limits are representative of those for DSS and NCRW sludge. These limits are very similar to those given in Table 2-1. Detection limits are directly affected by the concentration of major cations in the sample. High salt matrices like most tank farm samples require dilution to reduce salt effects. This results in increased detection limits. Detection limits shown here are representative of those for DST wastes. High actinide and uranium content also raise background levels and increase detection levels and increase detection limits. High fluoride samples (waste with high fluoride or solids dissolved in HNO_3/HF) must be further diluted for analysis. Additional development work will be needed to reduce some detection limits to meet regulatory requirements. Uses methods from EPA SW846 and Contract Laboratory Procedures statement of work for both nonradioactive and mixed hazardous waste samples.
		Al	1 E-03	
		B	9 E-04	
		Ba	2 E-05	
		Bi	5 E-04	
		Ca	3 E-04	
		Cd	2 E-04	
		Ce	8 E-04	
		Co	2 E-04	
		Cr	4 E-04	
		Cu	5 E-05	
		Dy	1 E-05	
		Fe	9 E-05	
		K	3 E-03	
		La	7 E-05	
		Li	1 E-03	
		Mg	4 E-04	
		Mn	3 E-05	
		Mo	1 E-04	
		Na		
		Nd	1 E-04	
		Ni	3 E-04	
		P	1 E-04	
		Pb	4 E-04	
		Pd	6 E-04	
		Rh		
		Ru	6 E-04	
		Si	7 E-04	
		Sn	2 E-03	
		Sr	2 E-05	
		Ta	3 E-04	
		Te	5 E-04	
		Ti	4 E-05	
		Zn	3 E-04	
		Zr	1 E-04	
	Graphite furnace--AA	Sb	50 µg/mL	Uses methods from EPA SW846 and Contract Laboratory Procedures statement of work for both nonradioactive and mixed hazardous waste samples.
		As	10	
		Se	10	
	Cold vapor--AA	Hg	$\leq$10 µg/g	Uses methods from EPA SW846 and Contract Laboratory Procedures statement of work for both nonradioactive and mixed hazardous waste samples.

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Table 2-2. Analytical Capabilities Matrix Pacific Northwest Laboratory. (Sheet 2 of 7)

Analyte type	Method	Analyte	Detection limit (M)[a]	Comments, problems, and method limitations
Chemical inorganic (cont.)	Titration	OH^-		
	Colorimetry - spectrophotometry	NH_3, Cr^{6+} Fe^{3+} NO_2^- CN^-, Fe^{2+} PO_4^{3-}, Th		Uses methods from EPA SW846 and Contract Laboratory Procedures statement of work for both nonradioactive and mixed hazardous waste samples.
	Specific ion electrode	S^{2-}, Cl^- NH_4^+, CN^- F^-, I^-		Only water-soluble cyanide can be analyzed.
	IC	Cl^-, F^- NO_3^-, NO_2^- S^{2-}, PO_4^{3-} SO_4^{2-}, Br^-		High anion concentrations (such as high nitrate wastes or solids dissolved in HNO_3) require dilution of sample before analysis. Dilution will result in higher detection limits.
Chemical organics	Derivatization and GC/MS	Hydrophilic organics	0.01 to 0.05 µg/g	Method includes speciation of chelator/complexants, chelator fragments, and carboxylic acids. Detection limits are constrained by primarily sample size (about 20 to 30 mL of tank farm samples were used).
	Purge and trap and GC/MS	Volatile organics	0.01 µg/g	Uses methods from EPA SW846 and Contract Laboratory Procedures statement of work for both nonradioactive and mixed hazardous waste samples.
	Solvent extraction and GC/MS	Acid/Base/ Neutral Organics	0.2 to 0.4 µg/g	Uses methods from EPA SW846 and Contract Laboratory Procedures statement of work for both nonradioactive and mixed hazardous waste samples.
	LC	Low MW polar organics EDTA HEDTA Citrate Oxalate Glycolate Dibutyl Phosphate Monobutyl Phosphate	 ~E-02 ~E-02	Method developed but not tested on tank farm samples.
	TOC analyzer	TOC Total carbon Total inorganic carbon	2 E-02 µg/g	

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Table 2-2. Analytical Capabilities Matrix Pacific Northwest Laboratory. (Sheet 3 of 7)

Analyte type	Method	Analyte	Detection limit (M)[a]	Comments, problems, and method limitations
Chemical organic (cont.)	Total organic halide analyzer	Total Organic Halide Purgeable Organic Halide Extractable Organic Halide	2 E-03 µg	
Radionuclide	GEA	^{108m}Ag	4.6 E+01 µCi/L	Detection limits are highly dependent on concentrations of radionuclides in sample. Limits given here are for a sample containing ~1 E+05 µCi/L ^{137}Cs, which is comparable to tank farm samples. The presence of ^{154}Eu interferes with ^{95}ZrNb determination. Due to the infrequency of analysis and/or matrix interferences, detection limits for a few radioisotopes have not been determined.
		^{110m}Ag	1.3 E+02 µCi/L	
		^{41}Ar	1.3 E+01 µCi/L	
		^{198}Au	3.9 E+01 µCi/L	
		^{133}Ba	4.9 E+01 µCi/L	
		^{139}Ba	1.1 E+02 µCi/L	
		^{140}Ba	2.0 E+03 µCi/L	
		^{141}Ba	6.7 E+01 µCi/L	
		^{7}Be	4.0 E+02 µCi/L	
		^{207}Bi	5.2 E+01 µCi/L	
		^{212}Bi	1.1 E+03 µCi/L	
		^{214}Bi	1.4 E+02 µCi/L	
		^{109}Cd	7.7 E+02 µCi/L	
		^{139}Ce	2.7 E+01 µCi/L	
		^{141}Ce	4.2 E+01 µCi/L	
		^{144}Ce		
		^{56}Co	1.9 E+01 µCi/L	
		^{57}Co	2.3 E+01 µCi/L	
		^{58}Co	2.1 E+01 µCi/L	
		^{60}Co	1.1 E+01 µCi/L	
		^{51}Cr	3.0 E+02 µCi/L	
		^{134}Cs		
		^{136}Cs	2.1 E+01 µCi/L	
		^{137}Cs		
		^{138}Cs	1.2 E+01 µCi/L	
		^{152}Eu	5.5 E+01 µCi/L	
		^{154}Eu	3.5 E+01 µCi/L	
		^{155}Eu	9.3 E+01 µCi/L	
		^{59}Fe	2.7 E+01 µCi/L	
		^{181}Hf	5.1 E+01 µCi/L	
		^{203}Hg	3.7 E+01 µCi/L	
		^{129}I	6.4 E+03 µCi/L	
		^{131}I	3.8 E+01 µCi/L	
		^{132}I	6.8 E+01 µCi/L	

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Table 2-2. Analytical Capabilities Matrix Pacific Northwest Laboratory. (Sheet 4 of 7)

Analyte type	Method	Analyte	Detection limit ($\underline{M}$)[a]	Comments, problems, and method limitations
Radionuclide (cont.)	GEA	^{133}I	5.8 E+01 µCi/L	
		^{134}I	2.5 E+01 µCi/L	
		^{135}I	4.5 E+01 µCi/L	
		^{40}K	9.5 E+01 µCi/L	
		^{85}Kr	1.2 E+04 µCi/L	
		^{85m}Kr	2.5 E+01 µCi/L	
		^{87}Kr	7.8 E+01 µCi/L	
		^{89}Kr	5.2 E+02 µCi/L	
		^{140}La	5.0 E+00 µCi/L	
		^{142}La	1.0 E+02 µCi/L	
		^{54}Mn	2.1 E+01 µCi/L	
		^{56}Mn	2.1 E+01 µCi/L	
		^{22}Na	1.2 E+01 µCi/L	
		^{24}Na	1.2 E+G1 µCi/L	
		^{95}Nb		
		^{97}Nb	1.2 E+02 µCi/L	
		^{238}Np	8.0 E+01 µCi/L	
		^{239}Np	2.0 E+02 µCi/L	
		^{233}Pa	8.0 E+01 µCi/L	
		^{234}Pa	2.9 E+03 µCi/L	
		^{210}Pb		
		^{212}Pb	6.0 E+01 µCi/L	
		^{214}Pb	1.0 E+02 µCi/L	
		^{210}Po	1.7 E+06 µCi/L	
		^{214}Po	3.0 E+04 µCi/L	
		^{216}Po	6.5 E+09 µCi/L	
		^{238}Pu	7.6 E+05 µCi/L	
		^{239}Pu	2.5 E+06 µCi/L	
		^{240}Pu	5.4 E+05 µCi/L	
		^{241}Pu	1.0 E+05 µCi/L	
		^{242}Pu	6.0 E+05 µCi/L	
		^{224}Ra	6.7 E+02 µCi/L	
		^{226}Ra	7.1 E+02 µCi/L	
		^{88}Rb	3.4 E+01 µCi/L	
		^{89}Rb	4.4 E+01 µCi/L	
		^{106}Ru		
		$^{106}RhRu$		
		^{220}Rn	7.1 E+05 µCi/L	
		^{103}Ru	5.3 E+01 µCi/L	
		^{124}Sb	5.2 E+01 µCi/L	
		^{125}Sb		
		^{46}Sc	1.5 E+01 µCi/L	
		^{75}Se	3.7 E+01 µCi/L	

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Table 2-2. Analytical Capabilities Matrix Pacific Northwest Laboratory. (Sheet 5 of 7)

Analyte type	Method	Analyte	Detection limit ($\underline{M}$)[a]	Comments, problems, and method limitations
Radionuclide (cont.)	GEA	^{113}Sn	5.5 E+01 µCi/L	
		^{85}Sr	5.3 E+01 µCi/L	
		^{91}Sr	9.5 E+01 µCi/L	
		^{92}Sr	1.2 E+01 µCi/L	
		^{182}Ta	2.6 E+01 µCi/L	
		^{99m}Tc	2.1 E+01 µCi/L	
		^{123m}Te	2.5 E+01 µCi/L	
		^{125m}Te	1.3 E+03 µCi/L	
		^{132}Te	2.7 E+01 µCi/L	
		^{228}Th	1.1 E+03 µCi/L	
		^{208}Ti	5.1 E+01 µCi/L	
		^{235}U	3.9 E+01 µCi/L	
		^{237}U	1.2 E+02 µCi/L	
		^{187}W	9.3 E+01 µCi/L	
		^{131m}Xe	1.1 E+03 µCi/L	
		^{133}Xe		
		^{133m}Xe	2.6 E+02 µCi/L	
		^{135}Xe	3.0 E+01 µCi/L	
		^{138}Xe	1.4 E+02 µCi/L	
		^{88}Y	2.2 E+01 µCi/L	
		^{91}Y	4.3 E+02 µCi/L	
		^{91m}Y	6.0 E+01 µCi/L	
		^{65}Zn	3.1 E+01 µCi/L	
		^{95}Zr		
		^{97}Zr	3.3 E+01 µCi/L	
	Radiochemical and AEA	$^{239,240}Pu$	2 nCi/g	
		^{237}Np, ^{241}Am	2 nCi/g	
		$^{242\text{-}244}Cm$		
		^{243}Am		
		Total alpha	2 nCi/g	
		Total beta	2 nCi/g	
	Mass spectroscopy	Pu, isotopic	4 µg/g	
		U, isotopic	15 µg/g	
	Fluorometry	U, total	0.1 µg/g	
	IX separation - beta counting	^{90}Sr	20 nCi/g	
		^{99}Tc	6 nCi/g	
		^{147}Pm	2 nCi/g	
	IX separation - gamma counting	^{129}I	0.5 nCi/g	

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Table 2-2. Analytical Capabilities Matrix Pacific Northwest Laboratory. (Sheet 6 of 7)

Analyte type	Method	Analyte	Detection limit (M)[a]	Comments, problems, and method limitations
Physical and rheological analyses	Haake viscometer	Flow Behavior Index (n) Yield Stress (t_y) Consistency Index (K) Apparent viscosity		Minimum 40-mL sample required for rheograms. Highly radioactive samples can be analyzed in hot cells.
		Shear strength (t_s)		Minimum 22-mL sample is required although 100 mL is desirable. Larger samples allow more measurements and therefore, greater accuracy.
Physical and miscellaneous analyses	Physical measurements	Volume percent Solids Weight percent Solids Density Specific gravity Solids settling rate	~1%	Detection limits are dependent on sample size and relative amounts of solids present in sample. Trailing edge settling rate usually measured.
	Particle size	HIAC Particle Size Analyzers (Elzone)	5 to 200 µm range 0.2 µm	Agglomerates and certain types of large particles can be broken up during measurement. This can result in inaccurate sizings.
	Microscopy	Optical Scanning Electron Microscopy (SEM)		Can be used for crystal identification.
	X-ray diffraction			Qualitative analysis of solids. Cannot be used to analyze highly radioactive samples because samples are handled within a hood.
	X-ray fluorescence	Ag Al As Au Ba Bi Br Ca	20 ppb 9,300 ppb 5 ppb 10/ppb 50 ppb 10 ppb 4 ppb 60 ppb	Minimum detection limits based on a total live time count of 3,500 s and 50 mL of water evaporated at ambient temperature on 500 mg of pure cellulose. These detection limits are for water samples. In other matrices the detection limits are in the ppm range.

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Table 2-2. Analytical Capabilities Matrix Pacific Northwest Laboratory. (Sheet 7 of 7)

Analyte type	Method	Analyte	Detection limit (M)[a]	Comments, problems, and method limitations
Physical and miscellaneous analyses (cont.)	X-ray fluorescence	Cd	30 ppb	
		Ce	50 ppb	
		Cl	220 ppb	
		Co	10 ppb	
		Cr	40 ppb	
		Cs	40 ppb	
		Cu	7 ppb	
		Fe	20 ppb	
		Ga	6 ppb	
		Ge	5 ppb	
		Hg	10 ppb	
		I	40 ppb	
		In	30 ppb	
		K	66 ppb	
		La	50 ppb	
		Mo	9 ppb	
		Mn	20 ppb	
		Nb	9 ppb	
		Ni	7 ppb	
		P	810 ppb	
		Pb	16 ppb	
		Pd	20 ppb	
		Pt	10 ppb	
		Rb	8 ppb	
		Ru	20 ppb	
		S	360 ppb	
		Sb	40 ppb	
		Sc	230 ppb	
		Se	5 ppb	
		Si	2,250 ppb	
		Sn	30 ppb	
		Sr	8 ppb	
		Te	40 ppb	
		Th	14 ppb	
		Ti	90 ppb	
		Tl	9 ppb	
		U	18 ppb	
		V	50 ppb	
		Y	8 ppb	
		Zn	6 ppb	
		Zr	8 ppb	

[a]Except as noted.

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New regulations provide for credible analytical data on any sample taken to characterize waste material for hazardous, nonradioactive components by requiring the use of or correlation to measurement methods accepted by the U.S. Environmental Protection Agency (EPA). In addition, draft U.S. Department of Energy (DOE) Orders have been received which require conformance or equivalency to accepted standard methods for radionuclide quantitation.

Implementation of the protocols required to provide analyses equivalent to a commercial laboratory participating in the "Contract Laboratory Program" (CLP) as defined by EPA and RCRA document SW-846 as administered by the Washington Department of Ecology (Ecology) is in progress. These protocols are acceptable by consensus of Washington State and EPA regulators. However, significant changes are required in documentation, sample handling, and analysis to complete implementation of the protocols. Deviations from strict compliance with CLP requirements will be documented and negotiated with regulators to ensure that valid analytical results will be produced. Deviations will usually arise due to the nature of the wastes, matrix interferences, and the need to limit radiation exposure to personnel.

Analytical development needs include the following:

- Development of a generic solids dissolution method with hot-cell application for tank farm waste samples to permit analysis of insoluble solids
- Removal of sodium from samples for ICP and IC to reduce problems experienced when using such instrumentation
- Transferal of organic analytical methods from PNL to Westinghouse Hanford to support GTF, HWVP, and other performance assessments
- Development of methodology to measure hazardous waste constituents
- Development of a mercury analysis method
- Development of methodology to determine the rheological properties of NCAW and other wastes
- Development of methodology to measure the TRU content in NCRW sludge
- Development of a thermal conductivity determination method
- Improvement of the thermal titration method to analyze hydroxide and aluminum in CC waste
- Hot-cell adaptation of the method for the determination of carbon-14 (^{14}C) in wastes
- Development of remote methods for sample preparation and analysis.

The full characterization of wastes requires the development of methods for dissolution of solids. Problems have been encountered in dissolving SST and DST wastes using the acid dissolution methods or potassium hydroxide fusion techniques normally used by PCEL. A high-temperature, high-pressure technique using a Parr* bomb has undergone limited testing for dissolving NCAW solids but requires handling of the sample outside of the hot cell, which increases radiation exposure

*The Parr Instrument Company, 211 Fifty-Third Street, Roline, Illinois.

to laboratory personnel. An acid leach dissolution was used at PNL to dissolve NCAW for transuranic (TRU) analysis but the method is time consuming and involves the use of perchloric acid, which cannot now be used at the 222-S laboratories. A method for the dissolution of solids is required; different methods may be necessary to dissolve solids for different chemical analyses. Several fusion methods, including potassium hydroxide and sodium peroxide followed by hydrochloric acid dissolution, were tested in FY 1988 with inconclusive results. Although some improvement in solids dissolution was realized with these methods, the technique proved unreliable. Therefore, these methods cannot be considered viable for routine operation.

Two microwave dissolution systems have been purchased for evaluation in FY 1989. Tests performed at SRL have demonstrated good success on tests performed on their wastes. Technology developed in SRL will be used as a basis for demonstrations here.

Regulations have increased the need to implement standard methods of analyses for both radionuclide and hazardous analytes. These protocols are necessary for grout processing formulation development, performance assessment, and regulatory assessment. A quality assurance (QA) plan for laboratory operation which includes the specific items identified in the regulations is required. An analysis plan is required for each program to meet specific requirements of analytes and conditions unique to the program.

Proposed deviations from standard procedures must be documented and negotiated with regulatory agencies before use. Deviations for operation in hot cells are being identified which will provide accurate data for mercury, cyanide, and sulfide determinations. A major laboratory upgrade, including a data management upgrade, is currently being performed on the implementation of RCRA procedures in the 222-S laboratories. This upgrade is expected to require a significant outlay of capital funding.

Each of the programs receiving analytical support will need full protocol data on certain samples. The same level of control and documentation will not be required for process control data. Availability of protocol analyses will be required for each of the waste types previously identified in this section.

Analytical requirements for HWVP waste characterization have been defined and documented. Testing of methods for applicability to waste matrices must be performed before routine support is required.

Rheological measurements are needed by retrieval and HWVP for equipment design. The measurements are needed for washed NCAW samples and HWVP feed samples as a function of both feed concentration and formic acid addition.

Detection levels for the determination of chloride and fluoride must be decreased to about $1 \times 10^{-4}\underline{M}$. The oxidation state of certain elements also affects the suitability of materials for HWVP feed. Chromium and noble metals have been identified as concerns.

Carbon-14 is an environmentally important radionuclide because of its long half-life and mobility in the groundwater.

The analytical method for ^{14}C in solution has been developed and transferred to AL. A demonstrated system which can be performed in a hot cell continues as a needed capability. Current commercial units are inappropriate for remote operation because the instruments are too large and require hands-on assembly and adjustment.

Remote analysis systems should be evaluated for routine sample preparation and analyses. These systems would reduce radiation exposure to laboratory personnel by reducing the amount of necessary sample handling. A system such as flow injection analysis (FIA) could be implemented to perform labor-intensive tasks such as the separation steps required to prepare samples for plutonium, americium, and neptunium analysis. Other systems should also be evaluated. As the number of samples submitted for analyses continues to increase, the justification for automated laboratory systems to relieve laboratory personnel of labor-intensive tasks also increases.

Implementation of the delayed neutron activation analysis system (DNAAS) is underway. A demonstration of the system on one waste sample showed that it will provide plutonium concentration measurements to much less than the 100 µCi/g TRU level. The DNAAS is expected to provide the capability for rapid plutonium analysis of solid, liquid, or slurry samples. Samples need not be dissolved for analysis. The applicability of this method is being evaluated for TRU analysis of NCAW supernatant, wash water, unwashed/washed solids, and HWVP feed samples from the pretreatment process at B Plant because it could provide analysis within the required 8-h turnaround time. This method should be applicable to all tank farm samples.

Other analytical needs and plans for methods development are discussed in Section 2.3.

2.3 DEVELOPMENT PLANS

The tasks identified below are those necessary to support waste characterization. Estimated costs are given in FY 1989 dollars and do not include capital equipment costs, which are listed separately. Tasks are also cross-referenced to the Hanford Waste Management Technology Plan (HWMTP).

2.3.1 Arsenic, Mercury, and Selenium

This task provides for the implementation of procedures to analyze and report mercury, arsenic, and selenium. Methods for the analysis of arsenic and selenium in SST and DST wastes have been developed. Methodology for mercury analysis will be developed in Section 2.3.19. This task is considered complete (FY 1988).

2.3.2 Sulfide and Cyanide

Analytical procedures to determine concentrations of sulfide and cyanide in DST wastes will be developed to support GTF, HWVP, and SST characterization. The cyanide and sulfide methods were tested on low- and intermediate-activity samples. The cyanide method was successful; the sulfide method needs additional development. Additional modifications to both methods are required to provide capability for hot-cell operation. Documentation of deviations from RCRA procedures must be completed and demonstrations of equivalency must be performed.

Estimated Cost ($000)	54 (WP), 19 (HL)
Need date (FY)	1989
Program(s) supported	GTF, HWVP, SST characterization
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Incomplete characterization of DST wastes will affect grout formulation studies. The inability to accurately measure these analytes may result in chemical incompatibility with the HWVP process.

2.3.3 Toxicity Characteristic Leaching Procedure

Toxicity characteristic leaching procedure (TCLP) capability is being developed for routine use to analyze for the leachability of silver, arsenic, barium, cadmium, chromium, mercury, lead, and

selenium. The EPA is expected to substitute the TCLP for the extraction procedure toxicity (EP toxicity) method being developed in Section 2.3.33.

Estimated Cost ($000)	15 (WP)
Need date (FY)	1990
Program(s) supported	GTF, SST characterization
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Regulatory requirements will not be met if the EPA substitutes the TCLP for the EP toxicity method.

2.3.4 Organics

A method for analyzing total organic halides in DST wastes is being established in the 222-S laboratories for routine use. Equipment for this methodology has been ordered and will be installed when received. Methods for analyzing chelators, complexants, and extractable organics are currently undergoing further development at PNL. When development has been completed, these methods will also be transferred to the 222-S laboratories and implemented. These analytical capabilities are necessary for GTF and HWVP technology development. Methods transferal and equipment procurement transactions will be documented.

Estimated Cost ($000)	19 (WP), 339 (EK)
Need date (FY)	1989
Program(s) supported	GTF, HWVP, CC pretreatment
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Incomplete characterization of HWVP feed may result in improper HWVP equipment design and may affect final glass quality. Performance assessment for GTF may not be possible. This may result in GTF processing delays and plant shutdowns.

2.3.5 Solids Dissolution

All samples submitted to AL for analyses must be fully in solution to perform complete analyses. Difficulties have been encountered, most recently in NCAW samples, in fully dissolving SST and DST waste samples. Attempts to dissolve solids by using a Parr bomb at high temperature and pressure have proven unsuitable for routine use on NCAW samples.

A generic solids dissolution method for SST and DST wastes must be developed. Sodium peroxide fusion and potassium hydroxide fusion solids dissolution methods similar to those used at the SRL were investigated but proved to be unreliable for Hanford wastes. Microwave dissolution systems have been received, and testing has been funded for FY 1989. More than one dissolution method may be necessary to accommodate all waste types and analytical requirements.

Estimated Cost ($000)	36 (HL)
Need date (FY)	1989
Program(s) supported	HWVP, NCAW pretreatment, CC pretreatment, SST characterization, tank farm technology (also supports all other programs)
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Characterization of some tank farm waste types will be incomplete because of the inability to dissolve all solids present in waste samples. Incomplete dissolution may lead to greater uncertainties in three areas: formulations for GTF and HWVP, heat loading calculations, and estimation of the environmental impact of final waste forms.

2.3.6 Separation Technology for Ion Chromatography and Inductively Coupled Plasma

Two problems have been encountered with Separation Technology for IC and ICP: (1) matrix interferences have resulted in difficulties with the analysis of chloride, fluoride, and sulfate and (2) the large amounts of sodium and aluminum in DST and SST wastes cause operational difficulties, increase instrument downtime, and adversely affect detection limits for cations by ICP analysis. Nitrate removal could also enhance IC performance for minor anions. This task provides for the development of a routine sodium removal method that does not remove analytes to be measured. This will improve detection limits for chloride, fluoride, and sulfate, trace heavy metals (e.g., silver, lead, cadmium, platinum) and other analytes. Also included in the scope of this task is the evaluation of the applicability of the IC to other analyses.

Estimated Cost ($000)	63 (HL)
Need date (FY)	1990
Program(s) supported	GTF, HWVP, NCAW pretreatment (supports all other programs by improving laboratory operations)
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	If chloride and fluoride detection limits are not reduced, conservative estimates must be used to evaluate the corrosion effects of any recycle streams on HWVP equipment. This could significantly increase equipment costs. Operating problems and frequent replacement of IC columns from sodium loading problems will continue. Heavy metals and other metals (barium, chromium) are of environmental concern and may not be detected to required levels if matrix interferences are not removed.

2.3.7 Carbon

Three carbon analysis methods require development or modification to meet tank farm characterization needs: (1) ^{14}C , (2) total organic carbon (TOC), and (3) total carbon (TC). Current ^{14}C, TOC,and TC methods require the dissolution of the solids which results in carbon loss. New methods that can be performed directly on solids in a hot cell need to be developed. Among the methods to be evaluated are a persulfate oxidation method and the direct oxidation of solids in a furnace.

Hot-cell methodology for ^{14}C is being developed at AL. Additional funding is planned to be allocated for hot-cell carbon methodology development at PNL in mid-FY 1989.

Estimated Cost ($000)	20 (HL) for ^{14}C at AL, 52(HL) for carbon analysis
CENRTC ($000)	40
Need date (FY)	1989
Program(s) supported	^{14}C supports GTF, HWVP, NCAW pretreatment, CC pretreatment, and SST characterization; TC and TOC support HWVP
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	If a method for the analysis of ^{14}C is not developed at AL, samples would have to be transported to PNL for analysis where a method is available. Delays in obtaining results may occur and overall costs would be higher. The inability to detect TOC and TC in DST and SST wastes may result in improper HWVP equipment design and may affect final glass quality.

2.3.8 Rheological Evaluation of Neutralized Current Acid Waste

This task provides for the adaptation and installation of a Haake viscometer in a hot cell at PNL to obtain rheological characteristics of NCAW and other wastes. This task was completed in FY 1988.

2.3.9 Automated Laboratory Analysis Systems

This task provides for the development of systems such as the Zymark laboratory robot system and FIA, currently available at Westinghouse Hanford laboratories, for routine use in the analysis of some samples. These systems will reduce radiation exposure of laboratory personnel consistent with as low as reasonably achievable (ALARA) principles and provide faster, more efficient analyses. The elemental separations necessary for the determination of plutonium, americium, and neptunium in DST waste samples is one possible application for FIA. A study to examine other remote analytical systems, estimate costs and benefits, and provide a schedule for further development will also be conducted.

Estimated Cost ($000)	137 (HL) in FY 1990
Need date (FY)	1990
Program(s) supported	GTF, NCAW pretreatment, tank farm technology, TFPE (also supports all other programs)
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Labor-intensive methods will continue to be used. With an increase in the number of samples expected and the lack of laboratory personnel, delays in obtaining results could occur.

2.3.10 Delayed Neutron Activation Analysis System

During FY 1987, the DNAAS was implemented, the californium source installed, and the equipment demonstrated on a single sample. Additional development work will be necessary to provide routine analysis for plutonium in DST wastes. This method is necessary because it will provide an analysis of NCAW supernatant, wash water, unwashed/washed solids, and HWVP/GTF feed samples from B Plant pretreatment within the required B Plant flowsheet turnaround time of 8 h from the time the 222-S laboratories receive the samples. The application of this method for the analysis of americium and nonradioactive heavy metals should also be investigated.

Estimated Cost ($000)	79 (HL)
Need date (FY)	1992
Program(s) supported	HWVP, NCAW pretreatment, tank farm technology, TFPE, GTF (also supports all other programs)
HWMTP tasks	DST-3.4
Predecessor task	None
Impact if not done	If this method is not fully developed, continued lengthy analyses for TRU content of HWVP and GTF feed from B Plant pretreatment will be required. This could force curtailment or shutdown of B Plant pretreatment activities. Also, dose rates to laboratory personnel would be greater.

2.3.11 Key Radionuclide Selection for Single-Shell Tank Characterization

Radionuclides essential to environmental performance assessment are being selected for analysis. These radionuclides are being selected because of their solubility and/or long half-life. Documentation of the rationale and justification of the radionuclide selection is being included within the SST Waste Characterization Plan (WCP) (Winters 1989). This task will be completed as part of Section 2.3.32 and is considered closed.

2.3.12 Chemicals Known to be Stored in Single-Shell Tanks

Detailed information regarding the amounts and types of chemicals used at Hanford has been compiled. This information was obtained from Tracks Radioactive Components (TRAC) source information, flowsheets, procurement records, and other historical data. The list of chemicals has been compiled and documented (Klem 1988). After extensive investigation into the effort required to quantify the chemicals stored, it was determined that the effort would not yield a quality product. Therefore, this task is considered complete without the chemical amounts (FY 1988).

2.3.13 Characterization of Key Radionuclides

This task will evaluate how well the key radionuclides must be identified to support proposed actions. All criteria, regulations, release limits, and measuring techniques for identifying radionuclide locations will be considered. In situ disposal and waste retrieval concepts will be considered. This task will be completed as part of Section 2.3.32 and is considered closed.

2.3.14 Parameters of Interest in Single-Shell Tank Waste Characterization

Complete

A comprehensive list of radionuclides; dose rates; hazardous, toxic, reactive, and carcinogenic materials; and physical parameters to support contemplated waste disposal alternatives was compiled. All assumptions and bases were included. A document will be issued to complete the task.

Estimated Cost ($000)	63 (EF)
Need date (FY)	1989
Program(s) supported	SST characterization
HWMTP tasks	SST-2.17
Predecessor task	None
Impact if not done	If this task is not completed, the rationale for the selection of waste characterization parameters will not be fully documented. This may delay approval for final disposition of Hanford wastes.

2.3.15 Requirements for Single-Shell Tank Waste Characterization

Sampling and analysis requirements that pertain to SST waste characterization will be reviewed. The adequacy of current procedures and capabilities to meet regulatory requirements will be assessed. Instances where onsite capability does not exist will be documented. This task will be completed as part of Section 2.3.32 and is considered closed.

2.3.16 Resource Conservation and Recovery Act Analytical Requirements for Single-Shell Tank and Double-Shell Tank Waste Characterization

This task provides for upgrading the 222-S and 325 laboratories to maximize capability for protocol analyses and to ensure regulatory compliance during waste characterization. A major upgrade will be construction of several hot cells to permit greater throughput and analysis of highly radioactive samples.

Estimated Cost ($000)	7,216 (WL), 1,255 (EF) FY 1989, 25,288 (WL), 18,699 (EF) FY 1990 through 1994
CENTRC ($000)	9,417
HEC ($000)	18,630
Need date (FY)	1994[a]
Program(s) supported	All programs because of upgrades to the 222-S laboratories
HWMTP tasks	SST-2.17, DST-3.9
Predecessor task	None
Impact if not done	Onsite laboratory capability and capacity to perform the required analyses to meet RCRA regulations may not exist. This would severely hinder waste cleanup efforts.

[a]Because wastes from each tank are expected to present unique problems, continual upgrading of analytical methods may be required throughout the entire waste characterization process.

2.3.17 Remote Particle Size

This task provides for the evaluation and procurement of particle size measurement equipment, its installation in a hot cell, and testing on actual NCAW samples.

Estimated Cost ($000)	126 (HL)
CENRTC ($000)	50
Need date (FY)	1991
Program(s) supported	HWVP, NCAW pretreatment
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	An important parameter in the correlation of simulant and actual HWVP feed will not be known. Improper HWVP equipment design may result.

2.3.18 Chromium(VI)

Evaluation of current Chromium (VI) (Cr^{6+}) analytical methodology will be included in the analysis of a limited number of waste samples. If current methodology proves unsatisfactory, then further development work will be conducted. The full scope of this methodology development still needs to be determined in order to fully address all HWVP concerns.

Estimated Cost ($000)	TBD (HL)
Need date (FY)	1989
Program(s) supported	HWVP, NCAW pretreatment, SST characterization
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	If current Cr^{6+} methodology is not evaluated, it will remain unknown whether the method will perform satisfactorily. If Cr^{6+} concentration in HWVP feeds cannot be measured, an important HWVP melter design parameter will not be available. This could result in improper melter design.

2.3.19 Mercury

The mercury concentration in HWVP and GTF feed streams and in SST wastes must be determined for regulatory compliance and proper flowsheet preparation and equipment design. However, no mercury analytical method which is satisfactory for all waste types exists in either the 222-S laboratories or PNL. This task provides for the development of a mercury analytical method. One analytical method to be evaluated is a gold-plated carbon rod and mercury amalgam atomic absorption system.

Estimated Cost ($000)	125 (EF), 31 (WP)
Need date (FY)	1989
Program(s) supported	GTF, HWVP, NCAW pretreatment, SST characterization
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Failure to detect mercury may result in an inadequate equipment design and improper equipment materials. Also, mercury is of environmental concern. The inability to detect mercury to prescribed levels may preclude compliance to regulatory requirements.

2.3.20 Noble Metal Analysis

Noble metals are present in Hanford wastes at concentrations near the detection limit for the current analytical methods [ICP and atomic absorption (AA)]. Current techniques need refinement and alternative methods need to be evaluated. This task is unfunded for FY 1989.

Estimated Cost ($000)	126 (HL)
CENRTC ($000)	15
Need date (FY)	1989
Program(s) supported	HWVP, NCAW pretreatment
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Noble metals palladium, rhodium, and ruthenium are presumed sludge formers in the glass melter. Failure to detect these metals may result in an inadequate melter design. Also, the inability to detect them to prescribed levels may preclude compliance to regulatory requirements.

2.3.21 Trace Heavy Metal Analysis

Concentrations of heavy metals are near the detection limits for existing ICP analytical methods. However, because of matrix interferences, these limits cannot always be reached or the results are unreliable. Methods for the removal of the interfering elements (aluminum and sodium) may need to be developed to establish the required ICP performance documentation and operating standards. This task will be completed as part of Section 2.3.6 and, therefore, is considered closed.

2.3.22 Antimony and Tellurium

This task will evaluate ICP and graphite furnace atomic absorption (GFAA) capability for antimony and tellurium analyses and establish detection limits, accuracy, precision and interferences. Sample preparation procedures will also be developed for each analyte. An antimony method was developed and incorporated into 222-S laboratories procedures during FY 1988. Further development work is required to make the tellurium method viable.

The behavior of tellurium in HWVP operations must be studied to determine if (1) tellurium forms oxides that go to the glass (most desirable scenario), (2) tellurium plates out in the offgas system, (3) tellurium volatilizes and is released to the environment, (4) tellurium combines with halogens in the offgas system and either goes back to the melter or out to the environment.

Due to the operational and environmental concerns, scenarios 2, 3, and 4 could raise, tellurium behavior needs to be established so that HWVP equipment can be adequately designed.

Estimated Cost ($000)	76 (HL)
Need date (FY)	1991
Program(s) supported	HWVP, NCAW pretreatment
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Failure to understand tellurium behavior could result in inadequate HWVP design, environmental releases, and plant shutdowns.

2.3.23 Rare Earth Separations

No current method exists for separation of europium-154 (^{154}Eu) and samarium-151 (^{151}Sm). Evaluation and development of liquid chromatography (LC), IC, and FIA methods need to be performed. Separation of promethium-147 (^{147}Pm) has been successfully demonstrated by LC (FY 1988).

Estimated Cost ($000)	38 (HL)
Need date (FY)	1991
Program(s) supported	HWVP, NCAW pretreatment
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	The HWVP WFQ effort may not be able to respond to reporting requirements imposed by DOE and the NRC.

NRC = Nuclear Regulatory Commission.
WFQ = waste form qualification.

2.3.24 Selenium-79

Due to its mobility, selenium-79 (^{79}Se) has been selected as one of the isotopes to be evaluated for GTF performance assessment. Separation by hydride formation should be evaluated.

Estimated Cost ($000)	84 (WP)
CENRTC ($000)	5
Need date (FY)	1989
Program(s) supported	GTF, NCAW pretreatment
HWMTP task	DST-3.2
Predecessor task	None
Impact if not done	If the ability to detect ^{79}Se cannot be developed, performance assessment for GTF may not be possible. This may result in processing delays and plant shutdowns.

2.3.25 Iodine-129 Counting System

The iodine-129 (^{129}I) detection limit has been improved to 1 x 10^{-3} µCi/L (FY 1988). If this limit could be improved two more orders of magnitude before HWVP submits its RCRA Part B permit to DOE (April 1989), iodine removal equipment in the offgas system could be eliminated. This would generate a cost savings of $1 million. This task is unfunded for FY 1989.

Estimated Cost ($000)	TBD (HL)
Need date (FY)	April 1989
Program(s) supported	HWVP, NCAW pretreatment
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	If the limit is not reduced to 1 x 10^{-5} µCi/L and alternative methods of determining ^{129}I concentrations in wastes cannot be found, the iodine abatement equipment will be needed.

2.3.26 Energy-Dispersive X-ray Spectrometer Solids

An energy-dispersive X-ray spectrometer (EDS) should be installed to provide quantitative elemental analysis on microscopic size samples. This system would provide a method for analyzing samples too small for standard methods and for samples that cannot be dissolved.

Estimated Cost ($000)	138 (HL)
Need date (FY)	1991
Program(s) supported	HWVP, retrieval, CC pretreatment, TFPE, tank farm technology
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	If this method is not developed, complete waste tank characterization data may not be obtained. The lack of this information may result in inadequate pretreatment operations and HWVP design.

2.3.27 Porosity

A method for the determination of porosity of interstitial liquid content of sludges was to be developed. This method was needed to support the core sampling and analysis of SSTs to determine if the tanks meet the interim stabilization requirement of less than 50,000 gal of drainable liquid. Work completed on synthetic wastes by PCL showed that no correlation between porosity and waste consolidation existed. It was concluded that a porosity measurement method does not exist and cannot be developed for this task. Therefore, this task is considered closed with no method developed (FY 1988).

2.3.28 Thermal Conductivity

This task provides for the development of methods to measure SST and DST waste thermal conductivities in situ and in waste samples and heat capacities of tank farm waste samples. Methods for measuring thermal conductivity will be developed from two sources: (1) in situ (done by ASL) and (2) waste samples (done by PCL). These measurements are needed to allow reanalysis of heat loads and reevaluation of stabilization alternatives for high-heat producing tank wastes (specifically tank 241-C-106). This task also provides for the development of time-temperature-temperature (TTT) diagrams that identify temperatures and exposure time to those temperatures that cause significant changes in either the phase structure or composition of the borosilicate glass for the expected range of waste form composition. These techniques could also be helpful for HWVP design calculations if used on NCAW, CC waste, PFP waste, and NCRW samples. Some equipment has been received, but this task is unfunded for FY 1989.

Estimated Cost ($000)	125 (WB); 125 (HL)
Need date (FY)	1990
Program(s) supported	SST stabilization
HWMTP tasks	SST-2.11
Predecessor task	None
Impact if not done	Water additions to tank 241-C-106 will continue and retrieval of part of the waste may be required to allow stabilization of the tank. Costly modifications to the HWVP design may have to be made if the thermoconductivities and heat capacities of the feed streams and TTT diagrams of the expected range of waste form composition are not determined before design completion.

2.3.29 Penetrometer Testing of Double-Shell Tank Waste Sludges

This task provides for penetrometer testing of a single tank 241-SY-102 sludge sample and the development of procedures to conduct the testing. Penetrometer testing of SST and DST sludges will help determine the resuspension characteristics of the wastes by determining whether the sludges are dilatant or cohesive. This information is important for DST retrieval operations because it will be used to help determine if the scaled retrieval work performed at PNL is applicable for DST wastes.

Additional funding may be necessary if further testing on various sludges is required and if further adaptations for hot-cell application are required.

Estimated Cost ($000)	6 (HL)
Need date (FY)	1989
Program(s) supported	Retrieval
HWMTP tasks	New
Predecessor task	None
Impact if not done	The inability to determine the resuspension properties of DST waste sludges may result in inaccurate estimates for the retrieval system design and equipment sizing.

2.3.30 Physical Evaluation of Double-Shell Tank Wastes

The abrasiveness of a waste (determined by the Miller number) is important in design of transporting and processing equipment. A Miller number measurement apparatus has been installed in the 325 Building hot cell and some testing performed. In synthetic NCRW tests, the instrument's "lap" material dissolves. This problem must be resolved. Further methods development is needed to ensure reproducible NCRW results. This task is unfunded for FY 1989.

Estimated Cost ($000)	16 (HL)
Need date (FY)	1990
Program(s) supported	HWVP, retrieval
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	The inability to determine the abrasiveness of DST wastes may result in inaccurate process and transport system designs.

2.3.31 Ruthenium in Neutralized Current Acid Waste

The concentration and behavior of ruthenium in NCAW solids and supernatant is needed to determine if ruthenium volatility out the E-20-2 concentrator will be a problem when pretreatment begins (scheduled October 1992 at B Plant). Ruthenium behavior must be investigated for each of the five following cases (listed in order from most desirable to least desirable):

1. Ruthenium passes through the cesium ion-exchange (IX) column and goes to grout.
2. Ruthenium is stripped off the IX column during sodium scrub operations and goes to grout.
3. Ruthenium remains on the IX column after nitric acid wash and is sent with the column resin to HWVP.
4. Ruthenium is eluted with the cesium during nitric acid wash and sent to the E-20-2 concentrator.
5. Ruthenium volatilizes in the E-20-2 concentrator.

Because ruthenium behavior is a function of valence state, studies are necessary to determine (1) valence state of ruthenium in all of the above cases, (2) process factors affecting the valence state of ruthenium in each case, and (3) optimization of pretreatment parameters so ruthenium behavior will be acceptable (remain in cases 1, 2, and 3).

Estimated Cost ($000)	289 (HL)
Need date (FY)	1992
Program(s) supported	HWVP, NCAW pretreatment
HWMTP tasks	DST-3.2
Predecessor task	None
Impact if not done	Failure to mitigate ruthenium volatility during pretreatment could result in environmental releases and plant shutdowns.

2.3.32 Single-Shell Tank Waste Characterization Plan

This task reviews current SST sampling methods for obtaining representative samples. It also assesses the parameters for which each sample will be tested and characterized (e.g., hazardous chemicals, key radionuclides, physical attributes). How well each sample component (e.g., chemical, radionuclide) has to be measured will be determined. Current analytical methodology will be reviewed for conformance to regulatory requirements and methods development work identified. Regulatory agencies will be consulted during the preparation of this plan. Documentation of the rationale and justification for waste characterization analyses, and analytical methods development to ensure regulatory compliance will be performed. Documentation of the rationale and justification of the key radionuclide selection process will be completed within the plan.

Estimated Cost ($000)	590 (EF)
Need date (FY)	1989
Program(s) supported	SST characterization
HWMTP tasks	SST-2.2, SST-2.3, SST-2.5, SST-2.7, SST-2.8, SST-2.10
Predecessor task	3.3.12, 3.3.14
Impact if not done	Regulatory requirements may not be met. Characterization data may not be auditable in accordance with QA Plans.

2.3.33 Hazardous Characteristics Procedures

Ecology requires unknown wastes to be tested for four types of hazards: reactivity, ignitibility, corrosivity, and EP toxicity, and, if applicable, declare the wastes dangerous or extremely hazardous with respect to these criteria. Specific procedures which are based on the EPA characteristics tests already exist, but were developed for nonradioactive wastes. These tests must be adapted for hot-cell operation so that highly radioactive wastes may be tested for the four hazard criteria.

Estimated Cost ($000)	50 (EF)
Need date (FY)	1989
Program(s) supported	GTF, SST characterization
HWMTP tasks	SST-2.10, SST-2.17, DST-3.2
Predecessor task	None
Impact if not done	If hazard characteristics procedures are not adapted for hot-cell work, then highly radioactive wastes will not be hazard-characterized according to EPA and Ecology protocols. Thus, regulatory requirements will not be met.

2.3.34 Analytical Needs from Single-Shell Tank Waste Characterization Plan

This task provides for the incorporation of analytical development needs identified in the SST WCP into this TPP. It is expected that when the WCP is issued, funding will have been confirmed and need dates established for several analytical items now under preliminary consideration for possible methods development.

Estimated Cost ($000)	6 (EF)
Need date (FY)	1989
Program(s) supported	SST characterization
HWMTP tasks	SST-2.2, SST-2.10
Predecessor task	3.3.32
Impact if not done	This document is an assimilation of all waste characterization analytical methods development needs. If the needs identified in the SST WCP are not incorporated, high-priority methods development tasks may be overlooked. Need dates may then not be met which could affect the ability to meet regulatory requirements.

2.3.35 Thermal Titration for Complexant Concentrate Waste

Thermal titration results have proved unreliable for CC waste when the aluminum concentration is high. Developmental work has been done to resolve the aluminum interference. This task provides for the implementation of the interference correction factors for aluminum into the thermal titration procedure in the analysis of hydroxide (OH^-) in CC waste. This task is unfunded for FY 1989.

Estimated Cost ($000)	13 (HL)
Need date (FY)	1990
Program(s) supported	GTF, HWVP, CC pretreatment, SST characterization
HWMTP tasks	DST-3.2, DST-3.18, SST-2.10
Predecessor task	None
Impact if not done	If the aluminum interference correction factors are not implemented, unreliable data will continue for $OH^- < 0.1\underline{M}$. The inability to accurately measure this analyte may result in chemical incompatibility with the CC acidification step in the transuranic extraction (TRUEX) process.

A schedule and a cost summary for analytical development are presented in Figure 2-1 and Table 2-3, respectively.

Task	Description	Fiscal Year 1989	1990	1991	1992	1993	1994
2.3.1	As, Hg, Se (Hg to be completed as part of Section 2.3.19)	(Completed)					
2.3.2	S^{2-}, CN^-						
2.3.3	TCLP						
2.3.4	Organics						
	– Total organic halides						
	– Chelator and complexants and extractable organics						
2.3.5	Solids dissolution						
2.3.6	Separation technology for IC and ICP						
2.3.7	Carbon (^{14}C, TOC, TC)						
2.3.8	Rheological evaluation of NCAW	(Completed)					
2.3.9	Automated laboratory analysis systems						
2.3.10	DNAAS						
	– Demonstrate	(Completed)					
	– Develop Pu method and evaluate for other methods						
2.3.11	Key radionuclide selection for SST characterization (to be completed as part of Section 2.3.32)	(Closed)					
2.3.12	Chemicals known to be stores in SSTs	(Completed)					
2.3.13	Characterization of key radionuclides (to be completed as part of Section 2.3.32)	(Closed)					
2.3.14	Parameters of interest in SST waste characterization						
2.3.15	Requirements for SST waste characterization (to be completed as part of Section 2.3.32)	(Closed)					
2.3.16	RCRA analytical requirements for SST waste characterization[a]						

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Figure 2-1. Schedule--Analytical Development. (Sheet 1 of 2)

Task	Description	Fiscal Year 1989	1990	1991	1992	1993	1994
2.3.17	Remote particle size						
2.3.18	Cr^{6+}						
2.3.19	Hg						
2.3.20	Noble metals						
2.3.21	Trace heavy metals (to be completed as part of Section 2.3.6)	(Closed)					
2.3.22	Sb and Te						
2.3.23	Rare earth separations						
2.3.24	^{79}Se						
2.3.25	^{129}I						
2.3.26	EDS solids						
2.3.27	Porosity	(Canceled. No method developed)					
2.3.28	Thermal conductivity						
2.3.29	Penetrometer testing						
2.3.30	Physical evaluation of DST wastes						
2.3.31	Ru in NCAW						
2.3.32	SST WCP						
2.3.33	Hazardous Characteristics Procedures						
2.3.34	Analytical needs from SST WCP						
2.3.35	Thermal titration for CC waste						

[a]See comment in Section 2.3.16.

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Figure 2-1. Schedule--Analytical Development. (Sheet 2 of 2)

Table 2-3. Cost Summary--Analytical Development. (Sheet 1 of 3)

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total
2.3.1	As, Hg, Se (Hg to be completed as part of Section 2.3.19)	(Completed)							
2.3.2	S^{2-}, CN^-	WP, HL	54, 19						73
2.3.3	TCLP	WP	15						15
2.3.4	Organics – Total organic halides – Chelator and complexants and extractable organics	WP, EK	19, 339						358
2.3.5	Solids dissolution	HL	36						36
2.3.6	Separation technology for IC and ICP	HL		63					63
2.3.7	Carbon (^{14}C, TOC, TC)	HL	112						112
2.3.8	Rheological evaluation of NCAW	(Completed)							
2.3.9	Automated laboratory analysis system	HL		137					137
2.3.10	DNAAS	HL	56	23					79
	– Demonstrate	(Completed)							
	– Develop Pu method and evaluate for other methods								
2.3.11	Key radionuclide selection for SST characterization (to be completed as part of Section 2.3.32)	(Closed)							
2.3.12	Chemicals known to be stored in SSTs	(Completed)							
2.3.13	Characterization of key radionuclides (to be completed as part of Section 2.3.32)	(Closed)							
2.3.14	Parameters of interest in SST waste characterization	EF	63						63
2.3.15	Requirements for SST waste characterization (to be completed as part of Section 2.3.32)	(Closed)							

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Table 2-3. Cost Summary--Analytical Development. (Sheet 2 of 3)

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
2.3.16	RCRA analytical requirements for SST waste characterization	WL EF HEC	7,933[d] 1,255 .	10,530 5,647	12,213 6,902 9,315	8,975 4,769 9,315	1,831 1,130	439 251	41,921 19,954 18,630
2.3.17	Remote particle size	HL		88	88				176
2.3.18	Cr^{6+}	HL							TBD
2.3.19	Hg	EF, WP	125,31						156
2.3.20	Noble metals	HL		141					141
2.3.21	Trace heavy metals (to be completed as part of Section 2.3.6)	(Closed)							
2.3.22	Sb and Te	HL		38	38				76
2.3.23	Rare earth separations	HL		19	19				38
2.3.24	^{79}Se	WP	89						89
2.3.25	^{129}I	HL							TBD
2.3.26	EDS solids	HL		113	25				138
2.3.27	Porosity	Canceled. No method developed.							
2.3.28	Thermal conductivity	WB, HL		125, 125					250
2.3.29	Penetrometer testing	HL	6[b]						6
2.3.30	Physical evaluation of DST wastes	HL		16					16
2.3.31	Ru in NCAW	HL	100	63	63	63			289
2.3.32	SST WCP	EF	590						590
2.3.33	Hazardous Characteristics Procedures	EF	50						50
2.3.34	Analytical needs from SST Waste Characterization Plan	EF	6						6

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Table 2-3. Cost Summary--Analytical Development. (Sheet 3 of 3)

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
2.3.35	Thermal titration for CC waste	HL		13					13
	Program funding beakdown	EF	2,089	0	0	0	0	0	2,089
		EK	339	0	0	0	0	0	339
		HEC	0	0	9,315	9,315	0	0	18,630
		HL	329	0	0	0	0	0	329
		WB	0	0	0	0	0	0	0
		WL	2,168	0	0	0	0	0	2,168
		WP	208	0	0	0	0	0	208
		Unfunded[c]	5,765	17,141	19,348	13,807	2,961	690	59,712
	FY total		10,898	17,141	28,663	23,122	2,961	690	83,475

[a]Cost in thousands of FY 1989 dollars.

[b]An additional $3,000 must be appropriated for this task when mid-year CAPS review is conducted.

[c]Tasks extending beyond FY 1989 are assumed unfunded.

[d]Only $2,168,000 have been funded. The remaining $5,765,000 is expected to be allocated in mid-FY 1989.

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3.0 IN SITU METHODS

3.1 CAPABILITIES

In situ methods are hybrid technologies that combine sampling and analysis without removing the waste from the tank. Current techniques are applicable for solid and liquid waste types. Chemical parameters, radiochemical parameters, and physical characteristics can be measured. In situ techniques have the advantage of rapid data availability and operating simplicity. The disadvantage is the limited data obtained.

3.1.1 Capabilities for In Situ Characterization Methods in Liquids

Liquid observation wells (LOW) are installed in 58 SSTs to detect liquid-level changes. Of these, one is unusable due to leakage from the tank to the interior of the LOW (241-SX-104) and one is unusable due to damage incurred by field equipment (241-TX-105). The LOWs are effective in detecting tank leaks and liquid intrusion. Tefzel LOWs are installed in two DSTs (241-AW-103 and -SY-102) to detect the solids-liquid interface. Two additional DSTs (241-AW-104 and -105) will have LOWs installed in the future. The purpose for these future installations is to detect sludge levels and experiment with organic-level detection techniques.

The LOW is a sealed drywell fabricated from fiberglass or Tefzel pipe. When inserted, it extends from the top of the 4-in-diameter tank riser to within 1 in. of the bottom liner. The LOW provides a leak-tight, contamination-free environment for the instrument probes to be inserted. The probes are the active portion of the system. They are used in conjunction with the LOW and a support van that contains the computer, power supply, and associated electronics. Three probes are used: neutron, gamma, and acoustic. Each is designed to measure moisture variations and interstitial liquid level in salt cake. The neutron and gamma probes can also be used in the steel drywells that were installed during construction of some of the tanks.

The acoustic probe measures the saturated salt-dry salt interfaces to determine the interstitial liquid level. The probe functions on the principle that each material has a characteristic acoustical impedance. The probe contains ultrasonic transducers for signal transmission and reception. The transmitted signal is reflected from the material in contact with the outer wall of the LOW. The amplitude of the reflected signal is proportional to the differences in the characteristics impedances. A steel LOW provides high acoustic reflections and the transmitted signal will not penetrate this type of LOW wall. The LOWs are currently fabricated from fiberglass. Tefzel LOWs have been installed in tanks 241-AW-103 and -SY-102. Preliminary tests indicate that Tefzel has a more uniform acoustic attenuation than fiberglass. An acoustic solution couples the transducer to the inner wall of the LOW. Several problem areas with the acoustic probe have been identified during its implementation. The inside of the LOW must be smooth and regular. The acoustic coupling fluid seal is lost when the LOW is bowed or the interior surface is rough or scored. Loss of fluid makes the probe inoperative and creates a cleanup problem at the bottom of the sealed LOW. Bowed LOWs have bound the acoustic probe several times. The cable has broken leaving the probe to be recovered by off-normal procedures. Straightness of the LOW is more critical with the acoustic probe because it is longer than either the gamma or neutron probe. The probe is desirable because of its high accuracy [$\pm$0.2 ft (2.4 in.)] and repeatability. The problem areas will have to be remedied before its use can be expanded.

The Drywell Van Surveillance System utilizes miniature, interchangeable neutron and gamma detection probes to provide an indication of salt cake moisture content and interstitial liquid level. The probes are used with the installed LOWs previously discussed. The neutron probe consists of a fast neutron source (^{241}Am-Be at 1.5 Ci) and a thermal neutron detector (BF_3). The fast neutrons are moderated by the presence of hydrogen in the water of the surrounding waste. The BF_3 detector is sensitive to the moderated neutrons. The detector output is proportional to the amount of hydrogen present. The neutron detector can be used in the waste tanks because the detector discriminates against the beta-gamma radiation and reads only the neutrons. Fast neutrons from trace amounts of americium and plutonium in the waste make negligible contribution to detector reading. The neutron probe achieves an accuracy of ± 0.2 ft. It has become the primary moisture- and liquid-level detector.

The gamma probe is also used to monitor conditions and changes within salt cake and interstitial liquid. It uses the waste as a source, not relying on an installed source as the neutron probe does. Use of the gamma probe is dependent on the assumption that the liquid contains the majority of the gamma emitters and that the gamma emitters move with the liquid. The Geiger-Muller tube detector is tightly collimated by lead shielding; the angle of view is very limited. The accuracy is ± 0.2 ft. The gamma probe is used as a secondary device to the neutron probe. The gamma probe does not distinguish the different gamma energies it detects. It cannot be used to perform GEA.

Liquid-level monitoring is performed by automatic Food Instrument Corporation (FIC) sensors. The FICs are currently installed on 98 DSTs and SSTs. Liquid-level readout is transmitted hourly to the Computer Automated Surveillance System (CASS).

The FIC uses a conductivity probe to sense liquid level. The conductivity probe is lowered into the tank on a weight. The weight and readout, which is mounted at the surface, are attached by a steel tape. The tape drives a counter which gives digital and analog readout. The weight is driven down until the conductivity sensor actuates by contacting conductive liquid. The downward motion is stopped, a short time delay initiated, and the weight raised until the sensor separates from the liquid. The process is then repeated. The FICs are limited in that they require conductive liquid to operate. Accuracy of liquid level detection is ± 0.25 in.

A manual tape system is provided for backup to the automatic FICs. A conductivity probe is lowered into the tank on a steel measuring tape. The probe completes an electrical circuit upon contacting the liquid, just as with the automatic FICs. The operator reads the tape at that position. Accuracies are ± 0.25 in. with the conductivity probe. No automatic readout is provided to CASS with the manual method.

3.1.2 Capabilities for In Situ Characterization of Solids

The LOWs were designed for installation into waste tanks containing liquid. A special installation procedure provides the methods to place LOWs in solid waste tanks. A water lance is used to break through the hard surface. The LOW is positioned near the tank bottom. Probes are inserted into the LOW as they are for liquid waste tanks. Even though water quantity introduced by lancing is limited, its presence may influence what the probe detects.

Shear vane technology has been developed at Westinghouse Hanford and at West Valley. A shear vane mechanism consists of a small (3.5-in-diameter, 3.5-in-tall) paddle that is rotated in the waste mixture. Theoretically, shear strength and viscosity can be determined by measuring vane torque and rotation speed. In-tank viscosity measurements have been ruled out because of equipment complexity and unresolved questions about what is actually being measured. Shear vane equipment, as currently conceived, is limited to measurement of shear strength. Shear strength data would be used to size pumps and associated equipment for waste retrieval. Scale-up and material relationships need to be worked out before this technology can be used for retrieval needs. Viscosity measurements are currently performed on core samples. Shear strength measurements taken from core samples are assumed to be less accurate than in situ methods because of the disturbance of the samples.

Level determination by manual tape is also performed. When the conductivity probe does not work because of the lack of liquids, the operator reads the tape when it becomes slack. Accuracy with this method is operator dependent. Sludge levels in SSTs are measured using a manual tape with a weighted "pancake" or conductivity probe although the probe does not function electrically. The weighted pancake is also to determine sludge levels in DSTs.

3.2 NEEDS

3.2.1 Needs for In Situ Measurements of Liquid in Waste Tanks

Current use of the LOW for organic detection is not satisfactory. The neutron and gamma probe are not designed for separable organic detection. The acoustic probe is capable of detecting the organics because of their different densities. However, the acoustic probe requires development effort to overcome its operational deficiencies. Acoustic probe improvements, new equipment design, or both are required to detect separable organics.

3.2.2 Needs of In Situ Measurements of Solids in Waste Tanks

New methods are needed to replace the existing sludge-level measurement technique, the manual tape. The manual tape method may be inaccurate depending on the hardness of the sludge. A number of methods for taking sludge-level measurements were identified in FY 1988. A preliminary feasibility study was performed on a thermal dispersion probe which is one of the instruments being investigated. A full engineering study of this and alternative methods is scheduled to be completed in FY 1989. Sludge levels are needed to support routine operations, retrieval development, and pretreatment characterization.

There is a need to be able to determine the amount of suspended solids in waste tanks. A system for determining suspended solids content was designed in FY 1988. This system will be fabricated and a process test in tank 241-AY-101 will be performed in FY 1990. The test will assess the progress of tank cleanout, the developed technology, and the affect of the radiation environment on the system. This measurement is needed to assess pumping progress for tank cleanout operations. A process test in tank 241-AZ-101 using similar technology may be performed in FY 1991 for retrieval information.

3.2.3 Needs for In Situ Measurements of Solids and Liquids in Waste Tanks

Well-logging technology currently exists for making in situ assays of radionuclides in underground locations. This technology has been applied at Hanford to monitoring specific radionuclides in wells in the tank farms areas external to the tanks and in and around waste cribs. Recent developments in detector materials (germanium) and supporting electronics now make it possible to build a high-resolution gamma ray detector system capable of in situ spectral measurements in the Hanford waste tanks.

… ments have focused mainly on increased sensitivity and … instrumentation using large-volume detectors can now detect … the low picocurie-per-gram range; however, waste tank characterization appli… the opposite end of the intensity scale where counting rates exceed the capabilities of the instrumentation. In this application, a specially designed small-volume detector, its preamplifie… and amplifier have to be constructed to operate in concert as an integrated system. With such a system it is possible to gather spectral data for GEA in very intense radiation fields, such as in wa… tanks, a feat not possible previously.

Neutron detection is another method that can be applied inside waste tanks. Neutron detectors are capable of determining TRU content by detecting neutrons from spontaneous fissions or from fissions resulting from an external neutron source (neutron generator). Liquid levels can sometimes be detected by changes in the neutron flux levels that result from neutron absorption in the adjacent hydrogen-bearing liquids. However, correct interpretation of neutron detector data is very difficult.

In situ spectral gamma instrumentation would be tested in existing (installed) LOWs. New LOWs would be installed in tanks that warrant characterization if they were not available. Any of the currently used LOW materials are suitable: fiberglass, Tefzel, or steel.

The advantages of in situ GEA systems are that they can provide rapid characterization and no sample preparation is required other than installation of the LOW. All raw spectral gamma information taken from LOWs can be archived for future reference on inexpensive optical disks.

The system limitation is that it detects only isotopic (elemental) data. Chemical compounds cannot be distinguished. The system works on the basis of neutron activation analyses. A neutron generator is lowered into a LOW, activation of major components produces radioactive species, and these are detected by a gamma detector. Although not sensitive to minor components, this system could provide significant data about waste homogeneity and major components.

There is a need to develop a volatile organic sampling train (VOST) method for analyzing organics and other components in the SST atmosphere above the waste. This method will require developing procedures and equipment to quantitatively sample the atmosphere in a tank and concentrate it by trapping on chromatographic media or in cryogenic collectors before analyzing by GC-MS. Successful implementation of the technology could (1) eliminate the questions concerning sample integrity for volatile organics and (2) verify that no toxic gases are being evolved during long-term storage of the waste.

There is a need to evaluate in situ and remote sensing techniques for SST waste for use in SSTs and in the hot cells. These techniques could be used to determine waste heterogeneity and provide screening analyses to reduce the amount of laboratory analyses required. Methods such as X-ray emission spectroscopy, activation foils, corrosivity probes, and others could be used to determine chemical, radiological, and physical properties. Potential dose, time, and cost savings may not be realized utilizing current technology.

3.3 DEVELOPMENT PLANS

3.3.1 Improve Liquid-Level Detection Methods

3.3.1.1 Improve Liquid-Level Detection Methods for Single-Shell Tank (Engineering Study).

- Review SST surveillance requirements.
- Issue surveillance document.
- Implement recommendations.

It has been determined that this task is beyond the scope of this document and therefore will not be addressed in subsequent revisions.

3.3.1.2 Develop In Situ Detection Method for Separable Organics. An engineering study will be performed to investigate different in situ methods of detecting separable organics and recommend one of the methods. The study will be performed following review of the current process flowsheets for normal paraffin hydrocarbon (NPH) and tributyl phosphate (TBP) organics. The recommendations from the engineering study will then be implemented.

Estimated Cost ($000)	125 (WB)
CENTRC ($000)	Dependent on engineering study recommendations
Need date (FY)	None
Program(s) supported	TFPE, tank farm technology
HWMTP tasks	New
Predecessor task	None
Impact if not done	An in situ method for detecting separable organics will not exist. Operational difficulties may be encountered if wastes containing separable organics are processed.

3.3.2 Improve Solids Detection Methods

3.3.2.1 Develop Liquid Observation Well Technology (Engineering Study).

- Redesign acoustic probe seals.
- Resolve Tefzel bowing: design, or alternate material, or both.
- Document that current LOW placement is adequate.

The assessment of current LOW placement was documented in FY 1988. Problems with Tefzel bowing has been partially rectified by adding weight to the bottom interior of the LOW. The acoustic probe seals will be redesigned and work will continue on the solution to Tefzel bowing in FY 1990. It has been determined that this task is beyond the scope of this document and therefore will not be addressed in subsequent revisions.

3.3.2.2 Develop Shear Vane Technology. A shear vane for the in situ measurement of shear strength was designed, fabricated, and cold tested. A test report was issued which detailed the results of the cold test and identified that the full-scale shear vane measurements did not match the laboratory-scale measurements.

Scale-up and material relationships need to be worked out before this technology can be used for retrieval needs. This task has been put on hold pending reevaluation of the work.

3.3.2.3 Develop Sludge-Level Measurement Technology. New solids measurement methods are needed to replace the existing sludge level technique, the manual tape. A number of methods for taking sludge level measurements were identified in FY 1988. The preliminary feasibility was evaluated on a thermal dispersion probe which is one of the instruments being investigated. A full engineering evaluation of this and alternative methods is scheduled to be completed in FY 1989. Sludge levels are needed to support retrieval development, operations, and pretreatment characterization. The following will be performed:

- Conduct technical exchange with Savannah River and West Valley.
- Conduct an alternative method study.
- Design and fabricate.
- Develop test plan.
- Issue test report.

Estimated Cost ($000)	62 (WB)
Need date (FY)	1990
Program(s) supported	Retrieval, TFPE, tank farm technology
HWMTP tasks	DST-3.3
Predecessor task	None
Impact if not done	Accurate sludge levels will not be available to support operations, retrieval equipment design, and pretreatment.

3.3.2.4 Develop In Situ Suspended Solids Method. A system for determining suspended solids content was designed in FY 1988. The system will be fabricated and a process test in tank 241-AY-101 will be performed in FY 1990.

Estimated Cost ($000)	69 (WB)
Need date (FY)	1990
Program(s) supported	Retrieval, TFPE
HWMTP tasks	DST-3.3
Predecessor task	None
Impact if not done	A method for TFPE to determine suspended solids will not be available. Process parameters will not be available.

3.3.2.5 Maintain Existing Liquid Observation Well Technology. Development of LOW technology has been recommended. The existing capability must be maintained until the techniques being developed become operational. No other techniques for determining interstitial liquid level changes exist.

Estimated Cost ($000)	19/yr (WB)
Need date (FY)	Continuous
Program(s) supported	SST stabilization, TFPE, tank farm technology
HWMTP tasks	DST-3.4
Predecessor task	None
Impact if not done	Changes in tank interstitial liquid levels would not be known. For tanks with LOWs installed, surveillance activities would not be in compliance with DOE requirements that tank liquid levels be monitored.

3.3.3 In Situ Characterization

3.3.3.1 Develop In Situ Assay Technology. Technology is favorable to develop a high-rate spectral gamma-ray detector. An engineering study that recommends detector system design (gamma and neutron) for in situ characterization will be issued. The engineering study will include detector type, electronics support, capabilities, and limitations and consider various tank wastes, LOW availability, and operating parameters.

Estimated Cost ($000)	25 (TBD)
Need date (FY)	None
Program(s) supported	GTF, HWVP, pretreatment, SST stabilization, SST characterization
HWMTP tasks	SST-2.13, DST-3.3
Predecessor task	None 2.12
Impact if not done	State-of-the-art techniques will not be evaluated for waste tank characterization applications.

3.3.3.2 Implement In Situ Characterization. Equipment will be procured and cold in-tank testing conducted to verify equipment performance. A report will be issued discussing test results and recommendations for additional testing and applications.

Estimated Cost ($000)	44 (TBD)
CENRTC ($000)	90
Need date (FY)	None
Program(s) supported	GTF, HWVP, pretreatment, SST stabilization, SST characterization
HWMTP tasks	SST-2.13, DST-3.3
Predecessor task	3.3.3.1
Impact if not done	Continued increasing sampling costs and limited information about the totality of the material in the tank. Understanding the dynamics of the major gamma ray emitting components in the tanks will be limited.

3.3.3.3 Develop Volatile Organic Sampling Train. Equipment will be procured and unit assembled. A performance assessment will be conducted using controlled conditions and a report issued which recommends additional testing and applications if necessary.

Estimated Cost ($000)	63 (WB)
Need date (FY)	FY 1989
Program(s) supported	GTF, SST stabilization
HWMTP tasks	New
Predecessor task	None
Impact if not done	Marginal sample control and undocumented collection performance would continue. Requests to provide vapor space characterization would not be met.

3.3.3.4 In Situ and Remote Sensing Methods Evaluation for Single-Shell Tank Waste Characterization. This task will evaluate possible remote characterization techniques for use in SSTs and in the hot cells. These methods could be used to determine waste heterogeneity and provide screening analyses to reduce the amount of laboratory analyses required. Methods such as X-ray emission spectroscopy, activation foils, corrosivity probes, and others could be used to determine chemical, radiological, and physical properties.

Estimated Cost ($000)	25 (EF)
Need date (FY)	(TBD)
Program(s) supported	SST characterization
HWMTP tasks	New
Predecessor task	None
Impact if not done	Potential dose, time, and cost savings may not be realized utilizing current technology.

A schedule and a cost summary for in situ characterization methods development are presented in Figure 3-1 and Table 3-1, respectively.

Figure 3-1. Schedule--In Situ Characterization Methods Development.

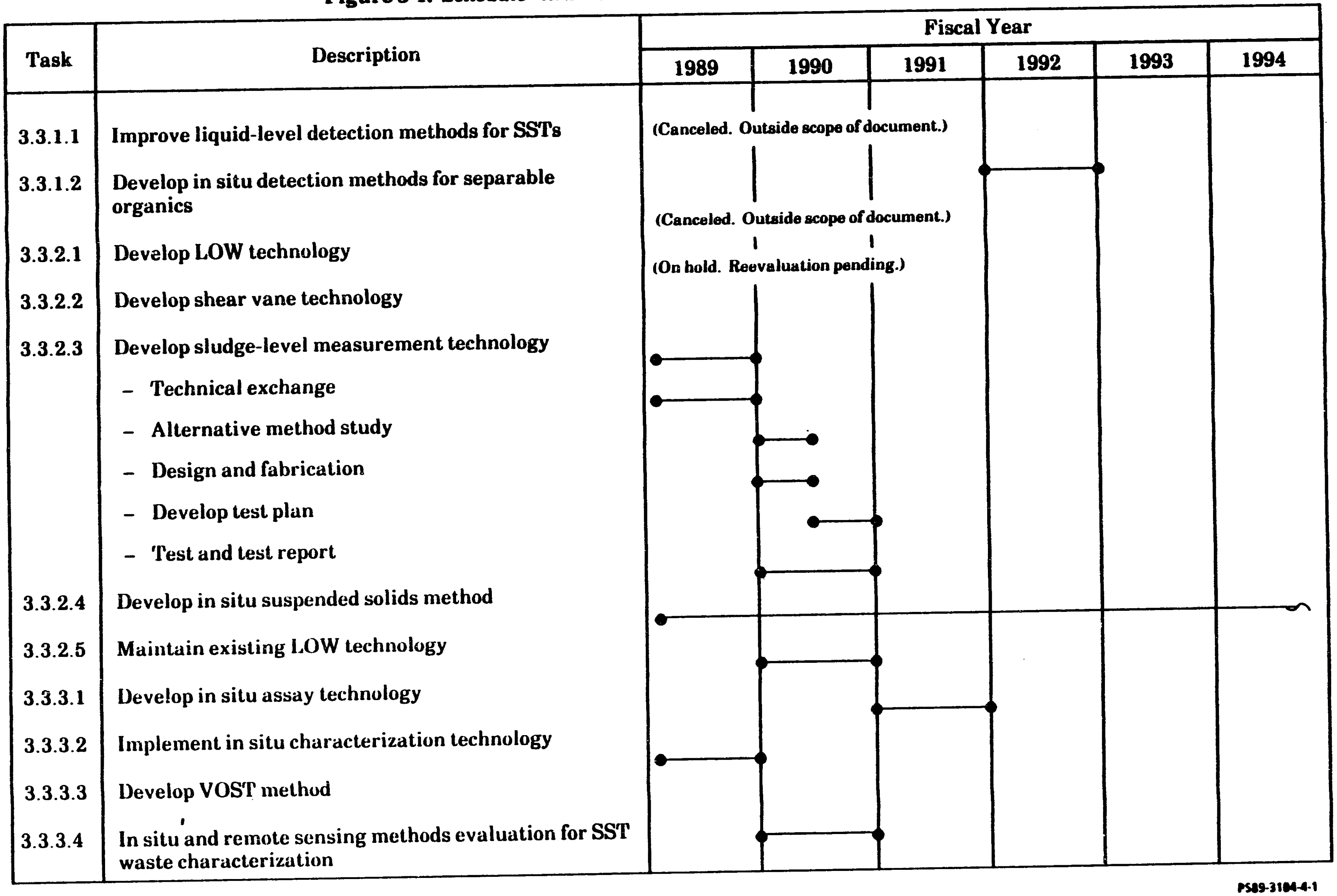

Table 3-1. Cost Summary--In Situ Characterization Methods Development.

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
3.3.1.1	Improve liquid-level detection methods for SSTs	Canceled. Outside scope of document.							
3.3.1.2	Develop in situ detection methods for separable organics	WB				125			125
3.3.2.1	Develop LOW technology	Canceled. Outside scope of document.							
3.3.2.2	Develop shear vane technology	On hold. Reevaluation pending.							
3.3.2.3	Develop sludge-level measurement technology	WB	31	31					62
3.3.2.4	Develop in situ suspended solids method	WB		69					69
3.3.2.5	Maintain existing LOW technology	WB	19	19	19	19	19	19	114
3.3.3.1	Develop in situ assay technology	(TBD)		25					25
3.3.3.2	Implement in situ characterization technology	(TBD)			134				134
3.3.3.3	Develop VOST method	WB	63						63
3.3.3.4	In situ and remote sensing methods evaluation for SST waste characterization	EF		25					25
	Program funding breakdown	WB EF Unfunded[b]	113 0 0	0 0 169	0 0 153	0 0 144	0 0 19	0 0 19	113 0 504
	FY total		113	169	153	144	19	19	617

[a]Cost in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assumed unfunded.

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4.0 SAMPLING METHODS

4.1 SAMPLING CAPABILITIES

Table 4-1 lists the capabilities for existing sampling equipment and for equipment in the development stage.

4.1.1 Solids (Core Sampling Truck)

Sampling of waste tank solids provides information necessary for accurate definition of tank contents. An understanding of tank solids content supports retrieval equipment design, definition of tank farm operations, and selection of pretreatment and disposal options. Solids are formed during waste stream neutralization (caustic addition) and by precipitation from saturated solutions during storage. Solids characteristics vary spatially within a tank and can change over time at any location as a result of compaction or aging.

The core sampling truck (CST) is capable of taking solid, sludge, and liquid samples; the CST will be addressed in this section on solids sampling capability because it is presently the primary sampling equipment designated for use in planned solids sampling activities. Other solids samplers are discussed in Section 4.3, "Development Plans--Sampling Methods."

The current CST is the second generation of mobile equipment designed for tank sampling. The SST samples and some of the DST samples have been taken with this equipment. Hard saltcake sampling has been difficult because of plugging in the sampler and drill bit. Specialized operational procedures for hard saltcake sampling have been attempted, with limited success; redesign of the drill bit is required for reliable hard saltcake sampling. The existing drill bit design is currently used for softer solids, for sludges, and for liquids.

The core sampler is capable of taking samples in 19-in-long, 1-in-diameter cylindrical segments (about 250 mL), though a sample is considered acceptable if 80% of each segment is recovered. The drill is pushed through liquid, sludge, or soft solid wastes and rotated as it samples harder solid wastes. The number of segments taken is dependent on the waste depth of each particular tank. Most core segments are shipped in shielded casks to the 222-S laboratories for analysis; samples of NCAW are analyzed in a hot cell at the 325 Building.

The CST sampling system is complex compared to other sampling equipment, but it offers a wider range of capabilities than any alternative methods available. The cost of sampling is high not only because of the complexity of the sampling operation, but also because of the extensive laboratory support required. In addition, decontamination of the samplers is required after each use, and the samplers, as presently designed, must be replaced after a limited number of uses.

4.1.2 Liquids

4.1.2.1 Aging Waste Sampler. The aging waste sampler was designed to take NCAW supernatant samples that consist of supernatant liquid and some suspended solids. Samples are highly radioactive (about 5 rem/h-mL), so radiation shielding is required.

Table 4-1. Sampling Capability--Equipment Matrix.

Consideration	Core sampling truck	Aging waste sampler	TMI sampler	Sludge sampler (bottle-on-a-string)[a]	Bottle and stick	Composite core sampler
Status	Existing	Discarded, unavailable	Fabricated and located at TMI	Existing	No longer used	Development stage
Design uses	SST and DST solids, liquids, and sludges	NCAW supernatant	Reactor core	Sludges and liquids	--	Sludges and liquids
Advantages	Portable, procedures in place, adequate shielding	Remote operation, shielded	Heavily shielded, sophisticated drill, monitoring instrumentation	Simple, portable	--	Lower operating cost than CST
Disadvantages	Expensive, slow sampling rate, decontamination required	Unreliable, not portable, limited sample size	Needs new sampler for liquid retrieval	Not ALARA, decontamination required, operational difficulties	--	Equipment development and testing required
Limitations	Cannot sample hard saltcake or bottom 3 in. of tank with current design	Liquid sampler only	Cohesive solids only	Sludges and liquids only, submersion depths imprecise	--	Sludges and liquids only, data applicability questionable
Cost considerations	$40,000/core sample	--	Unknown	Low cost	--	Dependent on depth of waste in tank
Analytical support required	Sample preparation and analysis, extensive laboratory support	Counting laboratory, minimal sample preparation	Counting laboratory, sample preparation	Minimal sample preparation required	--	Limited sample preparation required
Sampling rate	4 to 6 19-in. segments/8-h shift, ~1 d to move between risers and 2 to 4 d between tank farms	Not determined	High	High	--	Setup and move similar to CST

[a]A modified bottle-on-a-string method used for NCAW supernatant sampling employs a similar configuration, though a shielding barrier is interposed between the operator and the open riser.

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The sampler is positioned over the riser and is left in place. The sample is collected in an 8-mL sample bottle which is lowered into the waste on a special carrier. Adequate radiation shielding exists to obtain samples in the range of 40 rem/h.

Although sampling with the aging waste sampler does not require extensive preparations or support, as does core sampling with the CST, the dependability of this system has not proved adequate to warrant further development or use of this device. Only a small number of samples were taken because of operational difficulties, and no further sampling with this device is planned; the equipment has been buried.

4.1.2.2 Sludge Sampler (Bottle-on-a-String). This existing equipment is used to collect sludges and liquids near the waste surface. The assembled equipment is simple to set up and transport. The device can be submerged in the sludge layer, but it is difficult to measure precisely the actual depth at which the sample is taken. The equipment is simple to operate and the requirement for laboratory support is minimal, as in the case of the aging waste sampler. Each sampler is fabricated for one-time use and is disposed of after sampling is complete. Although this equipment is presently operational, potential improvements have been identified to increase containment. A similar configuration, termed "modified bottle-on-a-string" includes a shielding barrier between the operator and the open riser, and is used for sampling NCAW supernatant. The sample size for this device is 22 mL and wire is used instead of string.

Sampling has also been conducted using a similar configuration in which a sample bottle is fastened to a stick. This method of submersion allowed the sampling depth to be identified more accurately, but it is no longer used because of operational difficulties.

A brief design study was conducted to define improved liquid sampling methods based upon the bottle-on-a-string concept. Existing equipment utilized in other sampling applications, as well as new approaches, were considered. Three conceptual designs were selected as viable candidates for a safe, cost-effective liquid sampling system:

1. Pre-evacuated sampler

2. Hypodermic sampler

3. Modified version of a sampler used at West Valley.

4.1.2.3 B Plant Sampler. Evaluation of slurry sampling methods and limited development testing were conducted at the Hanford Engineering Development Laboratory and at the Savannah River Laboratory to assess waste sampling techniques potentially applicable to B Plant processing in support of HWVP. No cost-effective approaches significantly better than the in-place sampling techniques were identified.

4.1.3 Composite Samples

A sampling method in which a stratified core is automatically homogenized into a single, composite material offers potential safety and operational advantages. There is currently no operational capability to acquire composite liquid-solid samples. Limited design and proof-of-principle testing has been conducted.

4.2 SAMPLING DEVELOPMENT NEEDS

The capabilities for sampling various waste forms are summarized in Table 4-2. Equipment identified as sufficient to meet a particular requirement is not necessarily optimum for that application; development plans described in Section 4.3 include activities to modify and upgrade existing equipment, as well as to increase the inventory of equipment to meet program needs.

4.3 DEVELOPMENT PLANS--SAMPLING METHODS

4.3.1 Aging Waste Sampling

The CST (Section 4.1.1) is capable of sampling NCAW solids that settle to the tank bottom. The bottle-on-a-string and aging waste samplers retrieve only the supernatant liquid and suspended solids. The current sampler design used for sampling with the CST allows samples to be taken as deep as about 3 in. from the tank bottom. Sampling procedures and equipment introduce several potential modes of sample contamination that could compromise conformance with analysis protocols.

For the 19-in-long core samples currently taken, the activity level can be high, up to 5 Ci/sample for NCAW. An existing spent fuel transport cask is adequate for shipping NCAW samples, but a new cask designed expressly for loading, transporting, and unloading NCAW samples will be incorporated into the sampling system during FY 1989.

Design and modification of the CST, particularly the sampler itself, based upon experience gained during operability testing and initial sampling of NCAW, and upon requirements dictated by EPA sampling protocols, is planned for FY 1989.

Estimated Cost ($000)	402 (HL)
CENRTC ($000)	100
Need date (FY)	1989 and 1990
Program(s) supported	HWVP, retrieval, pretreatment, TFPE, tank farm technology
HWMTP tasks	DST-3.5
Predecessor task	None
Impact if not done	NCAW tank bottoms will not be characterized. Retrieval operations and the determination of HWVP design parameters will be delayed. Potential improvements to sampling safety and cost effectiveness will not be realized.

4.3.2 Core Sampling Truck Modifications for Hard Saltcake Sampling

The existing CST has demonstrated the capability to successfully sample sludges and liquids. Hard saltcake, found in SSTs, is difficult to sample because of plugging in the sampler and drill bit; waste cannot enter the sampler. Operational procedures have been modified to recover less than a full-length core if hard saltcake is encountered. These changes have not been successful in recovering hard saltcake samples. Alternate drill bit configurations and samplers need to be designed, fabricated, and tested to be used in hard saltcake sampling.

Table 4-2. Waste Sampling Equipment.

Waste type	Existing equipment sample needs	Sufficient	Equipment used
NCAW	Liquids	Yes[a]	Bottle-on-a-string/CST
	Solid-liquid suspensions	Yes[a]	CST
	Solids (sludge layers)	Yes[a]	CST
NCRW	Supernatant liquids	Yes	Bottle-on-a-string
	Solids	Yes	Bottle-on-a-string/CST
DSS/DSSF	Supernatant liquids	If present	Bottle-on-a-string
	Solids	Yes	CST
Concentrated PO_4^{3-}	Supernatant liquids	Yes	Bottle-on-a-string
	Solids	Yes	CST
SST waste	Liquid	Yes	CST
	Sludge	Yes	CST
	Salt cake	Yes[a]	CST
PSW	Liquids	Yes	Bottle-on-a-string/CST
	Solids	Yes	Bottle-on-a-string/CST
HFW	Liquids	Yes	Bottle-on-a-string/CST
	Solids	Yes	Bottle-on-a-string/CST
PFP	Liquids	Yes	Bottle-on-a-string/CST
	Solids	Yes	Bottle-on-a-string/CST
CC	Liquids	Yes	Bottle-on-a-string/CST
	Solids	Yes	Bottle-on-a-string/CST
HWVP feed	Liquids	Yes[a]	Bottle-on-a-string/CST
	Solid-liquid suspensions	Yes[a]	CST
	Solids (sludge layers)	Yes[a]	CST

[a]Indicates development effort needed to improve equipment capability. PST89-3104-5-2

Estimated Cost ($000)	150 (EF)
Need date (FY)	1989 and 1990
Program(s) supported	SST stabilization, SST characterization
HWMTP tasks	SST-2.16
Predecessor task	None
Impact if not done	Hard saltcake samples cannot be obtained. Critical characterization data will not be available to resolve SST disposal issues.

4.3.3 Three Mile Island Core Sampler

Assessment of sampling requirements did not identify a need for this equipment; therefore, no further development activities related to this sampling method are planned at this time.

4.3.4 B Plant Sampler

Assessment of sampling requirements did not identify a need for this equipment; therefore, no further development activities related to this sampling method are planned at this time.

4.3.5 Composite Core Sampling

Assessment of sampling requirements did not identify a need for this equipment; therefore, no further development activities related to this sampling method are planned at this time.

4.3.6 Upgraded Bottle-on-a-String

Three principal activities required for development of an improved sludge sampling system are based upon the existing bottle-on-a-string approach: (1) design of an enclosure for the existing sampler retrieval system, (2) incorporation of a portable glovebox, riser shielding, and a mechanical retrieval system, and (3) testing of the system before initiation of actual tank waste sampling. For the alternative bottle-on-a-string methods identified in the conceptual design study (Section 4.1.2.2); detailed design, fabrication, and prototype testing are required.

Estimated Cost ($000)	502 (WB)
Need date (FY)	1990
Program(s) supported	GTF, SST stabilization, retrieval, tank farm technology, TFPE
HWMTP tasks	DST-3.5
Predecessor task	None
Impact if not done	The equipment and procedures for this sampling method will not represent an ALARA approach.

4.3.7 Isolok Sampler for 241-AP Tank Farm

Assessment of sampling requirements did not identify a need for this equipment; therefore, no further development activities related to this sampling method are planned at this time.

4.3.8 Assessment of Sampling Methods for Single-Shell Tank Characterization

This task is required to assess SST sampling methods and procedures with respect to hazardous waste characterization requirements. Current methods and procedures will be compared to regulatory requirements, and potential problems will be identified. Methods for sampling hard saltcake and for eliminating the use of lubricants or other fluids will be assessed. As in the case of NCAW sampling (Section 4.3.1), drill bits for sampling closer to the tank bottom will be designed and developed.

Estimated Cost ($000)	188 (EF)
Need date (FY)	1989 and 1990
Program(s) supported	SST characterization
HWMTP tasks	SST-2.5
Predecessor task	None
Impact if not done	The regulatory requirements of the EPA and Ecology may not be met.

4.3.9 Maintenance of Existing Sampling Capability

The equipment used for current sampling activities needs to be maintained. The most complex equipment is the CST which requires spare parts, periodic preventive maintenance, and a dedicated facility for storage and maintenance. The operating crews require training and certification to develop and maintain acceptable levels of proficiency.

Estimated Cost ($000)	125 (FY 1989), 439 (FY 1990), 125/yr (annual starting in FY 1991) (all EF)
Need date (FY)	Continuous
Program(s) supported	All
HWMTP tasks	DST-3.7
Predecessor task	None
Impact if not done	Equipment and operating personnel will not be available when sampling is required. Delays will be encountered. Characterization data will not be obtained.

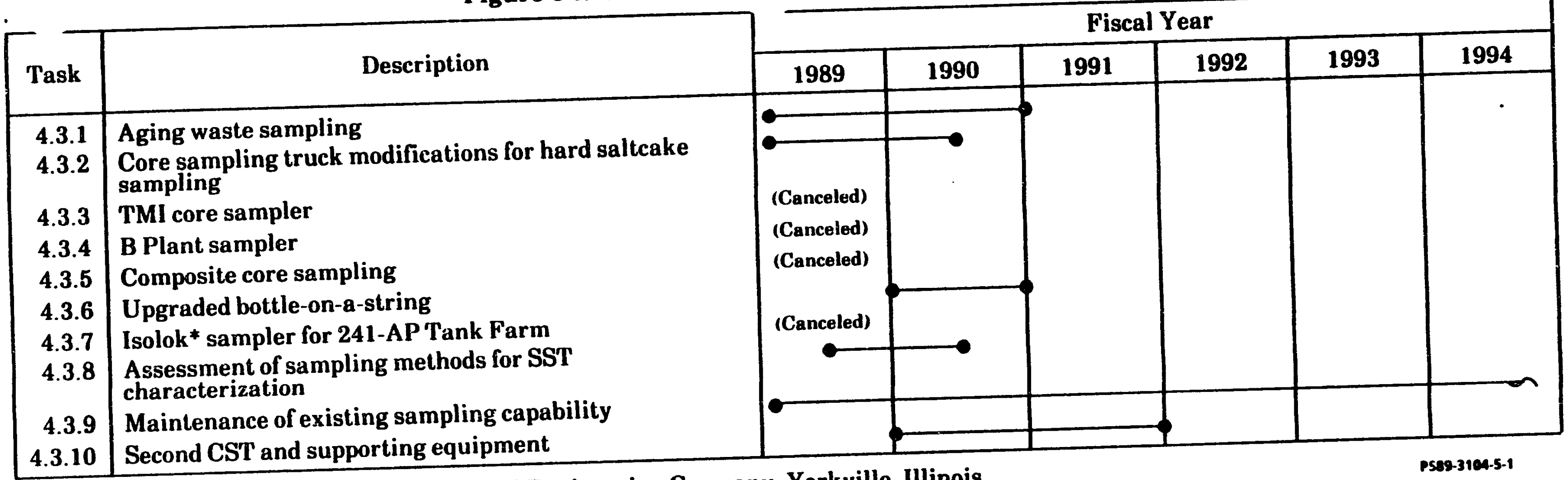
4.3.10 Second Core Sampling Truck and Supporting Equipment

A second CST will be designed and built to augment the capabilities of the first unit. The second unit will incorporate modifications identified as desirable from the operating experience with the first unit. The first CST will be modified to incorporate features that enhance safety and other features that improve the cost effectiveness of the unit.

Estimated Cost ($000)	1,632 (EF)
Need date (FY)	1991
Program(s) supported	All
HWMTP tasks	New
Predecessor task	None
Impact if not done	Tank waste sampling will be unable to be conducted at a rate commensurate with agreements with regulatory agencies or with the requirements of the treatment and disposal programs.

A schedule and a cost summary for sampling methods development are presented in Figure 4-1 and Table 4-3, respectively.

Figure 4-1. Schedule--S. ıg Methods Development.



*Isolok is a registered trademark of Bristol Engineering Company, Yorkville, Illinois.

Table 4-3. Cost Summary--Sampling Methods Development.

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total[a]
4.3.1	Aging waste sampling	HL	188	314					502
4.3.2	Core sampling truck modifications for hard saltcake sampling	EF	75	75					150
4.3.3	TMI core sampler	(Canceled)							
4.3.4	B Plant sampler	(Canceled)							
4.3.5	Composite core sampling	(Canceled)							
4.3.6	Upgraded bottle-on-a-string	WB		502					502
4.3.7	Isolok sampler for 241-AP Tank Farm	(Canceled)							
4.3.8	Assessment of sampling methods for SST characterization	EF	75	113					188
4.3.9	Maintenance of existing sampling capability	EF	125	439	125	125	125	125	1,064
4.3.10	Second CST and supporting equipment	EF		816	816				1,632
	Program funding breakdown	HL	188	0	0	0	0	0	188
		WB	0	0	0	0	0	0	0
		EF	275	0	0	0	0	0	275
		Unfunded[b]	0	2,259	941	125	125	125	3,575
	FY total		463	2,259	941	125	125	125	4,038

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[a]Cost in thousands of FY 1989 dollars.
[b]Isolok is a registered trademark of Bristol Engineering Company, Yorkville, Illinois.
[c]Tasks extending beyond FY 1989 are assumed unfunded.

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5.0 SAMPLE TRANSPORTATION AND STORAGE

5.1 TRANSPORTATION

Samples are obtained at tank farms in the 200 East and 200 West Areas and transported by truck to laboratories for analysis. Transport of these samples requires specialized equipment and procedures to prevent loss of containment and to minimize radiation exposure to operating personnel and the public.

5.1.1 Capabilities

Three different containment systems are in use for transporting waste samples:

1. For bottle-on-a-string and similar small samplers, a sample pig provides primary containment, and a 55-gal drum provides secondary containment. The assemblage is shipped in a shock-resistant overpack.

2. For low-activity samples taken by the CST, the sampler is contained within a stainless steel liner which is then sealed in a lead-lined shipping cask.

3. For NCAW samples, the sampler is contained within a stainless steel liner which is then sealed within a cask designed for shipping spent reactor fuel and then further contained within a steel overpack.

5.1.1.1 Sample Pig Transport System. The sample pig transport system is used for the interarea transport of bottle-on-a-string samples from B Plant, PUREX Plant, and Tank Farms to the 222-S laboratories and 300 Area laboratories. The samples are doubly contained in a sample pig inside a 55-gal drum. The drum is transported in an N-55 overpack containing polyurethane foam and ceiling tile packing. The special sample transport truck is equipped with tiedowns to secure the overpack to the truck. A maximum of two overpacks, each containing a sample pig, can be shipped on the truck at one time.

Three different pig configurations are used. The cavity of the unlined pig will carry one 100-mL sample vial. A lead liner that reduces capacity to a one 35-mL sample vial may be placed in the cavity. A "doorstop" liner that reduces capacity to a one 6-mL vial can be inserted. Curie content and surface dose rates are administratively limited according to pig configuration and content.

The sample pig transport system is designed to be reusable. The sample pig is approved for interarea (100, 200, 300, 400 Area) shipments of liquid, slurry, sludge, and solids; its use for offsite shipments is not authorized. There are currently two trucks (one operational, one standby) capable of transporting the sample and overpack.

5.1.1.2 Transport System for Low Activity Core Samples. As noted in Section 4.1.1, the core-sampling equipment is capable of taking liquid, sludge, and solid samples. The sample in any case is a 19-in-long and 1-in-diameter cylinder. Initial containment for transport of the sample is provided by the sampler itself, which occupies a 40-in-long and 2-in-diameter envelope, including the sampler latching device. For low-activity samples that are shipped to AL, the sampler is emplaced in a 0.12-in-thick stainless steel liner, which is enclosed within a steel, lead-lined cask having a lead thickness of about 1.2 in. The cask and contents weigh slightly less than 400 lb; packaged samples are usually shipped in groups of three mounted in cask stands on a 1-ton pickup truck. Cask handling by means of an overhead crane at the 222-S laboratories was identified as potentially hazardous; alternative equipment was acquired and placed in service.

5.1.1.3 Transport System for Neutralized Current Acid Waste Core Samples. For shipment of NCAW samples, the sampler is identical to the one used for low-activity samples, and the cask liner is similar, differing primarily in the size of end flanges. The shipping cask for NCAW samples is the principal containment and shielding barrier, providing shielding by a 1-in-thick stainless steel shell surrounding a 4-in-thick lead cylinder. An EBR-II spent fuel shipping cask is used for initial NCAW sample shipments, and a similar cask specially designed to accommodate sample handling operations at the AL is scheduled to be placed in service in the near future.

The shipping cask is transported within a 21PF-1 steel overpack which is bolted to the bed of a flatbed trailer. The trailer can accommodate two overpacks mounted transversely near the rear end of the bed; this arrangement is compatible with the crane location at the 325 Building Hot Cell Facility.

5.1.2 Development Needs--Sample Transportation

5.1.2.1 Transportation System Integration. A study is needed to integrate the transportation requirements and schedules for all sampling activities. Plans for bottle-on-a-string sampling in the tank farms and sampling at B Plant must be assessed to define facility and equipment requirements. Core sampling requirements must be estimated to determine the number of transport casks needed for shipment of low-activity and NCAW core samples. Performance of this study and implementation of recommendations derived from the study will ensure that the most efficient transportation systems are available to meet expected sampling requirements. The need for supplemental transportation equipment can be identified by means of this study.

5.1.2.2 Assessment of Regulations. Regulations governing waste transportation are constantly being amended, issued, and deleted. A review of current and anticipated regulations needs to be conducted to ensure availability of appropriate sample transportation systems when they are needed.

5.1.2.3 Evaluation of Sample Volumes for Grout Treatment Facility and Hanford Waste Vitrification Plant. Studies in support of GTF operations identified a potential need for liquid sample volumes of about 1 L to support analysis requirements. This volume of sample is larger than single samples obtained by current bottle-on-a-string sampling methods. An engineering study to address sample container, shipping cask, overpack, licensing, transportation, and laboratory handling equipment is required to optimize sample size with respect to safety and cost effectiveness of the overall sampling system.

5.1.2.4 Sample Pig Fabrication. The current inventory of sample pigs is not sufficient to support planned sampling activities. Results of the Transportation System Integration Study (Section 5.1.2.1) should be used to determine how many sample pigs are needed to support the routine use cycle and to provide adequate spares to replace pigs that are out of service for maintenance and repair.

5.1.2.5 Transport Casks for Low-Activity Core Samples. The sampling frequency envisioned in current characterization plans may entail the use of more transport casks than are presently available. Results of the Transportation System Integration Study will provide a basis for assessing the need for additional casks to support the waste characterization program.

5.1.2.6 Transport Casks for Neutralized Current Acid Waste Core Samples. High-level NCAW core samples will be transported in casks designed expressly for unloading and handling at the 325 Building analytical laboratory. A sufficient number of these casks must be fabricated to meet the characterization program needs identified in the Transportation System Integration Study.

5.1.3 Development Plans--Sample Transportation

5.1.3.1 Transportation System Integration. The planned scope envisioned for tank waste characterization activities has undergone substantial review and revision as the requirements imposed by state and federal environmental legislation have been interpreted and negotiated. An increased need for characterization data to support final disposal decisions has also been identified. A study must be conducted to define a comprehensive waste sampling and analysis program that will support the information needs of these regulatory and technical investigations, and to identify the facilities and equipment required to conduct this program.

Estimated Cost ($000)	94 (HL), 94 (EF)
Need date (FY)	1989
Program(s) supported	All
HWMTP tasks	DST-3.8, SST-2.17
Predecessor task	None
Impact if not done	Equipment (e.g., sample pigs, core sample transport casks) required to support waste sampling activities may not be available when needed. Characterization data, and the decisions supported by that data, may be delayed.

5.1.3.2 Regulatory Concerns. A study will be conducted to review current and anticipated regulatory changes that affect solid, liquid, sludge, slurry, and mixed waste shipments on the Hanford Site. The impacts of proposed and potential changes in regulatory requirements (RCRA, DOE, EPA, Washington State) will be assessed in terms of transportation system design, and procedural and documentation requirements.

Estimated Cost ($000)	38 (HL)
Need date (FY)	1989
Program(s) supported	All
HWMTP tasks	DST-3.9
Predecessor task	None
Impact if not done	Regulatory issues could halt sample shipments or require equipment redesign. Sampling data acquisition might be delayed or lost. Engineering commitments may not be met.

5.1.3.3 Sample Volume for Grout Treatment Facility and Hanford Waste Vitrification Plant. An engineering study will be performed to identify the optimum mix of sample sizes and associated sample transportation systems. Results of the study will provide a basis for recommendations of equipment modifications and additions, as well as changes in sample loading, transport, and unloading procedures. Criteria for system selection will be regulatory compliance, cost effectiveness, doses to operating personnel and nonradiologic safety.

Estimated Cost ($000)	25 (WP)
Need date (FY)	1989
Program(s) supported	GTF, HWVP
HWMTP tasks	SST-2.5
Predecessor task	6.1.3.1, 6.1.3.2
Impact if not done	Sampling program may be inadequate to provide required characterization data.

5.1.3.4 Fabrication of Additional Sample Pigs. An engineering study will be performed to define the required total pig inventory (both number and type), including spares. The study will include review of the existing design, in the context of experience gained in the use of this design, to assess the need for design changes. Based upon the study results, additional pigs of the current or modified design will be procured or fabricated. The cost estimate for this activity includes an assumption that it will be necessary to double the existing inventory.

Estimated Cost ($000)	126 (WB)
CENRTC ($000)	35
Need date (FY)	1990
Program(s) supported	All
HWMTP tasks	New
Predecessor task	None
Impact if not done	Transportation of samples may be delayed. Acquisition of characterization data may be delayed.

5.1.3.5 Core Sample Loader for Hot Cell. This issue was satisfactorily resolved by adaptation of existing equipment to cask handling at the 222-S laboratories.

5.1.3.6 Low-Activity Core Sample Transport Cask Fabrication. Additional transport casks and liners will be fabricated to ensure that a shortage of casks or liners will not delay delivery of tank waste samples to the 222-S laboratories. The indicated cost of this effort is predicated on the assumption that 10 new casks and 30 new liners will be needed.

Estimated Cost ($000)	125 (EF)
Need date (FY)	1991
Program(s) supported	SST characterization
HWMTP tasks	None
Impact if not done	Transport of samples to 222-S laboratories may be delayed. Characterization data may not be available for timely support of regulatory compliance and technical decisions.

5.1.3.7 Neutralized Current Acid Waste Core Sample Transport Cask Fabrication. Transport casks and liners for shipment of NCAW samples to the 325 Building hot cells will be fabricated to support the characterization program. The indicated cost of this activity is predicated on the assumption that four new casks and 20 new liners will be needed.

Estimated Cost ($000)	150 (HL)
Need date (FY)	1989 and 1990
Program(s) supported	HWVP, NCAW pretreatment, retrieval
HWMTP tasks	New
Predecessor task	None
Impact if not done	Transport of samples to AL may be delayed. Characterization data may not be available for timely support of regulatory compliance and technical decisions.

A schedule and a cost summary for sample transportation are presented in Figure 5-1 and Table 5-1, respectively.

5.2 STORAGE

5.2.1 Storage Capacity

Sample storage capacity exists in the 200 and 300 Areas, although current storage facilities are minimal. Space is barely sufficient to store samples as analysis is being conducted, and archive space is not sufficient. The existing facilities probably do not meet regulatory requirements for a controlled temperature storage environment. Table 5-2 lists storage facilities. Waste samples (composited segments, or residuals after analysis, obtained with the CST) from tanks 241-A-102, -A-103, -A-106, -AW-101, -BX-104, -BX-105, -C-103, -C-104, -TY-101 through -106, -SY-102, and -SY-103 are being stored at the 222-S facility. Material from tank 241-AY-102 is being stored at the 325 Building.

Figure 5-1. Schedule--Sample Transportation.

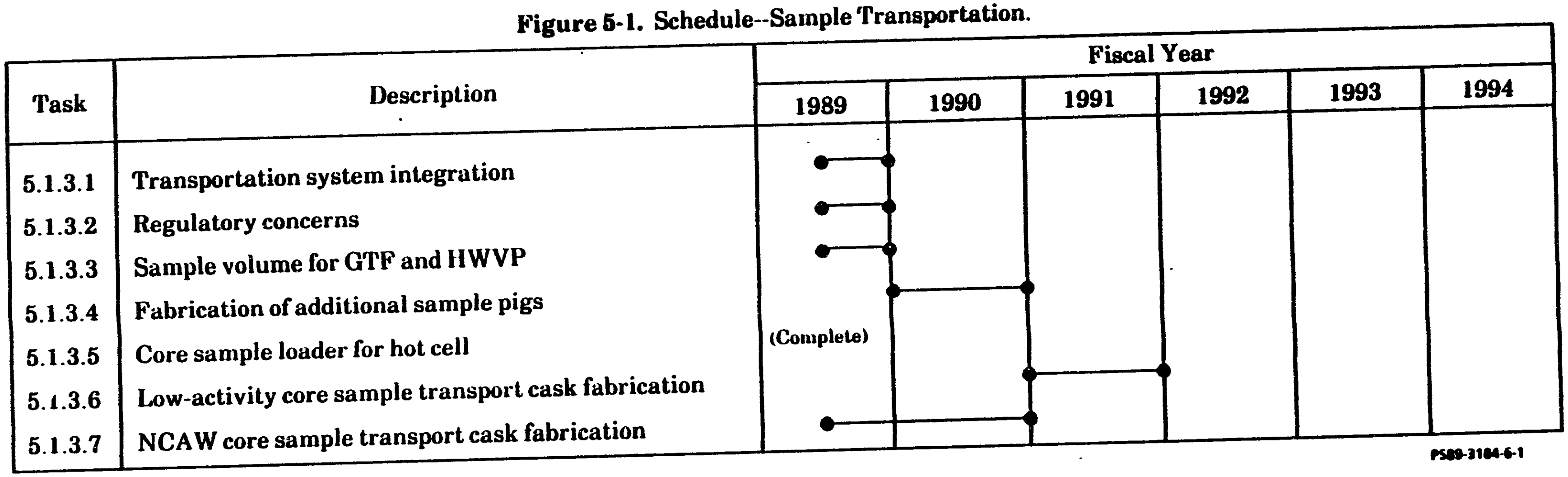

Table 5-1. Cost Summary--Sample Transportation.

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total[a]
5.1.3.1	Transportation system integration	HL, EF	94, 94						188
5.1.3.2	Regulatory concerns	HL	38						38
5.1.3.3	Sample volume for GTF and HWVP	WP	25						25
5.1.3.4	Fabrication of additional sample pigs	WB		161					161
5.1.3.5	Core sample loader for hot cell	(Complete)							
5.1.3.6	Low-activity core sample transport cask fabrication	EF			125				125
5.1.3.7	NCAW core sample transport cask fabrication	HL	75	75					150
	Program funding breakdown	EF	94	0	0	0	0	0	94
		HL	207	0	0	0	0	0	207
		WB	0	0	0	0	0	0	0
		WP	25	0	0	0	0	0	25
		Unfunded[b]	0	236	125	0	0	0	361
	FY total		326	236	125	0.	0	0	687

[a]Cost in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assumed unfunded.

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Table 5-2. Sample Storage Capability.

Facility	Configuration	Physical size (ft)	Dose limitations (Ci)	Special environment	Sample container (lb)	Storage duration
324 Building						
South Cell	Hot Cell	16 by 50	10^6 (1 mev)	Air	Unlimited	Unlimited
East Cell	Hot Cell	16 by 23	10^6 (1 mev)	Air	Unlimited	Unlimited
Airlock	Hot Cell	16 by 23	10^6 (1 mev)	Air	Unlimited	Transit only
325 Building						
Radiochemistry	Hot Cell	--	--	--	--	Short term
327 Building						
A Cell	Hot Cell	6 by 8 by 10	8.4 E+05	Air	<100	Unlimited
B, C, D, E, I, and H	Hot Cell	4 by 5 by 6	8.4 E+05	Air	<100	Unlimited
F and G	Hot Cell	5 by 8 by 12	8.4 E+05	Air	<100	Unlimited
Serf	Hot Cell	6 by 8 by 12	8.4 E+05	Nitrogen	<100	Unknown
Density Cell[a]	Hot Cell	2 by 2 by 3	8.4 E+05	Air	<100	Unlimited
Evaporator Cell[a]	Hot Cell	2 by 2 by 3	8.4 E+05	Air	<100	Unlimited
222-S Building						
Tunnel	Shielded hood	--	--	Air	Sample	Indefinite

[a]Specialized equipment. No alternate location.

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5.2.2 Development Needs--Sample Storage

An engineering study is required to interpret regulatory requirements governing sample storage, to assess compliance with applicable regulations, and to recommend corrective action as required. Many regulatory constraints are potentially applicable to various constituents of tank wastes:

- Refrigeration to prevent evaporation of volatiles
- Container materials that do not interact with waste
- "Chain-of-custody record"
- Prescribed sample labelling and sealing protocols
- Specified maximum storage durations before analysis.

The authenticity of sample analyses may be questionable, because samples may be perturbed or altered during storage. The concept of an authentic sample is complex; sample storage may change the sample. Solubility changes can occur over time, and chemicals can plate out onto the sample container. As a result of any changes during storage, the sample taken from the container for analysis may not be representative of what was initially put into the container.

5.2.3 Development Plans--Sample Storage

5.2.3.1 Sample Storage Regulations Review. An engineering study will be conducted to review state and federal regulations governing storage of radioactive waste and mixed waste and to define the sample storage requirements imposed by those regulations.

Estimated Cost ($000)	25 (HL)
Need date (FY)	1989
Program(s) supported	All
HWMTP tasks	New
Predecessor task	None
Impact if not done	Characterization efforts might be delayed by rulings that analysis results are invalid because samples were improperly stored. Characterization program cost and personnel exposures would be increased as a result of additional sampling.

5.2.3.2 Sample Archiving Economics. An engineering study to assess archiving economics will be conducted to develop recommendations for cost-effective storage, handling, and analysis approaches that minimize physical and chemical changes in samples during archived storage.

Estimated Cost ($000)	44 (HL)
Need date (FY)	1989
Program(s) supported	All
HWMTP tasks	DST-3.12
Predecessor task	None
Impact if not done	Archive samples may not be stored in the most cost-effective manner. Archived samples may not be suitable for analysis, and additional sampling may be required.

5.2.3.3 Sample Archiving Facility. An engineering study will be conducted to define the requirements for storage facilities for waste tank samples. The study will include modifications to existing facilities (such as the 305 Building) as well as new construction. Storage facilities would include provisions for storage of samples up to 1 L.

Estimated Cost ($000)	51 (HL)
CENRTC ($000)	TBD (dependent on engineering study recommendations)
Need date (FY)	1990
Program(s) supported	All
HWMTP tasks	DST-3.12
Predecessor task	None
Impact if not done	Available facilities are unlikely to be adequate for sample storage. Programs for acquisition of characterization data will be impeded by lack of sample storage space.

5.2.3.4 Maintenance of Existing Single-Shell Tank Sample Archives. Samples that have already been taken and analyzed are currently archived at the 222-S and 325 Buildings. They will remain stored until a decision is made for their disposition. Costs are associated with laboratory space and radiation monitoring.

Estimated Cost ($000)	38/yr (WB)
Need date (FY)	Continuous
Program(s) supported	SST characterization
HWMTP tasks	SST-2.18
Predecessor task	None
Impact if not done	Disposal of stored samples might require additional sampling; costs and personnel exposures during sampling would be incurred.

A schedule and a cost summary for sample storage are presented in Figure 5-2 and Table 5-3, respectively.

Figure 5-2. Schedule--Sample Storage.

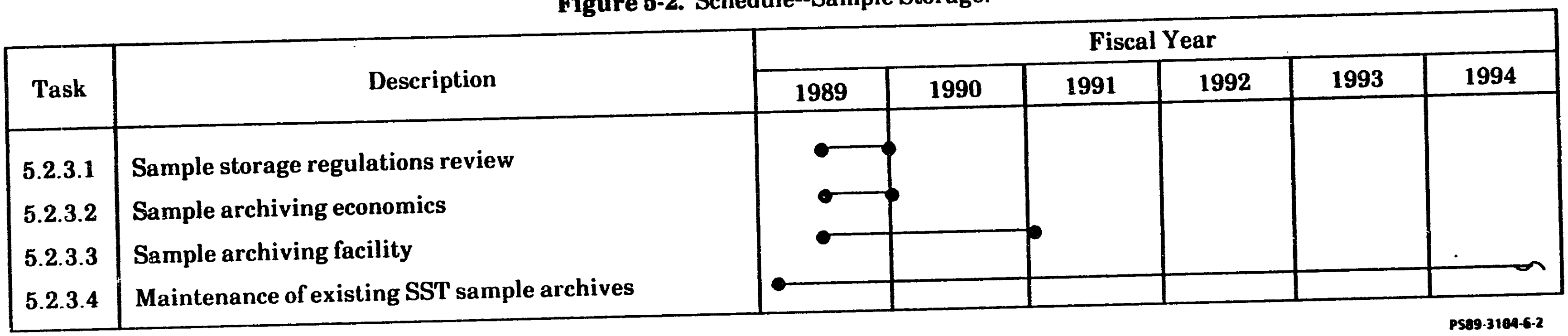

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Table 5-3. Cost Summary--Sample Storage.

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total[a]
5.2.3.1	Sample storage regulations review	HL	25						25
5.2.3.2	Sample archiving economics	HL	44						44
5.2.3.3	Sample archiving facility	HL	13	38					51
5.2.3.4	Maintenance of existing SST sample archives	WB	38	38	38	38	38	38	228
	Program funding breakdown	HL WB Unfunded[b]	82 38 0	0 0 76	0 0 38	0 0 38	0 0 38	0 0 38	82 38 228
	FY total		120	76	38	38	38	38	348

[a]Cost in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assumed unfunded.

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6.0 SAMPLE CONTROL AND DATA BASE MANAGEMENT

An Office of Sample Management (OSM) has been established to be a single point of contact for all environmental laboratory support and will assist all programs in identifying, sampling and analytical requirements. The OSM will coordinate sample distribution among the various laboratories and will coordinate laboratory capabilities with program needs and regulatory requirements. The OSM is intended to coordinate all laboratory samples and not just SST and DST samples. Specific SST and DST sampling integration and data management tasks separate from the OSM are discussed in this section.

The need for a system for the integration and control of tank sampling and sample analysis is discussed in Section 6.1. This system should eliminate unnecessary resampling and reanalysis.

Data base systems for the storage of tank farm sample analyses are discussed in Section 6.2. The SST waste characterization data are entered into the SST Waste Records Management system while DST waste characterization data are entered into the DST Waste Characterization Data Base.

6.1 SAMPLING INTEGRATION SYSTEM

6.1.1 Current Practice

For nonroutine tank farm samples, the sampling and analysis is normally handled in the following manner:

1. The requestor submits a formal or informal request to TFPE that particular tank samples be taken.

2. The requestor or TFPE notifies PCL that samples will be taken and obtains serial numbers ("R" numbers) for the samples. The requestor discusses sample analyses with PCL.

3. The TFPE personnel issue a process memo to Tank Farm Operations for the sample with a copy of this memo sent to the Sample Coordinator in the Tank Waste Characterization (TWC) Section.

4. Tank Farm Operations schedules the sampling, takes the sample, and transports it to the 222-S laboratories.

5. The PCL performs some analyses and prepares the sample for additional analysis by AL.

6. When analyses have been completed, the PCL issues a letter to the requestor and a copy to the Sample Coordinator documenting the results of the analysis.

Other groups are not generally notified when a sample is to be taken and input on sample analysis is not solicited. This can lead to a duplication of effort because a tank may have to be sampled several times to fulfill all characterization needs.

6.1.2 Sampling Integration Needs

An integrated system for requesting samples and distributing results is needed to eliminate unnecessary sampling of DSTs. The integrated system should provide for the following activities:

1. Notify different groups when samples are to be taken and are provided an opportunity to request sample analyses and indicate specific sampling restrictions (e.g., sampling method, volume required, special sample handling).

2. Enter analytical results into the characterization data base.

3. Evaluate analytical results and distribute the results to those requiring the information. The TWC section and TFPE should be included on the distribution of all sample results.

6.1.3 Development Plans

6.1.3.1 Study of Sampling and Analysis System. An improved method for requesting samples and distributing results is needed. The current system was examined and recommendations for modifications to this system were agreed upon by the TWC section, TFPE, and PCL (completed in FY 1988). The task of modifying the current system is detailed in Section 6.1.3.2.

6.1.3.2 Sampling and Analysis System Modification and Operation. This task would develop and put into operation the improved sampling integration system. An engineering instruction will be written to implement the modified system.

Estimated Cost ($000)	44 (HL) in FY 1989 to write engineering instruction and implement the modified system; 25/yr (HL) thereafter to continue system operation
Need date (FY)	1989
Program(s) supported	All
HWMTP tasks	DST-3.13
Predecessor task	6.1.3.1
Impact if not done	The potential for unneeded sampling will be present; therefore, the potential for unnecessary costs and exposure will continue.

A schedule and a cost summary for sampling integration are presented in Figure 6-1 and Table 6-1, respectively.

Figure 6-1. Schedule--Sampling Integration.

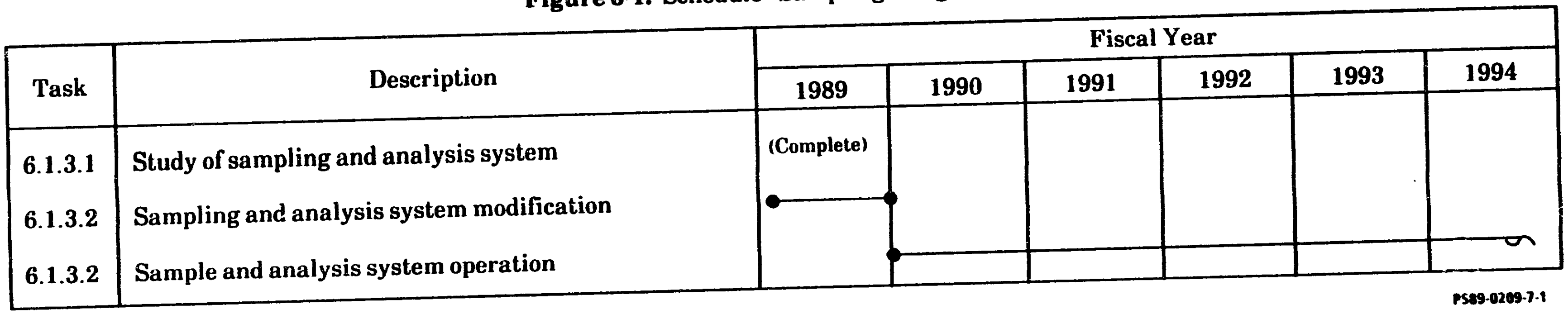

Table 6-1. Cost Summary--Sampling Integration.

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total[a]
6.1.3.1	Study of sampling and analysis system	(Complete)							
6.1.3.2	Sampling and analysis system modification	HL	44						44
6.1.3.2	Sample and analysis system operation	HL		25	25	25	25	25	125
	Program funding breakdown	HL Unfunded[b]	44 0	0 25	0 25	0 25	0 25	0 25	44 125
	FY total		44	25	25	25	25	25	169

[a]Costs in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assumed unfunded.

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6.2 DATA BASE MANAGEMENT

6.2.1 Current Systems

Results of sample analysis for the SST waste characterization program are entered into a data base maintained by the 100 Area/Technical Data Section. Procedures and systems have been developed for the safe storage and retrieval of these records.

All tank farm samples submitted to AL are entered into the computerized Laboratory Customer Communications System (LCCS). Analytical results are entered into the system and a sample remains on the active list for 90 d after the last result is entered. The data are easily obtained for routine TFPE samples provided that the sample number is available. Analytical results for nonroutine samples are documented in an internal letter or supporting document by PCL.

The DST Waste Characterization Data Base was developed during FY 1986 to provide a system for the storage and ready retrieval of information on DST sampling and analysis results. The most recent tank sampling and analysis information has been entered into the data base.
A Characterization Data Base report listing the latest analysis of each waste tank will be issued annually. This data base is managed by the TWC Section. A DSS/DSSF source-term document has been developed by the Grout Systems Group and is being used for a grout feed variability study.

6.2.2 Needs

The HWVP has identified the need for a data base to compile HWVP feed characterization data. The HWVP plans to obtain feed characterization information in two ways: by summing and averaging analytical results from sampling at B Plant and by sampling and analysis of HWVP feed storage tanks. Because of the large number of samples to be taken at B Plant, a data base will be necessary to store and process the data.

The TRAC data and programs were converted to the CRAY computer system in FY 1988. The data and programs need to be maintained for future use. The information will be stored on magnetic tape and will be maintained by Information Resource Management (IRM).

The SST characterization has identified the need for a data base to compile SST core sample analysis data. The SST Statistical Data Base will store SST characterization data generated from core samples and other sources. The data base will provide inventory and concentration estimates for each constituent with associated errors, material balance information, and hazardous waste designations. This data base needs to be developed and implemented before SST sampling and analyses start again.

The Environmental Restoration Division is developing an environmental data base to index, retrieve, and report division records. The data base emphasis will be on environmental restoration needs to meet EPA requirements to support the Administrative Record by February 28, 1989. This data base has the potential to absorb the SST Waste Records Management (Section 6.2.3.1) work scope in the future.

6.2.3 Data Base Development Plans

6.2.3.1 Single-Shell Tank Waste Records Management. The 100 Area Technical Data Section provides record management support to the SST waste characterization effort. Procedures and systems are in place for the safe storage and retrieval of these records. This task provides for maintaining the system.

Estimated Cost ($000)	25/yr (EF)
Need date (FY)	Continuous
Program(s) supported	SST Characterization
HWMTP tasks	SST-2.19
Predecessor task	None
Impact if not done	No single source for SST sample analyses would be available without this data base. This could result in difficulties in obtaining data on past sample analyses and possible data loss.

6.2.3.2 Double-Shell Tank Waste Characterization Data Base. Work on the characterization data base began in late FY 1986; the program for the data base has been written and the user's guide has been prepared and issued for review. The latest tank farm sample analysis data has been entered and the data base system is current. A document will also be issued listing the latest analysis of each waste tank. This document will be updated annually.

Estimated Cost ($000)	50/yr (HL)
Need date (FY)	Continuous
Program(s) supported	All
HWMTP tasks	DST-3.14
Predecessor task	None
Impact if not done	No single source for DST sample analyses would be available without the data base. This could result in difficulties in obtaining data on past sample analyses and possible data loss.

6.2.3.3 Double-Shell Slurry and Double-Shell Slurry Feed Source-Term Document and Feed Composition Variability Study. The DSS/DSSF Source-Term document and Feed Composition variability study was developed and is used by the Grout Systems Group to support development and permitting efforts. This document was used as the basis for the GTF Dangerous Waste Application.

Estimated Cost ($000)	25/yr (WP)
Need date (FY)	Continuous
Program(s) supported	GTF
HWMTP tasks	DST-3.15
Predecessor task	None
Impact if not done	The information necessary to estimate the final composition of GTF feed in the GTF feed tanks will not be in an easily accessible form and additional effort will be required to sum and average the analytical data.

6.2.3.4 Hanford Waste Vitrification Plant Feed Data Base. The HWVP feed data base should be developed and implemented before the startup of NCAW pretreatment at B Plant. Each batch of NCAW solids transferred from B Plant will be sampled and analyzed by B Plant Process Engineering. The data base will compile the results of these analyses and the volumes to estimate the composition of HWVP feed tanks. The data base should be designed to meed DOE-OCRW specifications for Waste Acceptance 1.1 and 1.2, DOE-OGR/B14 Quality Assurance Requirements and NUREG 0856.

Estimated Cost ($000)	63 in FY 1991 (TBD) for development of data base; 38/yr (TBD) thereafter to operate and maintain data base
Need date (FY)	1991
Program(s) supported	HWVP
HWMTP tasks	New
Predecessor task	None
Impact if not done	The information necessary to estimate the final composition of HWVP feed in the HWVP feed tanks will not be in an easily accessible form and additional effort will be required to sum and average the analytical data. Multiple core samples of washed sludge receiver tank would be required to characterize solids (at about $250,000/sample).

6.2.3.5 Convert Tracks Radioactive Components to CRAY Computer System. The TRAC program originally written for the UNIVAC* system has been converted to the CRAY operating system to be usable (completed in FY 1988).

*UNIVAC is a registered trademark of the Sperry Corporation.

6.2.3.6 Evaluate Tracks Radioactive Components for Hazardous Material. The TRAC program was designed to predict radioactive components in waste tanks. Although it was not designed for predicting hazardous waste content, it may be able to do so. A comparison was to be made with existing sampling data. This task was canceled in FY 1989 when the SST Characterization team determined TRAC technology should not be developed further at this time for the following reasons:

1. It would not be cost effective.

2. TRAC is not applicable to RCRA concerns.

3. TRAC cannot be validated on actual samples. Sampling all 149 SSTs would be required.

4. Excessive errors are associated with TRAC.

It may be possible to use TRAC to predict locations of key radionuclides but not to determine the radionuclide or hazardous waste inventory of the SSTs.

6.2.3.7 Develop Tracks Radioactive Components Statistical Techniques. A mathematical analysis was to be completed that would determine statistically valid techniques for comparing TRAC predictions with waste sampling and analysis. This task was canceled in FY 1989 for the same reasons listed under Section 6.2.3.6.

6.2.3.8 Complete Tracks Radioactive Components Assessment for Component Prediction. Upon completion of sampling 30 waste tanks, a comparison of TRAC and sampling and analysis data was to be performed. Results would show where additional methods improvements needed to be performed. This task was canceled in FY 1989 for the same reasons listed under Section 6.2.3.6.

6.2.3.9 Assess Tracks Radioactive Components Improvement. Improvements to the TRAC code were to be recommended. If the code is insufficient to reduce the scope of the waste tank sampling then a comparison was to be made between improving TRAC and expanding the sampling and analysis. This task was canceled in FY 1989 for the same reasons listed under Section 6.2.3.6.

6.2.3.10 Storage of Tracks Radioactive Components Data and Programs. The TRAC data and executable programs should be maintained for future use. The information will be stored on magnetic tape and will be maintained by IRM.

Estimated Cost ($000)	6/yr (EF)
Need date (FY)	Continuous
Program(s) supported	SST characterization
HWMTP tasks	New
Predecessor task	6.2.3.5
Impact if not done	The TRAC data and programs will not be accessible if they are needed in the future.

6.2.3.11 Single-Shell Tank Statistical Data Base. The SST Statistical Data Base will store SST characterization data generated from core samples and other sources. This task will develop the data base in FY 1989 and maintain the data base beginning in FY 1990.

Estimated Cost ($000)	31 in FY 1989 (EF) for development of data base; 25/yr (EF) thereafter to operate and maintain data base
Need date (FY)	1989
Program(s) supported	SST characterization
HWMTP tasks	New
Predecessor task	None
Impact if not done	The immense amount of information generated by SST core sample chemical and statistical analyses will not be easily compiled and interpreted.

6.2.3.12 Environmental Management Data Base. The Environmental Management Data Base will be used for indexing, retrieving, and reporting Environmental Restoration Division records. The emphasis of the data base will be on environmental restoration needs to meet EPA requirements to support the Administrative Record by February 28, 1989. This data base has the potential to absorb the SST Waste Records Management (6.2.3.1) work scope in the future.

Estimated Cost ($000)	25 in FY 1989 (EF) for development of data base, 19 (EF) in FY 1989 to operate and maintain data base; 31/yr (EF) thereafter to operate and maintain data base
Need date (FY)	1989
Program(s) supported	SST characterization
HWMTP tasks	New
Predecessor task	None
Impact if not done	EPA requirements will not be met. The index of the Administrative Record could not be distributed to the required regulatory agencies.

A schedule and a cost summary for data base management are presented in Figure 6-2 and Table 6-2, respectively.

Table 6-2. Cost Summary--Data Base Management.

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
6.2.3.1	SST waste records management	EF	25	25	25	25	25	25	150
6.2.3.2	DST waste characterization data base	HL	50	50	50	50	50	50	300
6.2.3.3	DSS/DSSF source-term document and feed composition variability study	WP	25	25	25	25	25	25	150
6.2.3.4	HWVP feed data base	(TBD)			63	38	38	38	177
6.2.3.5	Convert TRAC to CRAY computer system	(Complete)							
6.2.3.6	Evaluate TRAC for hazardous material	(Canceled)							
6.2.3.7	Develop TRAC statistical techniques	(Canceled)							
6.2.3.8	Complete TRAC assessment for component prediction	(Canceled)							
6.2.3.9	Assess TRAC improvement	(Canceled)							
6.2.3.10	Storage of TRAC data and programs	EF	6	6	6	6	6	6	36
6.2.3.11	SST statistical data base	EF	31	25	25	25	25	25	156
6.2.3.12	Environmental management data base	EF	44	31	31	31	31	31	199
	Program funding beakdown	HL EF WP Unfunded[b]	50 106 25 0	0 0 0 162	0 0 0 225	0 0 0 200	0 0 0 200	0 0 0 200	50 106 25 987
	FY total		181	162	225	200	200	200	1168

[a]Cost in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assumed unfunded.

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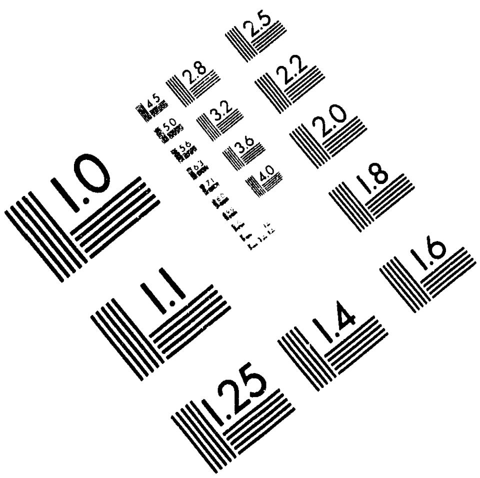

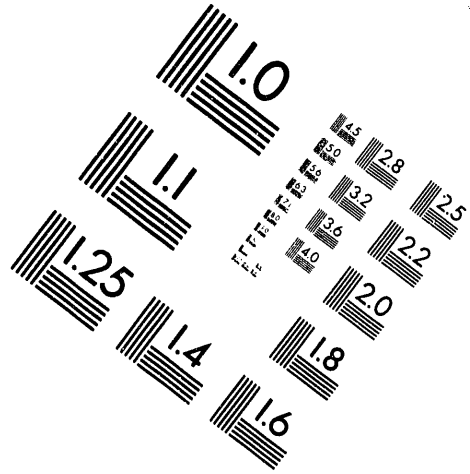

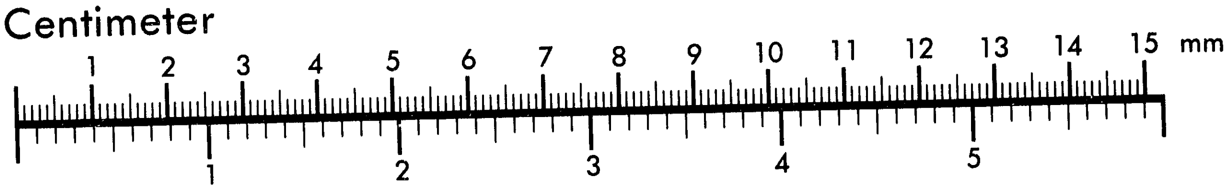

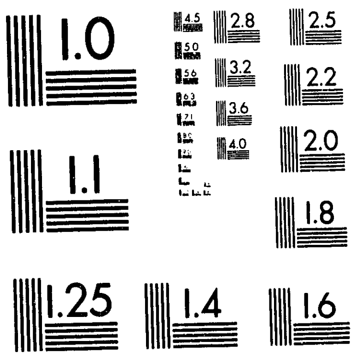

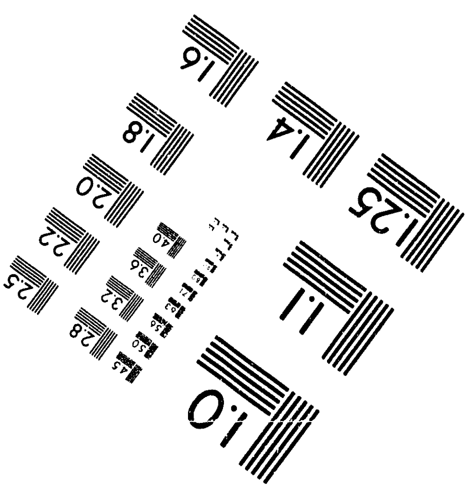

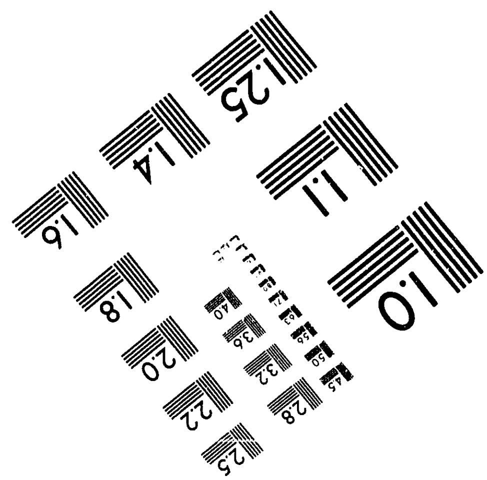

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Figure 6-2. Schedule--Data Base Management.

Task	Description	Fiscal Year 1989	1990	1991	1992	1993	1994
6.2.3.1	SST waste records management						
6.2.3.2	DST waste characterization data base						
6.2.3.3	DSS/DSSF source-term document and feed composition variability study						
6.2.3.4	HWVP feed data base						
	– Develop data base						
	– Operate data base						
6.2.3.5	Convert TRAC to CRAY computer system	(Complete)					
6.2.3.6	Evaluate TRAC for hazardous material	(Canceled)					
6.2.3.7	Develop TRAC statistical techniques	(Canceled)					
6.2.3.8	Complete TRAC assessment for component prediction	(Canceled)					
6.2.3.9	Assess TRAC improvement	(Canceled)					
6.2.3.10	Storage of TRAC data and programs						
6.2.3.11	SST statistical data base						
	– Develop data base						
	– Operate data base						
6.2.3.12	Environmental management data base						
	– Develop data base						
	– Operate data base						

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7.0 SAMPLING SCHEDULE

7.1 FISCAL YEAR 1988 SAMPLE SCHEDULE STATUS

Eighteen samplings from twelve DSTs were scheduled for FY 1988. In addition, samples from four SSTs, the 242-A Evaporator, and the 244-TX double-contained receiver tank (DCRT) were also planned for waste characterization. Of the 18 DST samplings, 11 were core samples. No core sampling was performed during FY 1988 due to modification of the CST to allow NCAW core sampling. Samples that were not taken and are still needed have been included in the sample schedule for FY 1989. The FY 1988 sample schedule is summarized in Table 7-1.

7.2 FISCAL YEAR 1989 SAMPLING SCHEDULE

The FY 1989 sample schedule includes six core samples from five DSTs and 15 core samples from two SSTs. In addition, 29 to 35 dip samples from four DSTs are scheduled. The tank farm sample schedule for FY 1989 is shown in Table 7-2. These samples are necessary to support GTF, HWVP, pretreatment, retrieval, SST issues, NCRW issues, and tank farm technology issues (such as tank corrosion and criticality specifications). Sampling is also required to support TFPE needs for the normal operations of the tank farms but is not shown in these schedules. The reason for each sampling is shown in the final column of Table 7-2. The number and type of sample, available funding, and need for sampling are also given in the table.

The NCAW sampling is one of the most important core samplings scheduled for FY 1988. Tank 241-AZ-101 and -102 samples are necessary to support both retrieval and HWVP technology development. Past sampling of NCAW using dip sampling methods have failed to recover sufficient amounts of solids for full characterization. Analysis of the solids is needed to verify the HWVP feed composition used in vitrification studies. The physical and rheological properties of NCAW are needed to support retrieval studies. All retrieval development work has been based on synthetic wastes and has not been verified with measurements of actual NCAW. This sampling is scheduled for the first quarter of FY 1989.

Tank 241-SY-102 PFP solids core sampling was performed to support disposal technology development (i.e., HWVP, pretreatment, and retrieval) and tank farm technology issues concerning 200 West Area wastes.

An NCRW core sample will be taken from tank 241-AW-103. This sample is needed to verify that the TRU removal process implemented at the PUREX Plant is effective. The sample will also be used for NCRW pretreatment and retrieval technology development. Complexed concentrate from tank 241-AN-107 will be sampled during FY 1989 to provide waste samples for CC pretreatment technology development.

Single-shell tank sampling will resume in FY 1989. The first SSTs to be sampled will be sampled according to a reference sampling plan. A total of 15 cores from two tanks will be taken to assess the uncertainties associated with different aspects of SST sampling and analysis. Data from the reference sampling will be used to determine the number of core samples required to adequately characterize a SST. Following completion of the reference sampling, SST characterization sampling will begin with the sampling of six SSTs (two cores per tank).

Table 7-1. Fiscal Year 1988 Sample Schedule Status.

Tank	Waste type	Sample quantity	Comments
241-AN-102	CC supernatant	1	Three samples taken, June 1988
241-AN-105	DSSF	--	Sample not taken
241-AN-106	Concentrated PO_4	One 20-segment core	Sample not taken
241-AN-107	CC supernatant	1	Two samples taken, June 1988
241-AW-103	NCRW supernatant	1	Three samples taken
241-AW-103	NCRW sludge	One core	Sample delayed to FY 1989 due to PUREX processing schedule changes
241-AW-104	Miscellaneous waste	2	Samples not taken, no longer needed
241-AW-105	NCRW supernatant	4	Two samples taken
241-AY-101	Dilute complexed heel	One 4-segment core	Sample not taken due to CST modifications, planned for FY 1991
241-AZ-101	NCAW supernatant	5 to 10	One sample taken, October 1987
241-AZ-101	NCAW solids	Two 2-segment core	Samples not taken due to CST modifications, planned for FY 1989
241-AZ-102	NCAW supernate	1 to 2	Two samples (1 supernatant, 1 solids) taken, October 1987
241-AZ-102	NCAW solids	One 3-segment core	Sample not taken due to CST modifications, planned for FY 1989
241-C-105	SST high-heat waste	One 3-segment core	Sample not taken due to CST modifications, planned for FY 1989
241-C-106	SST high-heat waste	One 4-segment core	Sample not taken due to CST modifications, planned for FY 1989
241-SY-102	PFP supernatant	1	Sample not taken, not needed
241-SY-102	PFP solids	One 3-segment core	Sample not taken in FY 1988 due to CST modifications, 4-segment core taken October 1988
242-A	Evaporator feed/slurry pairs	~2 wk during run	Samples taken
244-TX	PFP waste	1	One sample taken, 1Q FY 1988

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Table 7-2. Fiscal Year 1989 Sample Schedule. (Sheet 1 of 2)

Tank	Waste type	Sample date (FY)	Sample quantity and type	Program	Funding ($000)	Comments
241-SY-102	PFP sludge	November 1988	One 4-segment core	WB705 and HLCOD	[b] 9.9 PCL 24.2 AL 74.6 PNL	Tank Farm Technology--Determination of iron solids structure for criticality specification. X-ray and TRU (including Pu isotopic) analyses will be performed at PNL.
241-AW-103	NCRW sludge	December 1988	Bottle-on-a-string (6)	WB705	[a] 8.7 PCL 23.2 AL 5.3 PNL	Segregation of PUREX NCRW--These samples will be taken to support the process test at PUREX. Analysis to include TRU, GEA, ICP, IC, TOC, OH^-. PNL to determine isotopic distribution of Pu.
241-AW-101	DSSF	December 1988	Bottle-on-a-string (2)	HL	[a] 75.3	Pretreatment Development--Cs/Sr removal studies.
241-AN-106	Concentrated PO_4	1Q FY 1989	Bottle-on-a-string (9 to 12)	WP	[a,c]	Grout Technology--Laboratory work will include grout feed characterization and preparation, and charac.
241-AW-101 or other DST	DSSF	1Q FY 1989	Bottle-on-a-string (9 to 12)	WP	[a,c]	Grout Technology--Same as 241-AN-106 samples.
241-AW-103	NCRW sludge	January 1989	One 10-segment core	WB705 and HLCOD	[b] 17.4 PCL 29.1 AL 53.3 PNL	Segregation of PUREX HCRW--Top segments wil be taken in support of process test at PUREX. Same as 241-AW-103 bottle-on-a-string samples.
241-AN-102	CC	2Q FY 1989	Bottle-on-a-string (2)	HL	[a] 470.6	Pretreatment Development--Laboratory work will include TRUEX optimization, solvent poisoning, organic destruction studies.
241-AZ-101	NCAW solids	2Q FY 1989	Two 2-segment cores and one additional segment from tank bottom	HLCOD and WB705	[b] 1.1 PCL 303.8 PNL	Disposal Technology--Core samples will be sent directly to PNL. Characterization to include sample analysis, rheological analyses, solids washing, product analysis. Tank Farm Technology--Characterization of waste layers within NCAW solids at PNL.
241-AZ-102	NCAW solids	2Q FY 1989	One 2-segment core	HLCOD and WB705	[b] 0.9 PCL 151.9 PNL	Disposal Technology and Tank Farm Technology--Same as 241-AZ-101 samples.

Table 7-2. Fiscal Year 1989 Sample Schedule. (Sheet 2 of 2)

Tank	Waste type	Sample date (FY)	Sample quantity and type	Program	Funding ($000)	Comments
241-C-107 241-B-110	SST	April to June 1989	Eight 7-segment cores from 241-C-107 Seven 5-segment cores from 241-B-110	EF341	b 89.0 PCL 82.3 AL 319.8 PNL	SST Characterization--Reference sampling--Determination of errors in SST core sampling and analysis. Analysis per the reference sampling plan.
241-AN-107	CC	July 1989	One 21-segment core	HLCOD and WB705	b 22.1 PCL 26.6 AL 53.3 PNL	Disposal Technology--Rheological and physical analyses at PNL. Chemical and radiological characterization of sludge. Acid dissolution testing. Tank Farm Technology--Determination of OH^- concentration in each segment.
241-AN-102	CC	d	One 21-segment core	HLCOD and WB705	b 22.1 PCL 26.6 AL 53.3 PNL	Disposal Technology and Tank Farm Technology--Same as 241-AN-107 sample.

[a]Sampling funding for bottle-on-a-string samples if provided through the Tank Farm operating budget.
[b]Total core sampling funding is $1,042,000 for FY 1989.
[c]Total WP laboratory funding for waste analysis, hot-cell grout work and supporting laboratory work is $3,923,000 for FY 1989.
[d]Tank to be sampled as schedules allows.

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This schedule reflects current sampling needs and is subject to change. Some factors that may affect this schedule are the availability of laboratory support, sampling equipment availability, changes in program needs, plant operations, tank farm waste operations, or tank farm waste processing and operations. This schedule will be consistent with sampling milestones negotiated with DOE and regulatory agencies.

7.3 FUTURE SAMPLING

Changes in plant operations, tank farm operations, or technology development needs can affect the sample schedules for FY 1990 and beyond. This schedule will be revised annually in this document to reflect these changes. General sampling requirements for DSTs and SSTs are discussed below and a preliminary sample schedule is shown in Table 7-3.

7.3.1 Double-Shell Tank Sampling

Double-shell tanks are sampled to support various programs. The sampling and analysis of DSTs supports technology development for GTF, HWVP, pretreatment, retrieval, TFPE, and tank farm technology.

Double-shell tank sampling to support HWVP needs include the following types of samples. Tanks containing NCAW, CC, and PFP solids will require sampling for HWVP feed characterization and WFQ. It is expected that several core samples from a tank will be needed to adequately characterize these wastes for HWVP; however, the number of core samples required has not yet been determined. Tanks containing HWVP feed will be sampled several times during filling and after filling. The HWVP feed will also be sampled before transfer to HWVP for vitrification to determine frit requirements. Any heel left in a tank that has been cleaned out for use as an HWVP feed tank will be sampled as well.

Knowledge of the rheological and physical properties of DST wastes is necessary for the development of technology and the successful retrieval of the wastes. Concentrated phosphate wastes, DSS, NCAW, PFP waste, CC, HWVP feed, and various waste heels will be sampled and analyzed before retrieval.

Sampling of CC, PFP waste, and possibly other waste types will be necessary for the development of pretreatment technologies. Pretreatment of these wastes will be necessary before disposal in glass and grout.

Sampling to support the GTF will consist primarily of grout feed sampling for feed characterization and formulation development. Continued sampling will be necessary to meet operational needs and the needs of shorter term technology issues. The number of samples needed through FY 1994 is expected to remain relatively constant.

7.3.2 Single-Shell Tank Sampling

Single-shell tank sampling is performed to support the interim stabilization of SSTs and to provide characterization information on all SSTs to support decisions on the final disposition of the wastes contained in the SSTs.

Table 7-3. Preliminary Fiscal Year 1990 to 1994 Sample Schedule.

Tank	Waste type	Sample date (FY)	Sample quantity	Program	Funding ($000)	Comments
241-SY-101	CC/DSS	1990	22 segments	HL	226	Pretreatment development, retrieval
241-SY-102	PFP	1990	Two 3-segment cores	HL	452	Pretreatment development, HWVP retrieval
241-AZ-101	NCAW	1990	2-segments	HL	226	HWVP
241-AZ-102	NCAW	1990	2 segments	HL	226	HWVP
6 SSTs	SST	1990	Two cores per tank	EF	2,711	SST characterization
241-AW-103	NCRW	1990	2 segments	WB	226	NCRW TRU removal
241-AP-107	NCRW	1990	1 segment	WB	226	NCRW TRU removal
241-AP-107	NCRW	1990	Bottle-on-a-string (2)	WB	25	NCRW TRU removal
TBD	DSSF	1990	One core	HL	226	Retrieval
TBD	DSSF	1990	One core	HL	226	Retrieval
241-AP-107	NCRW	1991	One core	WB	226	NCRW TRU removal
241-AZ-101	NCAW	1991	2 segments	HL	226	HWVP, retrieval
241-AZ-102	NCAW	1991	2 segments	HL	226	HWVP, retrieval
241-AY-101	DC	1991	One core	HL	226	Pretreatment development, HWVP
241-SY-103	CC/DSS	1991	12 segments	HL	226	Pretreatment development, HWVP
241-AW-103	NCRW	1991	2 segments	WB	226	NCRW TRU removal
241-AN-107	CC	1991	Maximum 21 segments	HL	226	HWVP, pretreatment
10 SSTs	SST	1991	Two cores per tank	EF	4,518	SST characterization
241-AN-102	CC	1992	Maximum 21 segments	HL	226	HWVP, pretreatment
241-AZ-101	NCAW	1992	2 segments	HL	226	HWVP, retrieval
241-AZ-102	NCAW	1992	2 segments	HL	226	HWVP, retrieval
241-AY-102	Tank heel	1992	Three 2-segment cores	HL	678	HWVP
241-AN-103	DSS	1992	One core	HL	226	Retrieval
10 SSTs	SST	1992	Two cores per tank	EF	4,518	SST characterization
~5 DSTs	DST	1993	One core per tank	HL	1,128	Disposal technology (pretreatment, retrieval, HWVP)
11 SSTs	SST	1993	Two cores per tank	EF	4,970	SST characterization
~3 DSTs	DST	1994	One core per tank	HL	678	Disposal technology
22 SSTs	SST	1994	Two cores per tank	EF	9,940	SST characterization

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The SST interim stabilization issues that require sampling and analysis of SSTs and DCRTs include the evaluation of high-heat-load tanks and saltwell liquid (SWL) segregation.

Single-shell tank sampling for SST characterization will continue. The sampling is divided into three parts: the reference sampling plan, Phase I sampling, and Phase II sampling. The reference sampling plan is described briefly in Section 7.2. Phase I sampling, which involves the obtaining two core samples from each of the 149 SSTs, is expected to continue through FY 1998. The results of Phase I sampling and analysis will be used to collect data for technology development and reduce the amount of characterization for geological disposal candidates before retrieval. During the final Phase II sampling, additional cores will be obtained from SSTs for verification or to obtain the information necessary for proper disposal of the SST waste.

7.3.2.1 Identify Tanks to be Sampled for Single-Shell Tank Characterization (formerly Section 7.3.8.1). Due to changes in the SST characterization program, the decision has been made to sample all 149 SSTs. A recommended sampling order has been developed and will be included in the SST WCP (see Section 2.3.32).

7.3.2.2 Develop Resource Conservation and Recovery Act Sampling Plans and Procedures for Single-Shell Tank Characterization (formerly Section 7.3.8.2). A detailed plan will be prepared to ensure compliance with RCRA requirements and recommendations where possible and to document any deviations from RCRA. Items to be addressed include number and type of sample, chain of custody protocol, and sample preservation requirements. This task is now included within the scope of the SST WCP (see Section 2.3.32).

7.3.2.3 Sample and Analyze Single-Shell Tanks for Single-Shell Tank Characterization (formerly Section 7.3.8.3). This task provides for core sampling and analysis of SSTs to support the selection of waste disposal methods. A sample schedule is shown in Tables 7-2 and 7-3.

7.3.2.4 Complete Sampling and Analysis of Single-Shell Tanks if Tracks Radioactive Components is not Adequate (formerly Section 7.3.8.4). Due to changes in the SST characterization program, the decision has been made to sample all 149 SSTs (see Section 2.3.32).

A schedule and a cost summary for sampling are presented in Figure 7-1 and Table 7-4, respectively.

Figure 7-1. Schedule--Sampling.

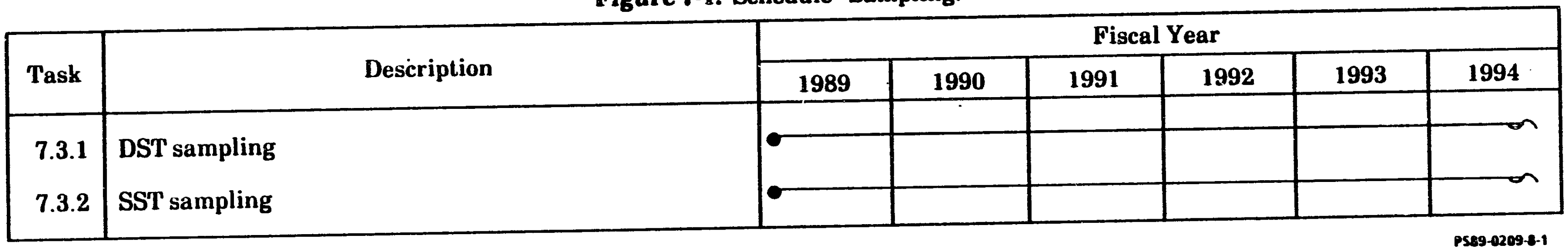

Table 7-4. Cost Summary--Sampling.

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total[a]
7.3.1	DST sampling	HL	1,860	1,581	1,130	1,581	1,130	678	7,960
		WB	318	477	452	TBD	TBD	TBD	1,247
		WP	424	TBD	TBD	TBD	TBD	TBD	424
7.3.2	SST sampling	EF	990	2,711	4,518	4,518	4,970	9,940	27,647
	Program funding beakdown	EF	990	0	0	0	0	0	990
		HL	1,860	0	0	0	0	0	1,860
		WB	318	0	0	0	0	0	318
		WP	424	0	0	0	0	C	424
		Unfunded[b]	0	4,769	6,100	6,099	6,100	10,618	33,686
	FY total		3,592	4,769	6,100	6,099	6,100	10,618	37,278

[a]Cost in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assu ed unfunded.

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8.0 QUALITY ASSURANCE

8.1 QUALITY ASSURANCE PROGRAM

DOE Order 5700.6B (DOE 1986) and DOE-RL Order 5700.1A (DOE/RL 1983) direct operations and engineering contractors to operate DOE sites in accordance with the consensus standard ANSI/ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities* (ANSI/ASME 1983). The QA Program implements DOE Order 5700.6B.

Waste tank sampling and analysis activities shall conform to applicable requirements of the Westinghouse Hanford QA Program. The QA program requirements and associated management control systems are tailored to the activities being performed based upon impacts to safety, consequence of failure, and achievement of program objectives. When required, QA program plans are prepared to identify applicable QA requirements and to implement procedures, management control systems and codes and standards (e.g., ASME, ASTM, RCRA, CERCLA).

8.2 DEVELOPMENT NEEDS

The tank waste characterization program requires full-time QA support to review requirements as applied to all sample acquisition, handling, transport, storage, and analysis activities. A QA engineer will also serve in an advisory role for definition of compliance requirements when additional standards and regulations are imposed. The QA liaison will also assist in identifying, integrating, and auditing documentation required by regulatory agencies, TFPE, tank farm technology, and AL. As needed, the individual will prepare and review QA plans for discrete tasks within waste characterization activities. A QA plan will be developed separately to define the objectives and approach for controlling operations and documentation in the SST waste characterization program.

An important function of the QA liaison engineer will be to review and audit existing sampling, transportation, analysis, and archiving procedures for NQA-1 compliance; the QA liaison will define and support actions required to correct nonconformances.

8.3 DEVELOPMENT PLAN

8.3.1 Quality Assurance Support

A QA liaison engineer will be provided as a dedicated participant in the waste tank characterization team. The QA engineer will advise the team on the publication and effects of new standards, will integrate preparation of required documentation, and will review and audit current procedures. The QA engineer will also prepare or review QA plans as required by Westinghouse Hanford and DOE procedures.

Estimated Cost ($000)	40/yr (HL), 30/yr (WB), 30/yr (EF)
Need date (FY)	Continuous
Program(s) supported	All
HWMTP tasks	DST-3.1, SST-2.1
Predecessor task	None
Impact if not done	Program requirements may not be met. Characterization data obtained may not be usable.

8.3.2 Quality Assurance Program Plan for Single-Shell Tank Waste

A QA program plan for SST waste characterization will be developed to ensure that requirements imposed by regulations and interagency agreements are met.

Estimated Cost ($000)	107 (EF)
Need date (FY)	1989
Program(s) supported	SST Characterization
HWMTP tasks	SST-2.1
Predecessor task	None
Impact if not done	Characterization procedures and data may be unsuitable to meet regulatory requirements.

A schedule and a cost summary for NQA-1 are presented in Figure 8-1 and Table 8-1, respectively.

Figure 8-1. Schedule--NQA-1.

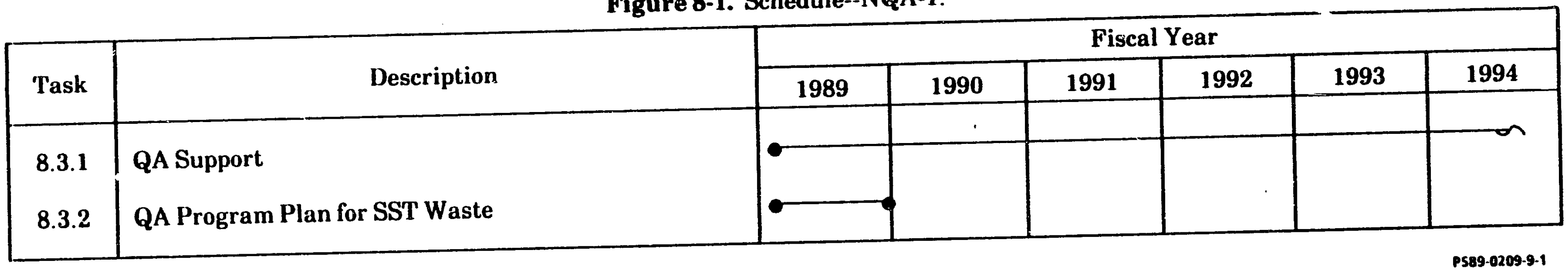

Table 8-1. Cost Summary--NQA-1.

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
8.3.1	QA Support	WB, HL, EF	38,50,38	126	126	126	126	126	756
8.3.2	QA Program Plan for SST Waste	EF	107						107
	Program funding breakdown	EF	145	0	0	0	0	0	145
		HL	80	0	0	0	0	0	50
		WB	38	0	0	0	0	0	38
		Unfnded[b]	0	126	126	126	126	126	630
	FY total		233	126	126	126	126	126	863

[a]Cost in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assumed unfunded.

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9.0 TANK WASTE CHARACTERIZATION PLANNING

This section describes tasks that involve the planning required to ensure that all waste characterization needs (and the development tasks necessary to meet those needs) have been identified and documented. Tank waste characterization planning includes the integration of various program needs, consultations with regulatory agencies and independent technical reviews as appropriate, and documentation of the needs and development tasks.

9.1 TANK FARM WASTE CHARACTERIZATION PLANNING

9.1.1 Status and Needs

The Tank Farm Waste Characterization TPP is necessary to provide the development needs required to integrate tank farm waste characterization to support waste management programs. Development plans outlined in the TPP will provide input to future waste management planning. The TPP is revised annually.

9.1.2 Development Plans

9.1.2.1 Tank Farm Waste Characterization Technology Program Plan. This TPP should be updated annually to reflect changes in tank farm waste characterization needs and to evaluate ongoing waste characterization efforts.

Estimated Cost ($000)	31/yr (HL)
Need date (FY)	Continuing
Program(s) supported	All
HWMTP tasks	DST-3.20
Predecessor task	None
Impact if not done	Identification of all development tasks required to support waste characterization cannot be ensured. Duplication of effort or inefficient use of resources may result.

9.2 SINGLE-SHELL TANK CHARACTERIZATION PLANNING

9.2.1 Status and Needs

During FY 1988, significant changes occurred in the SST waste characterization program and substantial progress was made in the development of a comprehensive strategy addressing the characterization of SST wastes.

Final disposal options for the SST wastes must address both radioactive and chemical waste hazards, and must be consistent with the regulation of such agencies as DOE, EPA, and Ecology. Characterization of SST wastes will support the development of the final disposal options. A WCP is being developed to address the sampling and analysis of SSTs; this plan is discussed in Section 2.3.32. Other planning tasks are described below.

9.2.2 Development Plans

9.2.2.1 Single-Shell Tank Waste Characterization Plan Revision. The *Single-Shell Tank Waste Characterization Plan* revision (RHO-RE-PL-41 P) was completed in FY 1987. This document, which outlined tasks, costs and schedules for the completion of SST characterization, is not related to the WCP described in Section 2.3.32. However, due to changes in the SST waste characterization program, much of this plan (RHO-RE-PL-41P) is no longer applicable. This task has been replaced by the task described in Section 9.2.2.4.

9.2.2.2 Consultation With Regulatory Agencies. Consultation with Ecology has been established to assist in decisions regarding SST characterization. Key areas include selection of parameters for analyses, sampling requirements, and use of alternative analytical procedures, protocols, and equipment. This task is required to ensure that the characterization plans and tasks will supply the appropriate data to support waste handling and disposal.

Estimated Cost ($000)	38/yr (EF)
Need date (FY)	Continuous
Program(s) supported	SST characterization
HWMTP tasks	SST-2.29
Predecessor task	None
Impact if not done	This task provides valuable input to the SST characterization program and its approach to SST waste characterization and the final disposition of these wastes. Lack of regulatory agency review could result in cost and schedule impacts to the characterization of SST wastes.

9.2.2.3 Independent Technical Review. A panel from the National Academy of Science (NAS) has been asked to examine and review SST waste disposal development and evaluation activities. Included in the reviews are technical plans, data reports, analyses, and conclusions. Periodic meetings are held between the NAS panel and representatives from Westinghouse Hanford, PNL, DOE, and Ecology. This task is required to ensure that the characterization plans and tasks will supply the appropriate data to support waste handling and disposal.

Estimated Cost ($000)	251/yr (EF)
Need date (FY)	Continuous
Program(s) supported	SST characterization
HWMTP tasks	None
Predecessor task	None
Impact if not done	This task provides valuable input to the SST characterization program and its approach to SST waste characterization and the final disposition of these wastes. Lack of independent technical review could result in cost and schedule impacts to the characterization of SST wastes.

9.2.2.4 Single-Shell Tank Systems Analysis Baseline Plan and Schedule. A baseline plan with associated costs and schedules for selecting and implementing a final disposal decision for SST sites will be prepared. This plan will identify technology tasks, major decision points, rough-order-of-magnitude costs, and schedules for reaching final disposition of SST sites. This plan will incorporate appropriate tank waste disposal milestones negotiated with EPA and Ecology. The scope of this plan extends beyond characterization and includes other aspects of SST waste disposal including waste retrieval, pretreatment, and long-term isolation.

Estimated Cost ($000)	376 (EF)
Need date (FY)	1989
Program(s) supported	SST characterization
HWMTP tasks	New
Predecessor task	None
Impact if not done	Identification of all development tasks required to support SST waste characterization and disposal and integration of characterization with other SST waste disposal activities cannot be ensured.

A schedule and a cost summary for tank waste characterization planning are presented in Figure 9-1 and Table 9-1, respectively.

Figure 9-1. Schedule--Tank Waste Characterization Planning.

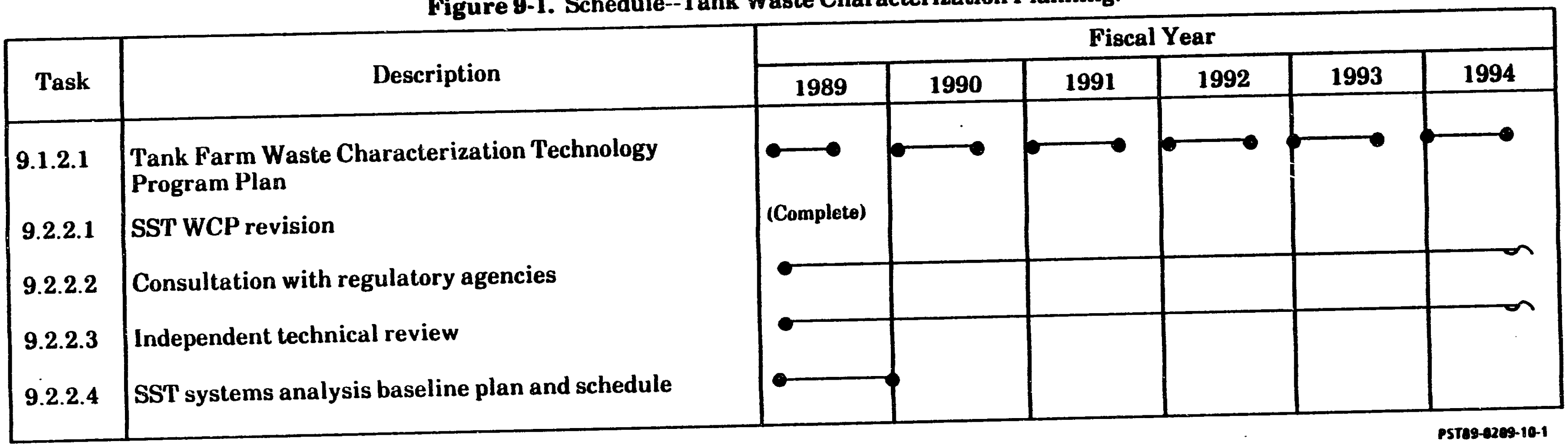

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Table 9-1. Cost Summary--Characterization Planning.

Task	Description	Program	Fiscal year[a]						Total
			1989	1990	1991	1992	1993	1994	
9.1.2.1	Tank Farm Waste Characterization Technology Program Plan	HL	31	31	31	31	31	31	186
9.1.2.1	SST WCP revision	(Complete)							
9.1.2.2	Consultation with regulatory agencies	EF	38	38	38	38	38	38	228
9.1.2.3	Independent technical review	EF	251	251	251	251	251	251	1,506
9.1.2.4	SST systems analysis baseline plan and schedule	EF	376						376
	Program funding breakdown	HL EF Unfunded[b]	31 665 0	0 0 320	0 0 320	0 0 320	0 0 320	0 0 320	31 665 1,600
	FY total		696	320	320	320	320	320	2,296

[a]Cost in thousands of FY 1989 dollars.
[b]Tasks extending beyond FY 1989 are assumed unfunded.

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10.0 CHARACTERIZATION INTEGRATION

Integration of the Tank Waste Characterization Program is presented in several forms. Individual program requirements are given first. A matrix of TPP tasks and the user programs (Table 10-6) is given to show the beneficiaries of each task. An integrated schedule (Figure 10-1) shows the duration and status of each task. A cost rollup (Table 10-7) is presented showing dollars planned for each FY. The dollars shown are FY 1989 dollars.

10.1 PROGRAM REQUIREMENTS AND TECHNOLOGY PROGRAM PLAN TASKS

Each program's requirements are listed in the following tables. These requirements have been developed from information supplied by each program.

10.1.1 Grout Characterization Requirements

Inorganic analysis requirements to support formulation development:

- pH
- wt% volatiles
- Chemical constituents (Table 10-1).

Radionuclide analysis requirements to support formulation development are presented in Table 10-2.

Organic analysis requirements to support formulation development:

- No specific organic analysis required. Constituents of TOC will be identified by flowsheet proportions.

Physical analysis requirements to support formulation development:

- Specific gravity
- wt% settled solids
- wt% centrifuged solids
- wt% filtered solids
- Visible appearance
- Viscosity
- wt% water

Table 10-1. Inorganic Compound Analysis Required to Support Grout Treatment Facility.

Species	Formulation development*	Performance assessment*	Regulatory assessment*
Ag	5	41	0.5
Al	500	--	1,000
As	5	2	0.5
Ba	100	61	10
Ca	500	--	1,000
Cd	1	0.2	0.1
Cl	500	10,200	1,000
CN	--	--	1,000
CO_3	500	--	1,000
Cr^{+3}	--	--	0.5
Cr^{+6}	--	--	0.5
Cr	5	5	--
Cu	500	53	1,000
F	500	164	1,000
Fe	500	12	1,000
Hg	0.2	0.1	0.2
K	500	--	1,000
Mg	500	--	--
Mn	500	2	1,000
MnO_4	--	--	1,000
Mo	500	--	1,000
Na	500	--	1,000
Ni	500	--	1,000
NH_3	500	--	1,000
NO_2	500	41	1,000
NO_3	500	409	1,000
OH	500	--	1,000
Pb	5	0.8	0.5
PO_4	500	--	1,000
RE	500	--	--
Se	1	2	0.1
S^{2-}	--	--	1,000
SO_4	500	10,200	1,000
U	500	--	--
Zn	500	205	1,000
Zr	500	--	1,000
TOC	100	--	100

*All entries represent maximum permissable lower levels of detection in mg/L.
RE = Rare earth.

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- Storage tank temperature
- Dilution factor (estimate).

Inorganic compounds analysis to support performance assessment are presented in Table 10-1.

Radionuclide analysis requirements to support performance assessment are presented in Table 10-2.

Organic analysis requirements to support performance assessment are presented in Table 10-3. These organic compounds are not used on the Hanford Site, and therefore, are not expected in the wastes as explained in the RCRA Part B licensing for GTF. Flowsheet estimations will be used as the primary method for determining the status of these compounds in SST and DST wastes. A screening for organics will also be performed on GTF feed to determine if further analysis is required.

Physical property analysis to support performance assessment:

- Specific Gravity
- wt% filtered solids
- Storage tank temperature
- Dilution factor (estimate)
- Total waste quantity.

Inorganic compound analysis to support regulatory assessment are presented in Table 10-1.

- pH
- wt% water and volatiles.

Radionuclide analysis to support regulatory assessment as presented in Table 10-1.

Organic analysis to support regulatory assessment:

- Total organic halides
- Extractable organics
- Volatile organics
- Direct injection organics
- Analysis by sampling or flowsheet analysis or combination of methods. Direct waste analysis requires four separate analyses to detect materials at or below 0.1 mg/L.

Table 10-2. Radionuclide Analysis Required to Support the Grout Treatment Facility.

Species	Formulation development*	Performance assessment*	Regulatory assessment*
^{3}H	4.00 E - 02	4.09 E - 05	4.00 E - 03
^{14}C	8.00 E - 03	1.23 E - 06	8.00 E - 04
^{22}Na	--	2.45 E - 07	--
^{51}Cr	--	2.05 E - 05	--
^{54}Mn	--	1.23 E - 06	--
^{58}Co	--	8.18 E - 07	--
^{59}Fe	--	4.09 E - 07	--
^{59}Ni	2.20 E - 01	--	2.20 E - 02
^{60}Co	7.00 E - 01	1.23 E - 07	7.00 E - 02
^{63}Ni	3.50 E - 03	--	3.50 E - 04
^{79}Se	--	2.45 E - 06	--
^{89}Sr	--	2.45 E - 07	--
^{90}Sr	4.00 E - 05	1.64 E - 08	4.00 E - 06
^{94}Nb	2.00 E - 04	--	2.00 E - 05
^{95}Zr	--	8.18 E - 06	--
^{99}Tc	3.00 E - 03	2.45 E - 06	3.00 E - 04
^{103}Ru	--	1.23 E - 06	--
^{106}Ru	--	1.23 E - 07	--
^{125}Sb	--	1.23 E - 06	--
^{127}Te	--	4.09 E - 06	--
^{129}I	8.00 E - 05	1.23 E - 08	8.00 E - 06
^{137}Cs	1.00 E - 03	4.09 E - 08	1.00 E - 04
^{144}Pr	--	2.86 E - 06	--
^{227}Np	--	8.18 E - 11	--
^{238}U	--	1.23 E - 08	--
^{239}Pu	--	4.09 E - 09	--
^{241}Pu	5.30 E - 03	--	5.30 E - 04
^{241}Am	--	1.23 E - 09	--
^{242}Cm	3.00 E - 02	4.09 E - 08	3.00 E - 03
Other	2.00 E - 05	--	2.00 E - 06
Other TRU	2.50 E - 04	--	2.50 E - 05
Total Alpha	2.50 E - 04	--	2.50 E - 05
Total Beta	4.00 E - 05	--	4.00 E - 06
Total Pu	5.30 E - 03	--	5.30 E - 04
Total U	3.00 E - 08	--	3.00 E - 09

*All entries represent maximum permissible lower levels of detection in Ci/L.

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Table 10-3. Organic Analysis Requirements to Support Grout Treatment Facility Performance Assessment.[c]

Compound	MPLLD (mg/L)
Acrylamide[a]	--
Alachlor[a]	--
Aldicarb, nos[a]	0.37
Benzene	0.20
Carbofuran[a]	1.47
1,2 Dichloropropane	0.25
Chlordane[a]	--
Cis-1,2 Dichloroethylene	2.86
DBCP[a]	--
Styrene	5.73
2,4-D[a]	2.86
Vinyl chloride[b]	0.04
Ethylbenzene	27.81
Heptachlor[a]	--
Heptachlor epoxide[a]	--
p-Dichlorobenzene	30.68
Monochlorobenzene	2.45
1,2-Dichloroethane	0.20
Methoxychlor[a]	13.91
Trans-1,2-Dichloroethylene	2.86
PCBs	--
Toluene	8.18
2,4,5-TP[a]	2.13
Lindane[a]	0.01
Xylene	18.00
Trichloroethylene	0.20
0-Dichlorobenzene	25.36
Carbon tetrachloride	0.20
1,1,1-Trichloroethane	4.09
Pentachlorophenol	9.00
1,1-Dichloroethylene	0.29
EDB[a]	--
Toxaphene[a]	--
Epichlorohydrin[a]	--

[a]Compound is an insecticide. It will not be found in any grout waste feed streams because it is not used in any process which generates waste to be disposed of in grout.

[b]Compound is extremely volatile. If it had been used, it would have escaped from any wastes stored in actively ventilated tanks.

[c]Regulations require that these compounds be analyzed for if organic screening criteria for GTF feed is not met.

MPLLD = Maximum permissable lower level of detection.

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Analytical requirements for predictor development:

- Acid base neutral extractable organic analysis (SW-846, method 8250)
- Volatile organics (SW-846, method 8240)
- Chelators and complexants (PNL method)
- TOC (SW-846, method 9060)
- TOX (halides) (SW-846, method 9020).

10.1.2 Hanford Waste Vitrification Plant Characterization Requirements

Wastes requiring characterization for glass formulation and HWVP design:

- Wastes which will be pretreated
  - NCAW
  - PFP solids
  - CC
  - TRU NCRW
- HWVP feed during production at B Plant
- HWVP feeds after feed tanks are full
  - Pretreated NCAW
  - PFP solids
  - CC
- HWVP feed tank heels.

Sampling requirements:

- Need to be able to sample the following:
  - HWVP receiving tank heels
  - HWVP feeds
  - NCAW

- PFP solids
- CC

Sample requirements:

- NCAW core samples
- Tank 241-AZ-101
- Tank 241-AZ-102
- Heel samples before HWVP feed is introduced
- Tank 241-AY-101
- Tank 241-AY-102

Data base requirements:

- The HWVP data base for tank 25-1 samples taken at B Plant. Tank 25-1 will hold HWVP solids before transfer to tank farm storage.

Analytical requirements are presented in Table 10-4.

10.1.3 Single-Shell Tank Characterization Requirements

Single-shell tank waste characterization required to support the following:

- Satisfaction of regulatory requirements for waste analysis
- Final disposal decisions of SST wastes
- Disposal options for wastes that are retrieved
- Disposal options for wastes that are left in-place
- Categorization of wastes (e.g., dangerous waste, extremely hazardous waste).

Detailed planning for SST characterization requirements is currently being documented in the SST Waste Characterization Plan.

Table 10-4. Hanford Waste Vitrification Plant Analytical Requirements.

Species	Detection limit (accuracy in parenthesis)
Elemental Analysis Ag, Al, As, B, Be, Ca, Cd, Ce, Cr, Cr^{6+}, Cs, Cu, F, Fe, Hg, K, La, Li, Mg, Mn, Mo, N, Na, Nd, Ni, P, Pb, Pd, Rh, Ru, S, Se, Si, Sn, Ta, Ti, U, Zn, Zr,	1 E - 04M (± 5%)
Anions Cl^-, OH^-, CO_4^{2-}, F^-, NO_3^-, NO_2^-, CO_3^{2-}, I^-, PO_4^{3-}	1 E - 04M (± 5%)
Carbon TOC, TC	(± 5%)
Radionuclides ^{3}H, ^{59}Ni, ^{63}Ni, ^{79}Se, ^{90}Sr, ^{93}Zr, ^{99}Tc, ^{103}Ru, ^{106}Ru, ^{107}Pd, ^{126}Sn, ^{135}Cs, ^{137}Cs, ^{144}Ce, ^{147}Pm, ^{151}Sm, ^{154}Eu, ^{226}Ra, ^{230}Th, ^{232}Th, ^{237}Np, ^{241}Am, ^{243}Am, ^{242m}Am, U isotopic, Pu isotopic	(± 5%)
^{129}I ^{14}C	1 E - 05 µCi/L (± 5%) 1 E - 05 µCi/L (± 5%)
Physical Analysis Specific gravity Solids settling rate Bulk settled solids (%) Centrifuged solids (%) Suspended solids (%) Particle size distribution Abrasiveness (Miller Number) Viscosity Oxides (wt%) Yield stress Heat capacity	
Other Analyses pH Formic acid addition Reducing potential	

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10.1.4 Single-Shell Tank Interim Stabilization Characterization Requirements

Single-shell tank and SWL characterization necessary to resolve the following interim stabilization issues:

- High-heat load tanks
- Sludge porosity
- SWL segregation
- SWL disposal options
- 241-T Tank Farm SWL pumping
- SST release impacts.

High-heat load tank requirements:

- Determine tank 241-C-106 sludge thermal conductivity.
- Perform development studies to support tank 241-C-106 retrieval alternative.
- Look at feasibility of pretreating tank 241-C-106 sludge like NCAW.
- Scale model tank retrieval studies with tank 241-C-106 simulant.
- Develop a more accurate method to determine the heat loads of the six suspect high-heat load tanks.

Sludge porosity requirements:

- Develop method for interstitial liquid/porosity measurement in sludges.
- Determine porosity of solids in the following tanks:
  - 241-C-102
  - 241-C-107
  - 241-C-110
  - 241-S-104
  - 241-C-104
  - 241-C-103.

Waste segregation sampling requirements:

- Analyze SWL samples from DCRTs for TOC and TRU.

Impact of SST constituents on disposal assessment:

- Sample SWL to determine need for sampling SST waste and components to be analyzed.
- Obtain and analyze SST core samples.
- Obtain SWL sample in DCRT.

Pumping of 241-T Tank Farm waste:

- Sample and analyze several 241-T Farm tanks.

Impact modeling of releases from SSTs:

- Characterize SST wastes per SST WCP.

10.1.5 Retrieval Characterization Requirements

Sample data requirements:

- Core sample data from tanks to be retrieved include the following waste types.

- NCAW
- DSSF/DSS
- NCRW
- PFP
- CC

Sample archive requirements:

- 1-yr minimum storage.

Solid/liquid interface instrumentation requirements:

- LOW installation in waste receiver tank

- Gamma probe
- Neutron probe

- Buoyancy probe installation in waste donor tank.

Physical analysis requirements:

- Shear stress versus shear rate rheograms
- Shear strength

- Penetrometer measurement
- Abrasiveness (Miller number)
- Density
- Particle size distribution
- Solids settling rate
- Weight % water
- Volume % settled solids
- Volume % centrifuged solids.

There may be other requirements depending on the sample.

10.1.6 Neutralized Cladding Removal Waste-Transuranic Characterization Requirements

Sample and analyze the following to meet NCRW-TRU characterization requirements:

- Existing NCRW sludge to determine TRU content
- Future NCRW sludges to determine TRU content.

The NCRW-TRU characterization required to support:

- Waste disposal options development
- The PUREX TRU removal operations verification.

10.1.7 Neutralized Current Acid Waste Pretreatment Characterization Requirements

Neutralized Current Acid Waste Characterization required to support the following:

- The HWVP feed composition specifications and flow sheet development
- The NCAW pretreatment specifications and flowsheet development
- Grout feed specifications and flow sheet development
- Retrieval operations.

B Plant NCAW processing analytical requirements are presented in Table 10-5.

Table 10-5. B Plant NCAW Processing Analytical Requirements. (Sheet 1 of 3)

Laboratory method	Analyte	Form	Detection level requirement	Accuracy requirement ± significant %	Program requesting analysis	
					GTF	HWVP
APP/OTR		Slurry				
pH	[d]	Supernate	7 - 14	4.0		
ICP	Al[d]	Supernate	1.00 E - 03	10.0		
ICP	Al	Slurry	1.00 E - 04	10.0		X
Atomic absorption	As	Slurry	1.00 E - 04	10.0		X
ICP	Ba	Slurry	1.00 E - 04	10.0		X
ICP	Ca	Slurry	1.00 E - 04	10.0		X
ICP	Cr	Slurry	1.00 E - 04	5.0		X
Various spec. methods	Cr^{6+}	Slurry	1.00 E - 04	10.0		X
Atomic absorption	Cs[d]	Supernate	1.00 E - 04	10.0		
Atomic absorption	Cs	Slurry	1.00 E - 04	10.0		X
ICP	Fe[d]	Supernate	2.00 E - 04	5.0		
ICP	Fe	Slurry	1.00 E - 04	10.0		X
Atomic absorption	Hg	Slurry	1.00 E - 04	10.0		X
ICP	K[d]	Supernate	5.00 E - 03	5.0		
ICP	Mg	Slurry	1.00 E - 04	5.0		X
ICP	Na[d]	Supernate	9.00 E - 03	10.0		
ICP	Na	Slurry	1.00 E - 04	5.0		X
ICP	Ni	Slurry	1.00 E - 04	5.0		X
ICP	P	Slurry	1.00 E - 04	5.0		X
ICP	Pd	Slurry	1.00 E - 04	5.0		X
Alpha total	Pu total	Slurry	1.90 E - 09 g/L	15.0		X
Atomic absorption	Rb[d]	Supernate	1.00 E - 06	15.0		
ICP	RE (LaNd)	Slurry	1.00 E - 04	10.0		X
ICP	Rh	Slurry	1.00 E - 04	5.0		X
ICP	Ru	Slurry	1.00 E - 04	5.0		X
ICP	Sb	Slurry	1.00 E - 04	5.0		X
Atomic absorption	Se	Slurry	1.00 E - 04	5.0		X
ICP	Si	Slurry	1.00 E - 04	5.0		X
ICP	Sn	Slurry	1.00 E - 04	5.0		X
ICP	Ti	Slurry	1.00 E - 04	10.0		X
ICP	Zr	Slurry	1.00 E - 04	5.0		X

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Table 10-5. B Plant NCAW Processing Analytical Requirements. (Sheet 2 of 3)

Laboratory method	Analyte	Form	Detection level requirement	Accuracy requirement ± significant %	Program requesting analysis	
					GTF	HWVP
ICP	Other[b]	Slurry	1.00 E - 04	10.0		X
Ion chromatography	Cl^-	Slurry	1.00 E - 04	5.0		X
Ion chromatography	F^-	Slurry	1.00 E -04	5.0		X
Ion chromatography	NO_3^-	Supernate	1.00 E - 04	5.0	X	X
Ion chromatography	SO_4^{2-}[d]	Supernate	1.00 E - 03	2.0		
Ion chromatography	SO_4^{2-}	Slurry	1.00 E - 04	5.0		X
Thermal titration	OH^-	Supernate	1.50 E - 02	20.0	X	X
Various spec. methods	NO_2^-	Supernate	4.70 E - 03	15.0	X	X
Various spec. methods	CO_3^{2-}[d]	Slurry	1.60 E - 01	20.0		
Various spec. methods	PO_4^{3-}[d]	Supernate	4.00 E - 04	5.0		
Various spec. methods	PO_4^{3-}	Slurry	1.00 E - 4	5.0		X
Various spec. methods	TOC	Supernate	2.00 E - 02 g/L	3.0	X	
Various spec. methods	TOC	Slurry	2.00 E - 02 g/L	5.0		X
Gamma energy analysis	^{144}CePr	Supernate	1.00 E +04	20.0	X	
Gamma energy analysis	^{144}CePr	Slurry	1.00 E +04	20.0		X
Gamma energy analysis	^{60}Co	Supernate	2.00 E +04	20.0	X	
Gamma energy analysis	^{60}Co	Slurry	1.50 E +04	20.0		X
Gamma energy analysis	^{134}Cs	Supernate	3.60 E +05	20.0	X	
Gamma energy analysis	^{134}Cs	Slurry	3.60 E +05	20.0		X
Gamma energy analysis	^{137}CsBa	Supernate	2.40 E +04	20.0	X	
Gamma energy analysis	^{137}CsBa	Slurry	2.10 E +04	7.0		X
Separation-GEA	^{129}I	Supernate	1.00 E - 05	20.0	X	
Separation-GEA	^{129}I	Slurry	1.00 E - 05	20.0		X
Alpha total	^{239}Pu	Supernate	10 nCi/g	18.0	X	X
Gamma energy analysis	^{106}RhRu	Supernate	5.00 E +05	20.0	X	
Gamma energy analysis	^{106}RhRu	Slurry	5.00 E +05	20.0		X
Gamma energy analysis	^{103}Ru	Slurry	1.00 E +04	10.0		X
Gamma energy analysis	^{125}Sb	Supernate	6.30 E +05	20.0	X	
Gamma energy analysis	^{125}Sb	Slurry	6.30 E +05	10.0		X
Gamma energy analysis	^{95}ZrNb	Slurry	3.30 E +05	15.0		X
Gamma energy analysis	Other[c]		Varies	20.0		X
Separation-AT/AEA	^{239,240}Pu	Supernate	10 nCi/g	10.0	X	

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Table 10-5. B Plant NCAW Processing Analytical Requirements. (Sheet 3 of 3)

Laboratory method	Analyte	Form	Detection level requirement	Accuracy requirement ± significant %	Program requesting analysis	
					GTF	HWVP
Separation-AT/AEA	$^{239,240}Pu$	Slurry	10 nCi/g	20.0		X
Separation-AT/AEA	^{241}Am	Supernate	10 nCi/g	10.0	X	
Separation-AT/AEA	^{241}Am	Slurry	10 nCi/g	20.0		X
Separation-AT/AEA	^{237}Np	Supernate	10 nCi/g	20.0	X	
Separation-AT/AEA	^{237}Np	Slurry	10 nCi/g	25.0		X
Alpha energy analysis	Alpha-Act.	Slurry	Varies	5.0		X
DNAAS	TRU	Supernate	10 nCi/g	20.0	X	
Laser fluorimeter	U	Slurry	1.00 E - 03 g/L	10.0		X
Oxidation scintill.	^{14}C	Supernate	1.00 E - 01	2.0	X	
Oxidation scintill.	^{14}C	Slurry	1.00 E - 01	5.0		X
Separation-total beta	^{147}Pm	Slurry	2 nCi/g	15.0		X
Beta analysis	^{79}Se	Supernate	4.00 E - 01	20.0	X	
Separation-total beta	^{90}Sr	Supernate	2.10 E + 05	20.0	X	
Separation-total beta	^{90}Sr	Slurry	1.00 E - 02	5.0		X
Separation-total beta	^{99}Tc	Supernate	4.00 E - 01	5.0	X	
Separation-total beta	^{99}Tc	Slurry	4.00 E - 01	5.0		X
	Total A	Slurry	1.40 E - 01	15.0		X
	Total B	Slurry	1.20 E - 01	15.0		X
Physical measurement	wt%	Solids	1	5.0		X
Physical measurement	vol%	Solids	1	25.0		X
Physical measurement	SpG[d]	Slurry	1	5.0		
Physical measurement	Oxides	Calcined	10 g/L	5.0		X

[a]Units: Molarity (chem-organic) or uCi/L (radionuclide) except as noted.
[b]Other: Ag, B, Bi, Cd, Ce, Co, Cu, K, Li, Mn, Mo, Pb, Sr, and Ta.
[c]Other isotopes: ^{155}Eu, ^{51}Cr, ^{59}Fe, and ^{113}Sn.
[d]Requested solely by B Plant.

DNAAS = Delayed neutron and activation analysis system.
AT = Alpha total.
AEA = Alpha energy analysis.
GEA = Gamma energy analysis
APP/OTR = Appearance/over top reading.
ICP = Inductively coupled plasma.

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10.1.8 Tank Farm Technology Characterization Requirements

Complete the following tasks to meet Tank Farm Technology characterization requirements:

- Develop accurate sludge level determination method(s).
- Improve LOW/detector capability.
- Maintain existing sampling capability.
- Conduct a sample transport system integration study.
- Define regulatory requirements.
- Define sampling and transport equipment needs.
- Define regulatory requirements for archived samples.
- Assess economics for a sample archive.
- Construct/designate a storage facility for archived samples.
- Integrate sample/analysis requests.
- Maintain DST waste characterization data base.
- Develop an "insoluble" solids analysis method.

10.1.9 Complexant Concentrate Pretreatment Characterization Requirements

Complexant Concentrate characterization required to support:

- Retrieval technology development
- Pretreatment technology development
- Flowsheet development
- Cost estimates
- Grout and glass technology development
- Grout and glass technology development
- Regulatory assessments
- Disposal criteria and standards development.

Analytical requirements:

- **Physical properties**
  - Visual analysis
  - Volume % settled solids
  - Volume % centrifuged solids
  - Density
  - wt% water
  - Particle size distribution
  - Rheological evaluation
  - % water soluble solids
  - Abrasiveness (Miller number)
  - Resuspension characteristics (penetrometer)
  - Solids settling rate
  - pH
- **Chemical constituents**

- cations (by ICP)	- OH^-	- NO_2^-	- NO_3^-
- PO_4^{3-}	- Cl^-	- SO_4^{2-}	- F^-
- CO_3^{2-}	- TC	- HEDTA/EDTA	- TOC
- VOA	- glycolate	- TOX	- A/B/N organics
- S^{2-}	- CN^-	- Fe^{2+}, Fe^{3+}	- Hg, As, Se, Cr

- **Radiochemical constituents/properties**

- alpha total	- beta total	- radionuclides (by GEA)	- Pu-isotopic
- U total	- ^{3}H	- ^{14}C	- ^{59}Ni
- ^{60}Co	- ^{63}Ni	- ^{79}Se	- ^{90}Sr
- ^{94}Nb	- ^{99}Tc	- $^{106}Ru/Rh$	- ^{129}I
- ^{134}Cs	- ^{137}Cs	- ^{241}Am	

Detection limit requirements are not stated for any of the chemical or radiological species.

10.1.10 Plutonium Finishing Plant Pretreatment Characterization Requirements

Plutonium Finishing Plant (PFP) characterization required to support:

- Pretreatment technology development
- Flowsheet development
- Cost estimates
- TGF and HWVP technology development.

Detailed planning for PFP sludge pretreatment technology development has begun but some characterization needs and parameters have not yet been determined.

It is estimated that PFP characterization efforts must begin by FY 1990 to support retrieval of solids for Pilot Plant operations in FY 1996.

The TPP should assume a FY 1990 start for PFP characterization for pretreatment.

10.1.11 Tank Farm Process Engineering Characterization Requirements

Complete the following tasks to meet Tank Farm Process Engineering characterization requirements:

- Upgrade sludge sampler to provide enclosure and shielding.
- Maintain existing sampling capability.

Table 10-6. Tank Farm Waste Characterization Technology Program Plan Program Matrix. (Sheet 1 of 6)

Task	Identification	Waste Management programs affected											Priority
		GTF	HWVP	NCAW pre-treatment	CC pre-treatment	PFP pre-treatment	Retrieval	SST stabi-lization	SST charac-terization	NCRW issues	TFPE	Tank farm technology	
TPP methods development: analytical methods													
2.3.1	As, Hg, and Se	X	X						X				
2.3.2	Sulfide and cyanide	X	X						X				
2.3.3	TCLP	X							X				
2.3.4	Organics	X	X		X								
2.3.5	Solids dissolution		X	X	X				X			X	
2.3.6	Separation tech. for IC and ICP	X	X	X									
2.3.7	Carbon	X	X	X	X				X				
2.3.8	Rheological evaluation of NCAW		X				X						
2.3.9	Automated analysis systems	X		X							X	X	
2.3.10	DNAAS	X	X	X							X	X	
2.3.11	Key radionuclide selection								X				
2.3.12	Chemicals in SSTs								X				
2.3.13	Key radionuclide adequacy								X				
2.3.14	Parameters of interest								X				
2.3.15	SST analytical capabilties								X				
2.3.16	RCRA analytical requirements	X	X	X	X	X	X	X	X	X	X	X	
2.3.17	Remote particle size		X	X									
2.3.18	Cr^{6+}		X	X					X				
2.3.19	Hg	X	X	X					X				

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Table 10-6. Tank Farm Waste Characterization Technology Program Plan Program Matrix. (Sheet 2 of 6)

Task	Identification	Waste Management programs affected											Priority
		GTF	HWVP	NCAW pre-treatment	CC pre-treatment	PFP pre-treatment	Retrieval	SST stabi-lization	SST charac-terization	NCRW issues	TFPE	Tank farm technology	
TPP methods development: analytical methods (cont.)													
2.3.20	Noble metals		X	X									
2.3.21	Trace heavy metals	X	X	X									
2.3.22	Sb and Te		X	X									
2.3.23	Rare earth separations		X	X									
2.3.24	^{79}Se	X		X									
2.3.25	^{129}I		X	X									
2.3.26	EDS solids		X		X		X				X	X	
2.3.27	Porosity (canceled)							X					
2.3.28	Thermal conductivity							X					
2.3.29	Penetrometer testing						X						
2.3.30	Physical evaluation of DST wastes		X				X						
2.3.31	Ruthenium in NCAW		X	X									
2.3.32	SST waste characterization plan								X				
2.3.33	Hazardous characteristics procedures	X							X				
2.3.34	Analytical needs from SST waste characterization plan								X				
2.3.35	Thermal titration for CC waste	X	X		X				X				
TPP methods development: in situ methods													
3.3.1.1	Improve liquid level detection limits for SSTs (canceled)							X					
3.3.1.2	Methods for separable organics										X	X	

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Table 10-6. Tank Farm Waste Characterization Technology Program Plan Program Matrix. (Sheet 3 of 6)

Task	Identification	Waste Management programs affected											Priority
		GTF	HWVP	NCAW pre-treatment	CC pre-treatment	PFP pre-treatment	Retrieval	SST stabi-lization	SST charac-terization	NCRW issues	TFPE	Tank farm technology	
TPP methods development: in situ methods (cont.)													
3.3.2.1	LOW technology (canceled)						X	X			X	X	
3.3.2.2	Shear vane technology						X	X					
3.3.2.3	Sludge-level measurement technology						X				X	X	
3.3.2.4	Suspended solids determination						X				X		
3.3.2.5	Maintain existing LOW technology							X			X	X	
3.3.3.1	Assay technology	X	X	X	X	X		X	X		X	X	
3.3.3.2	Implement in situ characterization	X	X	X	X	X		X	X		X	X	
3.3.3.3	Volatile organic sampling train	X						X					
3.3.3.4	In situ and remote sensing methods evaluation for SST								X				
TPP methods development: sampling methods													
4.3.1	Aging waste sampling		X	X	X	X	X				X	X	
4.3.2	CST modifications for hardcake sampling							X	X				
4.3.3	TMI core sampler (canceled)								X			X	
4.3.4	B Plant sampler (canceled)		X										
4.3.5	Composite core sampling (canceled)							X				X	
4.3.6	Upgrade sludge sampler (bottle-on-a-string)	X					X	X			X	X	
4.3.7	Isolok sampler for 241-AP Farm (canceled)	X											
4.3.8	Assessment of sampling methods								X				

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Table 10-6. Tank Farm Waste Characterization Technology Program Plan Program Matrix. (Sheet 4 of 6)

Task	Identification	Waste Management programs affected											Priority
		GTF	HWVP	NCAW pre-treatment	CC pre-treatment	PFP pre-treatment	Retrieval	SST stabi-lization	SST charac-terization	NCRW issues	TFPE	Tank farm technology	
TPP methods development: sampling methods (cont.)													
4.3.9	Maintain existing sampling capability	X	X	X	X	X	X	X	X	X	X	X	
4.3.10	Second CST and supporting equipment	X	X	X	X	X	X	X	X	X	X	X	
TPP methods development: sample transportation and storage													
5.1.3.1	Transport system integration	X	X	X	X	X	X	X	X	X	X	X	
5.1.3.2	Regulatory issues	X	X	X	X	X	X	X	X	X	X	X	
5.1.3.3	Sample volume for GTF and HWVP	X	X										
5.1.3.4	Fabricate additional sample pigs	X	X	X	X	X	X	X	X	X	X	X	
5.1.3.5	Core sample loader for hot cell		X	X	X	X	X	X	X	X		X	
5.1.3.6	Low-activity core sample transport cask fabrication								X				
5.1.3.7	NCAW core sample transport cask		X	X			X						
5.2.3.1	Sample storage regulations review	X	X	X	X	X	X	X	X	X	X	X	
5.2.3.2	Sample archiving economics	X	X	X	X	X	X	X	X	X	X	X	
5.2.3.3	Sample archiving facility	X	X	X	X	X	X	X	X	X	X	X	
5.2.3.4	Maintain existing SST sample archive								X				
TPP methods development: sample control and database management													
6.1.3.1	Sample/analysis system study	X	X	X	X	X	X	X	X	X	X	X	

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Table 10-6. Tank Farm Waste Characterization Technology Program Plan Program Matrix. (Sheet 5 of 6)

Task	Identification	Waste Management programs affected											Priority
		GTF	HWVP	NCAW pre-treatment	CC pre-treatment	PFP pre-treatment	Retrieval	SST stabi-lization	SST charac-terization	NCRW issues	TFPE	Tank farm technology	
TPP methods development: sample control and database management (cont.)													
6.1.3.2	Sample/analysis system modification and operation	X	X	X	X	X	X	X	X	X	X	X	
6.2.3.1	SST waste records management								X				
6.2.3.2	DST characterization database	X	X	X	X	X	X	X	X	X	X	X	
6.2.3.3	DSS/DSSF database and composition variability study	X											
6.2.3.4	HWVP database		X										
6.2.3.5	Convert TRAC to CRAY system								X				
6.2.3.6	Evaluate TRAC for hazardous material (canceled)								X				
6.2.3.7	Develop TRAC statistical techniques (canceled)								X				
6.2.3.8	Complete TRAC assessment for component prediction (canceled)								X				
6.2.3.9	Assess TRAC improvement (canceled)								X				
6.2.3.10	TRAC program and data storage								X				
6.2.3.11	Develop SST statistical database								X				
6.2.3.12	Environmental management database								X				

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Table 10-6. Tank Farm Waste Characterization Technology Program Plan Program Matrix. (Sheet 6 of 6)

Task	Identification	Waste Management programs affected											Priority
		GTF	HWVP	NCAW pre-treatment	CC pre-treatment	PFP pre-treatment	Retrieval	SST stabi-lization	SST charac-terization	NCRW issues	TFPE	Tank farm technology	
TPP methods development: tank sampling													
7.3.2.1	Identify tanks to be sampled for SST characterization								X				
7.3.2.2	Develop RCRA sampling plans and procedures for SST characterization								X				
7.3.2.3	Sample and analyze SSTs for SST characterization								X				
7.3.2.4	Complete sampling and analysis of SSTs if TRAC not adequate								X				
TPP methods development: Quality Assurance (QA)													
8.3.1	QA support	X	X	X	X	X	X	X	X	X	X	X	
8.3.2	QA program plan for SST waste								X				
TPP methods development: tank characterization planning													
9.1.2.1	SST characterization plan revision								X				
9.1.2.2	Consultation with regulatory agencies								X				
9.1.2.3	Independent technical review								X				
9.1.2.4	SST systems analysis baseline plan and schedule								X				
9.2.2.1	Tank farm waste characterization TPP	X	X	X	X	X	X	X	X	X	X	X	

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Table 10-7. Cost Summary--Characterization Integrated. (Sheet 1 of 5)

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
		Cost Summary--Analytical Development							
2.3.1	As, Hg, Se (Hg to be completed as part of Section 2.3.19)	(Completed)							
2.3.2	S^{2-}, CN^-	WP, HL	54, 19						73
2.3.3	TCLP	WP	15						15
2.3.4	Organics - Total organic halides - Chelator and complexants and extractable organics	WP, EK	19, 339						358
2.3.5	Solids dissolution	HL	36						36
2.3.6	Separation technology for IC and ICP	HL		63					63
2.3.7	Carbon (^{14}C, TOC, TC)	HL	112						112
2.3.8	Rheological evaluation of NCAW	(Completed)							
2.3.9	Automated laboratory analysis system	HL		137					137
2.3.10	DNAS	HL	56	23					79
	- Demonstrate	(Completed)							
	- Develop Pu method and evaluate for other methods								
2.3.11	Key radionuclide selection (to be completed as part of Section 2.3.32)	(Closed)							
2.3.12	List chemicals in SSTs	(Completed)							
2.3.13	Key radionuclide adequacy (to be completed as part of Section 2.3.32)	(Closed)							
2.3.14	Parameters of interest	EF	63						63
2.3.15	SST analytical capabilities (to be completed as part of Section 2.3.32)	(Closed)							
2.3.16	RCRA analytical requirements	EF	1,255	5,647	6,902	4,769	1,130	251	19,954
		WL	7,933[d]	10,530	12,213	8,975	1,831	439	41,921
		HEC			9,315	9,315			18,630
2.3.17	Remote particle size	HL		88	88				176
2.3.18	Cr^{6+}	HL							TBD

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Table 10-7. Cost Summary--Characterization Integrated. (Sheet 2 of 5)

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total[a]
Cost Summary--Analytical Development (Cont.)									
2.3.19	Hg	EF, WP	125, 31						156
2.3.20	Noble metals	HL		141					141
2.3.21	Trace heavy metals (to be completed as part of Section 2.3.6)	(Closed)							
2.3.22	Sb and Te	HL		39	38				76
2.3.23	Rare earth separations	HL		19	19				38
2.3.24	^{79}Se	WP	89						89
2.3.25	^{129}I	HL							TBD
2.3.26	EDS solids	HL		113	25				138
2.3.27	Porosity	Canceled. No method developed.							
2.3.28	Thermal conductivity	WB, HL		125, 125					250
2.3.29	Penetrometer testing	HL	6[b]						6
2.3.30	Physical evaluation of DST wastes	HL		16					16
2.3.31	Ruthenium in NCAW	HL	100	63	63	63			289
2.3.32	SST WCP	EF	590						590
2.3.33	Hazardous Characteristics Procedures	EF	50						50
2.3.34	Analytical needs from SST Waste Characterization Plan	EF	6						6
2.3.35	Thermal titration for CC waste	HL		13					13
Cost Summary--In-Situ Characterization									
3.3.1.1	Improve liquid-level detection methods for SSTs	(Canceled)							
3.3.1.2	Methods for separable organics	WB				125			125
3.3.2.1	Develop LOW technology	(Canceled)							
3.3.2.2	Develop shear vane technology	On hold. Reevaluation pending.							
3.3.2.3	Develop sludge-level measurement technology	WB	31	31					62
3.3.2.4	Develop in situ suspended solids method	WB		69					69
3.3.2.5	Maintain existing LOW technology	WB	19	19	19	19	19	19	114

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Table 10-7. Cost Summary--Characterization Integrated. (Sheet 3 of 5)

Task	Description	Program	Fiscal year[a] 1989	1990	1991	1992	1993	1994	Total[a]
	Cost Summary--In-Situ Characterization (Cont.)								
3.3.3.1	Develop in situ assay technology	(TBD)		25					25
3.3.3.2	Implement in situ characterization technology	(TBD)			134				134
3.3.3.3	Develop VOST method	WB	63						63
3.3.3.4	In situ and remote sensing methods evaluation for SST waste characterization	EF		25					25
	Cost Summary--Sampling Methods Development								
4.3.1	Aging waste sampling	HL	188	314					502
4.3.2	Core sampling truck modifications for hardcake sampling	EF	75	75					150
4.3.3	TMI core sampler	(Canceled)							
4.3.4	B Plant sampler	(Canceled)							
4.3.5	Composite core sampling	(Canceled)							
4.3.6	Upgraded bottle-on-a-string	WB		502					502
4.3.7	ISOLOK sampler at 241-AP Tank Farm	(Canceled)							
4.3.8	Assessment of sampling methods for SST characterization	EF	75	113					188
4.3.9	Maintenance of existing sampling capability	EF	125	439	125	125	125	125	1,064
4.3.10	Second CST and supporting equipment	EF		816	816				1,632
	Cost Summary--Sample Transportation								
5.1.3.1	Transportation system integration	HL, EF	94, 94						188
5.1.3.2	Regulatory concerns	HL	38						38
5.1.3.3	Sample volume for GTF and HWVP	WP	25						25
5.1.3.4	Fabrication of additional sample pigs	WB		161					161
5.1.3.5	Core sampler loader	(Complete)							
5.1.3.6	Low-activity core sample transport cask fabrication	EF			125				125
5.1.3.7	NCAW core sample transport cask fabrication	HL	75	75					150

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Table 10-7. Cost Summary--Characterization Integrated. (Sheet 4 of 5)

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
	Cost Summary--Sample Storage								
5.2.3.1	Sample storage regulations	HL	25						25
5.2.3.2	Sample archiving economics	HL	44						44
5.2.3.3	Sample archiving facility	HL	13	38					51
5.2.3.4	Maintenance of existing SST sample archives	WB	38	38	38	38	38	38	228
	Cost Summary--Sampling Integration								
6.1.3.1	Study of sampling and analysis system	(Complete)							
6.1.3.2	Sampling and analysis system modification	HL	44						44
6.1.3.2	Sample and analysis system operation	HL		25	25	25	25	25	125
	Cost Summary--Data Base Management								
6.2.3.1	SST waste records management	EF	25	25	25	25	25	25	150
6.2.3.2	Characterization data base	HL	50	50	50	50	50	50	300
6.2.3.3	DSS/DSSF data base and feed composition variability study	WP	25	25	25	25	25	25	150
6.2.3.4	HWVP feed data base	(TBD)			63	38	38	38	177
6.2.3.5	Convert TRAC to CRAY computer system	(Complete)							
6.2.3.6	Evaluate TRAC for hazardous material	(Canceled)							
6.2.3.7	Develop TRAC statistical techniques	(Canceled)							
6.2.3.8	Complete TRAC assessment for component prediction	(Canceled)							
6.2.3.9	Assess TRAC improvement	(Canceled)							
6.2.3.10	Storage of TRAC data and programs	EF	6	6	6	6	6	6	36
6.2.3.11	SST statistical data base	EF	31	25	25	25	25	25	156
6.2.3.12	Environmental management data base	EF	44	31	31	31	31	31	199

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Table 10-7. Cost Summary--Characterization Integrated. (Sheet 5 of 5)

Task	Description	Program	Fiscal year[a]						Total[a]
			1989	1990	1991	1992	1993	1994	
Cost Summary--Sampling									
7.3.1	DST sampling	HL	1,860	1,581	1,130	1,581	1,130	678	7,960
		WB	318	477	452	TBD	TBD	TBD	1,247
		WP	424	TBD	TBD	TBD	TBD	TBD	424
7.3.2	SST sampling	EF	990	2,711	4,518	4,518	4,970	9.940	27,647
Cost Summary--Quality Assurance									
8.3.1	QA support	WB, HL, EF	38, 50, 38	126	126	126	126	126	756
8.3.2	QA program plan for SST waste	EF	107						107
Cost Summary--Characterization Planning									
9.1.2.1	Tank Farm Waste Characterization Technology Program Plan	HL	31	31	31	31	31	31	186
9.2.2.1	SST WCP revision	(Complete)							
9.2.2.2	Consultation with regulatory agencies	EF	38	38	38	38	38	38	228
9.2.2.3	Independent technical review	EF	251	251	251	251	251	251	1,506
9.2.2.4	SST systems analysis baseline plan and schedule	EF	376						376
	Program funding beakdown	EF Funded	4,364	0	0	0	0	0	4,364
		EK Funded	339	0	0	0	0	0	339
		HEC Funded	0	0	9,315	9,315	0	0	18,630
		HL Funded	2,841	0	0	0	0	0	2,841
		WB Funded	507	0	0	0	0	0	507
		WL Funded	2,168	0	0	0	0	0	2,168
		WP Funded	682	0	0	0	0	0	682
		Unfunded[d]	5,765	25,283	27,401	20,884	9,914	12,161	101,408
	FY total		16,666	25,283	36,716	30,199	9,914	12,161	130,939

[a]Cost in thousands of FY 1989 dollars.
[b]An additional $3,000 must be appropriated for this task when mid-year CAPS review is conducted.
[c]Tasks extending beyond FY 1989 are assumed unfunded.
[d]Only $2,168K have been funded. The remaining $5,765K is expected to be allocated in mid FY 1989.

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Figure 10-1. Waste Tank Characterization Technology Program Plan Integrated Task Schedule. (Sheet 1 of 7)

Task	Description	Fiscal Year 1989	1990	1991	1992	1993	1994	Status beginning in FY 1989
	Analytical Development							
2.3.1	As, Hg, Se	(Completed)						As and Se done. Hg included as part of Section 2.3.19.
2.3.2	S^{2-}, CN^-	●——●						CN method successful. Need to modify for hot-cell use.
2.3.3	TCLP	●——	——●					
2.3.4	Organics – Total organic halides – Chelator and complexants and extractable organics	●——●						Organic halide method being established for routine use.
2.3.5	Solids dissolution	●——●						Fusion methods unreliable. Microwave equipment ordered.
2.3.6	Separation technology for IC and ICP		●——●					
2.3.7	Carbon (^{14}C, TOC, TC)	●——●						^{14}C method funded FY 1989.
2.3.8	Rheological evaluation of NCAW	(Completed)						
2.3.9	Automated laboratory analysis systems		●——●					
2.3.10	DNAAS – Demonstrate – Develop Pu method and evaluate for other methods	(Completed) ●——	 ——●					DNAAS demonstrated. Needs development for Pu analysis.
2.3.11	Key radionuclide selection for SST characterization	(Closed)						To be completed as part of Section 2.3.32.
2.3.12	Chemicals known to be stored in SST's	(Completed)						No chemical amounts included.

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Figure 10-1. Waste Tank Characterization Technology Program Plan Integrated Task Schedule. (Sheet 2 of 7)

Task	Description	Fiscal Year						Status beginning in FY 1989
		1989	1990	1991	1992	1993	1994	
	Analytical Development (Cont.)							
2.3.13	Characterization of key radionuclides	(Closed)						To be completed as part of Section 2.3.32.
2.3.14	Parameters of interest in SST waste characterization	●——●						Draft PNL document released.
2.3.15	Requirements for SST waste characterization	(Closed)						To be completed as part of Section 2.3.32.
2.3.16	RCRA analytical requirements for SST waste characterization[a]	●——	——	——	——	——	——●	Additional hot cells needed.
2.3.17	Remote particle size		●——	——●				Method needs to be evaluated.
2.3.18	Cr^{6+}	●——	——●					
2.3.19	Hg	●——●						No funding identified.
2.3.20	Noble metals	●——	——●					To be completed as part of Section 2.3.6.
2.3.21	Trace heavy metals	(Closed)						
2.3.22	Sb and Te		●——	——●				Sb method in use. Te method not yet viable.
2.3.23	Rare earth separations		●——	——●				^{147}Pm demonstrated by LC.
2.3.24	^{79}Se	●——●						No funding identified.
2.3.25	^{129}I	●——●						
2.3.26	EDS solids		●——	——●				No method developed.
2.3.27	Porosity	(Canceled)						
2.3.28	Thermal conductivity		●——●					
2.3.29	Penetrometer testing	●——●						

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Figure 10-1. Waste Tank Characterization Technology Program Plan Integrated Task Schedule. (Sheet 3 of 7)

Task	Description	Fiscal Year						Status beginning in FY 1989
		1989	1990	1991	1992	1993	1994	
	Analytical Development (Cont.)							
2.3.30	Physical evaluation of DST wastes							Miller number apparatus installed in 325 Building.
2.3.31	Ruthenium in NCAW							
2.3.32	SST WCP							
2.3.33	Hazardous Characteristics Procedures							
2.3.34	Analytical needs from SST WCP							
2.3.35	Thermal titration for CC waste							
	In Situ Characterization Methods Development							
3.3.1.1	Improve liquid-level detection methods for SSTs	(Canceled)						Outside scope of this document.
3.3.1.2	Develop in-situ detection methods for separable organics							
3.3.2.1	Develop LOW technology	(Canceled)						Outside scope of this document.
3.3.2.2	Develop shear vane technology	(On hold. Reevaluation pending.)						Test results unsatisfactory.
3.3.2.3	Develop sludge-level measurement technology							
	- Technical exchange							
	- Alternative method study							
	- Design and fabrication							
	- Develop test plan							
	- Test and test report							Method designed. Not built.
3.3.2.4	Develop in situ suspended solids method							

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Figure 10-1. Waste Tank Characterization Technology Program Plan Integrated Task Schedule. (Sheet 4 of 7)

Task	Description	Fiscal Year 1989	1990	1991	1992	1993	1994	Status beginning in FY 1989
	In Situ Characterization Methods Development (Cont.)							
3.3.2.5	Maintain existing LOW technology							
3.3.3.1	Develop in situ assay technology							
3.3.3.2	Implement in situ characterization technology							
3.3.3.3	Develop VOST method							
3.3.3.4	In situ and remote sensing methods evaluation for SST waste characterization							
	Sampling Methods Development							
4.3.1	Aging waste sampling							
4.3.2	Core sampling truck modifications for hard saltcake sampling							Modifications have not yet improved hard saltcake sampling.
4.3.3	TMI core sampler	(Canceled)						
4.3.4	B Plant sampler	(Canceled)						
4.3.5	Composite core sampling	(Canceled)						
4.3.6	Upgraded bottle-on-a-string							
4.3.7	ISOLOK sampler for 241-AP Tank Farm	(Canceled)						
4.3.8	Assessment of sampling methods for SST characterization							
4.3.9	Maintenance of existing sampling capability							
4.3.10	Second CST and supporting equipment							

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Figure 10-1. Waste Tank Characterization Technology Program Plan Integrated Task Schedule. (Sheet 5 of 7)

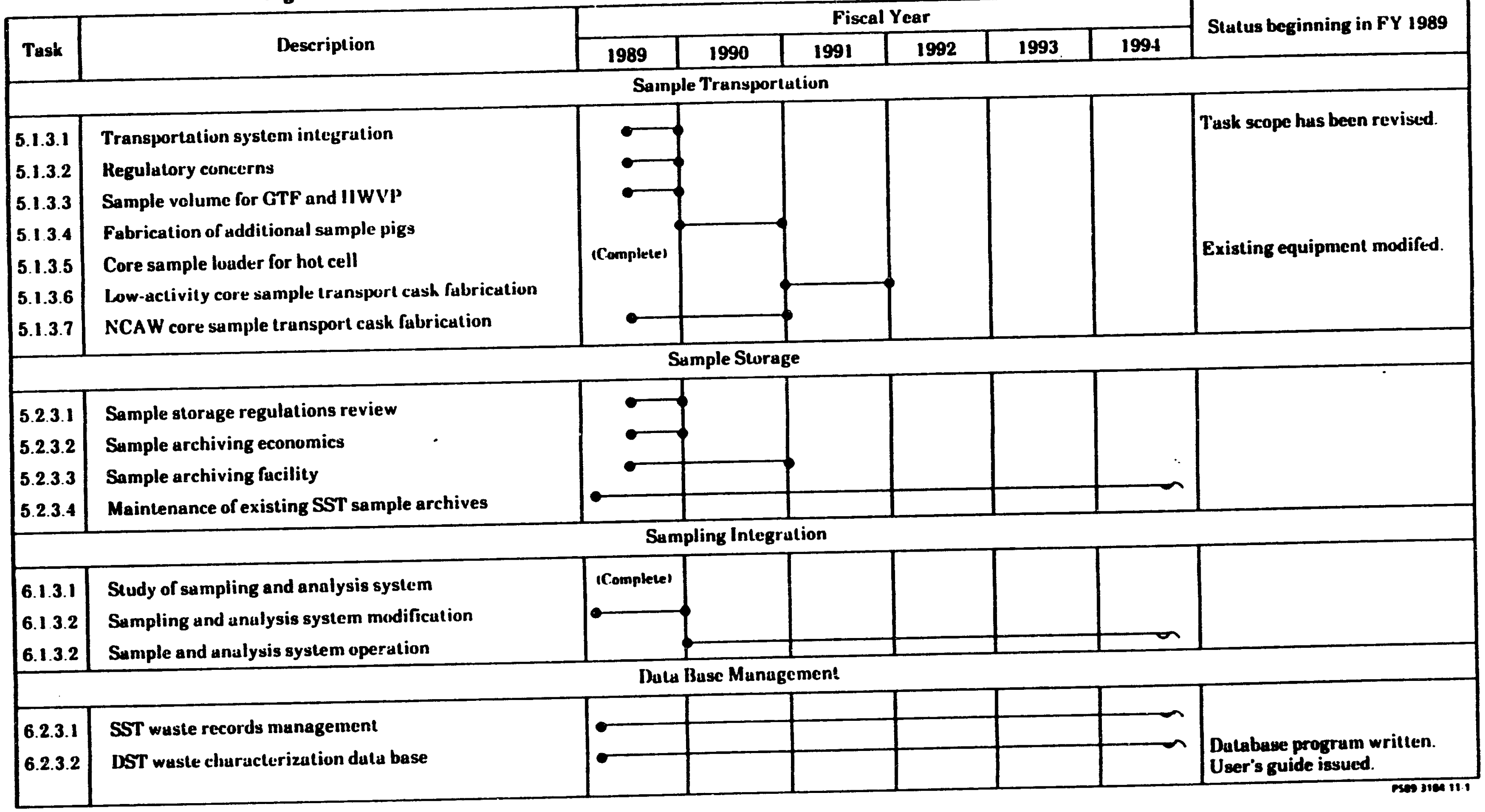

Figure 10-1. Waste Tank Characterization Technology Program Plan Integrated Task Schedule. (Sheet 6 of 7)

Task	Description	Fiscal Year						Status beginning in FY 1989
		1989	1990	1991	1992	1993	1994	
	Data Base Management (Cont.)							
6.2.3.3	DSS/DSSF data base and feed composition variability study							Data base partially developed and operational.
6.2.3.4	HWVP feed data base							
	- Develop data base							
	- Operate data base							
6.2.3.5	Convert TRAC to CRAY computer system	(Complete)						
6.2.3.6	Evaluate TRAC for hazardous material	(Canceled)						
6.2.3.7	Develop TRAC statistical techniques	(Canceled)						
6.2.3.8	Complete TRAC assessment for component prediction	(Canceled)						
6.2.3.9	Assess TRAC improvement	(Canceled)						
6.2.3.10	Maintenance of TRAC data and programs							
6.2.3.11	SST statistical data base							
	- Develop data base							
	- Operate data base							
6.2.3.12	Environmental management data base							
	- Develop data base							
	- Operate data base							
	Sampling							
7.3.1	DST sampling							
7.3.2	SST sampling							A sampling schedule to support waste disposal methods selection has been issued.

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Figure 10-1. Waste Tank Characterization Technology Program Plan Integrated Task Schedule. (Sheet 7 of 7)

Task	Description	Fiscal Year 1989	1990	1991	1992	1993	1994	Status beginning in FY 1989
Quality Assurance								
8.3.1	QA support							
8.3.2	QA program plan for SST waste							
Tank Waste Characterization Planning								
9.1.2.1	Tank Farm Waste Characterization Technology Program Plan							
9.2.2.1	SST WCP revision	(Complete)						Replaced by Section 9.1.2.4.
9.2.2.2	Consultation with regulatory agencies							Construction has been established and is ongoing.
9.2.2.3	Independent technical review							NAS panel to review SST waste characterization activities.
9.2.2.4	SST systems analysis baseline plan and schedule							

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[a]See comments in Section 2.3.16.

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11.0 REFERENCES

ANSI/ASME, 1983, *Quality Assurance Program Requirements for Nuclear Facilities*, NQA-1, American National Standards Institute/American Society of Mechanical Engineers (Location).

DOE, 1986, *Quality Assurance*, DOE Order 5700.6B, U.S. Department of Energy, Richland, Washington.

DOE/RL, 1983, *Quality Assurance*, DOE-RL Order 5700.1A, U.S. Department of Energy, Richland Operations Office, Richland, Washington (July 14).

DOE/RL, 1987, *Hanford Waste Management Technology Plan*, U.S. Department of Energy, Richland Operations Office, Richland, Washington (December).

Heath, W. O., 1986, *Development of an In Situ Method to Define the Rheological Properties of Slurries and Sludges Stored in Underground Tanks*, PNL 6083, Pacific Northwest Laboratory, Richland, Washington (August).

ITC, 1986, *Analytical Considerations for Hazardous Waste Characterization of Hanford Site Tank Waste*, International Technology Corporation, 23456 Hawthorne, Torrance, California (August).

ITC, 1986, *Hanford Site Waste Technical Issues in a Hazardous Waste Regulatory Context*, International Technology Corporation, 23456 Hawthorne, Torrance, California (June).

ITC, 1986, *Hazardous Waste Characterization Relative to the Contents of Hanford Site Wastes*, International Technology Corporation, 23456 Hawthorne, Torrance, California (July).

ITC, 1986, *Technology Program Plan: Hanford Tanks RCRA Compliance*, International Technology Corporation, 23456 Hawthorne, Torrance, California (September).

Klem, M. J., 1988, *Inventory of Chemicals Used at Hanford Production Plants and Support Operations* (1944-1980), Westinghouse Hanford Company, Richland, Washington (July).

Reddick, J. A., 1987, *Single-Shell Tank Waste Characterization Plan*, RHO-RE-PL-41 P, Rockwell Hanford Operations, Richland, Washington (March).

Weiss, R. L., 1986, *TY Tank Farm Waste Characterization Data*, RHO-WM-TI-1 P, Rockwell Hanford Operations, Richland, Washington (March).

Winter, W. I., L. Jensen, L. M. Sasaki, R. L. Weiss, J. F. Keller, R. S. Myers, A. J. Schmidt, M. G. Woodruff, 1989, *Waste Characterization Plan (Waste Analysis Plan) for the Hanford Site Single-Shell Tanks Predecisional Draft*, WHC-EP-0210, Westinghouse Hanford Company, Richland, Washington, (February).

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